Part 3

Pure Water Southern California

PROGRAM TITLE

Large-Scale Recycled Water Project Feasibility Study

U.S. Department of Interior, Bureau of Reclamation

January 19, 2024

PURE WATER SOUTHERN CALIFORNIA

Partnering Agencies:

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

LOS ANGELES COUNTY SANITATION DISTRICTS

Appendix C

Cost Backup

Appendix C.0: Cost Crosswalk

Appendix C.1: OPCC for Advanced Water Treatment Facilities (2023)

Appendix C.2: BOE Preliminary OPCC for Pure Water Conveyance (2023)

Appendix C.3: Final Distributed Treatment TM Cost Appendices (2022)

Appendix C.0

Cost Crosswalk

Appendix C. Cost Crosswalk

C.1. Introduction

Identification of all project-related costs is required for the selected water recycling project and the alternatives identified. Costs must be provided for all planning, design, and construction activities as well as operation and maintenance costs. Cost estimates must be presented in terms of pay items, quantities, unit prices, contract costs, non-contract costs, and escalation. PWSC is currently in the planning stage and the estimates provided in this report are continuing to evolve. Estimating details for individual project components were assembled into a comprehensive estimate in 2023. The cost continues to be updated and refined as design activities advance and pending project stage updated costs estimates can be provided to Reclamation as they are finalized.

C.2. Alternative 1: Pure Water Southern California

The costs of Alternative 1 are listed in Table 4-6, in Section 4.6.5, Costs, based on the costs provided by Metropolitan. The variances between the Metropolitan estimates in Table 4-6 and the costs listed below in the “Source(s) of Estimate” are generally due to Metropolitan assumptions.

Table C-1. Metropolitan Additional Cost Assumptions for Alternative 1

Construction AWPF	Phase 1	Notes	Source(s) of Estimate
Warren Facility upgrades	$93,700,000	• Assumes all new biological treatment at AWPF; no HPOAS modifications except RAS PS • Excludes: o $10.8M for campus water recycling system o $3M for grit cleaning station o $48.3M for side-stream centrate treatment	Appendix C.1, page 5
AWT facility	$1,474,500,000	• Includes $38M for site prep and environmental mitigation, including $3.1M for miscellaneous utility/storm drain relocation, and $8M for oil well abandonment • Includes over-excavation, compaction, general site prep • MBR based on Flex MBR option from JTAP 2 analysis; includes location and market adjustment factors • AWPF pump station estimated same as CONV PS • RO assumes single pass • Finished water clear well assumes 10 MG storage	Appendix C.1, page 2-5 MBR Cost Estimating Phase 1 (Jacobs 2023)

Construction AWPF	Phase 1	Notes	Source(s) of Estimate
		• BABA: 2% of equipment = $5.9M (about 1% of AWT) • Essential ancillary facilities were identified in 2018 to support core AWPF functions • Additional ancillary facilities include demonstration garden, tour galleries, solar, battery storage, parking, on-site substation/switchgear facilities, and SCE off-site substation/transmission facilities. o Off-site workforce facility cost TBD. o SCE facilities to be confirmed with SCE. • Excludes DPR piping, included in DPR facilities below	
DPR facilities	$225,000,000	• Assumes UV/chlorination at Weymouth WTP if < 10% blend, or 10% ozone/BAC/UV if > 10% blend.	Appendix C.1, page 5
Total AWPF	**$1,793,200,000**	• Includes Stantec's estimating allowance (including Jacobs MBR costs), phasing factor, sales tax, contractor markups	
Conveyance & recharge		The following industry resources were used in developing B&V's cost opinion: • B&V historical cost data • RS Means construction cost data • Mechanical Contractors Association, Labor Manual • Vendor quotes on equipment and materials from prior projects • Material quotes obtained for cement and mortar-lined steel pipe from Northwest Pipe on 07/19/2018 FLDR in 2018 served as the basis for this preliminary cost update. All prices are presented in June 2022 dollars based on a high-level quantity take-off of measured lengths and typical construction sections and have not been escalated to the mid-point of construction.	Appendix C.2, pages 1-1–1-6
Backbone pipeline	$855,000,000	• Pipeline assumes 42 miles of 84″ diameter welded steel pipe from AWPF to Canyon Spreading Grounds • Assumes cement mortar-lined and coated WSP. • Assumes wall thickness of ½″ for 84″ diameter and ⅜″ for pipes less than 84″ diameter. • FLDR dimensions for the launching and receiving pits were revised for all trenchless methods. • Metropolitan's separation requirements for the Pure Water pipeline had not been established, and there is a wide range of potential costs based on the final requirements. An allowance of 5% of the construction cost of the pipeline was provided to address this issue. It is intended that this value be updated once better information becomes available.	Appendix C.2, estimate detail, pages 1–27

Construction AWPF	Phase 1	Notes	Source(s) of Estimate
Upsized pipeline	$388,000,000	• Potential operation pipe increase. • Based on May 2023 dollars. • Assumes cement mortar-lined and coated WSP. • Assumes wall thickness of ¾″. • Shored construction is assumed for all open-cut construction methods. • Assumed 8-foot depth-of-cover on average in city streets and in SCE's easements. • All shafts for trenchless construction assumed secant piles. • No subsurface geotechnical investigation has been completed to fully confirm the extent or types of construction methods to be used. • The following are NOT included in upsized cost comparison: o Differences in the pump stations or isolation valves and vaults o Contingency for potential tariffs or material fluctuation o Removal, remediation, and/or disposal of contaminated soils and groundwater o Differences in right-of-way and/or easement acquisition	See Appendix C.2, pages 71–80 for all assumptions similar to base conveyance estimate, pages 81–96 for cost details for each pipe segment, pages 97–106 for each construction method similar to base conveyance estimate, and -pages 107–113 for cost adders similar to base estimate, with additional dewatering and permeable soils.
Backbone pump station	$118,000,000	• Two pump stations: Whittier Narrows and Santa Fe Dam. Third pump station at AWPF; it is not included with conveyance estimate. • The cost for the pump station at Whittier Narrows (Whittier Narrows PS) was based on the layout developed in the FLDR. Costs are based on the buildout capacity of 150 MGD. • The next pump station is assumed to be near the Santa Fe Spreading Grounds (SFSG PS) and would have a similar layout as the Whittier Narrows PS. The SFSG PS is assumed to pump up to 75 MGD at 200 feet of head at full buildout. Costs are based on the full buildout capacity. • Cost developed during FLDR converted to June 2022 dollars	Appendix C.2, estimate detail, page 31 of 59, "Backbone Pump Stations Phase 1"
Valves and service connections	$62,000,000	• Assumes nine service connections along backbone pipeline. • Each service connection sized up to 10–15 MGD. • Each service connection incudes a flow meter and isolation valve and would be located in below-grade vaults. • Up to seven sectionalizing valves would be constructed at approximately 6-mile spacing. • Sectionalizing valves would be located in below-grade vaults.	Appendix C.2, estimate detail, page 38 of 59, "Service Connections" Appendix C.2, estimate detail page 39 of 59, "Sectionalizing Valves"
Utility relocation/hazardous sub removal	$132,000,000	• The allowance was developed by reviewing available utility information and making assumptions on the size and length of relocations anticipated. Parametric values were then applied to the size and length of relocations assumed.	Appendix C.2, estimate detail page 40 of 59. "Utility Relocation Allowance"

Construction AWPF	Phase 1	Notes	Source(s) of Estimate
		• Allowance provided for utility relocations includes contingency for unknown utilities. • 5 percent of the construction cost of the pipeline was assumed as an allowance for the removal, remediation, and/or disposal of contaminated soils and groundwater. • Assumes parametric costs for smaller-diameter piping of $35/inch diameter LF • Assumes 4-inch duct with 48 count fiber.	Appendix C.2, estimate detail page 42 of 59. “Fiber Optics Allowance”
DPR pipelines and pump stations	$62,000,000	• DPR includes pipeline, pump stations, Azusa pipeline modifications, new junction structure at Weymouth WTP • The existing Devil Canyon–Azusa Pipeline owned by San Gabriel Valley Municipal Water District would be repurposed to convey up to 25 MGD of advanced treated water from the Canyon Spreading Grounds to the F.E. Weymouth WTP. No structural improvements to the existing pipeline were assumed. • New isolation and control valving would be required at the connection to the La Verne pipeline. • 7,100 feet of new 30-inch WSP was assumed to connect the backbone alignment to the existing Devil Canyon–Azusa Pipeline. • Two 25 MGD pump stations with approximately 370 feet of lift (each) would be required to reverse flow in the Devil Canyon–Azusa Pipeline. • It is assumed that the La Verne pipeline would convey flow from the Devil Canyon–Azusa Pipeline to the Weymouth WTP via the existing Junction Structure and that no improvements are required beyond those stated above. • A storge reservoir would be provided near Weymouth WTP for operational flexibility. The reservoir would provide up to 5 million gallons of active storage. • DPR pipeline assumed to be within public right-of-way; includes land acquisition for pump stations. • Assumes parametric costs for smaller-diameter piping of $40/inch diameter LF • Assumes $2/gallon for sizing pump station storage	Appendix C.2, estimate detail, page 43 of 59, “Repurposing Azusa Pipeline” Appendix C.2, estimate detail, page 44 of 59, “Operational Storage at Weymouth”
Recharge facilities	$135,000,000	• Backbone laterals by others (for LADWP, west Basin, Long Beach). Doesn’t include other ancillary facilities of member agency facilities. • Assumes 14 new injection wells at WRD wellfield • Spreading facility improvements include United Rock Pit #3 spillway below Santa Fe Dam	Appendix C.2, estimate detail pages 28 - 46

Construction AWPF	Phase 1	Notes	Source(s) of Estimate
		• Assumes wells and basin O&M by others	
Total conveyance & recharge	**$1,767,000,000**	• Includes $6M conveyance business impact allowances for small business claims	MWD assumptions
Total construction	**$3,560,200,000**	• Details of typical unit costs for each construction method covered in Appendix C.2 estimate detail, pages 45 through 53. • Does NOT include construction permits, including (but not limited to) excavation permits, encroachment permits, overweight vehicle special permits, and South Coast Air Quality Management District permits to construct • The 2018 Engineer's OPCC also utilized costs for non-typical features that may be encountered. These costs were escalated to June 2022 dollars. • Details on cost adder unit costs are found in Appendix C.2, estimate detail, pages 54–59 for the following: o Cathodic protection unit cost data o Major utility crossings o Major intersection crossings o Landscaped medians (demo & replace) o Raised medians (demo & replace) o Seismic hazards/fault zones	Appendix C.2
Engineering		—	—
Program management/consultant	$169,000,000	• 5% of AWPF + conveyance/recharge construction costs • See table below for detailed breakdown	Appendix C.1 pages 5–6, Metropolitan assumptions
Design (engineering)–AWT	$403,200,000	• 25% of AWPF construction costs • See table below for detailed breakdown	Appendix C.1 pages 5–6, Metropolitan assumptions
Design (engineering)–conveyance & recharge	$441,800,000	• 25% of conveyance/recharge construction costs • See table below for detailed breakdown	Appendix C.2, page 1-6, Metropolitan assumptions
Subtotal engineering	**$1,013,900,000**	—	—
Contingency (35%)	**$1,537,800,000**	—	Metropolitan assumptions
Subtotal engineering & construction	**$6,111,900,000**	—	—
Property & community benefits	**$457,000,000**	• Assumed worth of Sanitation Districts' property (FORCO) used for AWPF • FORCO used for off-site workforce development facilities. • Assumes purchase of United Rock Pit #3 • Outreach allowance for communities impacted by construction, 2% construction	Metropolitan assumptions

Construction AWPF	Phase 1	Notes	Source(s) of Estimate
		• Includes $30M of environmental mitigation measures (Environmental Mitigation in Section 4.5.6, Table 4-6)	
Total engineering & construction	**$6,568,900,000**	—	—

Notes:
Program management and engineering cost backup rates are provided in Tables C-1A, C-1B, and C-1C, below, which are taken from Reclamation 2023.

— = not applicable
AWPF = Advanced Water Purification Facility
AWT = advanced wastewater treatment
B&V = Black and Veatch
BABA = Build America, Buy America
BAC = biological activated carbon
CONV PS = conventional pump station
DPR = direct potable reuse
FLDR = Feasibility Level Design Report
FORCO = Fletcher Oil and Refining Company
HPOAS = high-purity oxygen-activated sludge
JTAP 2 = "Technical Analysis of Biological and Advanced Water Treatment Processes at the JWPCP"
LADWP = Los Angeles Department of Water and Power
LF = linear feet
MBR = membrane bioreactor
Metropolitan = Metropolitan Water District of Southern California
MG = million gallons
MGD = million gallons per day
O&M = operation and maintenance
OPCC = Opinion of Probable Construction Cost
RAS PS = return activated sludge pump station
RO = reverse osmosis
SCE = Southern California Edison
TBD = to be determined
UV = ultraviolet
Warren Facility = A.K. Warren Water Resource Facility
WRD = Water Replenishment District
WSP = welded steel pipe
WTP = Water Treatment Plant

Table C-1A. Personnel for Alternative 1

Personnel			
Position Title	**Time (Hrs)**	**Rate (Per Hr)**	**Total Cost**
Program Manager	5200	$114	**$590,554**
Assistant Program Manager	5200	$108	**$562,432**
Advanced Water Purification Program Manager	5200	$108	**$562,432**
Conveyance Program Manager	5200	$108	**$562,432**
Design Manager	5200	$108	**$562,432**
Water Resource Manager	2600	$84	**$219,348**
Water Systems Operations Liason	2600	$97	**$253,094**
Principal Engineer	5200	$93	**$483,692**
Principal Engineer	5200	$93	**$483,692**
Senior Engineer	5200	$84	**$438,697**
Senior Engineer	5200	$84	**$438,697**
Senior Engineer	5200	$84	**$438,697**
Engineer	2600	$76	**$196,851**
Engineer	2600	$76	**$196,851**
Engineer	2600	$76	**$196,851**
Project Controls	5200	$76	**$393,702**
QAQC	2600	$76	**$196,851**
Contracts Manager	2600	$76	**$196,851**
Construction Manager	2600	$76	**$196,851**
Environmental Specialist	5200	$84	**$438,697**
Field Survey	5200	$65	**$337,459**
Community Relations Manager	5200	$91	**$472,443**
Land Planning/Real Property	5200	$91	**$472,443**
Invoice/Administration Assistant	5200	$54	**$281,216**
			$0
			$0
			$0
		Total	**$9,173,186**

Source: Reclamation 2023.

Table C-1B. Fringe Benefits Under Alternative 1

Fringe Benefits				
Position Title	Compensation	Quantity	Total Cost	Comments [illegible]
Program Manager	$208.37	5200	$1,083,524	[illegible]
Assistant Program Manager	$200.10	5200	$1,040,499	
Advanced Water Purification Program Manager	$200.10	5200	$1,040,499	
Conveyance Program Manager	$200.10	5200	$1,040,499	
Design Manager	$200.10	5200	$1,040,499	
Water Resources Manager	$156.07	2600	$405,793	
Water Systems Operations [illegible]	$165.09	2600	$468,326	
Principal Engineer	$172.08	5200	$894,829	
Principal Engineer	$172.08	5200	$894,829	
Senior Engineer	$156.07	5200	$811,569	
Senior Engineer	$156.07	5200	$811,569	
Senior Engineer	$156.07	5200	$811,569	
Engineer	$140.07	2600	$364,175	
Engineer	$140.07	2600	$364,175	
Engineer	$140.07	2600	$364,175	
Project Controls	$140.07	5200	$728,349	
QA/QC	$140.07	2600	$364,175	
Contracts Manager	$140.07	2600	$364,175	
Construction Manager	$140.07	2600	$364,175	
Environmental Specialist	$156.07	5200	$811,569	
Field Survey	$120.06	5200	$624,300	
Community Relations Manager	$168.26	5200	$874,959	
Land Planning/Real Property	$168.26	5200	$874,959	
Project Administrative Assistant	$100.05	5200	$520,250	
			[illegible]	

Source: Reclamation 2023.

Table C-1C. Engineering Contracts for Alternative 1

Contractor Name	Purpose and Contracting Method	Total Cost	Description of costs	Basis of cost
AECOM and Brown and Caldwell Joint Venture	Program Management Team / Competitive Selection	$50,000,000	Program Management	Consultant Agreement
Environmental Documentation (Consultant TBD)	Environmental Planning Consultant / Competitive Selection	$2,000,000	Preparation of CEQA Report	Engineer's Estimate based on current environmental effort
Permitting Plan and Initiate Permits (Consultant TBD)	Develop PWSC Permitting Plan and initiate permits and consultations	$2,526,000		Engineer's estimate based on current efforts
Public Engagement / Community Benefits (Consultant TBD)	Public Engagement and interagency coordination including development of educational materials	$4,500,000	Consultant	Based on a percent of the total program cost
DPR and IDC Bench Scale and Pilot Testing (Consultant TBD)		$10,758,000		
Warren Facility Side Stream Centrate System Design (Consultant TBD)	A design consultant for the Side Stream Centrate System at the Warren Facility will be competitively selected by	$4,000,000	Advance project component's from planning level to 100 percent design	Engineer's Cost Estimate
Warren Facility Infrastructure Improvements and Site Preparation (Consultant TBD)	Design consultant for identified infrastructure improvements to convey required effluent to the AWPF	$15,700,000	Consultant Design Cost	Engineer's Cost Estimate
Designer TBD (Advanced Water Purification Facility including MBR design)	A design consultant for the design of the AWPF and MBR design. Advance design of this project element to 10, 30 and 60 percent design and procure CM contractor for construction activities.	$170,710,297	Consultant Design Cost	Engineer's Cost Estimate
Design of Reach 1 (100 percent design)	Design consultant to advance the design of Reach 1 from preliminary design (10 percent) to 100 percent design	$27,000,000	Consultant Design Cost	Engineer's Cost Estimate
Design of Reach 2 (100 percent design)	Design consultant to advance the design of Reach 2 from preliminary design (10 percent) to 100 percent design	$54,000,000	Consultant Design Cost	Engineer's Cost Estimate
Conveyance and Ancillary Facilities Designer	Design of PS, Pipeline, and Recharge Facilities	$95,000,000	Consultant Design Cost	Engineer's Cost Estimate
	Subtotal	$411,186,297		

Source: Reclamation 2023.

C.3. Alternative 2: Distributed Recycled Water Treatment Plants

The costs of Alternative 2 are listed in Table 4-7, in Section 4.7.6, Costs, of the main text based on the costs provided by Metropolitan. The variances between the Metropolitan estimates in Table 4-7 and the net present value costs listed in Table C-2 and the capital costs listed in Table C-3 are generally due to Metropolitan assumptions. Table C-4 lists the cost assumptions for the Diversion North Site 2, Commerce East location.

Table C-2. Metropolitan Alternate Cost Assumptions for Alternative 2: Net Present Value Cost Summary

Facility/Component	Unit	Distributed AWT Alternatives (Distributed AWT + Reduced-Size Centralized Facility)			Centralized AWT Project
		Diversion North Site 1 Commerce West	Diversion North Site 2 Commerce East	Diversion South Site 3 Long Beach	
Distributed Treatment Facilities					
O&M for Treatment Facility, NPV	$	$176,000,000	$126,600,000	$246,500,000	$1,346,000,000
O&M for Treatment Facility Conveyance and Pumping, New Components, NPV	$	$10,200,000	$5,170,000	$3,080,000	
Capital Cost for Treatment Facility	$	$527,200,000	$372,200,000	$724,100,000	$1,871,000,000
Capital Cost Conveyance/Pumping, New Components	$	$242,100,000	$169,200,000	$100,240,000	
Subtotal Distributed Treatment Facility and New Conveyance and Pumping Components	**$**	**$955,600,000**	**$673,200,000**	**$1,054,000,000**	**$3,217,000,000**
Unit Cost, $/gpd, treatment, per facility	**$/gpd**	**$58.3**	**$63.2**	**$43.7**	**$21.4**
Unit Cost, $/acre-ft, treatment, per facility	**$/acre-ft**	**$2,600/AF**	**$2,818/AF**	**$1,948/AF**	**$957/AF**
Centralized Treatment Cost Reductions					
Centralized Treatment O&M Reductions, NPV	$	-$147,160,000	-$95,650,000	-$220,740,000	
Capital Cost Savings for Centralized Treatment Facility	$	-$199,000,000	-$129,000,000	-$301,000,000	
Subtotal Centralized Treatment Facility Savings, NPV	**$**	**-$346,200,000**	**-$224,700,000**	**-$521,800,000**	
Product Water Conveyance and Pumping					
O&M Product Water Pumping NPV Reduction (-) or Increase (+)	$	-$14,810,000	-$10,330,000	+$1,000,000	
Capital Cost Savings Product Water Conveyance and Pumping	$	-$9,140,000	-$21,560,000	-$15,130,000	
Subtotal Product Water Conveyance/Pumping Reduction	**$**	**-$24,000,000**	**-$31,900,000**	**-$14,100,000**	
Total Net Present Value Cost Increase for Distributed Approach (Treatment + Conveyance)	**$**	**$585,000,000**	**$416,000,000**	**$538,000,000**	

Table C-3. Metropolitan Alternate Cost Assumptions for Alternative 2: Capital Cost Summary

Facility/Component	Distributed AWT Alternatives (Distributed AWT + Reduced-Size Centralized Facility) Diversion North Site 1 Commerce West	Diversion North Site 2 Commerce East	Diversion South Site 3 Long Beach	Centralized AWT Project
Treatment Plant Product Flow	**16.4**	**10.66**	**24.6**	**160**
Distributed Treatment Facility Capital Costs				
Land Cost	$26,330,000	$9,610,000	$45,350,000	
Treatment Facility Cost	$500,900,000	$362,600,000	$678,800,000	$1,871,000,000
Subtotal - Treatment Facility Land and Construction	**$527,200,000**	**$372,200,000**	**$724,100,000**	**$1,871,000,000**
Treatment Facility Capital Cost per gpd	$32.1	$34.9	$29.4	$12.5
Conveyance and Pumping - Distributed Treatment New Components				
Raw Wastewater Conveyance Cost	$66,740,000	$40,610,000	$28,290,000	
Raw Wastewater Pump Station Cost	$4,860,000	$3,060,000	$1,110,000	
Product Water Conveyance (to Backbone)	$43,590,000	$23,090,000	$24,480,000	
RO Concentrate Line Conveyance Cost (to JWPCP)	$126,380,000	$102,130,000	$45,730,000	
RO Concentrate Line Pump Station Cost	$0	$0	$450,000	
Subtotal Conveyance and Pumping - New Components	**$242,100,000**	**$169,200,000**	**$100,160,000**	
Conveyance/Pumping Cost per gpd	**14.8**	**15.9**	**4.1**	**N/A**
Total Distributed Treatment Capital Costs				
Total Capital Cost (Treatment + Conveyance/Pumping)	**$769,000,000**	**$541,000,000**	**$824,000,000**	**$1,871,000,000**
Unit Cost - Treatment Facility/Conveyance Cost per gpd	**$46.9**	**$50.8**	**$33.5**	**$12.5**
Cost Reductions to Centralized Facility w/ Distributed Approach				
Treatment Facility Capital Cost Reduction	**-$199,000,000**	**-$129,000,000**	**-$301,000,000**	
Conveyance/Pumping - Product Water Reductions				
• Product Water PS Cost at Distributed - Increase	$6,350,000	$3,850,000	$16,990,000	
• Product Water PS Cost at Centralized-Reduction	-$15,490,000	-$25,410,000	-$15,190,000	
Product Water Conveyance Pipeline Savings (Backbone)	$0	$0	-$16,920,000	
Subtotal Product Water Conveyance and Pumping Reduction	**-$9,140,000**	**-$21,560,000**	**-$15,130,000**	
Total Capital Cost Reduction to Centralized Facility (trt + Convey)	**-$208,140,000**	**-$150,560,000**	**-$316,130,000**	
Net Increase to Capital Cost (cost increases minus reductions)	**$561,000,000**	**$390,000,000**	**$5088,000,000**	
Net Increase as a % of Centralized AWT Cost	30%	21%	27%	
Distributed Product Water Flow as a % of Centralized AWT Flow	11%	7%	16%	

Table C-4. Metropolitan Additional Cost Assumptions for Alternative 2 Preferred Site

Item	Cost (Diversion North Site 2, Commerce East)	Notes	Source of Estimate
Distributed Treatment Facility Capital Costs			
Land cost	$9,607,000	• Assumes $1.8M as the average per-acre sale price of the property comps forwarded to 2022 values, which is multiplied by the land area • Assumes a 2% premium for sites with freeway proximity • Assumes a 10% premium for privately owned sites (Sites 2 and 3) • Assumes entire parcels will be purchased even if only part of the land is needed for the treatment facility • Assumes a total of 5.03 acres	Appendices C.3.B pages 9–10 and C.3.A page 5
Treatment facility cost	$362,600,000	• Distributed treatment train: The secondary treatment process includes a secondary MBR system, reverse osmosis (1 pass, 3 stages), advanced oxidation, and post conditioning • Centralized treatment train: The tertiary treatment process includes a tertiary MBR system, reverse osmosis (2 passes), advanced oxidation, and post conditioning	Appendices C.3.C page 2 and C.3.A page 5
Subtotal—Treatment facility land and construction	$372,207,000	—	—
Conveyance and Pumping—Distributed Treatment New Components			
Raw wastewater conveyance cost	$40,610,000	• Based on a 30″ C900 or ductile iron piping that is 4.22 miles from the AWT source	Appendix C.3.A pages 1, 3, 5
Raw wastewater pump station cost	$3,397,000	• Includes a pump station with three pumps and a building. • Based on PS3 cost from Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020, escalated to Q2 2021 to match other costs	Appendix C.3.A pages 1, 3, 5
Product water conveyance (to backbone)	$23,090,000	• The product water pipeline is 24″ in diameter, and the product water backbone pipeline is 84″ in diameter • Large diameter pipeline cost is based on Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020; with 25% engineering, CM, ESDC, and 35% contingency, SGV alignment, escalated to Q2 2021 to match other costs • Small-diameter pipeline cost is based on cement-lined and coated steel; planning-level cost includes 25% engineering, CM, ESDC, and 35% contingency	Appendix C.3.A pages 2–3, 5

Item	Cost (Diversion North Site 2, Commerce East)	Notes	Source of Estimate
		• Pumping cost is based on PS1 cost from Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020; with 25% engineering, CM, ESDC, and 35% contingency, escalated to Q2 2021 to match other costs • Includes cost savings of reducing backbone pipeline to 78″ before connection with distributed AWT product water • The Central Pump Station will require five pumps.	
RO concentrate line conveyance cost (to JWPCP)	$102,000,000	• The brine line pipeline diameter is 16″. • The distance from AWT to JWPCP is 19.9 miles.	Appendix C.3.A pages 2, 5
Subtotal conveyance and pumping—New components	$169,197,000	—	Appendix C.3.A page 5

Notes:
— = not applicable
AWT = advanced wastewater treatment
CM = construction management
ESDC = engineering services during construction
JWPCP = Joint Water Pollution Control Plant
MBR = membrane bioreactor
PS1 = pump station 1
PS3 = pump station 3
RO = reverse osmosis
SGV = San Gabriel Valley

C.4. References

Jacobs. 2023 (November 16). "Cost Estimating Phase 1 Backup."

Reclamation (U.S. Department of Interior, Bureau of Reclamation). 2023 (November 21). WaterSMART Large-Scale Water Recycling Projects for Fiscal Years 2023 and 2024: Pure Water Southern California Grant Proposal."

Appendix C.1

OPCC for Advanced Water Treatment Facilities (2023)

Opinion of Probable Construction Cost for the PWSC's Phase 1 Advanced Water Treatment Facilities

November 30, 2023

Prepared for:

Metropolitan Water District of Southern California

Prepared by:

Stantec

OPINION OF PROBABLE CONSTRUCTION COST FOR THE PWSC'S PHASE 1 ADVANCED WATER TREATMENT FACILITIES

Revision	Description	Author		Quality Check		Independent Review	
0	11/30/2023	J. Loucks		Z. Hirani	J. Borchardt	D. Bassett	

Estimated Construction Cost					PWSC Phase 1 AWT Facilities	Notes
	AREA	UNIT COST	UNIT	QUANTITY	COST	
1	**Other Facilities**					
	Required Ancillary Facilities					
	Storage Warehouse					
	Building Slab	$ 750	$/cubic yard	725	$ 543,750	
	Building Walls	$ 1,250	$/cubic yard	303	$ 378,750	
	Building Roof Slab	$ 1,750	$/cubic yard	223	$ 390,250	
	CSI 1-15 Less Div 3	$ 250	$/square foot	23,999	$ 5,999,750	
	Fueling Facilities	$ 1,500,000	lump sum	1	$ 1,500,000	
	Electrical Buildings					
	Electrical Building 1	$ 600.00	$/square foot	21,609	$ 12,965,400	
	Electrical Building 2	$ 600.00	$/square foot	10,976	$ 6,585,600	
	Electrical Building 3	$ 600.00	$/square foot	12,025	$ 7,215,000	
	Electrical Building 4	$ 600.00	$/square foot	8,400	$ 5,040,000	
	Clearwell, Pump Station & Electrical Building Concrete					
	Slab	$ 750	$/cubic yard	6,826	$ 5,119,500	
	Columns & Beams	$ 1,750	$/cubic yard	1,592	$ 2,786,000	
	Walls	$ 1,250	$/cubic yard	1,934	$ 2,417,500	
	Elevated Slab	$ 1,750	$/cubic yard	2,812	$ 4,921,000	
	CSI 1-15 Less Div 3	$ 200	$/square foot	55,000	$ 11,000,000	
	Finished Water Surge Tanks	$ 75,000	$/tank	5	$ 375,000	6,000 cf each, horizontal tanks at 12 ft diameter
	Mechanical/Process for Surge Tanks	50%	% of Subtotal Cost	1	$ 187,500	
	Generator Area	$ 350	$/square foot	27,004	$ 9,451,400	
	Generators	$ 1,000,000	$/generator	7	$ 7,000,000	
	Slab	$ 750	$/cubic yard	1,709	$ 1,281,750	
	CSI 1-15 Less Div 3	$ 250	$/square foot	30,400	$ 7,600,000	
	Battery Storage Area	$ 500	$/square foot	3,830	$ 1,915,000	
	Battery Packs	$ 1,000,000	$/MW	4	$ 4,000,000	
	Maintenance Building					
	Building Slab	$ 750	$/cubic yard	500	$ 375,000	
	Building Walls	$ 1,250	$/cubic yard	775	$ 968,750	
	Building Roof Slab	$ 1,750	$/cubic yard	499	$ 873,250	
	CSI 1-15 Less Div 3	$ 350	$/square foot	23,999	$ 8,399,650	
	Workforce Training Center					
	Building Slab	$ 750	$/cubic yard	889	$ 666,750	
	Building Walls	$ 1,250	$/cubic yard	542	$ 677,500	
	Building Roof Slab	$ 1,750	$/cubic yard	889	$ 1,555,750	
	CSI 1-15 Less Div 3	$ 500	$/square foot	26,000	$ 13,000,000	
	Additional Ancillary Facilities					
	Administration/Operations/Laboratory/Classrooms Building	$ 1,000	$/square foot	31,360	$ 31,360,000	
	Amphitheater/Innovation Center					Full public outreach building/theater-like structure. Indoor 2/3 floors, includes demonstration gardens and tour galleries
	Amphitheater/Innovation Center Building	$ 1,200	$/square foot	15,200	$ 18,240,000	
	Amphitheater/Innovation Center Outdoor	$ 750	$/square foot	15,200	$ 11,400,000	
	Parking Structures (P1, P2, P3)	$ 150	$/square foot	106,700	$ 16,005,000	
	Solar Panels	$ 10	$/sf	479,105	$ 4,791,050	To be added on top of available roof area
	Subtotal				**$ 206,985,850**	
2	**Chemical Systems**					
	Chemical Dosing and Storage Slab	$ 750	$/cubic yard	809	$ 606,750	
	Chemical Dosing and Storage Walls	$ 1,250	$/cubic yard	729	$ 911,250	
	Chemical Dosing and Storage Roof	$ 1,500	$/cubic yard	83	$ 124,500	

	AREA	UNIT COST	UNIT	QUANTITY	COST	
	Ammonium Sulfate					
	Chemical Tanks	$100,000	$/15,000-gallon tank	2	$ 200,000	RO feedwater pretreatment; chloramine formation
	Dosing System	$500,000	$/system	1	$ 500,000	
	Sodium Hydroxide					
	Chemical Tanks	$100,000	$/15,000-gallon tank	9	$ 900,000	RO membrane cleaning
	Dosing System	$500,000	$/system	1	$ 500,000	
	Citric Acid					
	Chemical Tanks	$100,000	$/15,000-gallon tank	1	$ 100,000	MBR and RO membrane cleaning
	Dosing System	$500,000	$/system	1	$ 500,000	
	Sulfuric Acid					
	Chemical Tanks	$100,000	$/15,000-gallon tank	3	$ 300,000	RO feedwater pretreatment
	Dosing System	$500,000	$/system	1	$ 500,000	
	Antiscalant					
	Chemical Tanks	$100,000	$/15,000-gallon tank	1	$ 100,000	RO feedwater pretreatment
	Dosing System	$500,000	$/system	1	$ 500,000	
	Carbon Dioxide System		Lump Sum	1	$ 6,500,000	
	Carbon Dioxide Storage Elevated Slab	$ 1,750	$/cubic yard	4,500	$ 7,875,000	
	Lime Process Area					
	Lime System		Lump Sum	1	$ 3,700,000	Quicklime storage, batch slaking, and slurry system. Includes quicklime silos, slakers,
	Concrete Slab	$ 750.00	$/cubic yard	133	$ 99,750	control system, grit separation tanks, lime slurry feed tanks, lime slurry pump skids.
	Concrete Walls	$ 1,250.00	$/cubic yard	114	$ 142,500	
	Concrete Elevated Slab	$ 1,750.00	$/cubic yard	101	$ 176,750	
	Lime Clarifiers					$/300,000-gallon clarifier, 65 ft diameter, 12 ft depth
	Concrete Slab	$ 750.00	$/cubic yard	586	$ 439,800	
	Concrete Walls	$ 1,250.00	$/cubic yard	307	$ 383,750	
	Chlorine Storage Building					
	Building Slab	$ 750	$/cubic yard	427	$ 320,250	
	Building Walls	$ 1,250	$/cubic yard	464	$ 580,000	
	Building Roof Slab	$ 1,750	$/cubic yard	244	$ 427,000	
	Sodium Hypochlorite Tanks					
	Chemical Tanks	$100,000	$/15,000-gallon tank	8	$ 800,000	
	Dosing System	$500,000	$/system	2	$ 1,000,000	RO feedwater and UV/AOP oxidant
	Installation		% of Chemical Systems Cost	25%	$ 4,025,000	
	Subtotal				**$ 32,212,300**	
3	**RO System**					
	RO Transfer Pumps	$ 565,000	$/pump	7	$ 3,955,000	
	RO High Pressure Feed pumps	$ 566,000	$/pump	13	$ 7,358,000	
	RO System	*varies*	Lump Sum	1	$ 62,400,000	Includes CIP/flush systems, chemical dosing skids and interstage booster pumps
	Cartridge Filters	*varies*	Lump Sum	1	$ 1,500,000	
	RO Building/Feed Tank Slab	$ 750	$/cubic yard	3,287	$ 2,465,250	6 in x 40 in filters, 38 cartridges per vessel
	RO Building/Feed Tank Walls	$ 1,250	$/cubic yard	328	$ 410,000	
	RO Building/Feed Tank Elevated Slab & Canopy	$ 1,500	$/cubic yard	6,018	$ 9,027,000	
	CSI 1-15 Less Div 3	$ 150	$/square foot	105,465	$ 15,819,750	
	RO Feed Tank Concrete Slab	$ 750	$/cubic yard	1,328	$ 996,000	10 MG- below grade concrete tank
	RO Feed Tank Concrete Walls	$ 1,250	$/cubic yard	1,094	$ 1,367,500	
	RO Feed Tank Elevated Slab	$ 1,750	$/cubic yard	1,296	$ 2,268,000	
	RO Feed Pump Electrical Building					
	Slab	$ 750	$/cubic yard	0	$ -	
	Walls	$ 1,250	$/cubic yard	401	$ 501,250	
	Elevated Slab	$ 1,750	$/cubic yard	521	$ 911,750	
	CSI 1-15 Less Div 3	$ 150	$/square foot	34,832	$ 5,224,800	
	RO Booster Pump Electrical Building					
	Slab	$ 750	$/cubic yard	446	$ 334,500	
	Walls	$ 1,250	$/cubic yard	870	$ 1,087,500	

	AREA	UNIT COST	UNIT	QUANTITY	COST	
	Elevated Slab	$ 1,750	$/cubic yard	446	$ 780,500	
	CSI 1-15 Less Div 3	$ 350	$/square foot	6,500	$ 2,275,000	
	Process Piping		% of RO Equipment Cost	25%	$ 18,803,250	
	Installation		% of RO Equipment Cost	20%	$ 15,042,600	
	Subtotal				**$ 152,527,650**	
4	**UV AOP System**					
	UV AOP System		Lump Sum	1	$ 29,300,000	Includes reactors, instrumentation, automated control, ballast enclosures, monitors
	CSI 1-15 Less Div 3	$ 100	$/square foot	31,800	$ 3,180,000	and analyzers.
	Isolation Valve (48 in)	$ 46,400	$/valve	16	$ 742,400	2 per reactor
	Magnetic Flow Meters (48 in)	$ 55,000	$/magmeter	8	$ 440,000	1 per reactor
	Building Slab w/ Rebar	$ 750	$/cubic yard	3,533	$ 2,649,750	
	System Canopy Cover	$ 150	$/square foot	31,800	$ 4,770,000	
	Process Piping		% of UV AOP Equipment Cost	20%	$ 5,860,000	
	Installation		% of UV AOP Equipment Cost	20%	$ 5,860,000	
	Subtotal				**$ 52,802,150**	
5	**Yard Piping**					
	Yard Piping		% of Process Subtotal	10%	$ 20,532,980	
	Subtotal				**$ 20,532,980**	
6	**Civil**					
	Site Preparation					
	Excavation	$ 35	$/cubic yard	760,000	$ 26,600,000	Total excavation volume
	Removals/Site Work	$ 2	$/cubic yard	152,000	$ 304,000	20% of the excavation volume
	Asphalt Paving, Driveways and Fencing Repairs	$ 500,000	Lump Sum	1	$ 500,000	
	Landscaping Allocation	$ 150,000	Lump Sum	1	$ 150,000	
	Site Earthworks Allowance	$ 500,000	Lump Sum	1	$ 500,000	
	Bldg Pad Development/Footing Exc	$ 2,500,000	Lump Sum	1	$ 2,500,000	
	Miscellaneous Site Improvements	$ 2,500,000	Lump Sum	1	$ 2,500,000	
	Civil Subtotal				**$ 33,054,000**	
	Equipment and Materials Subtotal				**$ 465,623,430**	
	Process Equipment Electrical and I&C	0.35	35% of Equipment Subtotal		**$ 46,675,265**	
	Sales Tax	0.095	9.5% of Equipment Subtotal		**$ 12,669,001**	
	EQUIPMENT, MATERIALS AND CIVIL TOTAL				**$ 558,021,696**	
	Contractor Overheads and Profit & Insurance/Permits	0.25	25% of Equipment, Materials, and Civil Subtotal		$ 139,505,424	
	Contractor General Conditions	0.1	10% of Equipment, Materials, and Civil Subtotal		$ 55,802,170	
	Construction Subtotal				**$ 754,000,000**	
7	**Additional Site Preparation**					
	Oil Well Closures		Lump Sum		$ 8,000,000	From Stantec's TM; total construction cost
	Storm Drain Relocation		Lump Sum		$ 40,000,000	From LACSD; total construction cost
	Utility Relocation		Lump Sum		$ 2,000,000	Total construction cost
8	**Wastewater Processes**					
	Sidestream Centrate Treatment		Lump Sum		$ 48,350,000	From LACSD / Hazen; total construction cost
	Influent Pumping, Fine Screening, MBR System, Odor Control		Lump Sum		$ 562,818,000	From LACSD / Jacobs; total construction cost
9	**Power Infrastructure**					
	Distribution SwitchYards/ Substation		Lump Sum		$ 25,000,000	From AECOM/B&C; total construction cost
	SCE Offsite 66 kV Facilities and Poles near AWPF		Lump Sum		$ 47,000,000	From AECOM/B&C; total construction cost
	Electrical Substation		Lump Sum		$ 160,000,000	From AECOM/B&C; total construction cost
10	**DPR Facilities at Weymouth WTP**					
	Phase 1 DPR Facility at Weymouth WTP		Lump Sum		$ 44,500,000	Total construction cost
	CONSTRUCTION TOTAL				**$ 1,692,000,000**	
11	**Soft Costs**					
	Admin, Engineering, Project and Construction Management	0.3	30% of Construction Total		$ 507,600,000	

AREA	UNIT COST	UNIT	QUANTITY	COST
Program Management Consultant	0.05	5% of Construction Total		$ 84,600,000
Subtotal				**$ 2,284,200,000**
Contingency	0.35	35% of Above Subtotal		$ 799,470,000
TOTAL CAPITAL COST				**$ 3,083,670,000**
Low Range (-20%)			-20%	**$ 2,467,000,000**
High Range (+40%)			40%	**$ 4,318,000,000**
Construction Mid-point Escalation			0%	

Appendix C.2

BOE Preliminary OPCC for Pure Water Conveyance (2023)

DRAFT

BASIS OF ENGINEER'S PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST FOR THE PURE WATER CONVEYANCE FACILITIES (PHASE 1)

B&V PROJECT NO. 410259

PREPARED FOR

Metropolitan Water District of Southern California

20 DECEMBER 2023

1.0 Basis of Engineer’s Preliminary Opinion of Probable Construction Cost (OPCC)

The Metropolitan Water District of Southern California (Metropolitan) tasked Black & Veatch with providing a preliminary update to the Engineer's OPCC previously prepared in 2018 for the Pure Water Southern California (Pure Water) conveyance system. This preliminary update was developed for the major facilities of the conveyance system based on the conceptual-level design as envisioned in June 2022, primarily using escalated unit rates. An updated Class 4 OPCC will be completed at the end of the California Environmental Quality Act (CEQA) planning phase. All cost opinion classification levels discussed in this memorandum are as defined by the Association for the Advancement of Cost Engineering, International (AACE).

This preliminary Engineer’s OPCC is comprised of direct and indirect construction costs. Direct costs are intended to include the contractor’s cost for labor, materials, and equipment estimates. Direct costs were developed using the industry resources discussed below. Indirect costs cover the contractor’s general conditions, overhead, profit, building permits, insurance, and bonding. Indirect costs were estimated based on a percentage of the direct costs, as is typical for this level of study. The following industry resources were used in developing this cost opinion:

- Black & Veatch Historical Cost Data
- RS Means Construction Cost Data
- Mechanical Contractors Association – Labor Manual
- Vendor quotes on equipment and materials from prior projects
- Material quotes obtained for cement and mortar lined steel pipe from Northwest Pipe on 07/19/2018

All prices are presented in June 2022 dollars and have not been escalated to the mid-point of construction.

1.1 Methodology

The Engineer’s OPCC previously developed for the conveyance system as part of the Feasibility Level Design Report (FLDR) in 2018 served as the basis for this preliminary cost update and was updated as follows:

1. The 2018 Engineer’s OPCC utilized typical unit costs for the following construction methods: construction in paved streets, construction in easements, pipe jacking, microtunneling, and traditional tunneling. These unit costs were escalated to June 2022 dollars using the Engineering News Record (ENR) Construction Cost Indices for Los Angeles, California with the following revisions:

    a. Trenchless construction costs were revised to separate the shaft costs and mobilization from the mining costs.

b. The dimensions for the launching and receiving pits were revised for all trenchless methods. In general, the length of the launching pits decreased for pipe jacking and microtunneling, while the length of the launching pits increased for traditional tunneling.

2. The 2018 Engineer's OPCC also utilized costs for non-typical features that may be encountered. These include features and work methods which were not included in the typical unit costs because they were not consistently required or uniformly found along each segment. Consistent with this level of study, these adders are items which are readily discernable and measurable from the desktop analysis, visual observations made in the field, review of readily available utility information, analysis of traffic control requirements, desktop study of geotechnical and groundwater conditions, and so on. These costs were escalated to June 2022 dollars using the ENR Construction Cost Indices for Los Angeles, California.

3. For items not included in the 2018 Engineer's OPCC, estimates were generally developed using parametric values.

4. Some items had not been studied and do not lend themselves to parametric values, such as the presence of hazardous soils. For this preliminary cost update, 5 percent of the construction cost of the pipeline was assumed as an allowance for the removal, remediation, and/or disposal of contaminated soils and groundwater.

5. Costs for the long tunnel from the 105 Freeway to Washington Blvd were estimated separately by McMillan Jacobs Associates (now Delve Underground) as part of the FLDR. The cost of the long tunnel was escalated to June 2022 dollars using the ENR Construction Cost Indices for Los Angeles, California.

6. A high-level quantity take-off was performed for the Pure Water conveyance system based on the measured lengths and typical construction sections, as described herein.

7. This preliminary Engineer's OPC was based upon the unit costs and quantity take off. See Attachment A for details.

8. Following the completion of the preliminary Engineer's OPCC in June 2022, a rough order of magnitude OPCC for increasing the pipe size from 84-inches to 108-inches from Whittier Narrows to the San Gabriel Canyon Spreading Grounds was developed and documented in the memorandum entitled "*Conceptual Cost Comparison to Upsize the Backbone Pipeline to 9 Feet*," which is included as Attachment B. The rough order of magnitude cost to increase the pipe size was then applied as a cost adder for this revised preliminary Engineer's OPCC.

It should be noted that this preliminary Engineer's OPCC is based on the planning-level information available in June 2022 and is intended to provide a cost range to assist with future planning efforts. Any pipeline alignment refinements that occurred after this cost update will be captured in the future OPCC update at the end of the CEQA planning phase. Final costs for the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and contract packaging, and other variable factors, such as market conditions.

1.2 OPCC Classification Level

The OPCC classification level varies for the major components of the conveyance system based on the level of design definition as of June 2022. Components that had a greater level of project definition received a Class 4 estimate, while components that had lower levels of project definition received a Class 5 estimate. Class 4 estimates have a level of accuracy of -30% to +50%. Class 5 estimates have a level of accuracy of -50% to +100%.

Table 1-1 presents the OPCC classification level for each major component of the conveyance system.

Table 1-1. OPCC Classification Levels

Description	AACE Classification Level
84-inch Diameter Backbone Pipeline	Class 4
Backbone Pump Stations	Class 4
Backbone Isolation Valves and Service Connections	Class 5
Cost Adder to Increase to 108-inch from Whittier Narrows to the Canyon Spreading Grounds	Class 5
Fiber Optics for Conveyance System	Class 5
Direct Potable Reuse (DPR) Pipelines, Pump Stations, and Storage, Including Improvements to the Devil Canyon-Azusa Pipeline	Class 5

1.3 Cost Parameters and Assumptions

The following general parameters and key assumptions apply to the preparation of the OPCC:

- Pipeline unit prices were developed based on the typical construction cross-sections depicted in the FLDR. The typical cross-sections assumed excavation with vertical trench shoring.
- Pipeline lengths were obtained using GIS and confirmed using Google Earth Pro.
- As noted earlier, an allowance of 5 percent of the construction cost of the pipeline was provided to account for hazardous soils. It is intended that this value be updated once better information becomes available.
- At the time this preliminary Engineer's OPCC was completed, Metropolitan's separation requirements for the Pure Water pipeline had not been established and there is a wide range of

potential costs based on the final requirements. An allowance of 5 percent of the construction cost of the pipeline was provided to address this issue. It is intended that this value be updated once better information becomes available.

- An allowance was provided for utility relocations. The allowance was developed by reviewing available utility information and making assumptions on the size and length of relocations anticipated. Parametric values were then applied to the size and length of relocations assumed. The allowance includes some contingency for unknown utilities based on experience from similar projects. However, limited utility information is available at this time, so the allowance was based upon the best available information and experience with similar projects.
- At the time this preliminary Engineer's OPCC was completed, the fiber optic requirements for the project had not yet been established. Costs were included for a fiber optic communication system based on typical unit costs for similar projects. It is expected that these costs will be updated as the fiber optic design is progressed.
- An allowance was provided for potential impacts to businesses along the pipeline alignment that may be directly impacted by construction of the conveyance system. This allowance value was estimated by Metropolitan based on experience with other pipeline projects.
- Permitting, appraisals, and land acquisition costs for conveyance facilities were estimated by Metropolitan based on market conditions in 2022.

1.3.1 Conveyance Facilities – Backbone Pipeline, Pump Stations, Isolation Valves, and Service Connections

The following general parameters and key assumptions apply to the preparation of the OPCC for the Backbone conveyance facilities:

- While the Backbone system is assumed to include three pump stations, the first pump station would be located on the Advanced Water Purification (AWP) Facility. Therefore, the cost for that pump station is included with the AWP Facility and not with this conveyance estimate.
- This preliminary Engineer's OPCC for the conveyance system includes two pump stations, one at Whittier Narrows and one at the Santa Fe Spreading Grounds.
    - The cost for the pump station at Whittier Narrows (Whittier Narrows PS) was based on the layout developed in the FLDR. Costs are based on the buildout capacity of 150 MGD.
    - The next pump station is assumed to be near the Santa Fe Spreading Grounds (SFSG PS) and would have a similar layout as the Whittier Narrows PS. The SFSG PS is assumed to pump up to 75 MGD at 200 feet of head at full buildout. Costs are based on the full buildout capacity.
- Pipeline materials are assumed to be cement mortar lined and coated welded steel pipe (WSP).
    - 108-inch diameter pipe is assumed to have a wall thickness of 3/4-inch.
    - 84-inch diameter pipe is assumed to have a wall thickness of 1/2-inch.

    - Pipes less than 84-inches in diameter are assumed to have a minimum wall thickness of 3/8-inch.
- 9 service connections are assumed. For the purposes of this cost update, each service connection is assumed to include a flow meter and isolation valve located in below grade vaults.
- 7 sectionalizing valves are assumed, spaced approximately every 6 miles. For the purposes of this cost update, sectionalizing valves are assumed to be located in below grade vaults.

1.3.2 Direct Potable Reuse Facilities – DPR Pipelines, Pump Stations, and Storage

The following general parameters and key assumptions apply to the preparation of the OPCC for the DPR pipelines, pump stations, and storage facilities:

- The existing Devil Canyon-Azusa Pipeline owned by San Gabriel Valley Municipal Water District would be repurposed to convey up to 25 MGD of advanced treated water from the Canyon Spreading Grounds to the F.E. Weymouth Water Treatment Plant (WTP). No structural improvements to the existing pipeline were assumed.
    - Improvements to the Devil Canyon-Azusa Pipeline would be required at Big Dalton Pressure Reducing Station to bypass the facility. The improvements were assumed to include two new tees on the existing pipeline, 1,000 feet of new 30-inch WSP, and an isolation valve located in a below grade vault.
    - New isolation and control valving would be required at the connection to the La Verne Pipeline.
- 7,100 feet of new 30-inch WSP was assumed to connect the Backbone alignment to the existing Devil Canyon-Azusa Pipeline.
- Two 25 MGD pump stations with approximately 370 feet of lift (each) would be required to reverse flow in the Devil Canyon-Azusa Pipeline.
- It is assumed that the La Verne Pipeline would convey flow from the Devil Canyon-Azusa Pipeline to the Weymouth WTP via the existing Junction Structure and that no improvements are required beyond those stated above.
- A storge reservoir would be provided near Weymouth WTP for operational flexibility. The reservoir would provide up to 5 million gallons of active storage.

1.4 Items Excluded from the Preliminary OPCC

The following items are not accounted for in the OPCC:

- Pipeline laterals and other infrastructure downstream of the Backbone service connections
- Construction permits, including but not limited to excavation permits, encroachment permits, overweight vehicle special permits, and South Coast Air Quality Management District permits to construct
- Contingency for potential tariffs or material fluctuation
- Soft costs

- Improvements to existing or new recharge facilities

1.5 Key Issues Still to be Evaluated

The following are key issues that still need to be worked through, which could impact this cost assessment:

- No geotechnical field investigations have been completed. The geotechnical data available for this cost assessment was limited to desktop information only. Field information is required to provide greater cost certainty.
- Further coordination is required with the United States Army Corps of Engineers and Southern California Edison (SCE) to fully understand and confirm their requirements, including separation from existing levees and transmission tower foundations. Recent feedback received from SCE indicates that they desire a greater depth of cover over the pipeline within their property than previously assumed, which could impact this assessment.
- This initial assessment made assumptions regarding the proximity the pipeline excavation could be from the visible extents of existing transmission towers for open cut construction before trenchless construction would be required. As foundation information is obtained on the existing towers, these assumptions could likely be refined.

1.6 Contingency

Project contingencies are included to account for unknown or unforeseen costs at the time the estimate was developed. The amount of contingency applied to an estimate is typically based on the level of project definition. For this cost comparison, a contingency of 35 percent was applied.

Soft costs were not included in this Preliminary Engineer's OPCC. For the Pure Water program, Metropolitan has assumed 30 percent of the estimated construction costs to account for these additional services which will be applied at the program level.

1.7 Engineer's Preliminary Opinion of Probable Construction Cost

The preliminary Engineer's OPCC is included as Attachment A. All values are presented in June 2022 dollars.

Attachment A - Preliminary OPCC for PWSC Phase 1 Conveyance/Distribution System

BLACK & VEATCH
Corporation

550 S. Hope Street, Suite 2250, Los Angeles, California 90071

B&V Project 410259

PRELIMINARY ENGINEERS OPCC

Metropolitan Water District of Southern California
Los Angeles County, CA

Conceptual-Level Design of Conveyance/Distribution System for Pure Water Southern California

June 2022

SUMMARY

Values provided by B&V
Values provided by Metropolitan

Item Description	Quantity	Size	Unit Rate w/o Contingency	Cost
Conveyance Facilities - Phase 1				
Backbone Conveyance Facilities				
Backbone Pump Stations				
Pump Station at Whittier Narrows	1		$ 88,000,000	$ 88,000,000
Pump Station at Santa Fe Spreading Grounds	1		$ 30,000,000	$ 30,000,000
Subtotal				$ 118,000,000
Backbone Pipeline				
Initial Delivery Project through Cities of Carson and Long Beach				
AWTF to East Side of LA River	34,706	84		$ 148,800,000
Remainder of Backbone Alignment to Canyon Spreading Grounds				
East Side of LA River to Palo Verde Ave	28,800	84		$ 106,100,000
Palo Verde Ave to North of 91 Freeway	11,550	84		$ 48,000,000
North of 91 Freeway to South of 105 Freeway	12,575	84		$ 28,400,000
River Tunnel	25,750	84		$ 180,300,000
North of Washington Blvd to Rose Hills Road/Shepherd St	19,900	84		$ 78,700,000
Rose Hills Road/Shepherd St to South of Valley Blvd	21,165	84		$ 83,100,000
South of Valley Blvd to Live Oak Ave	24,595	84		$ 74,900,000
Adders to Backbone (Additional to FLDR)				
Alignment East Around Santa Fe Dam	24,200	84		$ 80,000,000
From Foothill Blvd to Canyon Spreading Grounds	10,400	48		$ 12,000,000
IPR Laterals (Additional to FLDR)				
From Santa Fe Lateral to United Rock Pit 3	5,275	Varies		$ 12,500,000
From Backbone to San Gabriel Coastal Spreading Grounds	500	Varies		$ 2,400,000
Subtotal				$ 855,000,000
Backbone Valves and Service Connections				
Isolation Valves and Vaults (Additional to FLDR)				
Initial Delivery	1	84	$ 5,000,000	$ 5,000,000
Remainder of Backbone	6	84	$ 5,000,000	$ 30,000,000
Service Connections				
Initial Delivery	3		$ 3,000,000	$ 9,000,000
Remainder of Backbone	6		$ 3,000,000	$ 18,000,000
Subtotal				$ 62,000,000

Item Description	Quantity	Size	Unit Rate w/o Contingency	Cost
Utility Relocation Allowance				$ 20,000,000
Separation Requirements Allowance		5%		$ 46,000,000
Hazardous Soils and Groundwater Allowance		5%		$ 46,000,000
Hazardous Soils and Groundwater Allowance - Increase to 9' Pipe		5%		$ 20,000,000
Backbone Conveyance Facilities - Phase 1 Subtotal				$ 1,167,000,000
Additional Conveyance Facilities				
Increase to 9' Diameter Pipeline	1	108	$ 388,000,000	$ 388,000,000
Conveyance System Business Impacts				$ 6,000,000
Fiber Optics				$ 9,000,000
Subtotal				$ 403,000,000
Conveyance Facilities (Backbone and Additional) - Phase 1 Subtotal				$ 1,570,000,000
Contingency		35%		$ 550,000,000
TOTAL CONVEYANCE FACILITIES - PHASE 1 PROBABLE CONSTRUCTION COST AND CONTINGENCY				**$ 2,120,000,000**
DPR Facilities - Phase 1 (Conveyance Only)				
Repurposing Azusa Pipeline (Additional to FLDR)				
Pipeline and Pump Station Improvements				$ 52,000,000
Operational Storage at Weymouth				$ 10,000,000
DPR Facilities - Phase 1 (Conveyance Only) Subtotal				$ 62,000,000
Contingency		35%		$ 22,000,000
TOTAL DPR FACILITIES - PHASE 1 (CONVEYANCE ONLY) COST AND CONTINGENCY				**$ 84,000,000**
Permitting/Property - Phase 1				
Conveyance Permits, Appraisals, and Easement - Pipeline				$ 145,000,000
Land Acquisition - Pump Stations				$ 28,000,000
Permitting/Property - Phase 1 Subtotal				$ 173,000,000
Contingency		35%		$ 61,000,000
TOTAL PERMITTING/PROPERTY ACQUISITION - PHASE 1 (CONVEYANCE ONLY) COST AND CONTINGENCY				**$ 234,000,000**

Cost Details for 7' Diameter Pipe Segments and Facilities

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ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

FROM AWP FACILITY TO LOS ANGELES RIVER SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	58,978,020
General Requirement - Open Cut	15%	$	8,846,703
General Contractor OH&P - Open Cut	15%	$	8,846,703
Contingencies - Open Cut	35%	$	26,834,999
Bonds & Insurance - Open Cut	3.6%	$	3,705,936
SUBTOTAL - OPEN CUT		$	107,200,000
Direct Costs - Trenchless		$	50,236,274
General Requirement - Trenchless	15%	$	7,535,441
General Contractor OH&P - Trenchless	15%	$	7,535,441
Contingencies - Trenchless	35%	$	22,857,504
Bonds & Insurance - Trenchless	3.6%	$	3,156,641
SUBTOTAL - TRENCHLESS		$	91,300,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	148,800,000

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FROM AWP FACILITY TO LOS ANGELES RIVER SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	28,106	LF	$ 1,839.36	$ 51,697,190
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 51,697,190
Construction Method 2 - SCE Easement (Open Cut)				
84"		LF	$ 1,308.72	$ -
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ -
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	682	LF	$ 4,496.12	$ 3,066,356
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"	881	LF	$ 4,496.12	$ 3,961,084
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	18	EA	$ 374,625.47	$ 6,743,259
Mob/Demob (84")	9	EA	$ 200,000.00	$ 1,800,000
Subtotal -				$ 15,570,699
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"	5,037	LF	$ 5,620.15	$ 28,308,714
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	11	EA	$ 394,124.69	$ 4,335,372
Mob/Demob (84")	5	EA	$ 400,000.00	$ 2,000,000
Subtotal -				$ 34,644,086

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FROM AWP FACILITY TO LOS ANGELES RIVER SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	6	EA	$ 78,500.00	$ 529,418
Intersection Traffic Control (Trenchless)	2	EA	$ 12,500.00	$ 28,101
Landscaped Median (demo & replace)	1,150	LF	$ 214.44	$ 246,608
Raised Median (demo & replace)	5,300	LF	$ 202.94	$ 1,075,566
Subtotal -				$ 1,879,693
Added Pipeline Costs				
Major Utility Crossings				
84"	14	EA	$ 134,883.69	$ 1,888,372
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	2	EA	$ 899,224.60	$ 1,798,449
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 3,686,821
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"	1	EA	$1,199,973.51	$ 1,199,974
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	11,106	LF	$ 30.87	$ 342,895
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel		LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	406	LF	$ 35.29	$ 14,326
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	11,106	LF	$ 15.44	$ 171,447
Construction Method 2 - SCE Easement		LF	$ 3.09	$ -
Construction Method 3A - River Bank		LF	$ 3.09	$ -
Construction Method 3B & C - River Channel		LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	406	LF	$ 17.64	$ 7,163
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 58,978,020
Total Trenchless Direct Costs				$ 50,236,274

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ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

LOS ANGELES RIVER TO PALO VERDE AVE SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	60,192,999
General Requirement - Open Cut	15%	$	9,028,950
General Contractor OH&P - Open Cut	15%	$	9,028,950
Contingencies - Open Cut	35%	$	27,387,815
Bonds & Insurance - Open Cut	3.6%	$	3,782,280
SUBTOTAL - OPEN CUT		$	109,400,000
Direct Costs - Trenchless		$	17,644,275
General Requirement - Trenchless	15%	$	2,646,641
General Contractor OH&P - Trenchless	15%	$	2,646,641
Contingencies - Trenchless	35%	$	8,028,145
Bonds & Insurance - Trenchless	3.6%	$	1,108,694
SUBTOTAL - TRENCHLESS		$	32,100,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	106,100,000

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LOS ANGELES RIVER TO PALO VERDE AVE SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	27,031	LF	$ 1,839.36	$ 49,719,873
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 49,719,873
Construction Method 2 - SCE Easement (Open Cut)				
84"		LF	$ 1,308.72	$ -
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ -
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	172	LF	$ 4,496.12	$ 773,333
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"	628	LF	$ 4,496.12	$ 2,823,565
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	8	EA	$ 374,625.47	$ 2,997,004
Mob/Demob (84")	4	EA	$ 200,000.00	$ 800,000
Subtotal -				$ 7,393,902
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"	126	LF	$ 5,620.15	$ 708,139
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"	843	LF	$ 5,620.15	$ 4,737,790
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	8	EA	$ 394,124.69	$ 3,152,998
Mob/Demob (84")	4	EA	$ 400,000.00	$ 1,600,000
Subtotal -				$ 10,198,926

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LOS ANGELES RIVER TO PALO VERDE AVE SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	13	EA	$ 78,500.00	$ 1,147,073
Intersection Traffic Control (Trenchless)	3	EA	$ 12,500.00	$ 42,151
Landscaped Median (demo & replace)	1,145	LF	$ 214.44	$ 245,535
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ 1,434,760
Added Pipeline Costs				
Major Utility Crossings				
84"	21	EA	$ 134,883.69	$ 2,832,557
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	6	EA	$ 899,224.60	$ 5,395,348
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 8,227,905
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	17,500	LF	$ 30.87	$ 540,308
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	972	LF	$ 35.29	$ 34,297
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	17,500	LF	$ 15.44	$ 270,154
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	972	LF	$ 17.64	$ 17,149
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 60,192,999
Total Trenchless Direct Costs				$ 17,644,275

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Pure Water Feasibility Study

ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

PALO VERDE AVE TO NORTH OF 91 FREEWAY SUMMARY

Item Description	Quantity	Total Cost
Direct Costs - Open Cut		$ 19,036,415
General Requirement - Open Cut	15%	$ 2,855,462
General Contractor OH&P - Open Cut	15%	$ 2,855,462
Contingencies - Open Cut	35%	$ 8,661,569
Bonds & Insurance - Open Cut	3.6%	$ 1,196,170
SUBTOTAL - OPEN CUT		$ 34,600,000
Direct Costs - Trenchless		$ 16,150,742
General Requirement - Trenchless	15%	$ 2,422,611
General Contractor OH&P - Trenchless	15%	$ 2,422,611
Contingencies - Trenchless	35%	$ 7,348,587
Bonds & Insurance - Trenchless	3.6%	$ 1,014,846
SUBTOTAL - TRENCHLESS		$ 29,400,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$ 48,000,000

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PALO VERDE AVE TO NORTH OF 91 FREEWAY SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	9,122	LF	$ 1,839.36	$ 16,778,687
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 16,778,687
Construction Method 2 - SCE Easement (Open Cut)				
84"		LF	$ 1,308.72	$ -
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ -
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")		EA	$ 374,625.47	$ -
Mob/Demob (84")		EA	$ 200,000.00	$ -
Subtotal -				$ -
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"	2,428	LF	$ 5,620.15	$ 13,645,733
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	4	EA	$ 394,124.69	$ 1,576,499
Mob/Demob (84")	2	EA	$ 400,000.00	$ 800,000
Subtotal -				$ 16,022,232

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PALO VERDE AVE TO NORTH OF 91 FREEWAY SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	2	EA	$ 78,500.00	$ 176,473
Intersection Traffic Control (Trenchless)	3	EA	$ 12,500.00	$ 42,151
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)	145	LF	$ 202.94	$ 29,426
Subtotal -				$ 248,050
Added Pipeline Costs				
Major Utility Crossings				
84"		EA	$ 134,883.69	$ -
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	2	EA	$ 899,224.60	$ 1,798,449
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 1,798,449
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	4,561	LF	$ 30.87	$ 140,820
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	2,428	LF	$ 35.29	$ 85,673
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	4,561	LF	$ 15.44	$ 70,410
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	2,428	LF	$ 17.64	$ 42,836
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 19,036,415
Total Trenchless Direct Costs				$ 16,150,742

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Pure Water Feasibility Study

ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

NORTH OF 91 FREEWAY TO SOUTH OF 105 FREEWAY SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	16,154,575
General Requirement - Open Cut	15%	$	2,423,186
General Contractor OH&P - Open Cut	15%	$	2,423,186
Contingencies - Open Cut	35%	$	7,350,332
Bonds & Insurance - Open Cut	3.6%	$	1,015,087
SUBTOTAL - OPEN CUT		$	29,400,000
Direct Costs - Trenchless		$	4,708,579
General Requirement - Trenchless	15%	$	706,287
General Contractor OH&P - Trenchless	15%	$	706,287
Contingencies - Trenchless	35%	$	2,142,403
Bonds & Insurance - Trenchless	3.6%	$	295,868
SUBTOTAL - TRENCHLESS		$	8,600,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	28,400,000

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NORTH OF 91 FREEWAY TO SOUTH OF 105 FREEWAY SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"		LF	$ 1,839.36	$ -
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ -
Construction Method 2 - SCE Easement (Open Cut)				
84"	11,950	LF	$ 1,308.72	$ 15,639,238
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ 15,639,238
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"	625	LF	$ 4,496.12	$ 2,810,077
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	4	EA	$ 374,625.47	$ 1,498,502
Mob/Demob (84")	2	EA	$ 200,000.00	$ 400,000
Subtotal -				$ 4,708,579
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")		EA	$ 394,124.69	$ -
Mob/Demob (84")		EA	$ 400,000.00	$ -
Subtotal -				$ -

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NORTH OF 91 FREEWAY TO SOUTH OF 105 FREEWAY SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)		EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ -
Added Pipeline Costs				
Major Utility Crossings				
84"	3	EA	$ 134,883.69	$ 404,651
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"		EA	$ 899,224.60	$ -
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 404,651
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	11,950	LF	$ 6.17	$ 73,791
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	11,950	LF	$ 3.09	$ 36,895
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 16,154,575
Total Trenchless Direct Costs				$ 4,708,579

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SAN GABRIEL RIVER TUNNEL SUMMARY

Item Description	Quantity		Total Cost
Direct and Indirect Costs - Trenchless (from MJA Three Tunnels Report)		$	180,287,904
Contingencies - Trenchless	35%	$	63,100,766
SUBTOTAL - TRENCHLESS		$	243,400,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	180,300,000

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NORTH OF WASHINGTON AVE TO ROSE HILL / SHEPHERD ST SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	25,272,329
General Requirement - Open Cut	15%	$	3,790,849
General Contractor OH&P - Open Cut	15%	$	3,790,849
Contingencies - Open Cut	35%	$	11,498,910
Bonds & Insurance - Open Cut	3.6%	$	1,588,009
SUBTOTAL - OPEN CUT		$	45,900,000
Direct Costs - Trenchless		$	32,468,467
General Requirement - Trenchless	15%	$	4,870,270
General Contractor OH&P - Trenchless	15%	$	4,870,270
Contingencies - Trenchless	35%	$	14,773,153
Bonds & Insurance - Trenchless	3.6%	$	2,040,185
SUBTOTAL - TRENCHLESS		$	59,000,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	78,700,000

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NORTH OF WASHINGTON AVE TO ROSE HILL / SHEPHERD ST SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	3,045	LF	$ 1,839.36	$ 5,600,866
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 5,600,866
Construction Method 2 - SCE Easement (Open Cut)				
84"	12,340	LF	$ 1,308.72	$ 16,149,640
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ 16,149,640
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	110	LF	$ 4,496.12	$ 494,574
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	2	EA	$ 374,625.47	$ 749,251
Mob/Demob (84")	1	EA	$ 200,000.00	$ 200,000
Subtotal -				$ 1,443,824
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"	230	LF	$ 5,620.15	$ 1,292,635
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"	325	LF	$ 5,620.15	$ 1,826,550
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	4	EA	$ 394,124.69	$ 1,576,499
Mob/Demob (84")	2	EA	$ 400,000.00	$ 800,000
Subtotal -				$ 5,495,684

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NORTH OF WASHINGTON AVE TO ROSE HILL / SHEPHERD ST SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"	3,850	LF	$ 5,365.56	$ 20,657,420
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")	2	EA	$ 539,599.50	$ 1,079,199
Mob/Demob (84")	1	EA	$ 3,500,000.00	$ 3,500,000
Subtotal -				$ 25,236,619
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	1	EA	$ 78,500.00	$ 88,236
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ 88,236
Added Pipeline Costs				
Major Utility Crossings				
84"	8	EA	$ 134,883.69	$ 1,079,070
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	1	EA	$ 899,224.60	$ 899,225
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 1,978,294
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"	1	EA	$1,199,973.51	$ 1,199,974
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	3,045	LF	$ 30.87	$ 94,014
Construction Method 2 - SCE Easement	12,340	LF	$ 6.17	$ 76,199
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	110	LF	$ 49.99	$ 5,499
Construction Method 4B - Microtunnel	555	LF	$ 35.29	$ 19,583
Construction Method 4C - Traditional Tunneling	3,850	LF	$ 44.11	$ 169,811
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	3,045	LF	$ 15.44	$ 47,007
Construction Method 2 - SCE Easement	12,340	LF	$ 3.09	$ 38,099
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	110	LF	$ 24.99	$ 2,749
Construction Method 4B - Microtunnel	555	LF	$ 17.64	$ 9,792
Construction Method 4C - Traditional Tunneling	3,850	LF	$ 22.05	$ 84,906
Total Open Cut Direct Costs				$ 25,272,329
Total Trenchless Direct Costs				$ 32,468,467

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ROSE HILL / SHEPHERD ST TO SOUTH OF VALLEY BLVD SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	22,930,105
General Requirement - Open Cut	15%	$	3,439,516
General Contractor OH&P - Open Cut	15%	$	3,439,516
Contingencies - Open Cut	35%	$	10,433,198
Bonds & Insurance - Open Cut	3.6%	$	1,440,833
SUBTOTAL - OPEN CUT		$	41,700,000
Direct Costs - Trenchless		$	38,057,770
General Requirement - Trenchless	15%	$	5,708,665
General Contractor OH&P - Trenchless	15%	$	5,708,665
Contingencies - Trenchless	35%	$	17,316,285
Bonds & Insurance - Trenchless	3.6%	$	2,391,394
SUBTOTAL - TRENCHLESS		$	69,200,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	83,100,000

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ROSE HILL / SHEPHERD ST TO SOUTH OF VALLEY BLVD SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	880	LF	$ 1,839.36	$ 1,618,641
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 1,618,641
Construction Method 2 - SCE Easement (Open Cut)				
84"	12,875	LF	$ 1,308.72	$ 16,849,807
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ 16,849,807
Construction Method 3A - LAFCD Easement (River Bank)				
84"	2,540	LF	$ 1,317.74	$ 3,347,058
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ 3,347,058
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"	240	LF	$ 4,496.12	$ 1,079,070
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	2	EA	$ 374,625.47	$ 749,251
Mob/Demob (84")	1	EA	$ 200,000.00	$ 200,000
Subtotal -				$ 2,028,320
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"	125	LF	$ 6,182.17	$ 772,771
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"	4,505	LF	$ 5,921.39	$ 26,675,880
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	14	EA	$ 394,124.69	$ 5,517,746
Mob/Demob (84")	7	EA	$ 400,000.00	$ 2,800,000
Subtotal -				$ 35,766,397

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ROSE HILL / SHEPHERD ST TO SOUTH OF VALLEY BLVD SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	0	EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)	600	LF	$ 202.94	$ 121,762
Subtotal -				$ 121,762
Added Pipeline Costs				
Major Utility Crossings				
84"	6	EA	$ 134,883.69	$ 809,302
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	0	EA	$ 899,224.60	$ -
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 809,302
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	880	LF	$ 30.87	$ 27,170
Construction Method 2 - SCE Easement	12,875	LF	$ 6.17	$ 79,502
Construction Method 3A - River Bank	2,540	LF	$ 6.17	$ 15,684
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	240	LF	$ 49.99	$ 11,997
Construction Method 4B - Microtunnel	4,630	LF	$ 35.29	$ 163,371
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	880	LF	$ 15.44	$ 13,585
Construction Method 2 - SCE Easement	12,875	LF	$ 3.09	$ 39,751
Construction Method 3A - River Bank	2,540	LF	$ 3.09	$ 7,842
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	240	LF	$ 24.99	$ 5,999
Construction Method 4B - Microtunnel	4,630	LF	$ 17.64	$ 81,686
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 22,930,105
Total Trenchless Direct Costs				$ 38,057,770

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ROSE HILL / SHEPHERD ST TO SOUTH OF VALLEY BLVD SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	33,268,517
General Requirement - Open Cut	15%	$	4,990,277
General Contractor OH&P - Open Cut	15%	$	4,990,277
Contingencies - Open Cut	35%	$	15,137,175
Bonds & Insurance - Open Cut	3.6%	$	2,090,457
SUBTOTAL - OPEN CUT		$	60,500,000
Direct Costs - Trenchless		$	21,701,535
General Requirement - Trenchless	15%	$	3,255,230
General Contractor OH&P - Trenchless	15%	$	3,255,230
Contingencies - Trenchless	35%	$	9,874,198
Bonds & Insurance - Trenchless	3.6%	$	1,363,635
SUBTOTAL - TRENCHLESS		$	39,400,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	74,900,000

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ROSE HILL / SHEPHERD ST TO SOUTH OF VALLEY BLVD SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	6,420	LF	$ 1,839.36	$ 11,808,723
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 11,808,723
Construction Method 2 - SCE Easement (Open Cut)				
84"	15,575	LF	$ 1,308.72	$ 20,383,359
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ 20,383,359
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	420	LF	$ 4,496.12	$ 1,888,372
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"	230	LF	$ 4,496.12	$ 1,034,108
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	10	EA	$ 374,625.47	$ 3,746,255
Mob/Demob (84")	5	EA	$ 200,000.00	$ 1,000,000
Subtotal -				$ 7,668,735
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"	1,950	LF	$ 5,921.39	$ 11,546,718
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	4	EA	$ 394,124.69	$ 1,576,499
Mob/Demob (84")	2	EA	$ 400,000.00	$ 800,000
Subtotal -				$ 13,923,217

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ROSE HILL / SHEPHERD ST TO SOUTH OF VALLEY BLVD SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	2	EA	$ 78,500.00	$ 176,473
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)	250	LF	$ 214.44	$ 53,610
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ 230,083
Added Pipeline Costs				
Major Utility Crossings				
84"	6	EA	$ 134,883.69	$ 809,302
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	0	EA	$ 899,224.60	$ -
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 809,302
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	4,000	LF	$ 6.17	$ 24,700
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	85	LF	$ 49.99	$ 4,249
Construction Method 4B - Microtunnel	1,950	LF	$ 35.29	$ 68,807
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	4,000	LF	$ 3.09	$ 12,350
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	85	LF	$ 24.99	$ 2,124
Construction Method 4B - Microtunnel	1,950	LF	$ 17.64	$ 34,403
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 33,268,517
Total Trenchless Direct Costs				$ 21,701,535

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Pure Water Feasibility Study

ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

LIVE OAK AVE AND RIVERGRADE RD TO LARIO PARK ENTRANCE SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	46,943,956
General Requirement - Open Cut	15%	$	7,041,593
General Contractor OH&P - Open Cut	15%	$	7,041,593
Contingencies - Open Cut	35%	$	21,359,500
Bonds & Insurance - Open Cut	3.6%	$	2,949,765
SUBTOTAL - OPEN CUT		$	85,300,000
Direct Costs - Trenchless		$	11,737,861
General Requirement - Trenchless	15%	$	1,760,679
General Contractor OH&P - Trenchless	15%	$	1,760,679
Contingencies - Trenchless	35%	$	5,340,727
Bonds & Insurance - Trenchless	3.6%	$	737,559
SUBTOTAL - TRENCHLESS		$	21,300,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	80,000,000

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LIVE OAK AVE AND RIVERGRADE RD TO LARIO PARK ENTRANCE SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	22,737	LF	$ 1,839.36	$ 41,821,640
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ 41,821,640
Construction Method 2 - SCE Easement (Open Cut)				
84"		LF	$ 1,308.72	$ -
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ -
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	180	LF	$ 4,496.12	$ 809,302
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"	283	LF	$ 4,496.12	$ 1,272,403
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")	6	EA	$ 374,625.47	$ 2,247,753
Mob/Demob (84")	3	EA	$ 200,000.00	$ 600,000
Subtotal -				$ 4,929,458
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"	1,000	LF	$ 5,620.15	$ 5,620,154
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")	2	EA	$ 394,124.69	$ 788,249
Mob/Demob (84")	1	EA	$ 400,000.00	$ 400,000
Subtotal -				$ 6,808,403

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LIVE OAK AVE AND RIVERGRADE RD TO LARIO PARK ENTRANCE SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	15	EA	$ 78,500.00	$ 1,323,546
Intersection Traffic Control (Trenchless)	1	EA	$ 12,500.00	$ 14,050
Landscaped Median (demo & replace)	1,553	LF	$ 214.44	$ 333,028
Raised Median (demo & replace)	1,500	LF	$ 202.94	$ 304,406
Subtotal -				$ 1,975,030
Added Pipeline Costs				
Major Utility Crossings				
84"	10	EA	$ 134,883.69	$ 1,348,837
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"	2	EA	$ 899,224.60	$ 1,798,449
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 3,147,286
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 46,943,956
Total Trenchless Direct Costs				$ 11,737,861

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Pure Water Feasibility Study
ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

LARIO PARK ENTRANCE TO CANYON SPREADING GROUNDS SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	7,128,944
General Requirement - Open Cut	15%	$	1,069,342
General Contractor OH&P - Open Cut	15%	$	1,069,342
Contingencies - Open Cut	35%	$	3,243,670
Bonds & Insurance - Open Cut	3.6%	$	447,954
SUBTOTAL - OPEN CUT		$	13,000,000
Direct Costs - Trenchless		$	872,200
General Requirement - Trenchless	15%	$	130,830
General Contractor OH&P - Trenchless	15%	$	130,830
Contingencies - Trenchless	35%	$	396,851
Bonds & Insurance - Trenchless	3.6%	$	54,805
SUBTOTAL - TRENCHLESS		$	1,600,000
Direct and Indirect Costs - Vault Structure and Basin Outelts		$	1,100,000
Contingencies - Trenchless	35%	$	385,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	12,000,000

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Opinion of Probable Construction Cost
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LARIO PARK ENTRANCE TO CANYON SPREADING GROUNDS SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"		LF	$ 1,839.36	$ -
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ -
Construction Method 2 - SCE Easement (Open Cut)				
84"		LF	$ 1,308.72	$ -
66"		LF	$ 907.69	$ -
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
48"	10,320	LF	$ 678.77	$ 7,004,944
Subtotal -				$ 7,004,944
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"		LF	$ 835.56	$ -
54"		LF	$ 786.09	$ -
Subtotal -				$ -
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"		LF	$ 4,496.12	$ -
66"		LF	$ 4,533.72	$ -
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
48"	80	LF	$ 3,840.00	$ 307,200
200 - 2000 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
48"				
Shafts (48")	2	EA	$ 200,000.00	$ 400,000
Mob/Demob (48")	1	EA	$ 165,000.00	$ 165,000
Subtotal -				$ 872,200
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")		EA	$ 394,124.69	$ -
Mob/Demob (84")		EA	$ 400,000.00	$ -
Subtotal -				$ -

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Opinion of Probable Construction Cost
June 2022

LARIO PARK ENTRANCE TO CANYON SPREADING GROUNDS SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Vault Structure and Basin Outlets				
Single vault with multiple PRVs and two separate outlet structures	1	EA	$ 1,100,000.00	$ 1,100,000
Subtotal -				$ 1,100,000
Added Sitework Costs				
Intersection Traffic Control (Open Cut)		EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ -
Added Pipeline Costs				
Major Utility Crossings				
84"		EA	$ 134,883.69	$ -
66"		EA	$ 136,511.60	$ -
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
48"	1	EA	$ 124,000.00	$ 124,000
Major Intersection Crossings				
84"		EA	$ 899,224.60	$ -
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ 124,000
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
66"		EA	$689,030.85	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
48"	3	EA	$136,000.00	$ 408,000
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 7,128,944
Total Trenchless Direct Costs				$ 872,200
Total Vault Structure Direct and Indirect Costs Direct Costs				$ 1,100,000

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Metropolitan Water District of Southern California
Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

Backbone Pump Stations Phase 1

Assumptions

1. This preliminary Opinion of Probable Construction Cost used the cost developed during the FLDR escalated to June 2022 dollars.
2. More detailed cost estimates should be completed during subsequent design phases

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Pump Station at Whittier Narrows				
Pump Station at Whittier Narrows	1	each	$ 58,100,000.00	$ 58,100,000.00
DPR PS 1 - Set A 40 MGD @ 200 feet of lift; Set B 35 MGD	1	each	$ 30,312,396.41	$ 30,000,000.00
Total Direct and Indirect Costs - Pump Station at Whittier Narrows				**$ 88,000,000.00**
Contingency	35%			**$ 31,000,000.00**
TOTAL PROBABLE CONSTRUCTION COST - Pump Station at Whittier Narrows				**$119,000,000.00**

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Pure Water Feasibility Study

ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

SANTA FE LATERAL TO UNITED ROCK PIT 3 SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	4,177,782
General Requirement - Open Cut	15%	$	626,667
General Contractor OH&P - Open Cut	15%	$	626,667
Contingencies - Open Cut	35%	$	1,900,891
Bonds & Insurance - Open Cut	3.6%	$	262,515
SUBTOTAL - OPEN CUT		$	7,600,000
Direct Costs - Trenchless		$	3,616,072
General Requirement - Trenchless	15%	$	542,411
General Contractor OH&P - Trenchless	15%	$	542,411
Contingencies - Trenchless	35%	$	1,645,313
Bonds & Insurance - Trenchless	3.6%	$	227,219
SUBTOTAL - TRENCHLESS		$	6,600,000
Direct and Indirect Costs - Vault Structure and Basin Outelts		$	1,850,000
Contingencies - Trenchless	35%	$	647,500
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	12,500,000

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Opinion of Probable Construction Cost
June 2022

SANTA FE LATERAL TO UNITED ROCK PIT 3 SUMMARY

Item Description	Quantity	Unit		Unit Cost		Total Cost
Construction Method 1 - Roadway (Open Cut)						
84"		LF	$	1,839.36	$	-
60"		LF	$	1,367.30	$	-
54"		LF	$	1,341.71	$	-
Subtotal -					$	-
Construction Method 2 - SCE Easement (Open Cut)						
84"		LF	$	1,308.72	$	-
66"		LF	$	907.69	$	-
60"		LF	$	843.89	$	-
54"		LF	$	793.47	$	-
Subtotal -					$	-
Construction Method 3A - LAFCD Easement (River Bank)						
84"		LF	$	1,317.74	$	-
60"	5,000	LF	$	835.56	$	4,177,782
54"		LF	$	786.09	$	-
Subtotal -					$	4,177,782
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)						
84"		LF	$	2,159.54	$	-
60"		LF	$	1,533.17	$	-
54"		LF	$	1,438.70	$	-
Subtotal -					$	-
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)						
84"		LF	$	2,352.47	$	-
60"		LF	$	1,685.24	$	-
54"		LF	$	1,585.59	$	-
Subtotal -					$	-
Construction Method 4A - Jack & Bore (Trenchless)						
< 200 Feet						
84"		LF	$	4,496.12	$	-
60"		LF	$	4,383.72	$	-
54"		LF	$	4,271.32	$	-
200 - 2000 Feet						
84"		LF	$	4,496.12	$	-
60"		LF	$	4,459.03	$	-
54"		LF	$	4,248.84	$	-
Shafts (84")		EA	$	374,625.47	$	-
Mob/Demob (84")		EA	$	200,000.00	$	-
Subtotal -					$	-
Construction Method 4B - Microtunneling (Trenchless)						
< 200 Feet, No Boulders						
84"		LF	$	5,620.15	$	-
60"		LF	$	6,069.77	$	-
54"		LF	$	5,957.36	$	-
< 200 Feet, With Boulders						
84"		LF	$	6,182.17	$	-
60"	275	LF	$	6,069.77	$	1,669,186
54"		LF	$	5,957.36	$	-
200 - 2000 Feet, No Boulders						
84"		LF	$	5,620.15	$	-
60"		LF	$	4,796.24	$	-
54"		LF	$	4,586.05	$	-
200 - 2000 Feet, With Boulders						
84"		LF	$	5,921.39	$	-
60"		LF	$	4,964.84	$	-
54"		LF	$	4,754.65	$	-
Shafts (60")	4	EA	$	286,721.46	$	1,146,886
Mob/Demob (60")	2	EA	$	400,000.00	$	800,000
Subtotal -					$	3,616,072

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Los Angeles and Orange Counties, CA
Metropolitan Water District of Southern California
Pure Water Conveyance Feasibility Study
Opinion of Probable Construction Cost
June 2022

SANTA FE LATERAL TO UNITED ROCK PIT 3 SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Vault Structure and Basin Outlets				
Single vault with multiple PRVs and two separate outlet structures	1	EA	$ 1,850,000.00	$ 1,850,000
Subtotal -				$ 1,850,000
Added Sitework Costs				
Intersection Traffic Control (Open Cut)		EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ -
Added Pipeline Costs				
Major Utility Crossings				
84"		EA	$ 134,883.69	$ -
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"		EA	$ 899,224.60	$ -
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ -
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 4,177,782
Total Trenchless Direct Costs				$ 3,616,072
Total Vault Structure Direct and Indirect Costs Direct Costs				$ 1,850,000

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550 S. Hope Street, Suite 2250, Los Angeles, California 90071
B&V Project 410259

FINAL DRAFT SUBMITTAL

Metropolitan Water District of Southern California
Los Angeles and Orange Counties, CA
Pure Water Feasibility Study

ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

BACKBONE TO SAN GABRIEL COASTAL SPREADING GROUNDS SUMMARY

Item Description	Quantity		Total Cost
Direct Costs - Open Cut		$	417,778
General Requirement - Open Cut	15%	$	62,667
General Contractor OH&P - Open Cut	15%	$	62,667
Contingencies - Open Cut	35%	$	190,089
Bonds & Insurance - Open Cut	3.6%	$	26,251
SUBTOTAL - OPEN CUT		$	800,000
Direct Costs - Trenchless		$	-
General Requirement - Trenchless	15%	$	-
General Contractor OH&P - Trenchless	15%	$	-
Contingencies - Trenchless	35%	$	-
Bonds & Insurance - Trenchless	3.6%	$	-
SUBTOTAL - TRENCHLESS		$	-
Direct and Indirect Costs - Vault Structure and Basin Outelts		$	1,850,000
Contingencies - Trenchless	35%	$	647,500
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$	2,400,000

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Los Angeles and Orange Counties, CA
Metropolitan Water District of Southern California
Pure Water Conveyance Feasibility Study
Opinion of Probable Construction Cost
June 2022

BACKBONE TO SAN GABRIEL COASTAL SPREADING GROUNDS SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"		LF	$ 1,839.36	$ -
60"		LF	$ 1,367.30	$ -
54"		LF	$ 1,341.71	$ -
Subtotal -				$ -
Construction Method 2 - SCE Easement (Open Cut)				
84"		LF	$ 1,308.72	$ -
66"		LF	$ 907.69	$ -
60"		LF	$ 843.89	$ -
54"		LF	$ 793.47	$ -
Subtotal -				$ -
Construction Method 3A - LAFCD Easement (River Bank)				
84"		LF	$ 1,317.74	$ -
60"	500	LF	$ 835.56	$ 417,778
54"		LF	$ 786.09	$ -
Subtotal -				$ 417,778
Construction Method 3B - LAFCD Easement (Open Cut Earthen Channel)				
84"		LF	$ 2,159.54	$ -
60"		LF	$ 1,533.17	$ -
54"		LF	$ 1,438.70	$ -
Subtotal -				$ -
Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)				
84"		LF	$ 2,352.47	$ -
60"		LF	$ 1,685.24	$ -
54"		LF	$ 1,585.59	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,383.72	$ -
54"		LF	$ 4,271.32	$ -
200 - 2000 Feet				
84"		LF	$ 4,496.12	$ -
60"		LF	$ 4,459.03	$ -
54"		LF	$ 4,248.84	$ -
Shafts (84")		EA	$ 374,625.47	$ -
Mob/Demob (84")		EA	$ 200,000.00	$ -
Subtotal -				$ -
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,182.17	$ -
60"		LF	$ 6,069.77	$ -
54"		LF	$ 5,957.36	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 5,620.15	$ -
60"		LF	$ 4,796.24	$ -
54"		LF	$ 4,586.05	$ -
200 - 2000 Feet, With Boulders				
84"		LF	$ 5,921.39	$ -
60"		LF	$ 4,964.84	$ -
54"		LF	$ 4,754.65	$ -
Shafts (84")		EA	$ 394,124.69	$ -
Mob/Demob (84")		EA	$ 400,000.00	$ -
Subtotal -				$ -

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Los Angeles and Orange Counties, CA
Metropolitan Water District of Southern California
Pure Water Conveyance Feasibility Study
Opinion of Probable Construction Cost
June 2022

BACKBONE TO SAN GABRIEL COASTAL SPREADING GROUNDS SUMMARY

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 5,365.56	$ -
60"		LF	$ 5,121.94	$ -
54"		LF	$ 5,109.65	$ -
Slurry TBM				
84"		LF	$ 4,864.13	$ -
60"		LF	$ 3,474.38	$ -
54"		LF	$ 3,126.94	$ -
Shafts (84")		EA	$ 539,599.50	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Vault Structure and Basin Outlets				
Single vault with multiple PRVs and two separate outlet structures	1	EA	$ 1,850,000.00	$ 1,850,000
Subtotal -				$ 1,850,000
Added Sitework Costs				
Intersection Traffic Control (Open Cut)		EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 214.44	$ -
Raised Median (demo & replace)		LF	$ 202.94	$ -
Subtotal -				$ -
Added Pipeline Costs				
Major Utility Crossings				
84"		EA	$ 134,883.69	$ -
60"		EA	$ 131,511.60	$ -
54"		EA	$ 128,139.51	$ -
Major Intersection Crossings				
84"		EA	$ 899,224.60	$ -
60"		EA	$ 891,806.00	$ -
54"		EA	$ 849,767.25	$ -
Subtotal -				$ -
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,199,973.51	$ -
60"		EA	$574,284.19	$ -
54"		EA	$380,208.12	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 3B & C - River Channel	0	LF	$ 8.82	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 3B & C - River Channel	0	LF	$ 4.41	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -
Total Open Cut Direct Costs				$ 417,778
Total Trenchless Direct Costs				$ -
Total Vault Structure Direct and Indirect Costs Direct Costs				$ 1,850,000

Los Angeles, California
Metropolitan Water District of Southern California
Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

Service Connections

Assumptions
1. This preliminary Opinion of Probable Construction Cost used parametric costs for these facilities
2. More detailed cost estimates should be completed during subsequent design phases
3. Each service connection sized up to 10-15 MGD
4. Each service connection incudes a flow meter, isolation valve and would be located in below grade vaults

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Service Connections - Initial Delivery Package				
Service Connections	3	each	$ 3,000,000.00	$ 9,000,000.00
Total Direct and Indirect Costs - Initial Delivery Package				**$ 9,000,000.00**
Contingency	35%			**$ 3,000,000.00**
TOTAL PROBABLE CONSTRUCTION COST - INITIAL DELIVERY PACKAGE				**$ 12,000,000.00**

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Service Connections - Remainder of Backbone				
Service Connections	6	each	$ 3,000,000.00	$ 18,000,000.00
Total Direct and Indirect Costs - Remainder of Backbone				**$ 18,000,000.00**
Contingency	35%			**$ 6,000,000.00**
TOTAL PROBABLE CONSTRUCTION COST - REMAINDER OF BACKBONE				**$ 24,000,000.00**

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Service Connections - DPR				
Service Connections	0	each	$ 3,000,000.00	$ -
Total Direct and Indirect Costs - DPR Pipeline				**$ -**
Contingency	35%			**$ -**
TOTAL PROBABLE CONSTRUCTION COST - DPR PIPELINE				**$ -**

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Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
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Sectionalizing Valves

Assumptions

1. This preliminary Opinion of Probable Construction Cost used parametric costs for these facilities
2. More detailed cost estimates should be completed during subsequent design phases
3. Up to 7 sectionalizing valves would be constructed at approximately 6 mile spacing
4. Sectionalizing valves would be located in below grade vaults

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Sectionalizing Valve and Vault				
Initial Delivery Package	1	each	$ 5,000,000.00	$ 5,000,000.00
Total Direct and Indirect Costs - Initial Delivery Package				**$ 5,000,000.00**
Contingency	35%			**$ 2,000,000.00**
TOTAL PROBABLE CONSTRUCTION COST - INITIAL DELIVERY PACKAGE				**$ 7,000,000.00**

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Sectionalizing Valve and Vault				
Remainder of Backbone	6	each	$ 5,000,000.00	$ 30,000,000.00
Total Direct and Indirect Costs - Remainder of Backbone				**$ 30,000,000.00**
Contingency	35%			**$ 11,000,000.00**
TOTAL PROBABLE CONSTRUCTION COST - REMAINDER OF BACKBONE				**$ 41,000,000.00**

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Utility Relocation Allowance

Assumptions

1. An allowance has been provided for utility relocations along the pipeline. This allowance is based on the best available information.
2. This preliminary engineers Opinion of Probable Construction Cost uses parametric costs for smaller diameter piping of $35/in diam lf
3. More detailed cost estimates should be completed during subsequent design phases

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Utility Relocation				
24"	1,000	lf	$ 840.00	$ 840,000.00
20"	1,000	lf	$ 700.00	$ 700,000.00
18"	1,000	lf	$ 630.00	$ 630,000.00
16"	3,000	lf	$ 560.00	$ 1,680,000.00
12"	3,000	lf	$ 420.00	$ 1,260,000.00
8"	28,461	lf	$ 280.00	$ 7,969,080.00
6"	33,597	lf	$ 210.00	$ 7,055,370.00
4"	1,500	lf	$ 140.00	$ 210,000.00
3"	1,000	lf	$ 105.00	$ 105,000.00
Total Direct and Indirect Costs				**$ 20,000,000.00**
Contingency	35%			**$ 7,000,000.00**
TOTAL PROBABLE CONSTRUCTION COST				**$ 27,000,000.00**

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Hazardous Soils and Groundwater Allowance

Assumptions
1. Hazardous soils removal and/or remediation was not studied as part of this phase of work.
A placeholder cost has been included until Metropolitan can update it.

Item Description	Quantity	Unit	Unit Cost $		Total Cost $
Hazardous Soils Allowance					
Assumed 5 percent of pipeline costs	5%	%	Pipeline Costs	$	-
Total Direct and Indirect Costs				**$**	**-**
Contingency	35%			**$**	**-**
TOTAL PROBABLE COST				**$**	**-**

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Fiber Optics Allowance

Assumptions
1. 4-inch duct with 48 count fiber.

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Fiber Optics Allowance				
Fiber Optics on Backbone	42	mi	$ 200,000.00	$ 9,000,000.00
Total Direct and Indirect Costs				**$ 9,000,000.00**
Contingency	35%			**$ 3,000,000.00**
TOTAL PROBABLE COST				**$ 12,000,000.00**

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Los Angeles, California
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Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
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Repurposing Azusa Pipeline

Assumptions

1. This preliminary engineers Opinion of Probable Construction Cost uses parametric costs for smaller diameter piping of $40/in diam lf
2. More detailed cost estimates should be completed during subsequent design phases

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
New Piping to Reach Azusa Pipeline				
30"	7,100	lf	$ 1,200	$ 8,520,000
Improvements at Big Dalton PRS				
30" up to 1000 feet	1,000	lf	$ 1,200	$ 1,200,000
Valve Vault with isolation valve	1	each	$ 200,000	$ 200,000
Allowance for connection to existing pipeline	2	each	$ 40,000	$ 80,000
Isolation and Control Valving at La Verne Pipeline				
30" up to 250 feet	250	lf	$ 450	$ 112,500
Valve Vault with isolation valve and control valves	1	each	$ 400,000	$ 400,000
Allowance for connection to existing pipeline	1	each	$ 200,000	$ 200,000
New Pump Stations				
25 mgd pump station @ ~370 feet of head	2	each	$ 20,500,000	$ 41,000,000
Total Direct and Indirect Costs				**$ 52,000,000**
Contingency	35%			**$ 18,000,000**
TOTAL PROBABLE CONSTRUCTION COST				**$ 70,000,000**

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Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

Operational Storage at Weymouth

Assumptions
1. This preliminary engineers Opinion of Probable Construction Cost uses parametric costs for storage tanks of $2/gallon
2. More detailed cost estimates should be completed during subsequent design phases

Item Description	Quantity	Unit	Unit Cost $	Total Cost $
Operational Storage Tank				
Up to 5 MG	5,000,000	Gallon	$ 2.00	$ 10,000,000.00
Total Direct and Indirect Costs				**$ 10,000,000.00**
Contingency	35%			**$ 4,000,000.00**
TOTAL PROBABLE COST				**$ 14,000,000.00**

Details on Typical Unit Costs for Each Construction Method

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Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

Construction Method 1 - Roadways

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 Asphalt Paving is assumed to be 6" thick
5 For Every linear foot of pipe there will be a linear foot of temporary fencing
6 For every 8 feet of pipe there will be 1 foot of fabric silt fence
7 Pipe joint welds will be inspected every 40 ft
8 Pipe joints will be welded every 40 ft
9 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
10 Blow offs are assumed to be installed every 2500 feet.
11 Speed shoring is the standard shoring method
12 Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Calculate Cost per Linear Foot for Construction Method 1 - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	Notes
Demolition					
Sawcutting	2.000	LF	$ 2.41	$ 4.83	Quantity = 2 LF per 1 LF of pipe
Asphalt Paving Removal	15.000	SF	$ 0.90	$ 13.57	Quantity = (Trench Width + 4 ft) X 1 LF of Pipe
1" Milling	2.333	SY	$ 1.93	$ 4.50	Quantity = (((Width of construction zone - (Trench Width + 4ft)) X 1 LF of Pipe
Transportation and Disposal Fees (Recycle A/C)	0.278	CY	$ 241.28	$ 67.02	Quantity = (AC Paving Removal X Thickness X 1 LF)/27
Subtotal				$ 89.92	Per linear foot
Site Work					
Temporary Fencing	1.000	LF	$ 7.24	$ 7.24	Quantity = 1 LF per 1 LF of pipe
Traffic Control	1.000	LF	$ 34.80	$ 34.80	Quantity = 1 LF per 1 LF of pipe
Sweeper & Water Truck	1.000	LF	$ 44.54	$ 44.54	Quantity = 1 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 41.76	$ 41.76	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 180.96	$ 180.96	Quantity = 1 LF per 1 LF of pipe
Utility Crossings					
Gas	0.001	LF	$ 2,859.13	$ 3.25	Quantity = average of 2 1-mile sample segments
Telephone/Cable TV	0.001	LF	$ 289.53	$ 0.16	Quantity = average of 2 1-mile sample segments
Electric	0.001	LF	$ 1,435.59	$ 0.82	Quantity = average of 2 1-mile sample segments
Sewer	0.002	LF	$ 434.30	$ 0.90	Quantity = average of 2 1-mile sample segments
Water	0.001	LF	$ 434.30	$ 0.25	Quantity = average of 2 1-mile sample segments
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 3.62	$ 0.45	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 4.83	$ 0.09	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 315.22	Per linear foot
Earthwork					
Mass Trench Excavation - Vertical Trenching	6.60	CY	$ 12.06	$ 79.67	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	31.58	SF	$ 2.41	$ 76.20	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	6.60	CY	$ 4.22	$ 27.89	Quantity = Excavation
Gravel Bedding & Pipe Cover	0.96	CY	$ 38.60	$ 37.08	Quantity = (((Trench Width X ½ Pipe Dia) - (½ Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.41	$ 3.03	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	4.097	CY	$ 4.22	$ 17.30	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	4.097	CY	$ 21.71	$ 88.97	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	2.507	CY	$ 10.86	$ 27.22	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 3.62	$ 4.54	Quantity = Fine Grading & Compaction
Subtotal				$ 361.90	
Pipeline					
84" WSP CML	1.000	LF	$ 613.72	$ 613.72	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 168.89	$ 168.89	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,066.81	$ 126.67	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 506.68	$ 12.67	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 1.81	$ 1.81	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 3.33	$ 3.33	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.46	$ 0.46	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.0004	EA	$ 13,270.21	$ 5.31	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.0004	EA	$ 12,063.82	$ 4.83	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 937.69	Per linear foot
Site Restoration					
Asphalt Paving	1.667	SY	$ 65.14	$ 108.57	Quantity = Asphalt Paving Removal / 9
1" Asphalt Overlay	2.333	SY	$ 1.51	$ 3.52	Quantity = Milling / 9
General Site Restoration	36.000	SF	$ 0.60	$ 21.71	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 603.19	$ 0.83	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 134.64	Per linear foot
Total Cost per Linear Foot				**$ 1,839.36**	Per linear foot

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Los Angeles, California
Metropolitan Water District of Southern California
Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

Construction Method 2 - SCE Easement

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 For Every linear foot of pipe there will be a linear foot of temporary fencing
5 For every 8 feet of pipe there will be 1 foot of fabric silt fence
6 Pipe joint welds will be inspected every 40 ft
7 Pipe joints will be welded every 40 ft
8 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9 Blow offs are assumed to be installed every 2500 feet.
10 Speed shoring is the standard shoring method
11 Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.3
June 2022 ENR CCI for LA:	13488.7
Escalation %	12.4%

Calculate Cost per Linear Foot for Construction Method 2 - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	Notes
Demolition					
Clearing and Grubbing	0.001	AC	$ 4,463.61	$ 3.69	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 3.69	Per LF
Site Work					
Temporary Fencing	2.000	LF	$ 7.24	$ 14.48	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 8.35	$ 8.35	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 36.19	$ 36.19	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 3.62	$ 0.45	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 4.83	$ 0.09	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 59.56	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	4.93	CY	$ 12.06	$ 59.49	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	23.58	SF	$ 2.41	$ 56.90	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	4.93	CY	$ 4.22	$ 20.82	Quantity = Excavation
Gravel Bedding & Pipe Cover	0.96	CY	$ 38.60	$ 37.08	Quantity = (((Trench Width X ½ Pipe Dia) - (½ Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.41	$ 3.03	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	2.424	CY	$ 4.22	$ 10.24	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	2.424	CY	$ 21.71	$ 52.64	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	2.507	CY	$ 10.86	$ 27.22	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 3.62	$ 4.54	Quantity = Fine Grading & Compaction
Subtotal				$ 271.96	Per LF
Pipeline					
84" WSP CML	1.000	LF	$ 613.72	$ 613.72	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 168.89	$ 168.89	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,066.81	$ 126.67	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 506.68	$ 12.67	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 1.81	$ 1.81	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 16.67	$ 16.67	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.46	$ 0.46	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.000	EA	$ 13,270.21	$ 5.31	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.000	EA	$ 12,063.82	$ 4.83	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 951.02	Per LF
Site Restoration					
General Site Restoration	36.000	SF	$ 0.60	$ 21.71	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 603.19	$ 0.78	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 22.49	Per LF
Total Cost per Linear Foot				**$ 1,308.72**	Per LF

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Construction Method 3A - LAFCD Easement (River Bank)

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 For Every linear foot of pipe there will be a linear foot of temporary fencing
5 For every 8 feet of pipe there will be 1 foot of fabric silt fence
6 Pipe joint welds will be inspected every 40 ft
7 Pipe joints will be welded every 40 ft
8 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9 Blow offs are assumed to be installed every 2500 feet.
10 Speed shoring is the standard shoring method
11 Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Calculate Cost per Linear Foot for Construction Method 3A - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	Notes
Demolition					
Clearing and Grubbing	0.001	AC	$ 4,764.91	$ 3.94	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Subtotal				$ 3.94	Per LF
Site Work					
Temporary Fencing	2.000	LF	$ 7.73	$ 15.45	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 8.92	$ 8.92	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 38.63	$ 38.63	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 3.86	$ 0.48	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 5.15	$ 0.10	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 63.58	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	4.93	CY	$ 12.88	$ 63.51	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	23.58	SF	$ 2.58	$ 60.74	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	4.93	CY	$ 4.51	$ 22.23	Quantity = Excavation
Gravel Bedding & Pipe Cover	0.96	CY	$ 41.21	$ 39.58	Quantity = (((Trench Width X ½ Pipe Dia) - (½ Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.58	$ 3.23	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	2.424	CY	$ 4.51	$ 10.93	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	2.424	CY	$ 23.18	$ 56.20	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	2.507	CY	$ 11.59	$ 29.06	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 3.86	$ 4.85	Quantity = Fine Grading & Compaction
Subtotal				$ 290.32	Per LF
Pipeline					
84" WSP CML	1.000	LF	$ 613.72	$ 613.72	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 168.89	$ 168.89	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,066.81	$ 126.67	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 506.68	$ 12.67	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 1.81	$ 1.81	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 3.33	$ 3.33	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.46	$ 0.46	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.000	EA	$ 13,270.21	$ 5.31	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.000	EA	$ 12,063.82	$ 4.83	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 937.69	Per LF
Site Restoration					
General Site Restoration	36.000	SF	$ 0.60	$ 21.71	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 603.19	$ 0.50	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Subtotal				$ 22.21	Per LF
Total Cost per Linear Foot				**$ 1,317.74**	Per LF

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Construction Method 3B- LAFCD Easement (Open Cut Earthen Channel)

Assumptions

1. Units listed as LF are for 1 linear foot of the Construction Method
2. Units listed as areas or volumes are for 1 linear foot of the Construction Method
3. Units listed as areas or volumes are for 1 linear foot of the Construction Method
4. For Every linear foot of pipe there will be a linear foot of temporary fencing
5. For every 8 feet of pipe there will be 1 foot of fabric silt fence
6. Pipe joint welds will be inspected every 40 ft
7. Pipe joints will be welded every 40 ft
8. Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9. Blow offs are assumed to be installed every 2500 feet.
10. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Calculate Cost per Linear Foot for Construction Method 3B - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	Notes
Demolition					
Clearing and Grubbing	0.001	AC	$ 4,463.61	$ 3.69	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Subtotal				$ 3.69	Per LF
Site Work					
Temporary Fencing	2.000	LF	$ 7.24	$ 14.48	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 8.35	$ 8.35	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 36.19	$ 36.19	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 3.62	$ 0.45	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 4.83	$ 0.09	Quantity = 1 ft of hay roll per 52 ft of pipe
Rubber Dam/Flow Diversion	1.000	LF	$ 48.15	$ 48.15	
Subtotal				$ 107.71	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	7.48	CY	$ 12.06	$ 90.24	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	36.58	SF	$ 2.41	$ 88.27	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils	7.480	CY	$ 4.22	$ 31.58	Quantity = Excavation
Concrete encasement	1.921	CY	$ 241.28	$ 463.50	Quantity = (((Trench Width X Pipe Dia + 1) - (Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.41	$ 3.03	Quantity = ((Trench Width) X 1 LF) / 9
CLSM Backfill	4.013	CY	$ 96.51	$ 387.27	Quantity = Excavation - Concrete Encasement - Pipe
Off-Site Disposal Stockpile Spoils	1.921	CY	$ 10.86	$ 20.86	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 3.62	$ 4.54	Quantity = Fine Grading & Compaction
Subtotal				$ 1,089.29	Per LF
Pipeline					
84" WSP CML	1.000	LF	$ 613.72	$ 613.72	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 168.89	$ 168.89	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,066.81	$ 126.67	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 506.68	$ 12.67	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 1.81	$ 1.81	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 2.28	$ 2.28	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.46	$ 0.46	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.000	EA	$ 13,270.21	$ 5.31	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.000	EA	$ 12,063.82	$ 4.83	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 936.64	Per LF
Site Restoration					
General Site Restoration	36.000	SF	$ 0.60	$ 21.71	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 603.19	$ 0.50	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Subtotal				$ 22.21	Per LF
Total Cost per Linear Foot				**$ 2,159.54**	Per LF

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Construction Method 3C - LAFCD Easement (Open Cut Concrete Lined Channel)

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 For Every linear foot of pipe there will be a linear foot of temporary fencing
5 For every 8 feet of pipe there will be 1 foot of fabric silt fence
6 Pipe joint welds will be inspected every 40 ft
7 Pipe joints will be welded every 40 ft
8 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9 Blow offs are assumed to be installed every 2500 feet.
10 Speed shoring is the standard shoring method
11 Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Calculate Cost per Linear Foot for Construction Method 3C - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	Notes
Demolition					
Concrete Slab Removal	15.00	SF	$ 5.43	$ 81.43	Quantity = (Trench Width + 4ft) X 1 LF of Pipe
Subtotal				$ 200.68	Per LF
Site Work					
Temporary Fencing	2.00	LF	$ 7.24	$ 14.48	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.00	LF	$ 8.35	$ 8.35	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.00	LF	$ 36.19	$ 36.19	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.13	LF	$ 3.62	$ 0.45	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.02	LF	$ 4.83	$ 0.09	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 59.56	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	4.93	CY	$ 12.06	$ 59.49	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	23.58	SF	$ 2.41	$ 56.90	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils	4.931	CY	$ 4.22	$ 20.82	Quantity = Excavation
Concrete Pipe Encasement	1.921	CY	$ 241.28	$ 463.50	Quantity = (((Trench Width X Pipe Dia + 1) - (Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.41	$ 3.03	Quantity = ((Trench Width) X 1 LF) / 9
CLSM Backfill	1.464	CY	$ 96.51	$ 141.27	Quantity = Excavation - Concrete Encasement - Pipe
Off-Site Disposal Stockpile Spoils	1.921	CY	$ 10.86	$ 20.86	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 3.62	$ 4.54	Quantity = Fine Grading & Compaction
Subtotal				$ 770.41	Per LF
Pipeline					
84" WSP CML	1.00	LF	$ 613.72	$ 613.72	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.00	LF	$ 168.89	$ 168.89	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.03	EA	$ 5,066.81	$ 126.67	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.03	EA	$ 506.68	$ 12.67	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.00	LF	$ 1.81	$ 1.81	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.00	LF	$ 3.33	$ 3.33	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.00	LF	$ 0.46	$ 0.46	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.00	EA	$ 13,270.21	$ 5.31	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.00	EA	$ 12,063.82	$ 4.83	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 937.69	Per LF
Site Restoration					
General Site Restoration	36.00	SF	$ 0.60	$ 21.71	Quantity = Width of Const Zone per 1 LF of Pipe
Concrete Slabs	15.00	SF	$ 24.13	$ 361.91	Quantity = Concrete Slab Removal
Final Site Cleanup	0.00	AC	$ 603.19	$ 0.50	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Subtotal				$ 384.13	Per LF
Total Cost per Linear Foot				**$ 2,352.47**	Per LF

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Construction Method 4A - Jack & Bore

Assumptions

1. Launching pits are assumed to be 30 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 16 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

6. 84", 60", and 54" carrier will be installed within 108", 84", and 78" permalok steel casing pipe and the annular space will be filled with low density cellular grout.

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	Notes
84" Jack & Bore (<200 ft)					
Launching Pit					
Excavation	648	CY	$ 12.06	$ 7,819.14	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.22	$ 2,736.70	Quantity = Excavation
Gravel Bedding	69	CY	$ 42.22	$ 2,910.48	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.41	$ 160.85	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.22	$ 2,249.74	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 21.71	$ 11,570.11	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 3.62	$ 241.28	Quantity = Length X Width
				$ 221,308.15	
Receiving Pit					
Excavation	346	CY	$ 12.06	$ 4,170.21	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,100	SF	$ 65.00	$ 136,500.00	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	346	CY	$ 4.22	$ 1,459.57	Quantity = Excavation
Gravel Bedding	34	CY	$ 42.22	$ 1,421.65	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	36	SY	$ 2.41	$ 85.79	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	281	CY	$ 4.22	$ 1,186.80	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	281	CY	$ 21.71	$ 6,103.56	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	65	CY	$ 35.00	$ 2,261.07	Quantiy = Excavation - Backfill
Rough Surface Compaction	36	SY	$ 3.62	$ 128.68	Quantity = Length X Width
				$ 153,317.33	
Shafts Subtotal		LS		**$ 374,625.47**	
Mob/Demob/Setup/Dism		LS		**$ 200,000.00**	
Pipe Jacking	200	LF	$ 4,496.12	$ 899,224.60	
Total Cost per LF				**4,496**	**$/LF**
84" Jack & Bore (200 ft - 2000 ft)					
Launching Pit					
Excavation	648	CY	$ 12.06	$ 7,819.14	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.22	$ 2,736.70	Quantity = Excavation
Gravel Bedding	69	CY	$ 42.22	$ 2,910.48	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.41	$ 160.85	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.22	$ 2,249.74	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 21.71	$ 11,570.11	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 3.62	$ 241.28	Quantity = Length X Width
				$ 221,308.15	
Receiving Pit					
Excavation	346	CY	$ 12.06	$ 4,170.21	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,100	SF	$ 65.00	$ 136,500.00	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	346	CY	$ 4.22	$ 1,459.57	Quantity = Excavation
Gravel Bedding	34	CY	$ 42.22	$ 1,421.65	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	36	SY	$ 2.41	$ 85.79	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	281	CY	$ 4.22	$ 1,186.80	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	281	CY	$ 21.71	$ 6,103.56	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	65	CY	$ 35.00	$ 2,261.07	Quantiy = Excavation - Backfill
Rough Surface Compaction	36	SY	$ 3.62	$ 128.68	Quantity = Length X Width
				$ 153,317.33	
Shafts Subtotal		LS		**$ 374,625.47**	
Mob/Demob/Setup/Dism		LS		**$ 200,000.00**	
Pipe Jacking	2,000	LF	$ 4,496.12	$ 8,992,245.99	
Total Cost per LF				**4,496**	**$/LF**

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Construction Method 4B - Microtunneling

Assumptions
1. Bore pits are assumed to be 30 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 20 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.
August 2018 ENR CCI for LA: 12000.25
June 2022 ENR CCI for LA: 13488.65
Escalation % 0.12403
6. 84", 60", and 54" carrier will be installed within 108", 84", and 78" permalok steel casing pipe and the annular space will be filled with low density cellular grout.

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	
84" Microtunnel (<200 ft, No Boulders)					
Launching Pit					
Excavation	648	CY	$ 12.06	$ 7,819.14	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.22	$ 2,736.70	Quantity = Excavation
Gravel Bedding	69	CY	$ 42.22	$ 2,910.48	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.41	$ 160.85	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.22	$ 2,249.74	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 21.71	$ 11,570.11	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 3.62	$ 241.28	Quantity = Length X Width
				$ 221,308.15	
Receiving Pit					
Excavation	432	CY	$ 12.06	$ 5,212.76	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$ 65.00	$ 151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$ 4.22	$ 1,824.47	Quantity = Excavation
Gravel Bedding	46	CY	$ 42.22	$ 1,940.32	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$ 2.41	$ 107.23	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$ 4.22	$ 1,499.83	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$ 21.71	$ 7,713.41	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$ 35.00	$ 2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$ 3.62	$ 160.85	Quantity = Length X Width
				$ 172,816.54	
Shafts Subtotal		LS		**$ 394,124.69**	
Mob/Demob/Setup/Dism		LS		**$ 400,000.00**	
Microtunneling	200	LF	$ 5,620.15	$ 1,124,030.75	
Total Cost per LF				**$ 5,620**	**$/LF**
84" Microtunnel (<200 ft, With Boulders)					
Launching Pit					
Excavation	648	CY	$ 12.06	$ 7,819.14	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.22	$ 2,736.70	Quantity = Excavation
Gravel Bedding	69	CY	$ 42.22	$ 2,910.48	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.41	$ 160.85	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.22	$ 2,249.74	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 21.71	$ 11,570.11	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 3.62	$ 241.28	Quantity = Length X Width
				$ 221,308.15	
Receiving Pit					
Excavation	432	CY	$ 12.06	$ 5,212.76	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$ 65.00	$ 151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$ 4.22	$ 1,824.47	Quantity = Excavation
Gravel Bedding	46	CY	$ 42.22	$ 1,940.32	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$ 2.41	$ 107.23	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$ 4.22	$ 1,499.83	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$ 21.71	$ 7,713.41	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$ 35.00	$ 2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$ 3.62	$ 160.85	Quantity = Length X Width
				$ 172,816.54	
Shafts Subtotal		LS		**$ 394,124.69**	
Mob/Demob/Setup/Dism		LS		**$ 400,000.00**	
Microtunneling	200	LF	$ 6,182.17	$ 1,236,433.82	
Total Cost per LF				**$ 6,182**	**$/LF**

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Construction Method 4B - Microtunneling

Assumptions
1. Bore pits are assumed to be 30 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 20 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA: 12000.25
June 2022 ENR CCI for LA: 13488.65
Escalation % 0.12403

6. 84", 60", and 54" carrier will be installed within 108", 84", and 78" permalok steel casing pipe and the annular space will be filled with low density cellular grout.

Item Description	Quantity	Unit	Unit Cost (2022)	Total Cost	
84" Microtunnel (200 - 2000 ft, No Boulders)					
Launching Pit					
Excavation	648	CY	$ 12.06	$ 7,819.14	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.22	$ 2,736.70	Quantity = Excavation
Gravel Bedding	69	CY	$ 42.22	$ 2,910.48	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.41	$ 160.85	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.22	$ 2,249.74	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 21.71	$ 11,570.11	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 3.62	$ 241.28	Quantity = Length X Width
				$ 221,308.15	
Receiving Pit					
Excavation	432	CY	$ 12.06	$ 5,212.76	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$ 65.00	$ 151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$ 4.22	$ 1,824.47	Quantity = Excavation
Gravel Bedding	46	CY	$ 42.22	$ 1,940.32	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$ 2.41	$ 107.23	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$ 4.22	$ 1,499.83	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$ 21.71	$ 7,713.41	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$ 35.00	$ 2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$ 3.62	$ 160.85	Quantity = Length X Width
				$ 172,816.54	
Shafts Subtotal		LS		**$ 394,124.69**	
Mob/Demob/Setup/Dism		LS		**$ 400,000.00**	
Microtunneling	2,000	LF	$ 5,620.15	$ 11,240,307.49	
Total Cost per LF				**$ 5,620**	**$/LF**
84" Microtunnel (200 - 2000 ft, With Boulders)					
Launching Pit					
Excavation	648	CY	$ 12.06	$ 7,819.14	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.22	$ 2,736.70	Quantity = Excavation
Gravel Bedding	69	CY	$ 42.22	$ 2,910.48	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.41	$ 160.85	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.22	$ 2,249.74	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 21.71	$ 11,570.11	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 3.62	$ 241.28	Quantity = Length X Width
				$ 221,308.15	
Receiving Pit					
Excavation	432	CY	$ 12.06	$ 5,212.76	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$ 65.00	$ 151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$ 4.22	$ 1,824.47	Quantity = Excavation
Gravel Bedding	46	CY	$ 42.22	$ 1,940.32	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$ 2.41	$ 107.23	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$ 4.22	$ 1,499.83	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$ 21.71	$ 7,713.41	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$ 35.00	$ 2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$ 3.62	$ 160.85	Quantity = Length X Width
				$ 172,816.54	
Shafts Subtotal		LS		**$ 394,124.69**	
Mob/Demob/Setup/Dism		LS		**$ 400,000.00**	
Microtunneling	2,000	LF	$ 5,921.39	$ 11,842,787.98	
Total Cost per LF				**$ 5,921**	**$/LF**

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Construction Method 4C - Traditional Tunneling

Assumptions

1. Bore pits are assumed to be 60 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 20 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA: 12000.3
June 2022 ENR CCI for LA: 13488.7
Escalation % 12.4%

6. All traditional tunnels are assumed to be EPBM.
7. The minimum excavated diameter for EPBM is assumed to be 100 to 132 inches due to tunnel boring machine limitations. The excess granular space is assumed to be filled with grout.

Item Description	Quantity	Unit	Unit Cost (2022) $	Total Cost $	
84" EPBM (>2000 ft)					
Launching Pit					
Excavation	1,296	CY	$ 12.06	$ 15,638.29	Quantity = Length X Width X 4 Dia
Launching Pit Shoring (installation, bracing, and removal)	4,667	SF	$ 65.00	$ 303,333.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	1,296	CY	$ 4.22	$ 5,473.40	Quantity = Excavation
Gravel Bedding	138	CY	$ 42.22	$ 5,820.96	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	133	SY	$ 2.41	$ 321.70	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	1,066	CY	$ 4.22	$ 4,499.49	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	1,066	CY	$ 21.71	$ 23,140.22	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	231	CY	$ 35.00	$ 8,073.01	Quantiy = Excavation - Backfill
Rough Surface Compaction	133	SY	$ 3.62	$ 482.55	Quantity = Length X Width
				$ 366,782.96	
Receiving Pit					
Excavation	432	CY	$ 12.06	$ 5,212.76	Quantity = Length X Width X 4 Dia
Launching Pit Shoring (installation, bracing, and removal)	2,333	SF	$ 65.00	$ 151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$ 4.22	$ 1,824.47	Quantity = Excavation
Gravel Bedding	46	CY	$ 42.22	$ 1,940.32	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$ 2.41	$ 107.23	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$ 4.22	$ 1,499.83	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$ 21.71	$ 7,713.41	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$ 35.00	$ 2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$ 3.62	$ 160.85	Quantity = Length X Width
				$ 172,816.54	
Shafts Subtotal		LS		**$ 539,599.50**	
Mob/Demob/Setup/Dism		LS		**$ 3,500,000.00**	
EPBM	2,000	LF	$ 5,365.56	$ 10,731,127.44	
Total Cost per LF				**$ 5,365.56**	**$/LF**

Details on "Cost Adders" Unit Cost

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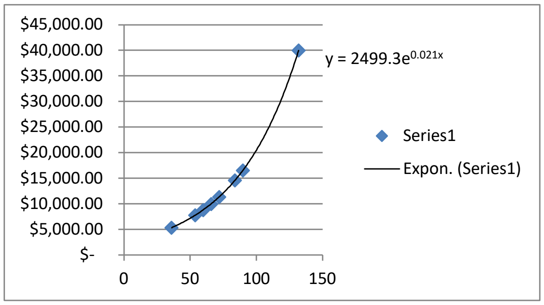
Cathodic Protection Unit Cost Data

Assumptions
1 Current is proportional to the radius of the pipe squared. As the pipe diameter increases the anode bed costs will increase exponentially.
2 For a 66" pipe the cost of the anode bed will be $10,000 per mile (per Brian Louque)
3 Incidental costs such as test stations will be $2,000 per mile
4 Add $40,000 per mile to anode bed costs for work in SCE Easement
5 These costs include materials and labor.

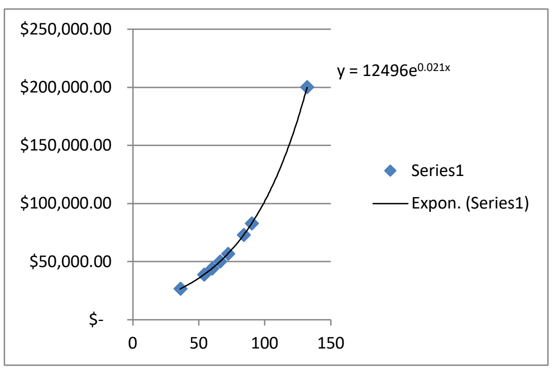
Determine anode bed costs for all pipe diameters outside of SCE Easement

Pipe Dia (inches)	Cost
132	$ 40,000.00
90	$ 16,548.42
84	$ 14,589.33
72	$ 11,339.48
66	$ 10,000.00
60	$ 8,813.55
54	$ 7,770.16
36	$ 5,324.35



Determine anode bed costs for all pipe diameters inside of SCE Easement

Pipe Dia (inches)	Cost
132	$ 200,000.00
90	$ 82,742.11
84	$ 72,946.67
72	$ 56,697.42
66	$ 50,000.00
60	$ 44,067.77
54	$ 38,850.80
36	$ 26,621.75



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Cost Adder Major Utility Crossings

Assumptions

1. Jacking length is 30 feet.
2. Costs are all inclusive and include:
   - Demolition, sitework, earthwork, dewatering, and site restoration costs for launching and receiving pits.
   - Piping costs associated with casing, steel pipe, annular space grout, casing spacers, pipe welding, testing, cathodic protection , air valves, and blow offs.
3. Bore pits are assumed to be 30 feet long and 20 feet wide
4. Receiving Pits are assumed to be 20 feet long and 16 feet wide
5. Major utilities are as defined in the CDR body.
6. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Item Description	Quantity	Unit		Unit Cost	Total Cost	
				$	$	
Major Utility Crossing Adder						
84"	30	LF	$ 4,496.12	$ 4,496.12	134,884	Jack & Bore
60"	30	LF	$ 4,383.72	$ 4,383.72	131,512	Jack & Bore
54"	30	LF	$ 4,271.32	$ 4,271.32	128,140	Jack & Bore
36"	30	LF	$ 904.86	$ 1,017.09	27,146	

Cost Adder Major Intersection Crossings

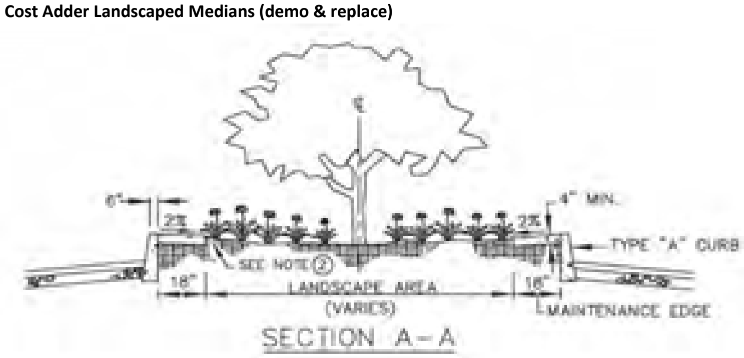
Assumptions

1. The cost for crossing a Major Intersection would be comparable to a trenchless installation regardless of whether it was installed with open trench methods or trenchless construction methods due to the slower construction rate.
2. Jacking length is 200 feet.
3. Costs are all inclusive and include:
   - Demolition, sitework, earthwork, dewatering, and site restoration costs for launching and receiving pits.
   - Piping costs associated with casing, steel pipe, annular space grout, casing spacers, pipe welding, testing, cathodic protection , air valves, and blow offs.
4. Bore pits are assumed to be 30 feet long and 20 feet wide
5. Receiving Pits are assumed to be 20 feet long and 16 feet wide
6. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost	
			$		$	
Major Intersection Crossing Adder						
84"	200	LF	$ 4,496.12	$ 4,496.12	899,225	Jack & Bore
60"	200	LF	$ 4,459.03	$ 4,459.03	891,806	Jack & Bore
54"	200	LF	$ 4,248.84	$ 4,248.84	849,767	Jack & Bore
Major Utility Crossing (54" & Less) Adder			$ -	$ -		
45 degree Elbow	4	EA	$ 12,064.80	$ 13,561.21	$ 48,259.20	
Additional Excavation	3.89	CY	$ 10.05	$ 11.30	$ 39.07	Quantity = (Trench Depth X Width X 1 LF) / 27
Concrete Pipe Encasement	1.921	CY	$ 201.08	$ 226.02	$ 386.28	Quantity = (((Trench Width X Pipe Dia + 1) - (Pipe Area)) X 1 LF)/27
Utility Support	1	LS	$ 1,005.40	$ 1,130.10	$ 1,005.40	
Air Vacuum/Air Release Valves	0.000	EA	$ 11,059.40	$ 12,431.11	$ 4.42	Quantity = 1 per 2500 LF of Pipe
Total					$ 49,694.38	
60"						
45 degree Elbow	4	EA	$ 9,551.30	$ 10,735.95	$ 38,205.20	
Additional Excavation	2.51	CY	$ 10.05	$ 11.30	$ 25.23	Quantity = (Trench Depth X Width X 1 LF) / 27
Concrete Pipe Encasement	1.351	CY	$ 201.08	$ 226.02	$ 271.59	Quantity = (((Trench Width X Pipe Dia + 1) - (Pipe Area)) X 1 LF)/27
Utility Support	1	LS	$ 1,005.40	$ 1,130.10	$ 1,005.40	
Air Vacuum/Air Release Valves	0.000	EA	$ 11,059.40	$ 12,431.11	$ 4.42	Quantity = 1 per 2500 LF of Pipe
Total					$ 39,511.84	
54"						
45 degree Elbow	4	EA	$ 8,043.20	$ 9,040.80	$ 32,172.80	
Additional Excavation	2.21	CY	$ 10.05	$ 11.30	$ 22.23	Quantity = (Trench Depth X Width X 1 LF) / 27
Concrete Pipe Encasement	1.218	CY	$ 201.08	$ 226.02	$ 244.91	Quantity = (((Trench Width X Pipe Dia + 1) - (Pipe Area)) X 1 LF)/27
Utility Support	1	LS	$ 1,005.40	$ 1,130.10	$ 1,005.40	
Air Vacuum/Air Release Valves	0.000	EA	$ 11,059.40	$ 12,431.11	$ 4.42	Quantity = 1 per 2500 LF of Pipe
Total					$ 33,449.77	

Cost Adder Landscaped Medians (demo & replace)



Assumptions
1. Trees are spaced every 25 feet
2. Average width of median = 10 feet
3. Quantities are calucation for 1 linear foot of landscaped median.
4. Unit costs were originally developed in August 2016 and were escalated to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Demolition					
Concrete Slab Removal	1	SF	$ 4.83	$ 5.43	$ 5.43
Concrete Curb Removal	2	LF	$ 5.37	$ 6.03	$ 12.06
Transportation and Disposal Fees (Recycle Concrete)	0.10	CY	$ 214.65	$ 241.28	$ 24.82
Tree Removal	0.04	EA	$ 912.27	$ 1,025.42	$ 41.02
Clearing and Grubbing	0.0002	AC	$ 3,971.08	$ 4,463.61	$ 0.82
subtotal					$ 84.15
Site Restoration					
Concrete Curbs	2	LF	$ 37.56	$ 42.22	$ 84.45
Concrete Slabs	1	SF	$ 21.47	$ 24.13	$ 24.13
Trees	0.04	EA	$ 482.97	$ 542.87	$ 21.71
subtotal					$ 130.29
Total					$ 214.44 per linear foot

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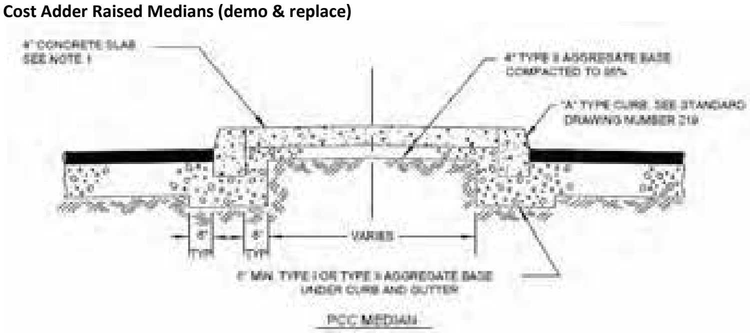
Opinion of Probable Construction Cost

Cost Adder Raised Medians (demo & replace)



Assumptions
1. No trees
2. Average width of median = 8 feet
3. Quantities are calucation for 1 linear foot of landscaped median.
4. Unit costs were originally developed in August 2016 and were escalated to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Demolition									
Concrete Slab Removal	2.3	SF	$	4.83	$	5.43	$	12.67	
Concrete Curb Removal	2.0	LF	$	5.37	$	6.03	$	12.06	
Transportation and Disposal Fees (Recycle Concrete)	0.15	CY	$	214.65	$	241.28	$	36.74	
subtotal							$	61.47	
Site Restoration									
Concrete Curb	2	LF	$	37.56	$	42.22	$	84.45	
Concrete Slabs	2.3	SF	$	21.47	$	24.13	$	56.30	
Type II Aggregate base	0.1	SY	$	6.44	$	7.24	$	0.72	
subtotal							$	141.47	
Total							$	202.94	per linear foot

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Los Angeles, California
Metropolitan Water District of Southern California
Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

Cost Adder Seismic Hazards/Fault Zones

DISCLAIMER: Assumptions are for a Class 4 cost estimate. A finite element analysis will be completed during later design phases to determine the exact method of ensuring seismic resiliency.

Assumptions:
1. Fault zone is 50 ft on each side of fault
2. D/t = 80 for 100 ft beyond D/t=60 zone
3. Unit cost of steel pipe is the price difference between the thicker pipe used in the fault zone and the standard pipe used in the construction methods
4. Unit costs shown were escalated from August 2018 to June 2022 dollars using ENR Construction Cost Indexes for Los Angeles, California.

August 2018 ENR CCI for LA:	12000.25
June 2022 ENR CCI for LA:	13488.65
Escalation %	12.4%

Calculate Cost per Linear Foot for 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost
Seismic Hazards/Fault Zones					
1" Thick Pipe	300	LF	$310	$348	$104,535
Ball Joint	2	EA	$487,281	$547,719	$1,095,439
Subtotal					$1,199,974

Calculate Cost per Linear Foot for 66-inch Pipe

Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost
Seismic Hazards/Fault Zones					
0.75" Pipe	300	LF	$310	$348	$104,535
Ball Joint	2	EA	$260,000	$292,248	$584,496
Slip Pipe		LF	$0	$0	$0
Subtotal					$689,031

Calculate Cost per Linear Foot for 60-inch Pipe

Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost
Seismic Hazards/Fault Zones					
0.75" Pipe	300	LF	$300	$337	$101,163
Ball Joint	2	EA	$210,458	$236,561	$473,121
Subtotal					$574,284

Calculate Cost per Linear Foot for 54-inch Pipe

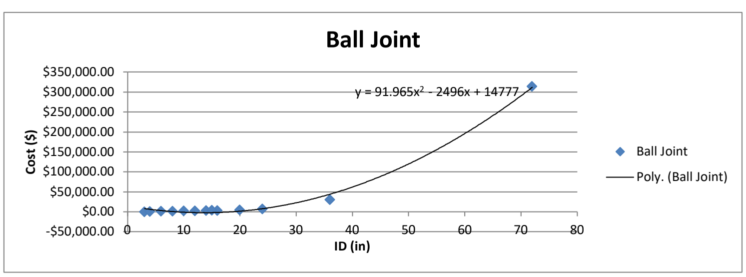
Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost
Seismic Hazards/Fault Zones					
0.75" Pipe	300	LF	$67	$76	$22,726
Ball Joint	2	EA	$159,018	$178,741	$357,482
Subtotal					$380,208

Ball Joint

Create trendline to interpolate ball joint costs

References:
1. EBAA Budgetary Quotation Emails, September 27 & 28, 2016

ID (in)	Cost ($)
3	$225.00
4	$638.00
6	$1,050.00
8	$1,416.00
10	$1,937.00
12	$2,582.00
14	$2,902.00
16	$3,340.00
15	$4,211.00
20	$4,936.00
24	$7,260.00
36	$30,201.00
72	$314,252.00



Use $y=91.965x^2 -2496x+14777$ to interpolate cost for ball joint diameters not included in the EBAA budgetary quote.

ID (in)	Cost ($)
42	$77,042.82
48	$114,069.16
54	$158,163.94
60	$209,327.14
84	$484,664.26

Attachment B - Conceptual Cost Comparison to Upsize the Backbone Pipeline to 9 Feet

DRAFT

CONCEPTUAL COST COMPARISON TO UPSIZE THE BACKBONE PIPELINE TO 9 FEET

B&V PROJECT NO. 410259

PREPARED FOR

Metropolitan Water District of Southern California

20 DECEMBER 2023

1.0 Introduction

The Metropolitan Water District of Southern California (Metropolitan) retained Black & Veatch to prepare a rough order of magnitude engineer's opinion of probable construction cost to determine the potential increase in construction costs that would result from upsizing the Pure Water Southern California (Pure Water) "Backbone" Pipeline from 84-inches to 108-inches in diameter. The purpose of this cost assessment was to assist in initiating discussions with potential project partners. Following this initial rough order of magnitude cost assessment, more detailed engineering evaluations and cost estimates are recommended. This memorandum presents the basis for this cost assessment, as well as the findings.

1.1 Background

Metropolitan is in the early stages of implementing the Pure Water program, consisting of an advanced water purification facility, a Backbone Pipeline, multiple pump stations, and laterals to potential discharge locations. As currently conceived, the Backbone Pipeline would extend from the new advanced water purification facility in Carson, California to the San Gabriel Canyon Spreading Grounds in Azusa, California. The Backbone Pipeline would be 84-inches in diameter and would convey up to 150 million gallons per day.

Metropolitan is considering upsizing the Backbone Pipeline from 84-inches to 108-inches from approximately the Whittier Narrows area to the San Gabriel Canyon Spreading Grounds to provide operational flexibility, including potential future interconnections with other regional advanced treated water programs.

For the purposes of this assessment, the upsizing was assumed to start 500-feet south of Rose Hills Road east of the 605 Freeway and end at the northwest corner of the San Gabriel Canyon Spreading Ground's southern basin. The total length of upsized Backbone Pipeline is approximately fourteen miles.

1.2 Methodology

The following methodology was utilized to assess the high-level cost impact:

1. A preliminary Engineer's opinion of probable construction cost (OPCC) was previously developed for the 84-inch Backbone Pipeline as part of the Feasibility Level Design Report (FLDR) prepared in 2018. This OPCC was Class 4 in accordance with Association for the Advancement of Cost Engineering, International (AACE) standards, with a level of accuracy of -30% to +50%. This previous preliminary Engineer's OPCC served as the basis for the cost of the 84-inch pipeline and was updated for the applicable areas as follows:
    a. The preliminary Engineer's OPCC utilized typical unit costs for construction in different alignment types: construction in paved streets, construction in easements, pipe jacking, microtunneling, and traditional tunneling. These unit costs were escalated to May 2023

dollars using the Engineering News Record (ENR) Construction Cost Indices for Los Angeles, California.

b. Costs for non-typical features that would be encountered along each alignment were developed during the FLDR. These cover features and work methods which were not included in the typical unit costs because they were not consistently required or uniformly found along each segment. Consistent with this level of study, these adders are items which are readily discernable and measurable from the desktop analysis, visual observations made in the field, review of utility information, analysis of traffic control requirements, desktop study of geotechnical and groundwater conditions, and so on. These costs were escalated to May 2023 dollars using the ENR Construction Cost Indices for Los Angeles, California.

c. A high-level quantity take-off was performed for the 84-inch Backbone Pipeline between Whittier Narrows and the San Gabriel Canyon Spreading Grounds based on the measured lengths, construction methodologies, and typical construction sections.

d. The cost assumed for the 84-inch Backbone Pipeline was based upon the escalated unit costs and the revised quantity take off.

2. A cost opinion was developed for the 108-inch pipeline, as follows. It should be considered a Class 5 estimate with a level of accuracy of -50% to +100%.

   a. A high-level assessment was completed to determine what conceptual level adjustments to the assumed construction methodologies (open-cut verses trenchless) would be required to accommodate the larger pipe size within the existing alignment. The applicable portion of the alignment is generally located between existing Southern California Edison (SCE) transmission towers and United States Army Corps of Engineers (USACE) levees. At this time, the specific requirements of these agencies regarding separation from their existing structures has not been fully defined. Furthermore, as with the original feasibility level design, no subsurface geotechnical investigation has been performed to corroborate the current construction methodology concepts. Therefore, additional refinements to the types and extents of assumed construction methodologies are anticipated as the project progresses.

   b. The typical unit costs for open-cut construction developed for the 84-inch pipe were revised parametrically for the larger 108-inch pipe.

   c. New unit costs were developed using parametric methods for the trenchless installations assumed for the 108-inch pipeline.

   d. A high-level quantity take-off was performed based on measured lengths and the typical construction methods.

e. The cost assumed for the 108-inch Backbone Pipeline was based upon the unit costs and quantity take off.

3. The costs developed for the 84-inch and 108-inch pipelines were compared to determine the rough order of magnitude impact to the program.

It should be noted that the cost comparison was intended to provide a rough order of magnitude of the construction cost impact to the program and is intended to assist in initial discussions with potential program partners. An updated Class 4 Engineer's opinion of probable construction cost will be completed for the Backbone Pipeline at the end of the CEQA process.

1.3 Cost Parameters and Assumptions

The following general parameters and key assumptions apply to the preparation of this high-level cost impact assessment.

1.3.1 General Items

The cost comparison is comprised of direct and indirect construction costs for the Backbone Pipeline. Direct costs are intended to include the contractor's cost for labor, materials, and equipment estimates. Indirect costs cover the contractor's general conditions, overhead, profit, building permits, insurance, and bonding. Indirect costs were estimated based on a percentage of the direct costs, as is typical for this level of study.

All prices shown are presented in May 2023 dollars and are not escalated to mid-point of construction. It is recommended that Metropolitan escalate the values to the mid-point of construction for all future planning.

1.3.2 84-inch Pipeline

- Pipeline materials assume cement mortar lined and coated welded steel pipe (WSP). The pipeline is assumed to be 84-inches in diameter with a wall thickness of 1/2-inch thick.
- Shored construction is assumed for all open-cut construction methods, including within easements alongside the San Gabriel River due to the congestion of existing infrastructure.
- The depth of cover was assumed to be 8-feet on average in city streets, 8-feet on average in SCE's easements.
- All shafts assume soldier piles with lagging and dewatering, where applicable.
- Construction methodologies were developed based on desktop level information and experience in similar settings; no subsurface geotechnical investigation has been completed to fully confirm the extent or types of construction methods, in particular for trenchless installations.
- Quantities are based on the following alignment and construction methods:

Figure 1-1. Map of Construction Methods for 84-inch Backbone Pipeline between Whittier Narrows and San Gabriel Canyon Spreading Grounds

1.3.3 108-inch Pipeline

- Pipeline materials assume cement mortar lined and coated welded steel pipe (WSP). The pipeline is assumed to be 108-inches in diameter with a wall thickness of 3/4-inch thick for pricing.
- Shored construction is assumed for all open-cut construction methods, including within easements alongside the San Gabriel River due to the congestion of existing infrastructure.
- The depth of cover was assumed to be 8-feet on average in city streets and 8-feet on average in SCE’s easements.
- All shafts for trenchless construction assumed secant piles.
- Construction methodologies were developed based on desktop level information and experience win similar settings; no subsurface geotechnical investigation has been

completed to fully confirm the extent or types of construction methods, in particular for trenchless installations.

- Quantities are based on the following alignment and construction methods:

Figure 1-2. Map of Construction Methods for 108-inch Backbone Pipeline between Whittier Narrows and San Gabriel Canyon Spreading Grounds

1.4 Items Excluded from Cost Comparison

The following items are not accounted for in this cost comparison:

- Differences in the pump stations or isolation valves and vaults
- Contingency for potential tariffs or material fluctuation
- Removal, remediation, and/or disposal of contaminated soils and groundwater
- Differences in right-of-way and/or easement acquisition
- Soft costs

1.5 Key Issues Still to be Evaluated

The following are key issues that still need to be worked through, which could impact this cost assessment:

- No geotechnical field investigations have been completed. The geotechnical data available for this cost assessment was limited to desktop information only. Given the amount of trenchless construction assumed for the 108-inch pipeline, field information is required to provide greater cost certainty.
- Further coordination is required with USACE and SCE to fully understand their requirements and gain their acceptance of the proposed alignment concepts, including separation from existing levees and transmission tower foundations. Recent feedback received from SCE indicates that they desire a greater depth of cover over the pipeline within their property than previously assumed, which would impact this assessment.
- This high-level comparison did not evaluate tunnel staging areas in detail. Several initial possibilities were identified as part of this general assessment, but further study is required to confirm space is available. Availability of intermediate shaft sites, or lack thereof, may impact cost, tunnel size, and schedule.
- Bends in the tunnel geometry were not fully evaluated. In order to achieve the required bending radius, the tunnels shown may extend under existing buildings. To avoid this, additional refinements may be required.
- This initial assessment made assumptions regarding the proximity the pipeline excavation could be from the visible extents of existing transmission towers for open cut construction before trenchless construction would be required. As foundation information is obtained on the existing towers from SCE (this information has not as of yet been available), these assumptions could likely be refined and the quantity of open cut construction could be optimized.
- This high-level cost assessment made assumptions as to the minimum length of open-cut construction between required trenchless drives that would be cost and schedule effective. More detailed evaluations are required to better define this length.

2.0 Cost Comparison

Table 2-1 presents a summary of the high-level cost comparison of upsizing the pipe from 84-inches to 108-inches for the portion of the Backbone Pipeline between Whittier Narrows and the San Gabriel Canyon Spreading Grounds. It should be noted that the costs were developed based upon conceptual information to provide a rough order of magnitude of the potential impact to the program. All costs are presented in May 2023 dollars. A copy of the Engineer's cost assessment is included in Attachment A.

Table 2-1. Rough Order of Magnitude Cost Comparison Summary

Size	Construction Costs[1]
84-inch pipeline	$398,200,000
108-inch pipeline	$922,600,000
Cost difference	$524,400,000

Notes:
1. All values include contingency but do not include pre-construction or construction management soft costs.

As can be seen in Table 2-1, upsizing the pipeline from 84-inches to 108-inches between Whittier Narrows and the San Gabriel Canyon Spreading Grounds would roughly double the construction costs for this stretch.

2.1 Contingencies

Project contingencies are included to account for unknown or unforeseen costs at the time the estimate was developed. The amount of contingency applied to an estimate is typically based on the level of project definition. For this cost comparison, a contingency of 35 percent was applied.

It should be noted that soft costs were not included in this comparison. Soft costs capture capital costs associated with the implementation of a project and include planning, environmental documentation and permits, engineering design services, public outreach, real property, legal, environmental mitigation, Metropolitan's staff time, program management, and construction management. While soft costs vary greatly from project to project and from component to component, at this level of planning it is most common to assume a percentage of the construction costs based on similar types of projects. For the Pure Water program, Metropolitan has assumed 30 percent of the estimated construction costs to account for these additional services. It would be appropriate to assume a similar percentage could be applied to this cost increase.

2.2 Key Observations

The following key observations have been made regarding the potential cost impact.

- The quantity of steel required for the 108-inch pipeline was double that of the 84-inch pipeline based upon the assumptions made. This is reflected in the increased unit cost of the larger pipe (dollars / linear foot). The increase in material cost accounts for significant portion of the anticipated cost impact.
- The length of trenchless construction assumed for the 108-inch pipeline increased by 2.8 miles – from eighteen percent to thirty-eight percent of the total length of the evaluated portion of the alignment. This is due to the lack of space between SCE's existing transmission towers and the adjacent levees.

Attachment A - Cost Assessment to Upsize to 9 ft

BLACK & VEATCH
Corporation

550 S. Hope Street, Suite 2250, Los Angeles, California 90071

B&V Project 410259

PRELIMINARY ENGINEERS OPCC COMPARISON OF 7' TO 9' FROM WHITTIER NARROWS TO CANYON SPREADING GROUNDS

Metropolitan Water District of Southern California
Los Angeles County, CA

Conceptual-Level Design of Conveyance/Distribution System for Pure Water Southern California

June 2023

SUMMARY

Item Description	Quantity	Size	Cost w/ Contingency
Comparison			
84" Backbone Pipeline (Whittier Narrows to Canyon SG)			
Rose Hills Road/Shepherd St to South of Valley Blvd	21,165	84	$ 125,500,000
South of Valley Blvd to Live Oak Ave	24,595	84	$ 114,500,000
Live Oak Ave to Santa Fe Spreading Grounds PS	15,327	84	$ 106,700,000
SFSG PS to Canyon SG	12,800	84	$ 51,500,000
Subtotal			$ 398,200,000
108" Pipeline (Whittier Narrows to Canyon SG)			
Segment 1 - Whittier Narrows to Santa Fe Spreading Grounds PS	60,943	108	$ 825,800,000
Segment 2 - Santa Fe Spreading Grounds PS to Canyon Spreading Grounds	12,800	108	$ 96,800,000
Subtotal			$ 922,600,000
Approximate Difference in Cost to Upsize to 9' (Whittier Narrows to Canyon SG)			**2.3**
Total Approximate Cost Increase to Upsize to 9' from Whittier Narrows to Canyon SG (with Contingency			**524,400,000**

Note: All costs presented assume 35 percent contingency.

Cost Details for 9' Diameter Pipe - Segment 1

Segment 1 - Whittier Narrows to SFSG PS Direct Costs for Open Cut (9' Diameter)
Direct Costs

Item Description	Quantity	Unit		Unit Cost		Total Cost
Construction Method 1 - Roadway (Open Cut)						
108"	8,125	LF	$	3,174.85	$	25,795,617
Subtotal -					$	25,795,617
Construction Method 2 - SCE Easement (Open Cut)						
108"	26,047	LF	$	2,645.28	$	68,901,736
Subtotal -					$	68,901,736
Added Sitework Costs						
Intersection Traffic Control (Open Cut)		EA	$	78,500.00	$	-
Intersection Traffic Control (Trenchless)		EA	$	12,500.00	$	-
Landscaped Median (demo & replace)		LF	$	215.00	$	-
Raised Median (demo & replace)	0	LF	$	200.00	$	-
Subtotal -					$	-
Added Pipeline Costs						
Major Utility Crossings						
108"	0	EA				
Major Intersection Crossings						
108"	0	EA				
Subtotal -						

Direct Costs - Open Cut		$	94,697,353
General Requirement - Open Cut	15%	$	14,204,603
General Contractor OH&P - Open Cut	15%	$	14,204,603
Recommended Contingency - Open Cut	35%	$	43,087,296
Bonds & Insurance - Open Cut	3.6%	$	5,950,392
SUBTOTAL - OPEN CUT		**$**	**172,100,000**

Trenchless Installations For Segment 1 - Whittier Narrows to Santa Fe Spreading Grounds Pump Station (9' Diameter)
Direct Costs

Shaft Construction

Shaft	Shaft Location	Shaft Type	Depth (ft)	ID (ft)	Subtotal Direct Cost
Segment 1 - Whittier Narrows to SFSG PS					
S1-Launch	TBD - TBM Tunnel	Secant Piles	70	45	$6,300,000
S1-Receiving	TBD - TBM Tunnel	Secant Piles	70	25	$2,000,000
S3-Launch	TBD - Pipe Ram or Shield	Secant Piles	45	45	$4,100,000
S3-Receiving	TBD - Pipe Ram or Shield	Secant Piles	45	25	$1,300,000
S5-Launch	TBD - TBM Tunnel	Secant Piles	70	45	$6,300,000
S5-Receiving	TBD - TBM Tunnel	Secant Piles	70	25	$2,000,000
S7-Launch	TBD - Pipe Ram or Shield	Secant Piles	45	45	$4,100,000
S7-Receiving	TBD - Pipe Ram or Shield	Secant Piles	45	25	$1,300,000
S9-Launch	TBD - Pipe Ram or Shield	Secant Piles	45	45	$4,100,000
S9-Receiving	TBD - Pipe Ram or Shield	Secant Piles	45	25	$1,300,000
S11-Launch	TBD - Shield Tunnel	Secant Piles	45	45	$4,100,000
S11-Receiving	TBD - Shield Tunnel	Secant Piles	45	25	$1,300,000
S13-Launch	TBD - Pipe Ram or Shield	Secant Piles	45	45	$4,100,000
S13-Receiving	TBD - Pipe Ram or Shield	Secant Piles	45	25	$1,300,000
S15-Launch	TBD - TBM Tunnel	Secant Piles	70	45	$6,300,000
S15-Receiving	TBD - TBM Tunnel	Secant Piles	70	25	$2,000,000
S17-Launch	TBD - Pipe Jacking	Secant Piles	45	45	$4,100,000
S17-Receiving	TBD - Pipe Jacking	Secant Piles	45	25	$1,300,000
S19-Launch	TBD - Pipe Jacking	Secant Piles	45	45	$4,100,000
S19-Receiving	TBD - Pipe Jacking	Secant Piles	45	25	$1,300,000
S21-Launch	TBD - Pipe Jacking	Secant Piles	45	45	$4,100,000
S21-Receiving	TBD - Pipe Jacking	Secant Piles	45	25	$1,300,000
S23-Launch	TBD - Pipe Ram or Pipe Jacking	Secant Piles	45	45	$4,100,000
S23-Receiving	TBD - Pipe Ram or Pipe Jacking	Secant Piles	45	25	$1,300,000
S25-Launch	TBD - Pipe Jacking	Secant Piles	45	45	$4,100,000
S25-Receiving	TBD - Pipe Jacking	Secant Piles	45	25	$1,300,000
S27-Launch	TBD - Pipe Jacking	Secant Piles	45	45	$4,100,000
S27-Receiving	TBD - Pipe Jacking	Secant Piles	45	25	$1,300,000

Tunnel Excavation and Carrier Pipe Construction

Tunnel Drive	Description	Length (ft)	Cost Per ft	Subtotal Direct Cost
Segment 1 - Whittier Narrows to SFSG PS				
S1	EPBM Escavation w/Bolted Gasket Segments - 12.9' Excav.	12,915	$4,900	$63,283,500
S1	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	12,915	$3,700	$47,785,500
-	Transport, Re-assemble machine for Re-launch	-	-	$5,000,000
S5	EPBM Escavation w/Bolted Gasket Segments - 12.9' Excav.	3,688	$4,900	$18,071,200
S5	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	3,688	$3,700	$13,645,600
S2	Open Cut Pipe Installation	4,687	-	
S3	Pipe ramming or Shield Tunnel with ribs and lagging	183	$3,800	$695,400
S3	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	183	$3,700	$677,100
S4	Open Cut Pipe Installation	3,516	-	
S6	Open Cut Pipe Installation	620	-	
S7	Pipe ramming or Shield Tunnel with ribs and lagging	85	$3,800	$323,000
S7	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	85	$3,700	$314,500
S8	Open Cut Pipe Installation	1,690	-	
S9	Pipe ramming or Shield Tunnel with ribs and lagging	110	$3,800	$418,000
S9	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	110	$3,700	$407,000
S10	Open Cut Pipe Installation	1,830	-	
S11	Shield Tunnel with ribs and lagging	458	$3,800	$1,740,400
S11	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	458	$3,700	$1,694,600
S12	Open Cut Pipe Installation	981	-	
S13	Pipe ramming or Shield Tunnel with ribs and lagging	118	$3,800	$448,400
S13	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	118	$3,700	$436,600
S14	Open Cut Pipe Installa*tion*	4,340	-	
-	Transport, Re-assemble machine for Re-launch	-	-	$5,000,000
S15	EPBM Escavation w/Bolted Gasket Segments - 12.9' Excav.	4,250	$4,900	$20,825,000
S15	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	4,250	$3,700	$15,725,000
S16	Open Cut Pipe Installation	4,800	-	
S17	Pipe Jacking	653	$4,800	$3,134,400
S17	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	653	$3,700	$2,416,100
S18	Open Cut Pipe Installation	2,045	-	
S19	Pipe Jacking	911	$4,800	$4,372,800
S19	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	911	$3,700	$3,370,700
S20	Open Cut Pipe Installation	5,890	-	
S21	Pipe Jacking	1,427	$4,800	$6,849,600
S21	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	1,427	$3,700	$5,279,900
S22	Open Cut Pipe Installation	1,334	-	
S23	Trenchless Pipe Ram or Pipe Jacking	173	$3,800	$657,400
S23	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	173	$3,700	$640,100
S24	Open Cut Pipe Installation	1,313	-	
S25	Pipe Jacking	1,312	$4,800	$6,297,600
S25	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	1,312	$3,700	$4,854,400
S26	Open Cut Pipe Installation	1,154	-	
S27	Pipe Jacking	488	$4,800	$2,342,400
S27	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	488	$3,700	$1,805,600

Direct Cost - Trenchless		$322,811,800
Mobilization - Trenchless	5%	$16,140,590
Overhead - Trenchless	27%	$87,159,186
Profit - Trenchless	18%	$58,106,124
Contingency - Trenchless	35%	$169,476,195
SUBTOTAL - TRENCHLESS - WHITTIER TO SFSG PS		**$653,700,000**

TOTAL PROBABLE CONSTRUCTION COST (OPEN CUT AND TRENCHLESS) **$825,800,000**

Cost Details for 9' Diameter Pipe - Segment 2

Segment 2 - SFSG PS to Canyon SGs Direct Costs for Open Cut (9' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
108"	753	LF	$ 3,174.85	$ 2,390,658
Subtotal -				$ 2,390,658
Construction Method 2 - SCE Easement (Open Cut)				
108"	11,017	LF	$ 2,645.28	$ 29,143,104
Subtotal -				$ 29,143,104
Added Sitework Costs				
Intersection Traffic Control (Open Cut)		EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 215.00	$ -
Raised Median (demo & replace)	0	LF	$ 200.00	$ -
Subtotal -				$ -
Added Pipeline Costs				
Major Utility Crossings				
108"	0	EA		
Major Intersection Crossings				
108"	0	EA		
Subtotal -				

Direct Costs - Open Cut		$ 31,533,762
General Requirement - Open Cut	15%	$ 4,730,064
General Contractor OH&P - Open Cut	15%	$ 4,730,064
Recommended Contingency - Open Cut	35%	$ 14,347,862
Bonds & Insurance - Open Cut	3.6%	$ 1,981,452
SUBTOTAL - OPEN CUT		**$ 57,300,000**

Trenchless Installations For Segment 2 - SFSG PS to Canyon Spreading Grounds (9' Diameter)
Direct Costs

Shaft Construction

Shaft	Shaft Location	Shaft Type	Depth (ft)	ID (ft)	Subtotal Direct Cost
Segment 2 - SFSG PS to Canyon Spreading					
S29-Launch	TBD - Pipe Jacking	Secant Piles	45	45	$4,100,000
S29-Receiving	TBD - Pipe Jacking	Secant Piles	45	25	$1,300,000
S31-Launch	TBD - Pipe Ram or Pipe Jacking	Secant Piles	45	45	$4,100,000
S31-Receiving	TBD - Pipe Ram or Pipe Jacking	Secant Piles	45	25	$1,300,000

Tunnel Excavation and Carrier Pipe Construction

Tunnel Drive	Description	Length (ft)	Cost Per ft	Subtotal Direct Cost
Segment 2 - SFSG PS to Canyon Spreading				
S28	Open Cut Pipe Installation	2,626	-	
S29	Pipe Jacking	973	$4,800	$4,670,400
S29	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	973	$3,700	$3,600,100
S30	Open Cut Pipe Installation	5,045	-	
S31	Trenchless Pipe Ram or Pipe Jacking	57	$3,800	$216,600
S31	Carrier Pipe Installation - 108" ID x .75", Cellular Backfill, Contact Grouting	57	$3,700	$210,900

Direct Cost - Trenchless		$19,498,000
Mobilization - Trenchless	5%	$974,900
Overhead - Trenchless	27%	$5,264,460
Profit - Trenchless	18%	$3,509,640
Contingency - Trenchless	35%	$10,236,450
SUBTOTAL - TRENCHLESS - SFSG PS TO CANYON SPREADING GROUNDS		**$39,500,000**

TOTAL PROBABLE CONSTRUCTION COST (OPEN CUT AND TRENCHLESS)	**$96,800,000**

Cost Details for 7' Diameter Pipe Segments

Rose Hills Road/Shepherd St to South of Valley Blvd (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	880	LF	$ 2,060.43	$ 1,813,178
Subtotal -				$ 1,813,178
Construction Method 2 - SCE Easement (Open Cut)				
84"	12,875	LF	$ 1,607.44	$ 20,695,768
Subtotal -				$ 20,695,768
Construction Method 3A - LAFCD Easement (River Bank; Open Cut)				
84"	2,540	LF	$ 1,476.11	$ 3,749,326
Subtotal -				$ 3,749,326
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"		LF	$ 5,036.49	$ -
200 - 2000 Feet				
84"	240	LF	$ 5,036.49	$ 1,208,758
Shafts (84")	2	EA	$ 379,702.66	$ 759,405
Mob/Demob (84")	1	EA	$ 200,000.00	$ 200,000
Subtotal -				$ 2,168,163
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
< 200 Feet, With Boulders				
84"	125	LF	$ 6,925.18	$ 865,647
200 - 2000 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
200 - 2000 Feet, With Boulders				
84"	4,505	LF	$ 6,633.06	$ 29,881,934
Shafts (84")	14	EA	$ 399,670.91	$ 5,595,393
Mob/Demob (84")	7	EA	$ 400,000.00	$ 2,800,000
Subtotal -				$ 39,142,973
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 6,010.43	$ -
Slurry TBM				
84"		LF		$ -
Shafts (84")		EA	$ 548,473.45	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	0	EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 240.21	$ -
Raised Median (demo & replace)	600	LF	$ 227.33	$ 136,396
Subtotal -				$ 136,396
Added Pipeline Costs				
Major Utility Crossings				
84"	6	EA	$ 151,094.75	$ 906,569
Major Intersection Crossings				
84"	0	EA	$ 1,007,298.35	$ -
Subtotal -				$ 906,569

Rose Hills Road/Shepherd St to South of Valley Blvd (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,344,192.92	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	880	LF	$ 30.87	$ 27,170
Construction Method 2 - SCE Easement	12,875	LF	$ 6.17	$ 79,502
Construction Method 3A - River Bank	2,540	LF	$ 6.17	$ 15,684
Construction Method 4A - Jack & Bore	240	LF	$ 49.99	$ 11,997
Construction Method 4B - Microtunnel	4,630	LF	$ 35.29	$ 163,371
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	880	LF	$ 15.44	$ 13,585
Construction Method 2 - SCE Easement	12,875	LF	$ 3.09	$ 39,751
Construction Method 3A - River Bank	2,540	LF	$ 3.09	$ 7,842
Construction Method 4A - Jack & Bore	240	LF	$ 24.99	$ 5,999
Construction Method 4B - Microtunnel	4,630	LF	$ 17.64	$ 81,686
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -

Direct Costs - Open Cut		$ 27,484,771
General Requirement - Open Cut	15%	$ 4,122,716
General Contractor OH&P - Open Cut	15%	$ 4,122,716
Contingencies - Open Cut	35%	$ 12,505,571
Bonds & Insurance - Open Cut	3.6%	$ 1,727,030
SUBTOTAL - OPEN CUT		$ 50,000,000
Direct Costs - Trenchless		$ 41,574,189
General Requirement - Trenchless	15%	$ 6,236,128
General Contractor OH&P - Trenchless	15%	$ 6,236,128
Contingencies - Trenchless	35%	$ 18,916,256
Bonds & Insurance - Trenchless	3.6%	$ 2,612,351
SUBTOTAL - TRENCHLESS		$ 75,600,000
TOTAL PROBABLE CONSTRUCTION COST		**$ 125,500,000**

South of Valley Blvd to Live Oak Ave (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	6,420	LF	$ 2,060.43	$ 13,227,960
Subtotal -				$ 13,227,960
Construction Method 2 - SCE Easement (Open Cut)				
84"	15,575	LF	$ 1,607.44	$ 25,035,851
Subtotal -				$ 25,035,851
Construction Method 3A - LAFCD Easement (River Bank; Open Cut)				
84"		LF	$ 1,476.11	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	420	LF	$ 5,036.49	$ 2,115,327
200 - 2000 Feet				
84"	230	LF	$ 5,036.49	$ 1,158,393
Shafts (84")	10	EA	$ 379,702.66	$ 3,797,027
Mob/Demob (84")	5	EA	$ 200,000.00	$ 1,000,000
Subtotal -				$ 8,070,746
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,925.18	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
200 - 2000 Feet, With Boulders				
84"	1,950	LF	$ 6,633.06	$ 12,934,466
Shafts (84")	4	EA	$ 399,670.91	$ 1,598,684
Mob/Demob (84")	2	EA	$ 400,000.00	$ 800,000
Subtotal -				$ 15,333,150
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 6,010.43	$ -
Shafts (84")		EA	$ 548,473.45	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	2	EA	$ 78,500.00	$ 197,682
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)	250	LF	$ 240.21	$ 60,054
Raised Median (demo & replace)		LF	$ 227.33	$ -
Subtotal -				$ 257,736
Added Pipeline Costs				
Major Utility Crossings				
84"	6	EA	$ 151,094.75	$ 906,569
Major Intersection Crossings				
84"	0	EA	$ 1,007,298.35	$ -
Subtotal -				$ 906,569

South of Valley Blvd to Live Oak Ave (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,344,192.92	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	4,000	LF	$ 6.17	$ 24,700
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 4A - Jack & Bore	85	LF	$ 49.99	$ 4,249
Construction Method 4B - Microtunnel	1,950	LF	$ 35.29	$ 68,807
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	4,000	LF	$ 3.09	$ 12,350
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 4A - Jack & Bore	85	LF	$ 24.99	$ 2,124
Construction Method 4B - Microtunnel	1,950	LF	$ 17.64	$ 34,403
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -

Direct Costs - Open Cut		$ 39,465,165
General Requirement - Open Cut	15%	$ 5,919,775
General Contractor OH&P - Open Cut	15%	$ 5,919,775
Contingencies - Open Cut	35%	$ 17,956,650
Bonds & Insurance - Open Cut	3.6%	$ 2,479,828
SUBTOTAL - OPEN CUT		$ 71,700,000
Direct Costs - Trenchless		$ 23,513,479
General Requirement - Trenchless	15%	$ 3,527,022
General Contractor OH&P - Trenchless	15%	$ 3,527,022
Contingencies - Trenchless	35%	$ 10,698,633
Bonds & Insurance - Trenchless	3.6%	$ 1,477,490
SUBTOTAL - TRENCHLESS		$ 42,700,000
TOTAL PROBABLE CONSTRUCTION COST		**$ 114,500,000**

Live Oak Ave to Santa Fe Spreading Grounds PS (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	3,800	LF	$ 2,060.43	$ 7,829,634
Subtotal -				$ 7,829,634
Construction Method 2 - SCE Easement (Open Cut)				
84"	7,017	LF	$ 1,607.44	$ 11,279,394
Subtotal -				$ 11,279,394
Construction Method 3A - LAFCD Easement (River Bank; Open Cut)				
84"		LF	$ 1,476.11	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	170	LF	$ 5,036.49	$ 856,204
200 - 2000 Feet				
84"		LF	$ 5,036.49	$ -
Shafts (84")	2	EA	$ 379,702.66	$ 759,405
Mob/Demob (84")	1	EA	$ 200,000.00	$ 200,000
Subtotal -				$ 1,815,609
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
< 200 Feet, With Boulders				
84"	190	LF	$ 6,925.18	$ 1,315,783
200 - 2000 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
200 - 2000 Feet, With Boulders				
84"	4,150	LF	$ 6,633.06	$ 27,527,197
Shafts (84")	12	EA	$ 399,670.91	$ 4,796,051
Mob/Demob (84")	6	EA	$ 400,000.00	$ 2,400,000
Subtotal -				$ 36,039,032
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 6,010.43	$ -
Shafts (84")		EA	$ 548,473.45	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)	1	EA	$ 78,500.00	$ 98,841
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)	200	LF	$ 240.21	$ 48,043
Raised Median (demo & replace)		LF	$ 227.33	$ -
Subtotal -				$ 146,884
Added Pipeline Costs				
Major Utility Crossings				
84"	4	EA	$ 151,094.75	$ 604,379
Major Intersection Crossings				
84"	1	EA	$ 1,007,298.35	$ 1,007,298
Subtotal -				$ 1,611,677

Live Oak Ave to Santa Fe Spreading Grounds PS (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,344,192.92	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -

Direct Costs - Open Cut		$ 20,867,589
General Requirement - Open Cut	15%	$ 3,130,138
General Contractor OH&P - Open Cut	15%	$ 3,130,138
Contingencies - Open Cut	35%	$ 9,494,753
Bonds & Insurance - Open Cut	3.6%	$ 1,311,233
SUBTOTAL - OPEN CUT		$ 37,900,000
Direct Costs - Trenchless		$ 37,854,641
General Requirement - Trenchless	15%	$ 5,678,196
General Contractor OH&P - Trenchless	15%	$ 5,678,196
Contingencies - Trenchless	35%	$ 17,223,862
Bonds & Insurance - Trenchless	3.6%	$ 2,378,630
SUBTOTAL - TRENCHLESS		$ 68,800,000
TOTAL PROBABLE CONSTRUCTION COST - WITHOUT CONTIGENCY		$ 80,000,000
TOTAL PROBABLE CONSTRUCTION COST		**$ 106,700,000**

SFSG PS to Canyon SG (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Construction Method 1 - Roadway (Open Cut)				
84"	750	LF	$ 2,060.43	$ 1,545,322
Subtotal -				$ 1,545,322
Construction Method 2 - SCE Easement (Open Cut)				
84"	11,050	LF	$ 1,607.44	$ 17,762,193
Subtotal -				$ 17,762,193
Construction Method 3A - LAFCD Easement (River Bank; Open Cut)				
84"		LF	$ 1,476.11	$ -
Subtotal -				$ -
Construction Method 4A - Jack & Bore (Trenchless)				
< 200 Feet				
84"	60	LF	$ 5,036.49	$ 302,190
200 - 2000 Feet				
84"		LF	$ 5,036.49	$ -
Shafts (84")	2	EA	$ 379,702.66	$ 759,405
Mob/Demob (84")	1	EA	$ 200,000.00	$ 200,000
Subtotal -				$ 1,261,595
Construction Method 4B - Microtunneling (Trenchless)				
< 200 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
< 200 Feet, With Boulders				
84"		LF	$ 6,925.18	$ -
200 - 2000 Feet, No Boulders				
84"		LF	$ 6,295.61	$ -
200 - 2000 Feet, With Boulders				
84"	940	LF	$ 6,633.06	$ 6,235,076
Shafts (84")	2	EA	$ 399,670.91	$ 799,342
Mob/Demob (84")	1	EA	$ 400,000.00	$ 400,000
Subtotal -				$ 7,434,418
Construction Method 4C - Traditional Tunneling (Trenchless)				
EPBM				
84"		LF	$ 6,010.43	$ -
Shafts (84")		EA	$ 548,473.45	$ -
Mob/Demob (84")		EA	$ 3,500,000.00	$ -
Subtotal -				$ -
Added Sitework Costs				
Intersection Traffic Control (Open Cut)		EA	$ 78,500.00	$ -
Intersection Traffic Control (Trenchless)		EA	$ 12,500.00	$ -
Landscaped Median (demo & replace)		LF	$ 240.21	$ -
Raised Median (demo & replace)		LF	$ 227.33	$ -
Subtotal -				$ -
Added Pipeline Costs				
Major Utility Crossings				
84"	2	EA	$ 151,094.75	$ 302,190
Major Intersection Crossings				
84"		EA	$ 1,007,298.35	$ -
Subtotal -				$ 302,190

SFSG PS to Canyon SG (7' Diameter)
Direct Costs

Item Description	Quantity	Unit	Unit Cost	Total Cost
Geotechnical Added Costs				
Seismic Hazards/Fault Zones				
84"		EA	$1,344,192.92	$ -
Dewatering				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 30.87	$ -
Construction Method 2 - SCE Easement	0	LF	$ 6.17	$ -
Construction Method 3A - River Bank	0	LF	$ 6.17	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 49.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 35.29	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 44.11	$ -
Permeable Soils				
Construction Method 1 - Roadway (Open Cut)	0	LF	$ 15.44	$ -
Construction Method 2 - SCE Easement	0	LF	$ 3.09	$ -
Construction Method 3A - River Bank	0	LF	$ 3.09	$ -
Construction Method 4A - Jack & Bore	0	LF	$ 24.99	$ -
Construction Method 4B - Microtunnel	0	LF	$ 17.64	$ -
Construction Method 4C - Traditional Tunneling	0	LF	$ 22.05	$ -

Direct Costs - Open Cut		$ 19,609,705
General Requirement - Open Cut	15%	$ 2,941,456
General Contractor OH&P - Open Cut	15%	$ 2,941,456
Contingencies - Open Cut	35%	$ 8,922,416
Bonds & Insurance - Open Cut	3.6%	$ 1,232,193
SUBTOTAL - OPEN CUT		$ 35,600,000
Direct Costs - Trenchless		$ 8,696,013
General Requirement - Trenchless	15%	$ 1,304,402
General Contractor OH&P - Trenchless	15%	$ 1,304,402
Contingencies - Trenchless	35%	$ 3,956,686
Bonds & Insurance - Trenchless	3.6%	$ 546,422
SUBTOTAL - TRENCHLESS		$ 15,800,000
TOTAL PROBABLE CONSTRUCTION COST		**$ 51,500,000**

Details on Typical Unit Costs for Each Construction Method

Construction Method 1 - Roadways 84-inch ID WSP

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 Asphalt Paving is assumed to be 6" thick
5 For Every linear foot of pipe there will be a linear foot of temporary fencing
6 For every 8 feet of pipe there will be 1 foot of fabric silt fence
7 Pipe joint welds will be inspected every 40 ft
8 Pipe joints will be welded every 40 ft
9 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
10 Blow offs are assumed to be installed every 2500 feet.
11 Speed shoring is the standard shoring method and the average depth of cover is 8 feet.
12 Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
0.25912	August 2018 ENR CCI for LA:	12000.25	
	May 2023 ENR CCI for LA:	15109.79	25.91%

Calculate Cost per Linear Foot for Construction Method 1 - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	Notes
Demolition					
Sawcutting	2.000	LF	$ 2.70	$ 5.41	Quantity = 2 LF per 1 LF of pipe
Asphalt Paving Removal	15.000	SF	$ 1.01	$ 15.20	Quantity = (Trench Width + 4 ft) X 1 LF of Pipe
1" Milling	2.333	SY	$ 2.16	$ 5.05	Quantity = (Width of construction zone - (Trench Width + 4ft)) X 1 LF of Pipe
Transportation and Disposal Fees (Recycle A/C)	0.278	CY	$ 270.27	$ 75.08	Quantity = (AC Paving Removal X Thickness X 1 LF)/27
Subtotal				$ 100.73	Per linear foot
Site Work					
Temporary Fencing	1.000	LF	$ 8.11	$ 8.11	Quantity = 1 LF per 1 LF of pipe
Traffic Control	1.000	LF	$ 38.98	$ 38.98	Quantity = 1 LF per 1 LF of pipe
Sweeper & Water Truck	1.000	LF	$ 49.90	$ 49.90	Quantity = 1 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 46.78	$ 46.78	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 202.71	$ 202.71	Quantity = 1 LF per 1 LF of pipe
Utility Crossings					
Gas	0.001	LF	$ 3,202.75	$ 3.64	Quantity = average of 2 1-mile sample segments
Telephone/Cable TV	0.001	LF	$ 324.33	$ 0.18	Quantity = average of 2 1-mile sample segments
Electric	0.001	LF	$ 1,608.13	$ 0.91	Quantity = average of 2 1-mile sample segments
Sewer	0.002	LF	$ 486.49	$ 1.01	Quantity = average of 2 1-mile sample segments
Water	0.001	LF	$ 486.49	$ 0.28	Quantity = average of 2 1-mile sample segments
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 4.05	$ 0.51	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 5.41	$ 0.10	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 353.11	Per linear foot
Earthwork					
Mass Trench Excavation - Vertical Trenching	6.60	CY	$ 13.51	$ 89.25	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	31.58	SF	$ 2.70	$ 85.36	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	6.60	CY	$ 4.73	$ 31.24	Quantity = Excavation
Gravel Bedding & Pipe Cover	0.96	CY	$ 43.24	$ 41.54	Quantity = (((Trench Width X ½ Pipe Dia) - (½ Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.70	$ 3.39	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	4.097	CY	$ 4.73	$ 19.38	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	4.097	CY	$ 24.32	$ 99.66	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	2.507	CY	$ 12.16	$ 30.49	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 4.05	$ 5.09	Quantity = Fine Grading & Compaction
Subtotal				$ 405.39	
Pipeline					
84" WSP CML	1.000	LF	$ 687.48	$ 687.48	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 189.19	$ 189.19	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,675.76	$ 141.89	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 567.58	$ 14.19	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 2.03	$ 2.03	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 3.73	$ 3.73	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.51	$ 0.51	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.0004	EA	$ 14,865.09	$ 5.95	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.0004	EA	$ 13,513.72	$ 5.41	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 1,050.38	Per linear foot
Site Restoration					
Asphalt Paving	1.667	SY	$ 72.97	$ 121.62	Quantity = Asphalt Paving Removal / 9
1" Asphalt Overlay	2.333	SY	$ 1.69	$ 3.94	Quantity = Milling / 9
General Site Restoration	36.000	SF	$ 0.68	$ 24.32	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 675.69	$ 0.93	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 150.82	Per linear foot
Total Cost per Linear Foot				**$ 2,060.43**	Per linear foot

Construction Method 1 - Roadways 108-inch ID WSP

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 Asphalt Paving is assumed to be 6" thick
5 For Every linear foot of pipe there will be a linear foot of temporary fencing
6 For every 8 feet of pipe there will be 1 foot of fabric silt fence
7 Pipe joint welds will be inspected every 40 ft
8 Pipe joints will be welded every 40 ft
9 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
10 Blow offs are assumed to be installed every 2500 feet.
11 Speed shoring is the standard shoring method and the average depth of cover is 11 feet.
12 Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
	August 2018 ENR CCI for LA:	12000.25	
0.25912	May 2023 ENR CCI:	15109.79	25.91%

Calculate Cost per Linear Foot for Construction Method 1 - 108-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	Notes
Demolition					
Sawcutting	2.000	LF	$ 2.70	$ 5.41	Quantity = 2 LF per 1 LF of pipe
Asphalt Paving Removal	19.000	SF	$ 1.01	$ 19.26	Quantity = (Trench Width + 4 ft) X 1 LF of Pipe
1" Milling	1.889	SY	$ 2.16	$ 4.08	Quantity = (Width of construction zone - (Trench Width + 4ft)) X 1 LF of Pipe
Transportation and Disposal Fees (Recycle A/C)	0.352	CY	$ 270.27	$ 95.10	Quantity = (AC Paving Removal X Thickness X 1 LF)/27
Subtotal				$ 123.84	Per linear foot
Site Work					
Temporary Fencing	1.000	LF	$ 8.11	$ 8.11	Quantity = 1 LF per 1 LF of pipe
Traffic Control	1.000	LF	$ 38.98	$ 38.98	Quantity = 1 LF per 1 LF of pipe
Sweeper & Water Truck	1.000	LF	$ 49.90	$ 49.90	Quantity = 1 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 46.78	$ 46.78	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 202.71	$ 202.71	Quantity = 1 LF per 1 LF of pipe
Utility Crossings					
Gas	0.001	LF	$ 3,202.75	$ 3.64	Quantity = average of 2 1-mile sample segments
Telephone/Cable TV	0.001	LF	$ 324.33	$ 0.18	Quantity = average of 2 1-mile sample segments
Electric	0.001	LF	$ 1,608.13	$ 0.91	Quantity = average of 2 1-mile sample segments
Sewer	0.002	LF	$ 486.49	$ 1.01	Quantity = average of 2 1-mile sample segments
Water	0.001	LF	$ 486.49	$ 0.28	Quantity = average of 2 1-mile sample segments
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 4.05	$ 0.51	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 5.41	$ 0.10	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 353.11	Per linear foot
Earthwork					
Mass Trench Excavation - Vertical Trenching	10.36	CY	$ 13.51	$ 140.00	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	36.58	SF	$ 2.70	$ 98.88	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	10.36	CY	$ 4.73	$ 49.00	Quantity = Excavation
Gravel Bedding & Pipe Cover	3.32	CY	$ 43.24	$ 143.46	Quantity = (((Trench Width X Pipe Dia + 1 FT) - (Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.699	SY	$ 2.70	$ 4.59	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	4.531	CY	$ 4.73	$ 21.43	Quantity = Excavation - CLSM - Pipe
Backfill & Compact Native Soil	4.531	CY	$ 24.32	$ 110.21	Quantity = Excavation - CLSM - Pipe
Off-Site Disposal Stockpile Spoils	5.829	CY	$ 12.16	$ 70.89	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.699	SY	$ 4.05	$ 6.89	Quantity = Fine Grading & Compaction
Subtotal				$ 645.34	
Pipeline					
108" WSP CML	1.000	LF	$ 1,324.60	$ 1,324.60	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 219.09	$ 219.09	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 9,821.16	$ 245.53	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 571.64	$ 14.29	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 2.52	$ 2.52	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 9.54	$ 9.54	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.51	$ 0.51	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.0004	EA	$ 14,865.09	$ 5.95	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.0004	EA	$ 113,321.06	$ 45.33	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 1,867.35	Per linear foot
Site Restoration					
Asphalt Paving	2.111	SY	$ 72.97	$ 154.06	Quantity = Asphalt Paving Removal / 9
1" Asphalt Overlay	1.889	SY	$ 1.69	$ 3.19	Quantity = Milling / 9
General Site Restoration	40.000	SF	$ 0.68	$ 27.03	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 675.69	$ 0.93	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 185.21	Per linear foot
Total Cost per Linear Foot				**$ 3,174.85**	Per linear foot

Construction Method 2 - SCE Easements 84-inch ID WSP

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 For Every linear foot of pipe there will be a linear foot of temporary fencing
5 For every 8 feet of pipe there will be 1 foot of fabric silt fence
6 Pipe joint welds will be inspected every 40 ft
7 Pipe joints will be welded every 40 ft
8 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9 Blow offs are assumed to be installed every 2500 feet.
10 Speed shoring is the standard shoring method and the average depth of cover is 8 feet.
11 Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
0.25912	August 2018 ENR CCI for LA:	12000.3	
	May 2023 ENR CCI for LA:	15109.8	25.91%

Calculate Cost per Linear Foot for Construction Method 2 - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	Notes
Demolition					
Clearing and Grubbing	0.001	AC	$ 5,000.08	$ 4.13	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 4.13	Per LF
Site Work					
Temporary Fencing	2.000	LF	$ 8.11	$ 16.22	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 9.36	$ 9.36	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 40.54	$ 40.54	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 4.05	$ 0.51	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 5.41	$ 0.10	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 66.72	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	6.60	CY	$ 13.51	$ 89.25	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	23.58	SF	$ 2.70	$ 63.74	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	6.60	CY	$ 4.73	$ 31.24	Quantity = Excavation
CLSM Backfill	0.96	CY	$ 108.11	$ 103.84	Quantity = (((Trench Width X ½ Pipe Dia) - (½ Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.70	$ 3.39	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	4.097	CY	$ 4.73	$ 19.38	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	4.097	CY	$ 24.32	$ 99.66	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	2.507	CY	$ 12.16	$ 30.49	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 4.05	$ 5.09	Quantity = Fine Grading & Compaction
Subtotal				$ 446.07	Per LF
Pipeline					
84" WSP CML	1.000	LF	$ 687.48	$ 687.48	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 189.19	$ 189.19	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,675.76	$ 141.89	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 567.58	$ 14.19	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 2.03	$ 2.03	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 18.67	$ 18.67	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.51	$ 0.51	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.000	EA	$ 14,865.09	$ 5.95	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.000	EA	$ 13,513.72	$ 5.41	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 1,065.32	Per LF
Site Restoration					
General Site Restoration	36.000	SF	$ 0.68	$ 24.32	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 675.69	$ 0.87	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 25.19	Per LF
Total Cost per Linear Foot				**$ 1,607.44**	Per LF

Construction Method 2 - SCE Easements 108-inch ID WSP

Assumptions

1 Units listed as LF are for 1 linear foot of the Construction Method
2 Units listed as areas or volumes are for 1 linear foot of the Construction Method
3 Units listed as areas or volumes are for 1 linear foot of the Construction Method
4 For Every linear foot of pipe there will be a linear foot of temporary fencing
5 For every 8 feet of pipe there will be 1 foot of fabric silt fence
6 Pipe joint welds will be inspected every 40 ft
7 Pipe joints will be welded every 40 ft
8 Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9 Blow offs are assumed to be installed every 2500 feet.
10 Speed shoring is the standard shoring method and the average depth of cover is 11 feet.
11 Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
0.25912	August 2018 ENR CCI for LA:	12000.3	
	May 2023 ENR CCI:	15109.8	25.91%

Calculate Cost per Linear Foot for Construction Method 2 - 108-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	Notes
Demolition					
Clearing and Grubbing	0.001	AC	$ 5,000.08	$ 4.59	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 4.59	Per LF
Site Work					
Temporary Fencing	2.000	LF	$ 8.11	$ 16.22	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 9.36	$ 9.36	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 40.54	$ 40.54	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 4.05	$ 0.51	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 5.41	$ 0.10	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 66.72	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	10.36	CY	$ 13.51	$ 140.00	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	36.58	SF	$ 2.70	$ 98.88	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	10.36	CY	$ 4.73	$ 49.00	Quantity = Excavation
Gravel Bedding & Pipe Cover	3.32	CY	$ 43.24	$ 143.46	Quantity = (((Trench Width X Pipe Dia + 1 FT) - (Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.699	SY	$ 2.70	$ 4.59	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	4.531	CY	$ 4.73	$ 21.43	Quantity = Excavation - CLSM - Pipe
Backfill & Compact Native Soil	4.531	CY	$ 24.32	$ 110.21	Quantity = Excavation - CLSM - Pipe
Off-Site Disposal Stockpile Spoils	5.829	CY	$ 12.16	$ 70.89	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.699	SY	$ 4.05	$ 6.89	Quantity = Fine Grading & Compaction
Subtotal				$ 645.34	Per LF
Pipeline					
108" WSP CML	1.000	LF	$ 1,324.60	$ 1,324.60	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 219.09	$ 219.09	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 9,821.16	$ 245.53	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 571.64	$ 14.29	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 2.52	$ 2.52	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 42.92	$ 42.92	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.51	$ 0.51	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.0004	EA	$ 14,865.09	$ 5.95	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.0004	EA	$ 113,321.06	$ 45.33	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 1,900.73	Per LF
Site Restoration					
General Site Restoration	40.000	SF	$ 0.68	$ 27.03	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 675.69	$ 0.87	Quantity = ((Width of Const Zone + Travel Zone) X 1 LF of Pipe)/43560
Subtotal				$ 27.90	Per LF
Total Cost per Linear Foot				**$ 2,645.28**	Per LF

Construction Method 3A - LAFCD Easement (River Bank) 84-inch ID WSP

Assumptions

1. Units listed as LF are for 1 linear foot of the Construction Method
2. Units listed as areas or volumes are for 1 linear foot of the Construction Method
3. Units listed as areas or volumes are for 1 linear foot of the Construction Method
4. For Every linear foot of pipe there will be a linear foot of temporary fencing
5. For every 8 feet of pipe there will be 1 foot of fabric silt fence
6. Pipe joint welds will be inspected every 40 ft
7. Pipe joints will be welded every 40 ft
8. Air Vacuum/Air Release Valves are assumed to be installed every 2500 feet.
9. Blow offs are assumed to be installed every 2500 feet.
10. Speed shoring is the standard shoring method and the average depth of cover is 4 feet.
11. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
	August 2018 ENR CCI for LA:	12000.25	
0.25912	May 2023 ENR CCI for LA:	15109.79	25.91%

Calculate Cost per Linear Foot for Construction Method 3A - 84-inch Pipe

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	Notes
Demolition					
Clearing and Grubbing	0.001	AC	$ 5,337.58	$ 4.41	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Transpiration and Disposal Fees Vegetation (NON-HAZ)		LS	$ -	$ -	
Subtotal				$ 4.41	Per LF
Site Work					
Temporary Fencing	2.000	LF	$ 8.66	$ 17.31	Quantity = 2 LF per 1 LF of pipe
Dust Control	1.000	LF	$ 9.99	$ 9.99	Quantity = 1 LF per 1 LF of pipe
Survey & Layout	1.000	LF	$ 43.28	$ 43.28	Quantity = 1 LF per 1 LF of pipe
Erosion Control					
Fabric Silt Fence - Installation & Maintenance	0.125	LF	$ 4.33	$ 0.54	Quantity = 1 ft of silt fence per 8 ft of pipe
Hay Rolls	0.019	LF	$ 5.77	$ 0.11	Quantity = 1 ft of hay roll per 52 ft of pipe
Subtotal				$ 71.23	Per LF
Earthwork					
Mass Trench Excavation - Vertical Trenching	4.93	CY	$ 14.43	$ 71.14	Quantity = (Trench Depth X Width X 1 LF) / 27
Trench Shoring	23.58	SF	$ 2.89	$ 68.04	Quantity = Trench Depth X 1 LF of Pipe X 2
Load/Haul Excavated Soils to Laydown Area	4.93	CY	$ 5.05	$ 24.90	Quantity = Excavation
Gravel Bedding & Pipe Cover	0.96	CY	$ 46.16	$ 44.34	Quantity = (((Trench Width X ½ Pipe Dia) - (½ Pipe Area)) X 1 LF)/27
Fine Grading & Compaction	1.255	SY	$ 2.89	$ 3.62	Quantity = ((Trench Width) X 1 LF) / 9
Load/Haul Laydown Soils to Trench Areas	2.424	CY	$ 5.05	$ 12.24	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	2.424	CY	$ 25.97	$ 62.95	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	2.507	CY	$ 12.98	$ 32.55	Quantity = Excavation - Laydown Soils
Rough Surface Compaction	1.255	SY	$ 4.33	$ 5.43	Quantity = Fine Grading & Compaction
Subtotal				$ 325.21	Per LF
Pipeline					
84" WSP CML	1.000	LF	$ 687.48	$ 687.48	Quantity = 1 LF per 1 LF of Pipe
Pipeline Install - L & EQ	1.000	LF	$ 189.19	$ 189.19	Quantity = 1 LF per 1 LF of Pipe
Welding Pipe Joints	0.025	EA	$ 5,675.76	$ 141.89	Quantity = 1 per 40 LF of Pipe
Welding Inspections	0.025	EA	$ 567.58	$ 14.19	Quantity = 1 per 40 LF of Pipe
Hydrostatic Testing	1.000	LF	$ 2.03	$ 2.03	Quantity = 1 LF per 1 LF of Pipe
Cathodic Protection					
Anode Bed	1.000	LF	$ 3.73	$ 3.73	Quantity = 1 LF per 1 LF of Pipe
Incidentals (Test Stations)	1.000	LF	$ 0.51	$ 0.51	Quantity = 1 LF per 1 LF of Pipe
Air Vacuum/Air Release Valves	0.000	EA	$ 14,865.09	$ 5.95	Quantity = 1 per 2500 LF of Pipe
Blow Off Assembly	0.000	EA	$ 13,513.72	$ 5.41	Quantity = 1 per 2500 LF of Pipe
Subtotal				$ 1,050.38	Per LF
Site Restoration					
General Site Restoration	36.000	SF	$ 0.68	$ 24.32	Quantity = Width of Const Zone per 1 LF of Pipe
Final Site Cleanup	0.001	AC	$ 675.69	$ 0.56	Quantity = (Width of Const Zone X 1 LF of Pipe)/43560
Subtotal				$ 24.88	Per LF
Total Cost per Linear Foot				**$ 1,476.11**	Per LF

Construction Method 4A - Jack & Bore 84-inch ID WSP

Assumptions

1. Launching pits are assumed to be 30 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 16 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
	August 2018 ENR CCI for LA:	12000.3	
0.25912	May 2023 ENR CCI for LA:	15109.8	25.91%

6. 84" carrier will be installed within 108" permalok steel casing pipe and the annular space will be filled with low density cellular grout.

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	Notes
84" Jack & Bore (<200 ft)					
Launching Pit					
Excavation	648	CY	$ 13.51	$ 8,758.89	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.73	$ 3,065.61	Quantity = Excavation
Gravel Bedding	69	CY	$ 47.30	$ 3,260.28	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.70	$ 180.18	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.73	$ 2,520.13	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 24.32	$ 12,960.67	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantity = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 4.05	$ 270.27	Quantity = Length X Width
				$ 224,635.88	
Receiving Pit					
Excavation	346	CY	$ 13.51	$ 4,671.41	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,100	SF	$ 65.00	$ 136,500.00	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	346	CY	$ 4.73	$ 1,634.99	Quantity = Excavation
Gravel Bedding	34	CY	$ 47.30	$ 1,592.51	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	36	SY	$ 2.70	$ 96.10	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	281	CY	$ 4.73	$ 1,329.44	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	281	CY	$ 24.32	$ 6,837.12	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	65	CY	$ 35.00	$ 2,261.07	Quantity = Excavation - Backfill
Rough Surface Compaction	36	SY	$ 4.05	$ 144.15	Quantity = Length X Width
				$ 155,066.78	
Shafts Subtotal		LS		**$ 379,702.66**	
Mob/Demob/Setup/Dism		LS		**$ 200,000.00**	
Pipe Jacking	200	LF	$ 5,036.49	$ 1,007,298.35	
Total Cost per LF				**5,036**	**$/LF**
84" Jack & Bore (200 ft - 2000 ft)					
Launching Pit					
Excavation	648	CY	$ 13.51	$ 8,758.89	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$ 65.00	$ 189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$ 4.73	$ 3,065.61	Quantity = Excavation
Gravel Bedding	69	CY	$ 47.30	$ 3,260.28	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$ 2.70	$ 180.18	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$ 4.73	$ 2,520.13	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$ 24.32	$ 12,960.67	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$ 35.00	$ 4,036.51	Quantity = Excavation - Backfill
Rough Surface Compaction	67	SY	$ 4.05	$ 270.27	Quantity = Length X Width
				$ 224,635.88	
Receiving Pit					
Excavation	346	CY	$ 13.51	$ 4,671.41	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,100	SF	$ 65.00	$ 136,500.00	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	346	CY	$ 4.73	$ 1,634.99	Quantity = Excavation
Gravel Bedding	34	CY	$ 47.30	$ 1,592.51	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	36	SY	$ 2.70	$ 96.10	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	281	CY	$ 4.73	$ 1,329.44	Quantity = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	281	CY	$ 24.32	$ 6,837.12	Quantity = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	65	CY	$ 35.00	$ 2,261.07	Quantity = Excavation - Backfill
Rough Surface Compaction	36	SY	$ 4.05	$ 144.15	Quantity = Length X Width
				$ 155,066.78	
Shafts Subtotal		LS		**$ 379,702.66**	
Mob/Demob/Setup/Dism		LS		**$ 200,000.00**	
Pipe Jacking	2,000	LF	$ 5,036.49	$10,072,983.48	
Total Cost per LF				**5,036**	**$/LF**

Construction Method 4B - Microtunneling 84-inch ID WSP

Assumptions

1. Bore pits are assumed to be 30 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 20 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %	August 2018 ENR CCI for LA:	12000.25	Escalation from 2018
0.25912	May 2023 ENR CCI for LA:	15109.79	25.91%

6. 84" carrier will be installed within 108" permalok steel casing pipe and the annular space will be filled with low density cellular grout.

Item Description	Quantity	Unit		Unit Cost (2023)		Total Cost	
						$	
84" Microtunnel (<200 ft, No Boulders)							
Launching Pit							
Excavation	648	CY	$	13.51	$	8,758.89	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$	65.00	$	189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$	4.73	$	3,065.61	Quantity = Excavation
Gravel Bedding	69	CY	$	47.30	$	3,260.28	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$	2.70	$	180.18	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$	4.73	$	2,520.13	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$	24.32	$	12,960.67	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$	35.00	$	4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$	4.05	$	270.27	Quantity = Length X Width
					$	224,635.88	
Receiving Pit							
Excavation	432	CY	$	13.51	$	5,839.26	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$	65.00	$	151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$	4.73	$	2,043.74	Quantity = Excavation
Gravel Bedding	46	CY	$	47.30	$	2,173.52	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$	2.70	$	120.12	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$	4.73	$	1,680.09	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$	24.32	$	8,640.45	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$	35.00	$	2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$	4.05	$	180.18	Quantity = Length X Width
					$	175,035.03	
Shafts Subtotal		LS			**$**	**399,670.91**	
Mob/Demob/Setup/Dism		LS			**$**	**400,000.00**	
Microtunneling	200	LF	$	6,295.61	$	1,259,122.93	
Total Cost per LF					**$**	**6,296**	**$/LF**
84" Microtunnel (<200 ft, With Boulders)							
Launching Pit							
Excavation	648	CY	$	13.51	$	8,758.89	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$	65.00	$	189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$	4.73	$	3,065.61	Quantity = Excavation
Gravel Bedding	69	CY	$	47.30	$	3,260.28	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$	2.70	$	180.18	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$	4.73	$	2,520.13	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$	24.32	$	12,960.67	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$	35.00	$	4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$	4.05	$	270.27	Quantity = Length X Width
					$	224,635.88	
Receiving Pit							
Excavation	432	CY	$	13.51	$	5,839.26	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$	65.00	$	151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$	4.73	$	2,043.74	Quantity = Excavation
Gravel Bedding	46	CY	$	47.30	$	2,173.52	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$	2.70	$	120.12	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$	4.73	$	1,680.09	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$	24.32	$	8,640.45	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$	35.00	$	2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$	4.05	$	180.18	Quantity = Length X Width
					$	175,035.03	
Shafts Subtotal		LS			**$**	**399,670.91**	
Mob/Demob/Setup/Dism		LS			**$**	**400,000.00**	
Microtunneling	200	LF	$	6,925.18	$	1,385,035.23	
Total Cost per LF					**$**	**6,925**	**$/LF**
84" Microtunnel (200 - 2000 ft, No Boulders)							
Launching Pit							
Excavation	648	CY	$	13.51	$	8,758.89	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$	65.00	$	189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$	4.73	$	3,065.61	Quantity = Excavation
Gravel Bedding	69	CY	$	47.30	$	3,260.28	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$	2.70	$	180.18	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$	4.73	$	2,520.13	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$	24.32	$	12,960.67	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$	35.00	$	4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$	4.05	$	270.27	Quantity = Length X Width
					$	224,635.88	
Receiving Pit							
Excavation	432	CY	$	13.51	$	5,839.26	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$	65.00	$	151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$	4.73	$	2,043.74	Quantity = Excavation
Gravel Bedding	46	CY	$	47.30	$	2,173.52	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$	2.70	$	120.12	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$	4.73	$	1,680.09	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$	24.32	$	8,640.45	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$	35.00	$	2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$	4.05	$	180.18	Quantity = Length X Width
					$	175,035.03	
Shafts Subtotal		LS			**$**	**399,670.91**	
Mob/Demob/Setup/Dism		LS			**$**	**400,000.00**	
Microtunneling	2,000	LF	$	6,295.61	$	12,591,229.35	
Total Cost per LF					**$**	**6,296**	**$/LF**

Construction Method 4B - Microtunneling 84-inch ID WSP

Assumptions

1. Bore pits are assumed to be 30 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 20 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
0.25912	August 2018 ENR CCI for LA:	12000.25	
	May 2023 ENR CCI for LA:	15109.79	25.91%

6. 84" carrier will be installed within 108" permalok steel casing pipe and the annular space will be filled with low density cellular grout.

84" Microtunnel (200 - 2000 ft, With Boulders)

Launching Pit							
Excavation	648	CY	$	13.51	$	8,758.89	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,917	SF	$	65.00	$	189,583.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	648	CY	$	4.73	$	3,065.61	Quantity = Excavation
Gravel Bedding	69	CY	$	47.30	$	3,260.28	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	67	SY	$	2.70	$	180.18	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	533	CY	$	4.73	$	2,520.13	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	533	CY	$	24.32	$	12,960.67	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	115	CY	$	35.00	$	4,036.51	Quantiy = Excavation - Backfill
Rough Surface Compaction	67	SY	$	4.05	$	270.27	Quantity = Length X Width
					$	224,635.88	
Receiving Pit							
Excavation	432	CY	$	13.51	$	5,839.26	Quantity = Length X Width X 4 Dia
Launching Pit Shoring	2,333	SF	$	65.00	$	151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$	4.73	$	2,043.74	Quantity = Excavation
Gravel Bedding	46	CY	$	47.30	$	2,173.52	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$	2.70	$	120.12	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$	4.73	$	1,680.09	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$	24.32	$	8,640.45	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$	35.00	$	2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$	4.05	$	180.18	Quantity = Length X Width
					$	175,035.03	
Shafts Subtotal		LS			**$**	**399,670.91**	
Mob/Demob/Setup/Dism		LS			**$**	**400,000.00**	
Microtunneling	2,000	LF	$	6,633.06	$	13,266,119.24	
Total Cost per LF					**$**	**6,633**	**$/LF**

Construction Method 4C - Traditional Tunneling 84-inch ID WSP

Assumptions

1. Bore pits are assumed to be 60 feet long, 20 feet wide, and 4 Diameters Deep
2. Receiving Pits are assumed to be 20 feet long, 20 feet wide, and 4 Diameters Deep
3. Launching and receiving pits will be fully shored excavations with soldier piles and lagging
4. Source of unit costs are based on cost histories from previous construction bids.
5. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %			Escalation from 2018
	August 2018 ENR CCI for LA:	12000.25	
0.25912	May 2023 ENR CCI for LA:	15109.79	25.91%

6. All traditional tunnels are assumed to be EPBM.
7. The minimum excavated diameter for EPBM is assumed to be 100 to 132 inches due to tunnel boring machine limitations. The excess granular space is assumed to be filled with grout.

Item Description	Quantity	Unit	Unit Cost (2023)	Total Cost $	
84" EPBM (>2000 ft)					
Launching Pit					
Excavation	1,296	CY	$ 13.51	$ 17,517.78	Quantity = Length X Width X 4 Dia
Launching Pit Shoring (installation, bracing, and removal)	4,667	SF	$ 65.00	$ 303,333.33	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	1,296	CY	$ 4.73	$ 6,131.22	Quantity = Excavation
Gravel Bedding	138	CY	$ 47.30	$ 6,520.56	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	133	SY	$ 2.70	$ 360.37	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	1,066	CY	$ 4.73	$ 5,040.26	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	1,066	CY	$ 24.32	$ 25,921.34	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	231	CY	$ 35.00	$ 8,073.01	Quantiy = Excavation - Backfill
Rough Surface Compaction	133	SY	$ 4.05	$ 540.55	Quantity = Length X Width
				$ 373,438.42	
Receiving Pit					
Excavation	432	CY	$ 13.51	$ 5,839.26	Quantity = Length X Width X 4 Dia
Launching Pit Shoring (installation, bracing, and removal)	2,333	SF	$ 65.00	$ 151,666.67	Quantity = ((Length X 4 Dia) X 2)+((Width X 4 Dia) X 2)
Load Haul Excavated Soils	432	CY	$ 4.73	$ 2,043.74	Quantity = Excavation
Gravel Bedding	46	CY	$ 47.30	$ 2,173.52	Quantity = (Length X Width X (0.5 Dia + 0.5')) - (Pipe Area X Length)/2
Fine Grade Compaction	44	SY	$ 2.70	$ 120.12	Quantity = Length X Width
Load/Haul Laydown Soils to Trench Areas	355	CY	$ 4.73	$ 1,680.09	Quantiy = Excavation - Gravel Bedding - Pipe
Backfill & Compact Native Soil	355	CY	$ 24.32	$ 8,640.45	Quantiy = Excavation - Gravel Bedding - Pipe
Off-Site Disposal Stockpile Spoils	77	CY	$ 35.00	$ 2,691.00	Quantiy = Excavation - Backfill
Rough Surface Compaction	44	SY	$ 4.05	$ 180.18	Quantity = Length X Width
				$ 175,035.03	
Shafts Subtotal		LS		**$ 548,473.45**	
Mob/Demob/Setup/Dism		LS		**$ 3,500,000.00**	
EPBM	2,000	LF	$ 6,010.43	$ 12,020,853.25	
Total Cost per LF				**$ 6,010.43**	**$/LF**

Details on "Cost Adders" Unit Cost

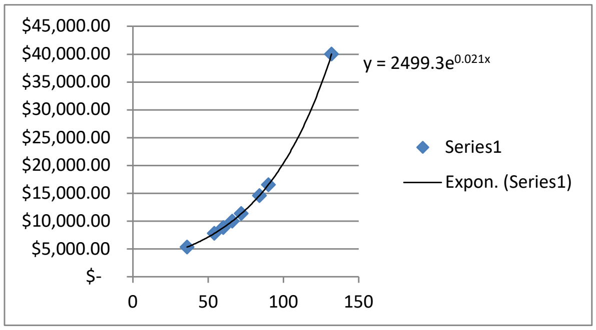
Cathodic Protection Unit Cost Data

Assumptions

1 Current is proportional to the radius of the pipe squared. As the pipe diameter increases the anode bed costs will increase exponentially
2 For a 66" pipe the cost of the anode bed will be $10,000 per mile
3 Incidental costs such as test stations will be $2,000 per mile
4 Add $40,000 per mile to anode bed costs for work in SCE Easement
5 These costs include materials and labor.

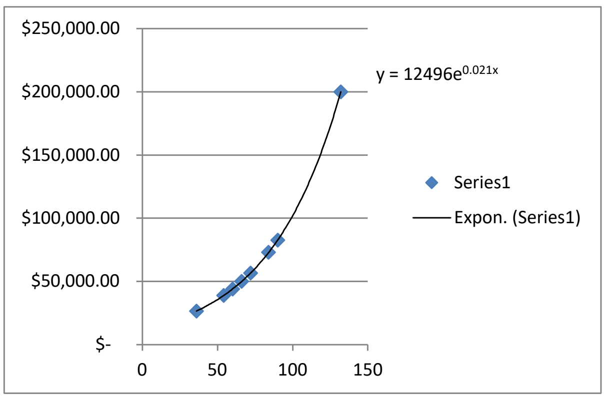
Determine anode bed costs for all pipe diameters outside of SCE Easement

Pipe Dia (inches)	Cost
132	$ 40,000.00
90	$ 16,548.42
84	$ 14,589.33
72	$ 11,339.48
66	$ 10,000.00
60	$ 8,813.55
54	$ 7,770.16
36	$ 5,324.35



Determine anode bed costs for all pipe diameters inside of SCE Easement

Pipe Dia (inches)	Cost
132	$ 200,000.00
90	$ 82,742.11
84	$ 72,946.67
72	$ 56,697.42
66	$ 50,000.00
60	$ 44,067.77
54	$ 38,850.80
36	$ 26,621.75



Cost Adder Major Utility Crossings

Assumptions

1 Jacking length is 30 feet.

2 Costs are all inclusive and include:
- Demolition, sitework, earthwork, dewatering, and site restoration costs for launching and receiving pits.
- Piping costs associated with casing, steel pipe, annular space grout, casing spacers, pipe welding, testing, cathodic protection , air valves, and blow offs.

3 Bore pits are assumed to be 30 feet long and 20 feet wide

4 Receiving Pits are assumed to be 20 feet long and 16 feet wide

5 Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Item Description	Quantity	Unit	Unit Cost	Total Cost	
			$	$	
Major Utility Crossing Adder					
84"	30	LF	$ 5,036.49	151,095	Jack & Bore

Cost Adder Major Intersection Crossings

Assumptions

1 The cost for crossing a Major Intersection would be comparable to a trenchless installation regardless of whether it was installed with open trench methods or trenchless construction methods due to the slower construction rate.

2 Jacking length is 200 feet.

3 Costs are all inclusive and include:
- Demolition, sitework, earthwork, dewatering, and site restoration costs for launching and receiving pits.
- Piping costs associated with casing, steel pipe, annular space grout, casing spacers, pipe welding, testing, cathodic protection , air valves, and blow offs.

4 Bore pits are assumed to be 30 feet long and 20 feet wide

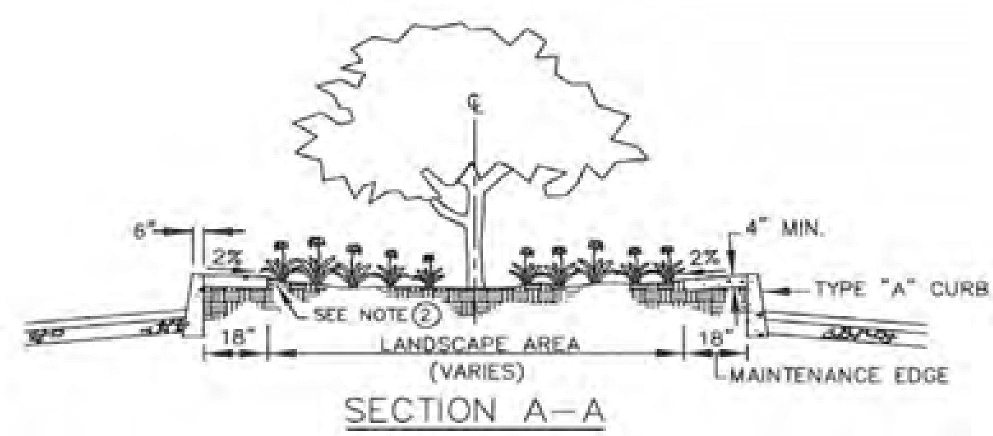
5 Receiving Pits are assumed to be 20 feet long and 16 feet wide

6. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %		
0.25912	August 2018 ENR CCI for LA:	12000.25
	May 2023 ENR CCI for LA:	15109.79

Item Description	Quantity	Unit	Unit Cost	Total Cost	
				$	
Major Intersection Crossing Adder					
84"	200	LF	$ 5,036.49	1,007,298	Jack & Bore

Cost Adder Landscaped Medians (demo & replace)

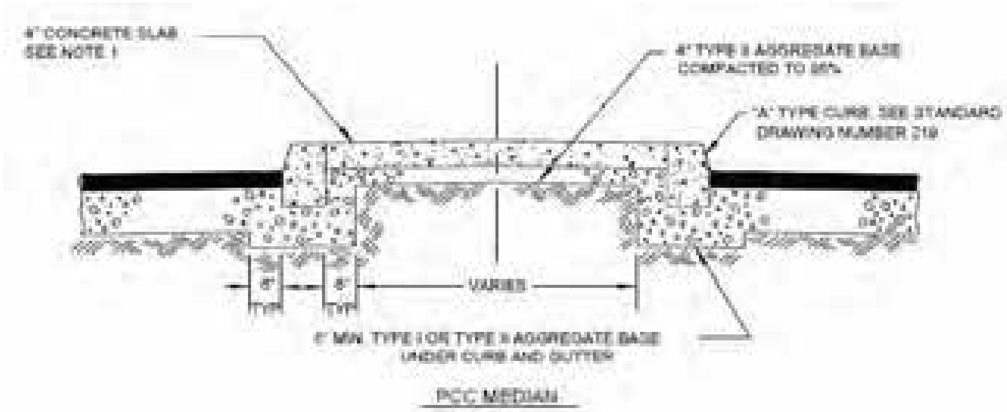


Assumptions
1. Trees are spaced every 25 feet
2. Average width of median = 10 feet
3. Quantities are calucation for 1 linear foot of landscaped median.
4. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %		
	August 2018 ENR CCI for LA:	12000.25
0.25912	May 2023 ENR CCI for LA:	15109.79

				Unit Cost (2023)		
Demolition						
Concrete Slab Removal	1	SF	$	6.08	$	6.08
Concrete Curb Removal	2	LF	$	6.76	$	13.51
Transportation and Disposal Fees (Recycle Concrete)	0.10	CY	$	270.27	$	27.81
Tree Removal	0.04	EA	$	1,148.67	$	45.95
Clearing and Grubbing	0.0002	AC	$	5,000.08	$	0.92
subtotal					$	94.27
Site Restoration						
Concrete Curbs	2	LF	$	47.30	$	94.60
Concrete Slabs	1	SF	$	27.03	$	27.03
Trees	0.04	EA	$	608.12	$	24.32
subtotal					$	145.95
Total					$	240.21 per linear foot

Cost Adder Raised Medians (demo & replace)



Assumptions
1. No trees
2. Average width of median = 8 feet
3. Quantities are calucation for 1 linear foot of landscaped median.
4. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

			Unit Cost (2023)		
Demolition					
Concrete Slab Removal	2.3	SF	$ 6.08	$ 14.19	
Concrete Curb Removal	2.0	LF	$ 6.76	$ 13.51	
Transportation and Disposal Fees (Recycle Concrete)	0.15	CY	$ 270.27	$ 41.15	
Subtotal				$ 68.86	
Site Restoration					
Concrete Curb	2	LF	$ 47.30	$ 94.60	
Concrete Slabs	2.3	SF	$ 27.03	$ 63.06	
Type II Aggregate base	0.1	SY	$ 8.11	$ 0.81	
Subtotal				$ 158.47	
Total				$ 227.33	per linear foot

Cost Adder Seismic Hazards/Fault Zones

DISCLAIMER: Assumptions are for a Class 5 cost estimate. A finite element analysis will be completed during later design phases to determine the exact method of ensuring seismic resiliency.

Assumptions:

1. Fault zone is 50 ft on each side of fault
2. D/t = 80 for 100 ft beyond D/t=60 zone
3. Unit cost of steel pipe is the price difference between the thicker pipe used in the fault zone and the standard pipe used in the construction methods
4. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %		
	August 2018 ENR CCI for LA:	12000.25
0.25912	May 2023 ENR CCI for LA:	15109.79

Calculate Cost per Linear Foot for 84-inch Pipe

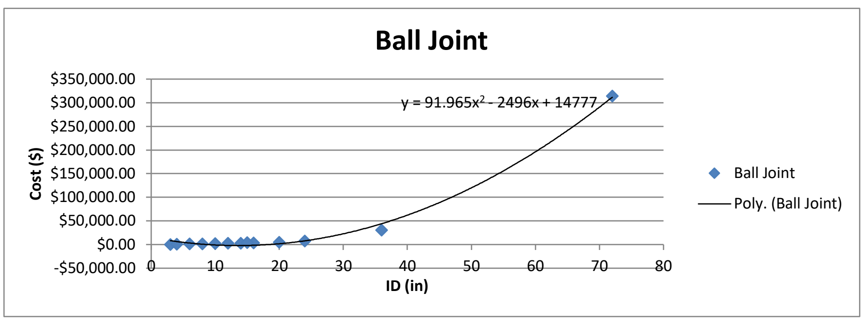
Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost
Seismic Hazards/Fault Zones					
1" Thick Pipe	300	LF	$310	$390	$117,098
Ball Joint	2	EA	$487,281	$613,547	$1,227,094
Subtotal					$1,344,193

Create trendline to interpolate ball joint costs

References:

1. EBAA Budgetary Quotation Emails, September 27 & 28, 2016

ID (in)	Cost ($)
3	$225.00
4	$638.00
6	$1,050.00
8	$1,416.00
10	$1,937.00
12	$2,582.00
14	$2,902.00
16	$3,340.00
15	$4,211.00
20	$4,936.00
24	$7,260.00
36	$30,201.00
72	$314,252.00



Use $y=91.965x^2 -2496x+14777$ to interpolate cost for ball joint diameters not included in the EBAA budgetary quote.

ID (in)	Cost ($)
42	$77,042.82
48	$114,069.16
54	$158,163.94
60	$209,327.14
84	$484,664.26

Cost Adder Dewatering

Notes
1. Microtunneling and traditional tunneling only require dewatering at the launching and receiving pits.
2. Jack & Bore requires dewatering at the pits and alongth the alignment.
3. Unit costs shown were escalated from August 2018 to May 2023 dollars using ENR Construction Cost Indexes for Los Angeles, California.

Escalation %		
0.25912	August 2018 ENR CCI for LA:	12000.25
	May 2023 ENR CCI for LA:	15109.79

Dewatering Location	Unit Cost ($/MO)	Construction Rate (ft/day)	Unit Cost (2023) ($/ft)
Roadway	$ 37,363	40	$ 38.88
SCE Easement	$ 37,363	200	$ 7.78
LAFCD Easement (River Bank)	$ 37,363	200	$ 7.78
LAFCD Easement (River Channel)	$ 53,375	200	$ 11.11
Trenchless			
Pits (Jack & Bore)	$ 53,375	60	$ 37.02
Alignment (Jack & Bore)	$ 37,363	60	$ 25.92
		Subtotal =	$ 62.94
Pits (Microtunnel)	$ 53,375	50	$ 44.43
Pits (Traditional)	$ 53,375	40	$ 55.54

Cost Adder Permeable Soils

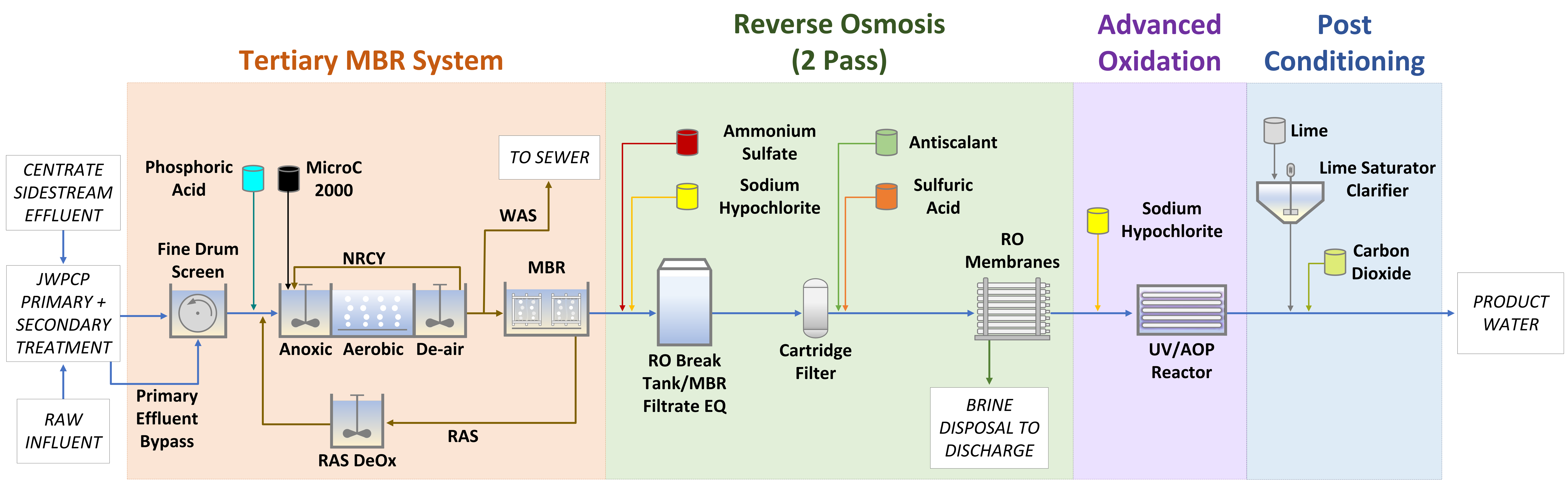
Notes:
1. Where permeable soils such as sand are present the cost of dewatering will be increased by 50%

Dewatering Location	Unit Cost ($/MO)	Construction Rate (ft/day)	Unit Cost ($/ft)
Roadway	$ 18,681	40	$ 19.44
SCE Easement	$ 18,681	200	$ 3.89
LAFCD Easement (River Bank)	$ 18,681	200	$ 3.89
LAFCD Easement (River Channel)	$ 26,688	200	$ 5.55
Trenchless			
Pits (Jack & Bore)	$ 26,688	60	$ 18.51
Alignment (Jack & Bore)	$ 18,681	60	$ 12.96
		Subtotal =	$ 31.47
Pits (Microtunnel)	$ 26,688	50	$ 22.21
Pits (Traditional)	$ 26,688	40	$ 27.77

Appendix C.3

Final Distributed Treatment TM Cost Appendices (2022)

CENTRALIZED TREATMENT PROCESS FLOW DIAGRAM



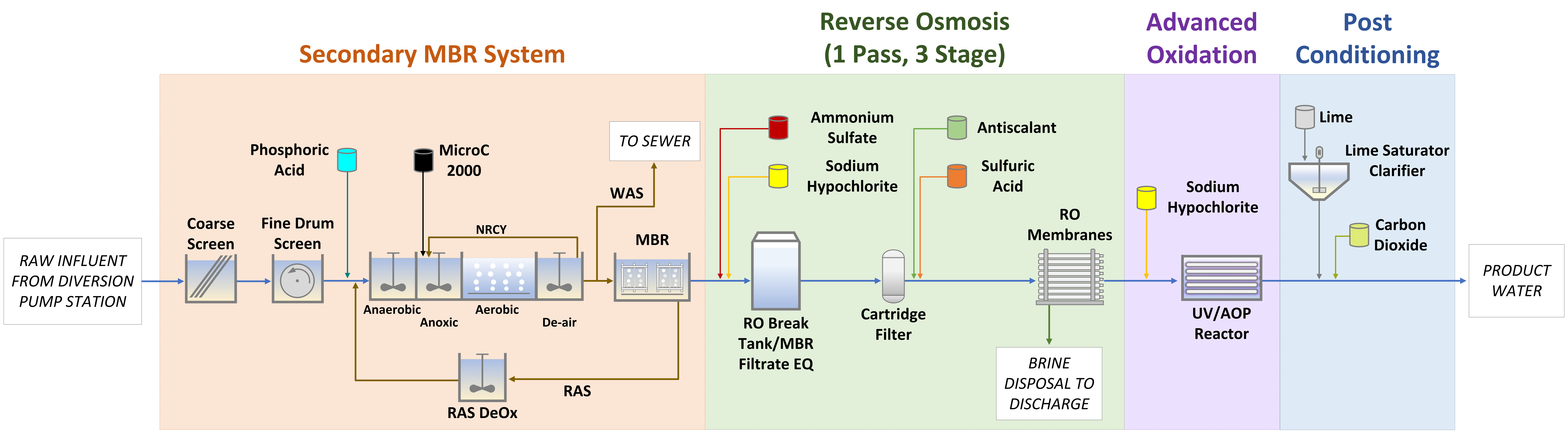
KEY TERMS

NRCY	Nitrate Recycle
RAS	Return Activated Sludge
WAS	Waste Activated Sludge
MBR	Membrane Bioreactor
RO	Reverse Osmosis
UV/AOP	Ultraviolet Advanced Oxidation Process

LEGEND

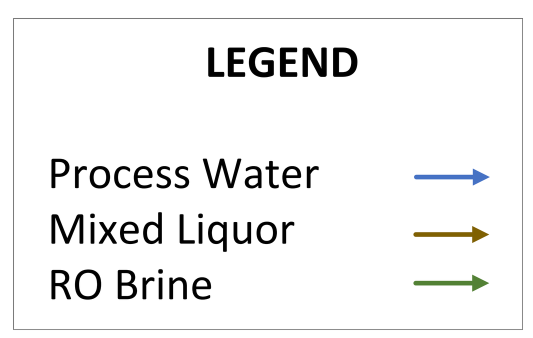
Process Water →
Mixed Liquor →
RO Brine →

DISTRIBUTED TREATMENT PROCESS FLOW DIAGRAM



KEY TERMS

NRCY	Nitrate Recycle
RAS	Return Activated Sludge
WAS	Waste Activated Sludge
MBR	Membrane Bioreactor
RO	Reverse Osmosis
UV/AOP	Ultraviolet Advanced Oxidation Process



MWD RRWP Distributed Recycled Water Treatment Cost Analysis

Inputs, Sizing, Cost Model

Inputs & Calculations	Unit	Diversion North Site 1 Commerce West	Diversion North Site 2 Commerce East	Diversion South Site 3 Long Beach	Notes
Flow Rates					
Wastewater Influent Flow Rate	mgd	20	13	30	based on available flow at noted diversion location, reduced to fit land available if footprint is a limiting factor
WAS flow	mgd	0.6	0.39	0.9	assumed as 3% of Influent Flow
RO Brine Flow	mgd	3	1.95	4.5	Assumed RO recovery of 85%, brine (RO Concentrate) is 15% of influent flow
Product Water Flow Rate	mgd	16.4	10.66	24.6	
Land Required					
Land required - Headworks and Odor Control	acre/mgd	0.045	0.045	0.045	based on area required for plants of similar scale
Land required - Secondary MBR	acre/mgd	0.08	0.08	0.08	assumes 8 hr HRT and 20 ft deep tanks, 1.5x factor for roads, yard piping; based on influent flow rate
Land required - AWT (RO, AOP, Chemicals, Buildings, etc.)	acre/mgd	0.32	0.32	0.32	based on area required for plants of similar scale, though there is a range. Low range found to be 0.2 acre/mgd but was not used based on vertical construction (2 level process building/tanks) and larger plant (>30 mgd)
Total size of parcel, required, minimum	acre	7.68	4.99	13.24	calculated
Size of parcel	acre	14.39	5.03	21.30	
Assumed Parcel for Study Basis	-	6336-017-908	6356-005-028	7310-015-019/034	Study Basis Parcels selected for allowing realistic location and infrastructure sizing considerations
Elevations					
Elevation at JWPCP	ft msl	44	44	44	elevation of FORCO site per Google Earth
Elevation at Distributed AWT Site	ft msl	150	156	30	approximated from Google Earth
Elevation at Distributed AWT Headworks	ft msl	175	181	55	site + 25 feet, assume headworks and secondary treatment process tanks are above grade
Elevation at WW source	ft msl	100	100	54	approximated from Google Earth
Elevation at Dist AWT-Backbone Connection	ft msl	100	100	18	approximated from Google Earth
Elevation at PS-3 forebay	ft msl	236	236	236	based on Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020
HGL at Dist AWT-Backbone Connection	ft msl	286	286	361	based on Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020
WW Pipeline and Pump Station Sizing					
WW Pipeline Diameter (New)	in	36	30	42	nearest 6" increment standard pipe size, within velocity target, pipe size is conservative to limit energy cost
Velocity	ft/s	4.4	4.1	4.8	>2.5 ft/s to keep solids suspended, < 6 ft/s
Distance from WW source to AWT	mi	5.78	4.22	2.1	estimated from google earth pipeline alignment
Static Head	ft	75	81	1	local high point along pipeline alignment is within 5 feet of beginning/end point elevation, so high point was ignored for these calculations
Hazen Williams Coefficient	-	130	130	130	slightly conservative for relatively smooth pipe 130-140 (e.g. HDPE, PVC lined, cement lined)
Dynamic Headloss	ft	49.2	39.3	17.9	Based on Hazen Williams friction loss equation, ignores minor losses as insignficant for this study (typical all dynamic headloss calculations)
Total Dynamic Head	ft	124.5	120.6	19.3	static head + dynamic headloss + velocity head (typical all TDH calculations)
Pumping Power Calculated	hp	622	392	142	assumes 70% wire to water efficiency due to solids passage pumps being less efficient than for clean water
Number of Pumps	-	3	3	3	2 duty + 1 standby
Pumping Power Calculated, with Standby Pump	hp	933.6	587.7	213.1	

MWD RRWP Distributed Recycled Water Treatment Cost Analysis

Inputs, Sizing, Cost Model

Inputs & Calculations	Unit	Diversion North Site 1 Commerce West	Diversion North Site 2 Commerce East	Diversion South Site 3 Long Beach	Notes
New Product Water Pipeline and Pump Station Sizing					
Product Water Pipeline Diameter (New)	in	30	24	36	nearest 6" increment standard pipe size, within velocity target
Velocity	ft/s	5.2	5.3	5.4	< 6 ft/s
Distance from AWT to Backbone	mi	4.53	3	2.12	estimated from google earth pipeline alignment
Static Head	ft	86	80	206	based on static lift to PS-3 forebay,
Hazen Williams Coefficient	-	130	130	130	slightly conservative for relatively smooth pipe 130-140 (e.g. HDPE, PVC lined, cement lined)
Dynamic Headloss, AWT to Backbone Pipeline Connection	ft	64.9	57.3	26.5	
Dynamic Headloss, Backbone Pipeline Connection to PS-3	ft	49.5	49.5	125.4	plus friction losses from backbone connection point to PS-3 forebay
Total Dynamic Head	ft	200.8	187.3	358.3	
Pumping Power, Calculated	hp	770	467	2061	assumes 75% wire to water efficiency
Number of Pumps	-	3	3	3	2 duty + 1 standby
Pumping Power Calculated, with Standby Pump	hp	1155	700	3091	
Product Water Backbone Pipeline and Central Pump Station Reduction					
Product Water Pipeline Diameter	in	84	84	84	
Velocity - base project	ft/s	6.03	6.03	6.03	150 mgd pumped from JWPCP
Updated Pipeline Diameter, between JWPCP and Dist AWT Backbone Connection	in	84	84	78	based on velocity of approximately 6 ft/s, diameter selection to the nearest 6" standard size
Updated Velocity	ft/s	5.37	5.60	5.85	
Distance from JWPCP to Dist AWT Backbone Connection	mi	19.7	19.9	6.48	estimated from google earth pipeline alignment
Static Head	ft	192	192	192	based on static lift to PS-3 forebay,
Hazen Williams Coefficient	-	130	130	130	slightly conservative for relatively smooth pipe 130-140 (e.g. HDPE, PVC lined, cement lined)
Dynamic Headloss Reduction/Addition	ft	-21.9	-14.6	1.1	calculation is for the difference in dynamic headloss for new pipeline size and flow compared to 150 mgd at 84 inches, for the length of pipe between PS-1 and distributed AWT/backbone connection
Total Dynamic Head	ft	330.5	337.9	353.6	TDH addition/reduction from 352 ft design point from Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020
Pumping Power Calculated	hp	10325	11007	10368	assumes 75% wire to water efficiency
Number of Pumps	-	5	5	5	4 duty + 1 standby
Pumping Power Calculated, with Standby Pump	hp	12906	11100	12960	
Brine Pipeline Sizing					
Brine Line Pipeline Diameter (New)	in	20	16	22	based on RO Brine Flow only; assume WAS returned to local gravity sewer
Velocity	ft/s	2.1	2.2	2.6	> 2 ft/s, since ground level elevations for most distributed treatment sites allow to convey by gravity to JWPCP the pipe size and velocity were selected to avoid a pump station if possible
Distance from AWT to JWPCP	mi	19.7	19.9	6.48	need from GIS analysis
Static Head	ft	-106	-112	14	local high point along pipeline alignment is within 5 feet of beginning/end point elevation, so high point was ignored for these calculations
Hazen Williams Coefficient	-	130	130	130	slightly conservative for relatively smooth pipe 130-140 (e.g. HDPE, PVC lined, cement lined)
Dynamic Headloss	ft	87.3	117.6	38.3	
Total Dynamic Head	ft	-18.7	5.7	52.4	assume there is residual pressure from RO skids of ~ 5 psi (10.2 ft), if TDH is greater than this a pump station is required
Pumping Power Calculated	hp			55	assumes 75% wire to water efficiency
Number of Pumps	-			3	2 duty + 1 standby
Pumping Power Calculated, with Standby Pump	hp			82.5	

MWD RRWP Distributed Recycled Water Treatment Cost Analysis

Inputs, Sizing, Cost Model

Capital Costs	Unit	Diversion North Site 1 Commerce West	Diversion North Site 2 Commerce East	Diversion South Site 3 Long Beach	Notes
Distributed Treatment Product Water Flow Rate	mgd	16.4	10.66	24.6	
Reduced Centralized Treatment Product Water Flow Rate	mgd	133.6	139.34	125.4	
Treatment					
Unit Cost of Land	$/acre	$ 1,829,900	$ 1,909,930	$ 2,128,940	based on market analysis of similar properties, study assumes that entire parcel would be purchased even if only part of the land is needed for the treatment facility
Land Cost	**$**	**$ 26,332,000**	**$ 9,607,000**	**$ 45,346,000**	
Centralized AWT (MBR-RO-AOP) - Capital Cost for 150 mgd	$	$ 2,397,000,000	$ 2,397,000,000	$ 2,397,000,000	from JTAP Train 3 Greenfield Secondary MBR NdN, 1 Pass RO - this includes 30% Engineering, Admin, ESDC, and 35% Contingency, May 2021 dollars
Centralized AWT (MBR-RO-AOP) - Total Product Flow	mgd	150	150	150	
Wastewater Screening - Reference Capital Cost for 15 mgd	$	$ 36,300,000	$ 36,300,000	$ 36,300,000	Reference facility cost for 15 mgd, escalated to today's dollars, plus 30% engineering admin, esdc, and 35% contingency to be consisted with other costs
Wastewater Screening Cost	$	$ 45,100,000	$ 32,700,000	$ 61,100,000	Reference facility cost for wastewater screening for 15 mgd facility, scaled using power factor of 0.75
Distributed AWT Facility Cost - scaled use power rule	$	$ 455,800,000	$ 329,900,000	$ 617,700,000	JTAP Train 3 SMBR Cost, scaled using power rule with factor of 0.75, which compares within 10-20% of other AWT unit process costs
Centralized AWT Facility Cost Offset - - scaled use power rule	$	$ (199,400,000)	$ (128,900,000)	$ (301,300,000)	JTAP Train 3 SMBR Cost, scaled, using power rule with factor of 0.75
Total Treatment Facility Cost - Net	**$**	**$ 301,500,000**	**$ 233,700,000**	**$ 377,500,000**	
Wastewater Conveyance					
Conveyance - WW Unit Cost	$/in-diam/ft	$ 61	$ 61	$ 61	based on C900 or ductile iron, planning level cost includes 25% engineering, CM, ESDC, and 35% contingency
WW Pumping Cost	$/hp	$ 5,781	$ 5,781	$ 5,781	pump station w/ building, based on PS3 cost from Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020, escalated to Q2 2021 to match other costs
Wastewater Conveyance Cost	$	$ 66,740,000	$ 40,610,000	$ 28,290,000	
Wastewater Pump Station Cost	**$**	**$ 5,397,000**	**$ 3,397,000**	**$ 1,232,000**	
Product Water Conveyance					
Conveyance - Product Water Unit Cost	$/in-diam/ft	$ 82	$ 82	$ 82	based on Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020; with 25% engineering, CM, ESDC, and 35% contingency, SGV alignment, escalated to Q2 2021 to match other costs
Conveyance - Product Water Unit Cost, Small Diameter (<36")	$/in-diam/ft	$ 61	$ 61	$ 61	based on cement lined and coated steel, planning level cost includes 25% engineering, CM, ESDC, and 35% contingency
Product Water Pumping Cost, pump station at treatment facility	$/hp	$ 5,495	$ 5,495	$ 5,495	based on PS1 cost from Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020; with 25% engineering, CM, ESDC, and 35% contingency, escalated to Q2 2021 to match other costs
Product Water Conveyance Savings	$	$ -	$ -	$ (16,922,342)	
Product Water Conveyance Cost	$	$ 43,590,000	$ 23,090,000	$ 24,480,000	
Product Water Conveyance Cost - Net	**$**	**$ 43,590,000**	**$ 23,090,000**	**$ 7,557,658**	
Product Water Pump Station Cost - Dist AWT	$	$ 6,346,000	$ 3,846,000	$ 16,985,000	
Product Water Pump Station Cost - Reduced PS-1	$	$ 70,910,000	$ 60,990,000	$ 71,210,000	
Product Water Pump Station Cost - PS-1 Centralized Only Option	$	$ 86,400,000	$ 86,400,000	$ 86,400,000	
Product Water Pump Station Cost - PS-1 Net	**$**	**$ (15,490,000)**	**$ (25,410,000)**	**$ (15,190,000)**	
Product Water Pump Station Cost - Total Net	**$**	**$ (9,144,000)**	**$ (21,564,000)**	**$ 1,795,000**	
Brine Line Conveyance Cost					
Conveyance - Brine Line Unit Cost	$/in-diam/ft	$ 61	$ 61	$ 61	based on C900 or ductile Iron, planning level cost includes 25% engineering, CM, ESDC, and 35% contingency. Needs to have separation from product water line, assume separate trench/alignment
Brine Pump Station Unit Cost	$/hp	$ 5,495	$ 5,495	$ 5,495	
Brine Line Conveyance Cost	**$**	**$ 126,400,000**	**$ 102,100,000**	**$ 45,700,000**	
Brine Pump Station Cost	**$**	**$ -**	**$ -**	**$ 453,200**	
All Pump Station - Net	**$**	**$ (3,747,000)**	**$ (18,167,000)**	**$ 3,480,200**	

MWD RRWP Distributed Recycled Water Treatment Cost Analysis

Inputs, Sizing, Cost Model

O&M Costs	Unit	Diversion North Site 1 Commerce West	Diversion North Site 2 Commerce East	Diversion South Site 3 Long Beach	Notes
Distributed Treatment Product Water Flow Rate	mgd	16.4	10.66	24.6	
Centralized Treatment Product Water Flow Rate	mgd	133.6	139.34	125.4	
Treatment					
Additional O&M cost for Screening - Unit Cost	$/gpd	$ 0.014	$ 0.014	$ 0.014	unit cost per EPA 1980, escalated to 2021 dollars w/ 3% average annual inflation, plus 15% adder for EPA undestimation
Additional O&M cost for WW Treatment at AWT	$/year	$ 270,500	$ 175,800	$ 405,700	
Labor FTEs for Distributed AWT		14	13	17	6 base staff = 2 plant managers (operations, maintenance), 1 chief operator, 2 shift supervisors/operators, 1 I&E supervisor, approximately 2 I&E tech and 6 operations/main staff for first 15 mgd, then 1 I&E tech, 2 maintenance tech, and 2 operators per 15 mgd after that
Reduced Labor FTEs for Centralized AWT		-5	-4	-8	Based on OCWD, approximately 1 I&E tech, 2 maintenance techs, 2 operators per 15 mgd
Additional Labor Cost for Distributed AWT	$/year	$ 4,368,000	$ 4,056,000	$ 5,304,000	
Additional Labor Savings for Centralized AWT	$/year	$ (1,560,000)	$ (1,248,000)	$ (2,496,000)	
Net Labor Cost for AWT	$/year	$ 2,808,000	$ 2,808,000	$ 2,808,000	assume average burdened cost rate of $150/hr
Conveyance and Pumping					
Average Energy Unit Cost	$/kWh	$ 0.15	$ 0.15	$ 0.15	based on Recycled Water Conveyance/Distribution System, Feasibility-Level Design Report, June 2020
Pumping Power WW source to AWT	hp	622	392	142	calculated wire to water power required, not motor size
Pumping Energy Use WW source to AWT, per year	kWh/year	3,945,400	2,483,400	900,500	assume 97% online factor
Annual Energy Cost	**$/year**	**$ 591,800**	**$ 372,500**	**$ 135,100**	
Pumping Power Dist. AWT Product Water Pump Station	hp	770	467	2061	calculated wire to water power required, not motor size
Pumping Energy Dist. AWT Product Water Pump Station	kWh	4,881,000	2,958,000	13,064,000	assume 97% online factor
Annual Energy Cost	**$/year**	**$ 732,200**	**$ 443,700**	**$ 1,959,600**	
Pumping Power, PS-1 (Reduced Centralized Product Water PS)	hp	10325.2	11007.0	10368.1	calculated wire to water power required, not motor size
Pumping Energy, PS-1 (Reduced Centralized Product Water PS)	kWh	65,450,000	69,770,000	65,720,000	assume 97% online factor
Annual Energy Cost	**$/year**	**$ 9,817,500**	**$ 10,465,500**	**$ 9,858,000**	
Pumping Power Original PS-1	hp	12345	12345	12345	4 duty pumps at 37.5 mgd at 352 ft, 75% efficiency
Pumping Energy, Original PS-1	kWh	78,250,000	78,250,000	78,250,000	assume 97% online factor
Pumping Power Savings PS-1	hp	-2019.7	-1337.9	-1976.8	
Pumping Energy Offset JWPCP to Backbone Connection	kWh	-12,803,000	-8,481,000	-12,531,000	assume 97% online factor
Annual Energy Cost	**$/year**	**$ (1,920,000)**	**$ (1,270,000)**	**$ (1,880,000)**	
Pumping Power, Brine Pump Station	hp	0.0	0.0	55.0	
Pumping Energy, Brine Pump Station	kWh	0	0	348,500	
Annual Energy Cost	**$/year**	$ -	$ -	**$ 52,280**	
Annual Energy Savings	kWh/yr	(3,976,600)	(3,039,600)	1,782,000	
Annual Net Maintenance of Pipelines and Pump Stations unit cost	$	0.5%	0.5%	0.5%	
Annual Net Maintenance of Pipelines and Pump Stations, 0.5% of capital	$/year	226,200	41,600	61,350	
O&M Costs - Centalized AWT, For Reference Only					
Annual Energy Use, 150 mgd AWT (reference only)	kWh/yr	222,000,000	222,000,000	222,000,000	scaled from OCWD GWRS 2019-2020 O&M
Annual Energy Use, Product Water Pumping (reference only)	kWh/yr	156,500,000	156,500,000	156,500,000	estimated from RRWP conveyance feasibility study
Annual Energy Cost, Product Water Pumping (reference only)	**$/year**	**$ 23,475,000**	**$ 23,475,000**	**$ 23,475,000**	estimated from RRWP conveyance feasibility study
Annual Centalized AWT O&M Cost	**$/year**	**$ 108,000,000**	**$ 108,000,000**	**$ 108,000,000**	based on JTAP Train 1E estimate

MWD RRWP Distributed Recycled Water Treatment Cost Analysis

Cost Summary

Cost Summary	Unit	Diversion North Site 1 Commerce West (Distributed AWT + Reduced-Size Centralized Facility)	Diversion North Site 2 Commerce East (Distributed AWT + Reduced-Size Centralized Facility)	Diversion South Site 3 Long Beach (Distributed AWT + Reduced-Size Centralized Facility)	Centralized AWT Project	Notes
AWT Product Flow		**16.4**	**10.66**	**24.6**	**150**	
Capital Cost						
Distributed Treatment Facility						
Land Cost	$	$ 26,332,000	$ 9,607,000	$ 45,346,000		based on market analysis of similar properties
Treatment Facility Cost	$	$ 500,900,000	$ 362,600,000	$ 678,800,000	$ 1,871,000,000	**Distributed AWT cost scaled based on 0.75 power factor; influent screening-secondary MBR-RO-AOP-stablilization**
Capital Cost Total - Treatment Facility Land and Construction	**$**	**$ 527,232,000**	**$ 372,207,000**	**$ 724,146,000**		
Capital Cost Treatment Facility per mgd		**$ 32.15**	**$ 34.92**	**$ 29.44**	**$ 12.47**	
Conveyance and Pumping - Distributed Treatment New Components						
Wastewater Conveyance Cost	$	$ 66,740,000	$ 40,610,000	$ 28,290,000		
Wastewater Pump Station Cost	$	$ 5,397,000	$ 3,397,000	$ 1,232,000		
Product Water Conveyance Pipeline (Distributed Treatment to Backbone)	$	$ 43,590,000	$ 23,090,000	$ 24,480,000		Site 2 alternative includes cost savings of reducing backbone pipeline to 78" prior to connection with distributed AWT product water
Brine Line Conveyance Cost	$	$ 126,400,000	$ 102,100,000	$ 45,700,000		
Brine Line Pump Station Cost	$	$ -	$ -	$ 453,200		
Capital Cost Total Conveyance and Pumping - New Components	$	$ 242,127,000	$ 169,197,000	$ 100,155,200		
Conveyance/Pumping Cost per mgd	$	$ 14.8	$ 15.9	$ 4.1		
Total Capital Cost - Distributed Facility Components	**$**	**$ 769,000,000**	**$ 541,000,000**	**$ 824,000,000**	**$ 1,871,000,000**	
Capital Cost Total Distributed Facility Components per mgd		**$ 46.89**	**$ 50.75**	**$ 33.50**	**$ 12.47**	
Centralized Facility Savings						
Centralized Treatment Facility Cost - Savings		$ (199,000,000)	$ (129,000,000)	$ (301,000,000)		
Conveyance and Pumping - Savings of Product Water Components						
Product Water Pump Station Cost - at Distributed Facility	$	$ 6,346,000	$ 3,846,000	$ 16,985,000		
Product Water Pump Station Cost - Savings at Centralized Facility	$	$ (15,490,000)	$ (25,410,000)	$ (15,190,000)		
Product Water Conveyance Net Cost (Includes savings of Backbone Pipeline Diameter Reduction, if applicable)	$	$ -	$ -	$ (16,930,000)		Site 2 alternative includes cost savings of reducing backbone pipeline to 78" prior to connection with distributed AWT product water
Total Product Water Conveyance and Pumping Savings	**$**	**$ (9,144,000)**	**$ (21,564,000)**	**$ (15,135,000)**		
Total Capital Cost - Savings on Centralized Facility Components	**$**	**$ (208,144,000)**	**$ (150,564,000)**	**$ (316,135,000)**		
Total Capital Cost - Net	**$**	**$ 561,000,000**	**$ 390,000,000**	**$ 508,000,000**	**$ 1,871,000,000**	centralized project assumes Tertiary NdN MBR Train, Train 1E
Net Increase as a % of Centralized AWT Cost		**30%**	**21%**	**27%**		
Distributed Product Water Flow as a % of Centralized AWT Flow		**11%**	**7%**	**16%**		
O&M Costs						
Conveyance and Pumping Costs/Savings						
WW Diversion Lift Station - Energy Cost	$/year	$ 591,800	$ 372,500	$ 135,100		
Brine Pump Station - Energy Cost	$/year	$ -	$ -	$ 52,280		
Pumping from Distributed AWT to Backbone - Energy Cost	$/year	$ 732,200	$ 443,700	$ 1,959,600		
Pumping from Centralized AWT to Backbone - Energy Cost Savings	$/year	$ (1,920,000)	$ (1,270,000)	$ (1,880,000)		
Total Additional Energy Cost/Savings	**$/year**	**$ (596,000)**	**$ (454,000)**	**$ 267,000**		
Annual Energy Use/Savings - Net	kWh/yr	(3,976,600)	(3,039,600)	1,782,000	156,500,000	
Annual Energy Use/Savings, % of Product Water Pumping for Centralized Project	**%**	**-2.5%**	**-1.9%**	**1.1%**		
Pump Station and Conveyance Maintenance Costs/Savings, Net	**$/year**	**$ 226,200**	**$ 41,600**	**$ 61,350**		
Total Conveyance and Pumping O&M Cost/Savings	**$/year**	**$ (369,800)**	**$ (412,400)**	**$ 328,350**		
Treatment Facility O&M Costs/Savings						
Additional O&M for WW Treatment at Distributed AWT	$/year	$ 270,500	$ 175,800	$ 405,700		
O&M for SMBR train at Distributed AWT	$/year	$ 11,042,667	$ 7,177,733	$ 16,564,000		**uses $101M/year and scales by flow rate from JTAP Train 3 greenfield SMBR-RO-AOP AWT Cost**
O&M for Centralized AWT	$/year	$ 96,192,000	$ 100,324,800	$ 90,288,000		O&M for centralized project is based on jacobs estimate for tertiary NdN, Train 1E, reduced by flow rate
Additional Labor Cost for Distributed Treatment	$/year	$ 2,808,000	$ 2,808,000	$ 2,808,000		additional staffing required due to 2 facilities
Total O&M for Facility Operation	**$/year**	**$ 110,310,000**	**$ 110,490,000**	**$ 110,070,000**	**$ 108,000,000**	O&M for centralized project is based on jacobs estimate for tertiary NdN, Train 1E
Total Treatment Facility O&M Cost/Savings	**$/year**	**$ 2,310,000**	**$ 2,490,000**	**$ 2,070,000**		
Total O&M Cost - Net	**$/year**	**$ 1,940,200**	**$ 2,077,600**	**$ 2,398,350**		

MWD RRWP Distributed Recycled Water Treatment Cost Analysis

Cost Summary

Net Present Value						
Distributed Treatment Facilities						
O&M for Treatment Facility, NPV	$	$ 175,990,000	$ 126,640,000	$ 246,480,000	$ 1,345,920,000	Uses O&M $/gal estimate from centralized project SMBR JTAP train 3
O&M for Treatment Facility Conveyance and Pumping, New Components, NPV	$	$ 10,200,000	$ 5,170,000	$ 3,100,000		
Capital Cost for Treatment Facility	$	$ 527,232,000	$ 372,207,000	$ 724,146,000	$ 1,871,000,000	
Capital Cost for Conveyance and Pumping, New Components	$	$ 242,127,000	$ 169,197,000	$ 100,155,200		
Total Distributed Treatment Facility and New Conveyance and Pumping Components	$	**$ 955,550,000**	**$ 673,220,000**	**$ 1,073,890,000**	**$ 3,216,920,000**	
$/gpd, treatment, per facility	$	$ 58.3	$ 63.2	$ 43.7	$ 21.4	
$/acre-ft, treatment, per facility	$	**$ 2,600.62**	**$ 2,818.82**	**$ 1,948.46**	**$ 957.23**	
Centralized Treatment Savings						
Centralized Treatment O&M Savings, NPV	$	$ (147,160,000)	$ (95,650,000)	$ (220,740,000)		
Capital Cost Savings for Centralized Treatment Facility	$	$ (199,000,000)	$ (129,000,000)	$ (301,000,000)		
Total Centralized Treatment Facility Savings, NPV	**$**	**$ (346,200,000)**	**$ (224,700,000)**	**$ (521,700,000)**		
Product Water Conveyance and Pumping						
O&M Savings Product Water Pumping, NPV	$	$ (14,810,000)	$ (10,300,000)	$ 1,000,000		
Capital Cost Savings Product Water Conveyance and Pumping	$	$ (9,144,000)	$ (21,564,000)	$ (15,135,000)		
Total Product Water Conveyance and Pumping Savings	$	**$ (24,000,000)**	**$ (31,900,000)**	**$ (14,100,000)**		Uses Capital cost NPV as year zero cost
Total Net Present Value Cost/Savings	**$**	**$ 585,350,000**	**$ 416,620,000**	**$ 538,090,000**	**$ -**	**Uses Capital cost NPV as year zero cost**
Inputs						
Discount Rate	**5%**					
Time (years)	**20**					

Century Distribution Center
Photo credit: Costar

Acquisition Cost Analysis
Three Candidate Sites for Distributed Recycled Water Treatment Study

Report Date:
March, 2022

Prepared for:
Metropolitan Water District of Southern California

Prepared by:
Stantec

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I. Purpose and Scope of Analysis

The selection of a location for a new water treatment facility in southern Los Angeles County requires consideration of multiple factors. This analysis focuses on one such factor—that is, the cost of site acquisition. This analysis is one part of a larger feasibility evaluation that is summarized in the Assessment of Distributed Recycled Water Plants Study Technical Memorandum.

Stantec real estate staff investigated the cost context for property acquisition for three candidate sites—two in the City of Commerce, and one in the City of Long Beach. Candidate sites are as described in Table 1.

Table 1. Candidate Sites

	Site 1	Site 2	Site 3
APN	6336-017-908	6356-005-028	7310-015-018, 7310-015-019, 7310-015-020, 7310-015-021, 7310-015-022, 7310-015-033
Location	Fronts on Telegraph Road North of S Tubeway Ave	Fronts on Bandini Blvd East of Garfield Ave	Frontage on Via Oro Ave, W Carson St, Via Alcalde Ave, W Via Plata St
City	Commerce	Commerce	Long Beach
Owner	Community Development Commission of Commerce City	Russian Molokan Christian Spiritual Jumpers Cemetery	Intex Properties South Bay Corp
Land Area (acres)	14.39	5.03	24.94
Zoning	C-2 Unlimited Commercial	PF Public Facility	PD-26 West Long Beach Business Park
Land Use Code	Industrial - Vacant Land	Cemetery	Industrial - Vacant Land

The analysis and findings can be thought of as an initial foundation for understanding the likely acquisition cost of each site. They take into consideration:

- Prevailing sale prices for industrial property in the areas surrounding the candidate sites
- The trendline for industrial property sale prices over the past eight years
- The price premium for larger industrial properties
- The price premium for locations proximate to the area's freeway infrastructure

The analysis yields an estimated acquisition cost for each site based on these considerations.

The eventual actual acquisition cost is dependent on additional considerations that go beyond the scope of this initial analysis. One important group of additional considerations relates to a broader set of site-specific and location-specific characteristics of each site. A subsequent phase of research or a full property appraisal can surface and analyze these additional factors.

An additional important factor is true of every real estate transaction, and that is the price expectations of the particular property owner and/or their level of interest in the sale of their property.

II. Analysis

The price point for property acquisition is based on the market for the private development of each property. The research of the candidate sites resolved to an assessment that private sector demand for all three properties will be for industrial development. In two cases that is because of the zoning of the property and the nature of the surrounding land uses. While site 1 allows for other commercial uses are allowed, this research shows that the prevailing sale prices of large properties for retail and office purposes is on the average lower than the average sale prices of large properties for industrial development. That indicates an industrial developer will outcompete a commercial developer for the property.

Selection of Comparable Sales

Based on this understanding, Stantec utilized the Costar database (a market data service which provides information on the vast majority of commercial properties in the United States) to select four sets of properties with recent land sales to use as points of comparison.

A set of newly developed industrial properties were selected in a ten mile radius of each of the three candidate sites. The identified properties were investigated to determine whether there was a property acquisition that preceded the industrial development, and if so how much was paid for the property. Where there was clear sale data preceding the development, that property was considered a comp (comparable property), and was the subject of further analysis. Selection criteria were as follows.

- **Site 1.** Properties were selected within a 10 mile radius of Site 1 for industrial developments that were completed in 2017 or later, and where the land area was 8 acres or larger. Seventeen properties were identified, of which five had usable data relative to a property sale prior to development, and are considered comps.
- **Site 2.** Properties were selected within a 10 mile radius of Site 2 for industrial developments that were completed in 2017 or later, and where the land area was 3 to 8 acres. 23 properties were identified, of which eleven had usable data relative to a property sale prior to development, and are considered comps.
- **Site 3.** Properties were selected within a 10 mile radius of Site 3 for industrial developments that were completed in 2017 or later, and where the land area was 12 acres or larger. Eight properties were identified, of which four had usable data had usable data relative to a property sale prior to development, and are considered Comps.

Maps of the properties identified through this process are located in the Appendix, with tables providing relevant data for each property.

The fourth set of properties utilized Costar's property sales inventory to identify land sales of industrial property that are from a broader area, or which have not yet led to industrial redevelopment. Selection criteria is as follows.

- **Industrial land sales.** Properties were selected within a 20 mile radius of the midpoint of the candidate sites. Selected sites were identified as industrial land that had sold within the past five years, and were 10 acres or greater in area. (Commercial land of the same size was also selected to compare industrial land sales to land sales for retail or office development.)

Maps of the properties identified through this process are located in the Appendix, with tables providing relevant data for each property.

Analysis of Sales Data

The per acre sale price of land for industrial development varied widely between properties in our samples. But patterns can be observed that are helpful in estimating acquisition costs for our candidate sites.

Sale price trend. In order to estimate the likely acquisition cost for properties in 2022, sale prices occurring in past years need to be adjusted to their 2022 equivalent. Figure 1 is a scatterplot that illustrates the 31 property sales events from the combined four sets of comps. Each diamond represents a sale event, illustrating the date of sale on the horizontal axis, and the per acre sale price on the vertical axis.

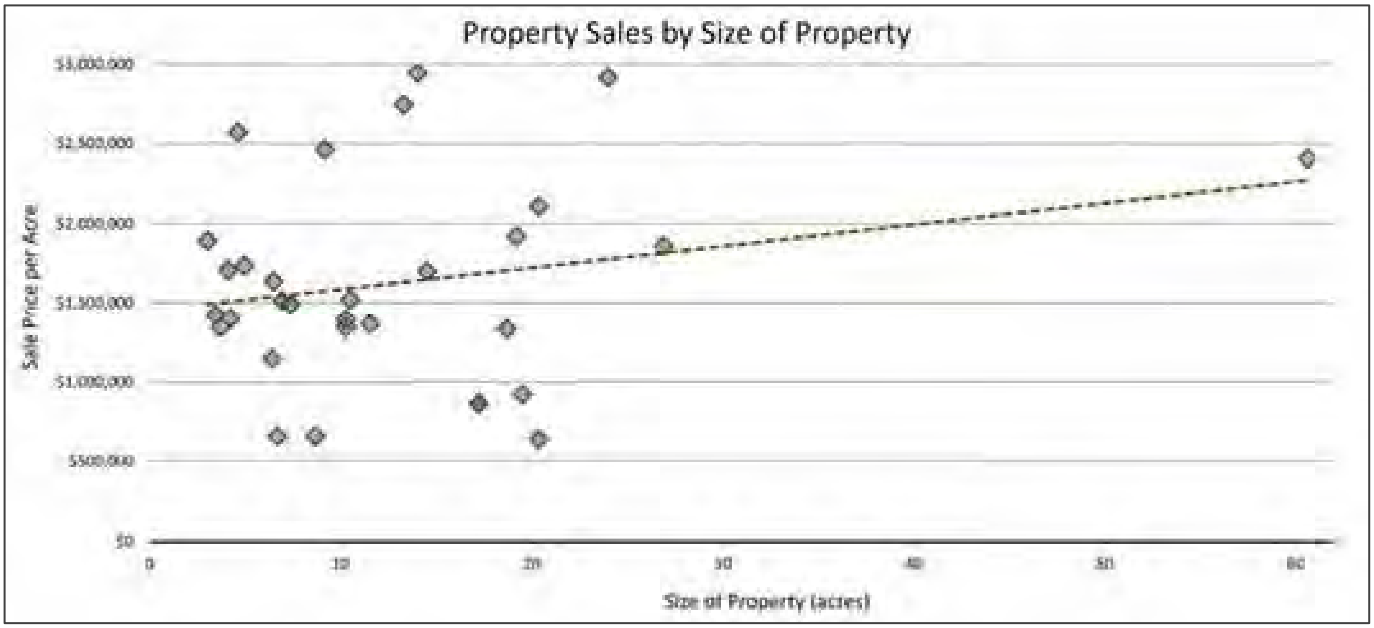
Figure 1. Per Acre Sale Price of Comparable Properties, by Date of Sale

Source: Costar

The trend line shows the trajectory of the average sale price over time. Over a ten year period from 2012 to 2022, the average sale price increased by around $500,000. The scatterplot also implies that if all sales were advanced to 2022 market conditions, utilizing 2022 dollars, the average sale price of industrial land in this sample of properties would be around $1.8 million per acre, or around $41 per square foot.

Property size. Given the high demand for distribution centers, and the relative scarcity of large properties in the fully developed areas of Los Angeles County, we anticipated a possible price premium for large sites. Figure 2 and Figure 3 are scatterplots that examine the correlation between sale price and property size. The diamonds represent sale events. The horizontal axis is the size of the property being sold, and the the vertical axis shows the sale price on a per-acre basis. The difference between the Figures 2 and 3 is that Figure 3 eliminates the sale of the 60+ acre property that is an anomaly in this sample, and verifies that the correlation of greater property size to greater sale price continues to hold without that property.

Figure 2. Per Acre Sale Price of Comparable Properties, by Size of Property



Source: Costar

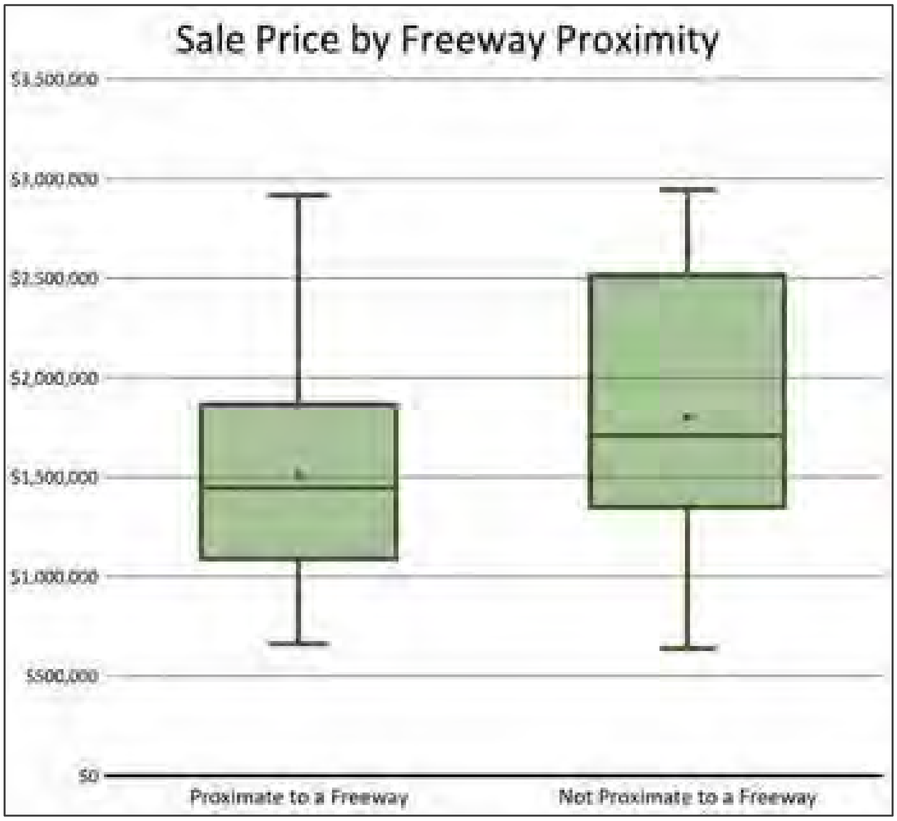
Figure 3. Per Acre Sale Price of Comparable Properties, by Size of Property (Outlier Property Exempted)

Source: Costar

The trend line confirms that, despite a diversity of sale prices, the sale of larger properties is associated with higher average sale prices. More specifically, a ten acre increase in size is, among these reference sales, associated with an increase of about $100,000 in average sale price per acre.

Freeway proximity. Proximity to the regional transportation network is known to be an asset for industrial properties. Properties near freeways generally have higher value and therefore higher sale prices. Given that, we categorized the same set of property sale comps into those that are closely proximate to one of the area's freeways, and those that are less proximate—using simple observation to divide the properties into those two groups. Figure 4 shows the findings from that analysis.

Figure 4. Per Acre Sale Price of Comparable Properties, by Freeway Proximity



Source: Costar

For this sample of properties, the median sale price was lower for properties with immediate freeway proximity than for those that were further away from freeways. This runs counter to the known value that convenient transportation access has for industrial properties. Without further research we can't determine whether that's an anomaly in this particular set of properties, or whether there are reasons why freeway proximity in LA County is less of a differentiator than it is in some other areas.

Estimated Acquisition Costs

The preceding analysis supports the estimation of acquisition cost for the three candidate sites. Table 2 provides those estimates, and illustrates how the analytical findings play into those estimates. Note the following.

- **2022 base value.** The base value for each site assumes $1.8 million as the average per-acre sale price of the property comps forwarded to 2022 values. The per acre value is multiplied by the land area.
- **Adjustment for property size.** The sale price was adjusted to reflect the level of price premium for larger properties that were found in our sample of properties.
- **Adjustment for freeway proximity.** Given that these sale comps who no positive price impact related to freeway proximity, this model assumed a very modest 2% price premium for the

three candidate sites due to their strong positioning relative to the area transportation network.

- **Adjustment for public acquisition.** Public site acquisition or condemnation typically requires paying a price premium in the real world market because the timing of public acquisitions does not typically align perfectly with the seller's timing or price expectations. A 10% price premium was assumed for the privately owned sites—Site 2 and Site 3. Site 1 is in public ownership, so no price premium is assigned for Site 1.

Table 2. Estimated Acquisition Costs

	Site 1	Site 2	Site 3
APN	6336-017-908	6356-005-028	7310-015-018 & five others
Land Area (acres)	14.39	5.03	24.94
2022 Base Value	$25,902,000	$9,054,000	$44,892,000
Adjustment for Property Size	-$87,779	-$501,491	$2,479,036
Adjustment for Freeway proximity	$518,040	$181,080	$897,840
Adjustment for Public Acquisition	$0	$873,359	$4,826,888
Estimated Acquisition Cost	**$26,332,261**	**$9,606,948**	**$53,095,764**
Estimated Acquisition Cost per Acre	**$1,829,900**	**$1,909,930**	**$2,128,940**

Note the following general findings.

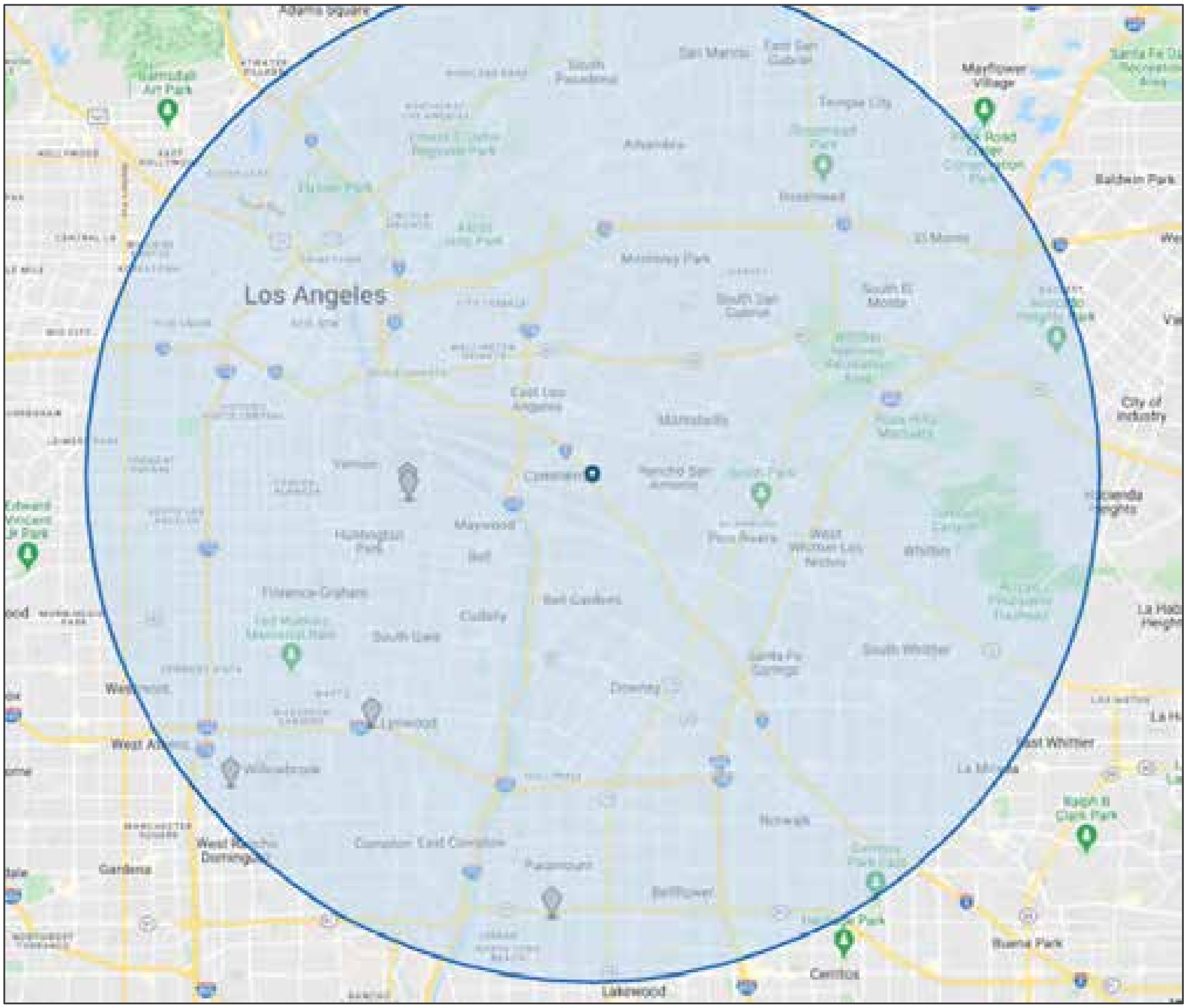
- The lowest cost site to acquire is estimated to be Site 2, at an estimated acquisition cost of $9.6 million. Site 3 is estimated to cost the most, at an estimated $53 million. The primary explanation of the cost difference is simply the size of the property. If the water treatment facility requires the same physical footprint regardless of which site that is acquired, the excess property on the larger sites can be resold and that part of the acquisition expenditure would then be largely recouped.

- The estimated lowest cost on a per acre basis would be for Site 1, at an estimated $1.83 million per acre. It benefits in comparison to the other two sites by being already in public ownership. Site 2 is estimated to cost a bit more, at around $1.91 million per acre. It benefits in comparison to Sites 1 and 3 by being the smallest site, so it is not subject to the cost premium associated with large sites. Site 3 would be an attractive site for an industrial development that requires a large site. And it is not in public ownership. So it has the highest per-acre site cost of the three sites.

Appendix

Site 1 Aerial

Site 1 Comps - Map

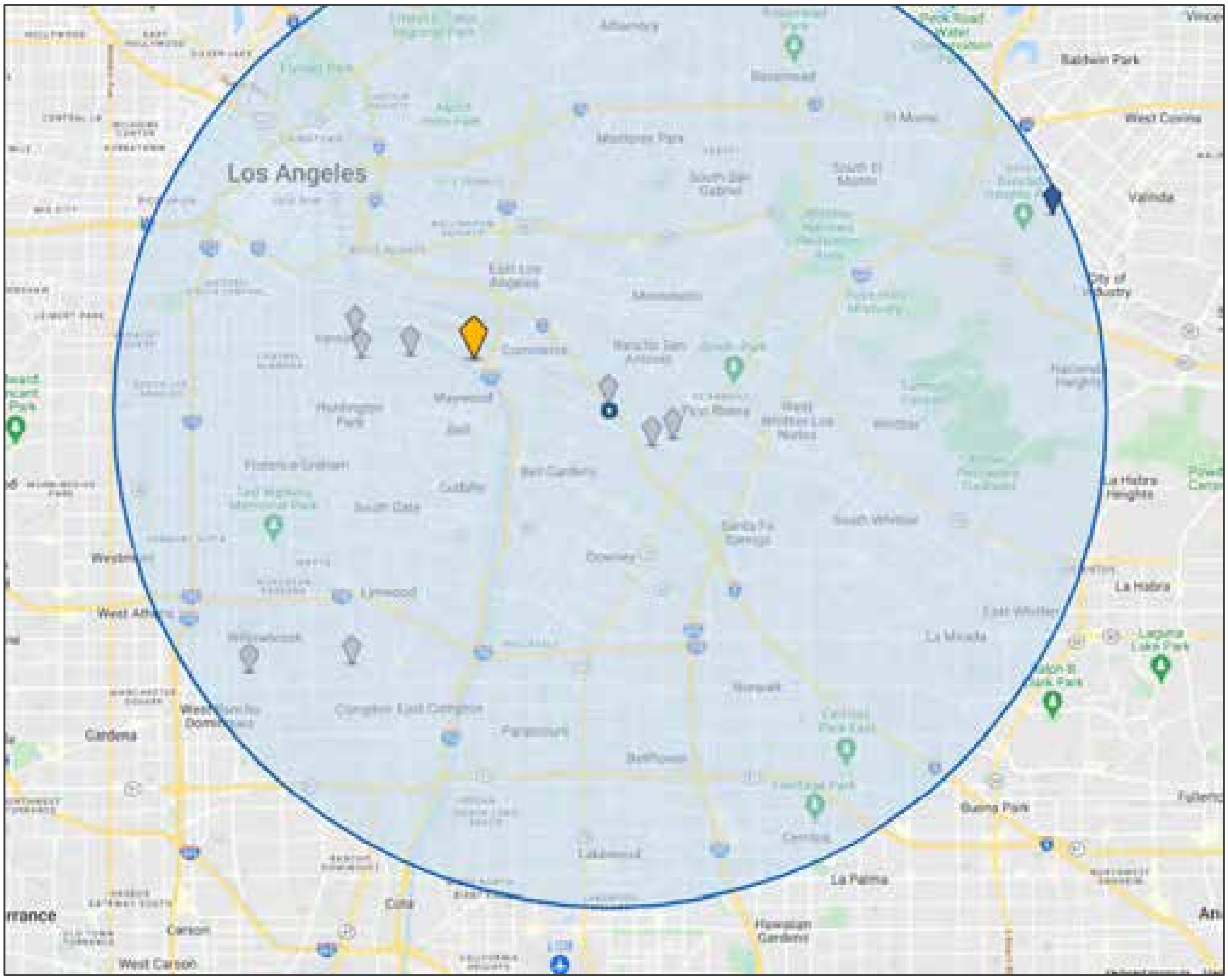


Site 1 Comps - Table

Property Address	11600 Alameda St	2400 E Artesia Blvd	5300 S Boyle Ave	5370 S Boyle Ave	13344 S Main St
City	Lynwood	Long Beach	Vernon	Vernon	Los Angeles
Developer		Bridge Development Partners	Xebec Realty Partners	Xebec Realty Partners	
Owner	Duke Realty Corporation	Bridge Industrial	The Church of Jesus Christ of Latter-Day Saints	Xebec Realty Partners	Duke Realty Corporation
Year Built	2017	2021	2018	2017	2021
Property Type	Industrial	Industrial	Industrial	Industrial	Industrial
Subtype	Distribution	Warehouse	Manufacturing	Distribution	Distribution
Building Class	A	A	A	A	A
Tenancy	Single	Single	Single	Multi	Single
Land Area (acres)	8.68	17.23	14.53	9.17	13.30
Building Floor Area (s.f.)	201,027	415,160	305,350	203,317	290,303
Land Area Coverage	53%	55%	48%	51%	50%
Land Acquisition Cost	$5,720,000	$14,874,780	$24,713,083	$22,557,000	$36,510,000
Acquisition Date	7/16/2015	7/12/2018	2/1/2016	1/26/2016	10/1/2018
Land Acquisition Cost per Acre	$658,986	$863,307	$1,701,031	$2,461,131	$2,745,113
Zoning	LYM*	LBIG	VEM*	VEM*	LCM11/2-B1

Site 2 Aerial

Site 2 Comps - Map



Site 2 Comps – Table (A)

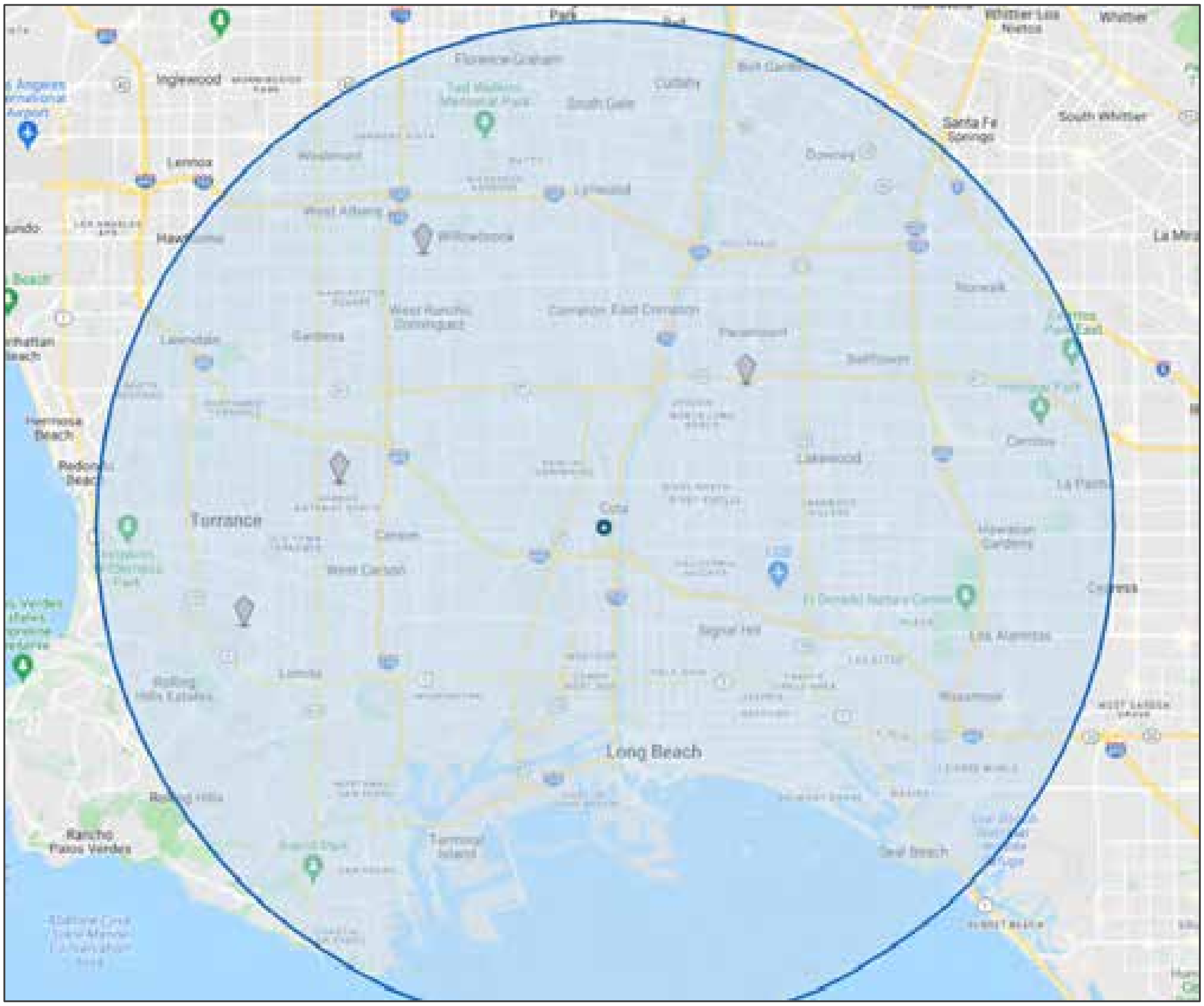
Property Address	221 N Orange Ave	2651 E 45th St	4490 Ayers Ave	7140 Bandini Blvd	4224 District Blvd	1420 N Mckinley Ave
City	City Of Industry	Vernon	Vernon	Commerce	Vernon	Compton
Developer					Bridge Development Partners	
Owner		Brookfield Premier Real Estate Partners	Isaac Alchalel	JFC International Inc	Winix Inc	Rexford Industrial Realty, Inc.
Year Built	2019	2018	2018	2020	2020	2017
Property Type	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial
Subtype		Warehouse	Warehouse	Distribution	Distribution	Warehouse
Building Class		A	B	A	B	A
Tenancy	Multi	Single	Single		Single	Single
Land Area (acres)	3.71	3.44	4.21	7.38	4.63	6.70
Building Floor Area (s.f.)	80,814	82,559	94,769	170,440	117,360	136,685
Land Area Coverage	50%	55%	52%	53%	58%	47%
Land Acquisition Cost	$5,000,000	$4,900,000	$5,900,000	$11,000,000	$11,900,000	$4,393,483
Acquisition Date	11/1/2016	4/1/2012	8/1/2014	7/1/2013	6/1/2018	2/1/2016
Land Acquisition Cost per Acre	$1,348,239	$1,424,419	$1,401,425	$1,490,515	$2,570,194	$656,135
Zoning	IDM	VEM*	VM1	CMM2*	VEM*	MH

Site 2 Comps – Table (B)

Property Address	126 E Oris St	7860 Paramount Blvd	7919 S Paramount Blvd	5001 S Soto St	7875 Telegraph Rd
City	Compton	Pico Rivera	Pico Rivera	Vernon	Pico Rivera
Developer		Sares-Regis Group			
Owner	Westcore Properties	Sares-Regis Group	Paramount Pico Rivera Industrial LLC	Hamid R. & Mahasti Mashhoon	Alere Property Group
Year Built	2020	2019	2019	2017	2019
Property Type	Industrial	Industrial	Industrial	Industrial	Industrial
Subtype	Warehouse	Distribution	Warehouse	Distribution	Warehouse
Building Class	B	A	B	A	A
Tenancy	Single	Multi	Single	Single	Single
Land Area (acres)	4.10	6.92	3.03	4.96	6.48
Building Floor Area (s.f.)	97,204	141,872	62,206	118,714	118,664
Land Area Coverage	54%	47%	47%	55%	42%
Land Acquisition Cost	$7,000,000	$10,497,000	$5,735,752	$8,612,500	$10,600,000
Acquisition Date	5/1/2018	8/1/2017	4/1/2016	6/1/2015	7/1/2014
Land Acquisition Cost per Acre	$1,707,317	$1,515,856	$1,892,987	$1,735,520	$1,635,802
Zoning	COMH	I-G	IG	VEM	PRIG-IL

Site 3 Aerial

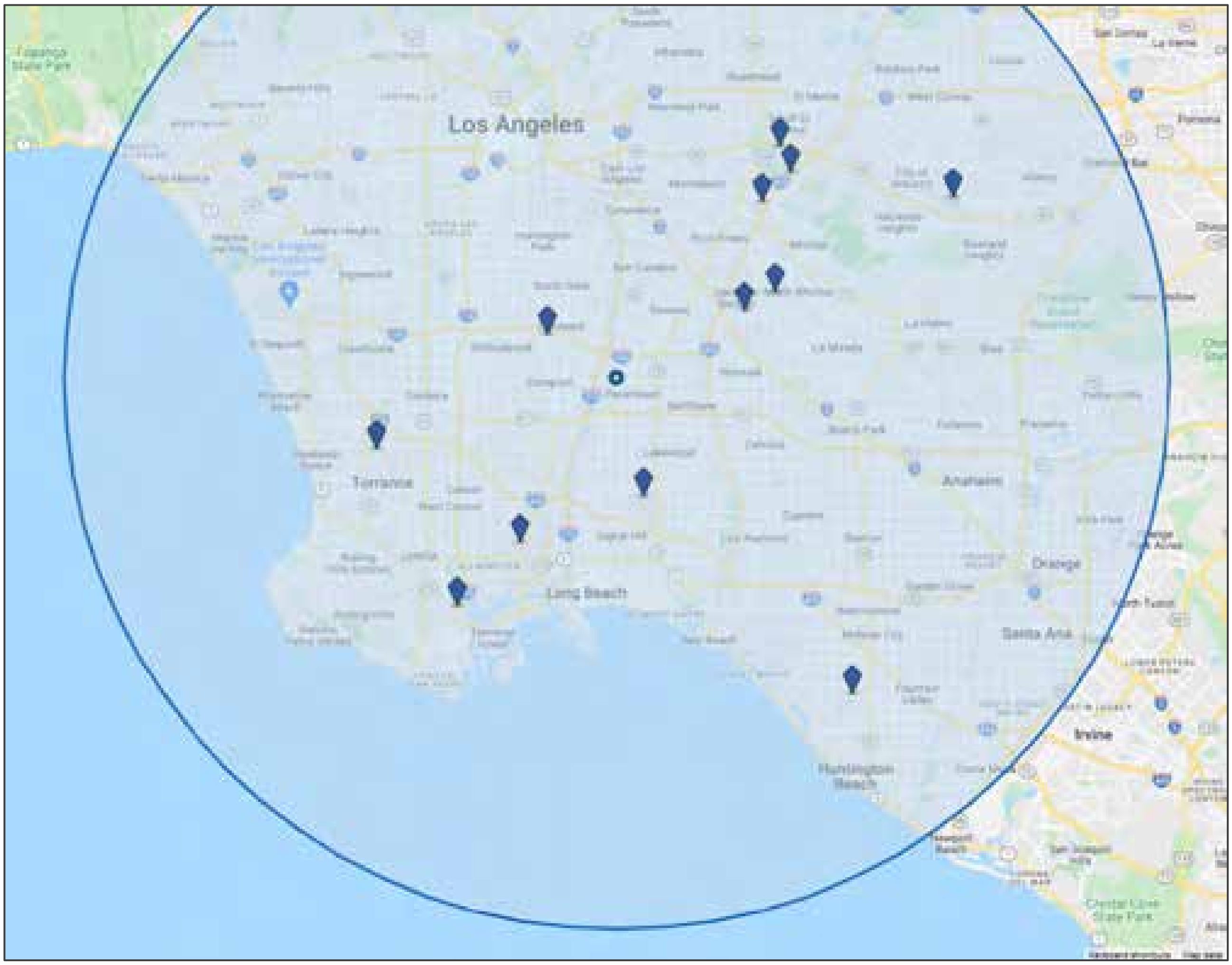
Site 3 Comps - Map



Site 3 Comps - Table

Property Address	2400 E Artesia Blvd	13344 S Main St	20333 Normandie Ave	2751 Skypark Dr
City	Long Beach	Los Angeles	Torrance	Torrance
Developer	Bridge Development Partners		Bridge Industrial	Bridge Industrial
Owner	Bridge Industrial	Duke Realty Corporation	Morgan Stanley Services Group Inc.	Realterm US, Inc.
Year Built	2021	2021	2018	2020
Property Type	Industrial	Industrial	Industrial	Industrial
Subtype	Warehouse	Distribution	Distribution	Distribution
Building Class	A	A	A	A
Tenancy	Single	Single	Multi	Single
Land Area (acres)	17.23	13.30	20.37	14.02
Building Floor Area (s.f.)	415,160	290,303	512,490	130,200
Land Area Coverage	55%	50%	58%	21%
Land Acquisition Cost	$14,874,780	$36,510,000	$43,000,000	$41,298,000
Acquisition Date	7/12/2018	10/1/2018	7/1/2016	11/1/2019
Land Acquisition Cost per Acre	$863,307	$2,745,113	$2,110,947	$2,945,082
Zoning	LBIG	LCM11/2-B1	M2	M2

Land Sale Comps - Map



Land Sale Comps – Table (A)

Address	888 S Azusa Ave	Cover St	11852 Alameda St (Part of Multi-Property Sale)	3900 Baybar Rd	Beverly Blvd	9648 Santa Fe Springs Rd
City	City Of Industry	Long Beach	Lynwood	Pico Rivera	Pico Rivera	Santa Fe Springs
Buyer	Forever Link International, Inc.	Sares-Regis Group	Terreno Realty Corporation	CenterPoint Properties	Insite Property Group	CenterPoint Properties
Property Type (at time of sale)	Land	Land	Land	Land	Land	Land
Property Subtype	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial
Land Area (acres)	10.28	60.63	11.53	6.41	19.51	20.38
Sale Price	$14,329,504	$146,000,000	$15,761,509	$7,349,500	$18,000,000	$13,000,000
Sale Date	9/7/2018	9/17/2020	4/20/2017	10/1/2020	7/6/2021	2/13/2019
Price Per Acre	$1,393,920	$2,408,049	$1,366,999	$1,146,566	$922,708	$637,880
Zoning	IDM	LKM2	LYM	Industrial	PRIG	SSM2YY

Land Sale Comps – Table (B)

Address	825 Lexington Gallatin Rd	4102 190th St	1800 Eastman Ave	E Florence Ave & Hathaway Dr	7242 Slater Ave	John Gibson Blvd
City	South El Monte	Torrance	Wilmington	Santa Fe Springs	Huntington Beach	San Pedro
Buyer	Magellan Value Partners	Kearny Real Estate Company	Rexford Industrial Realty, Inc.	Westcore Properties	Overton Moore Properties	Howard Industrial Partners
Property Type (at time of sale)	Land	Land	Land	Land	Land	Land
Property Subtype	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial
Land Area (acres)	10.50	19.20	24.00	26.90	10.26	18.70
Sale Price	$15,959,000	$36,900,000	$70,000,000	$50,000,000	$13,834,000	$25,000,000
Sale Date	1/28/2022	8/13/2019	8/9/2021	6/26/2019	6/28/2017	9/28/2017
Price Per Acre	$1,519,905	$1,921,875	$2,916,667	$1,858,736	$1,348,342	$1,336,898
Zoning	SEC	TOMI-LT	LAM3	SSM2-BP		M3, Los Angeles

See Part 2 of the Large-Scale Water Recycling Project Feasibility Study for:

- **Appendix D NPDES Permit for Warren Facility**
- **Appendix E Independent Review**
- **Addendum**
- **LSWRP Feasibility Study Revision 1 track page 4-35 and**
- **LSWRP Feasibility Study Review 1 track page 6-2**

Appendix D

NPDES Permit for Warren Facility

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

320 West 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 • Fax (213) 576-6640
[Los Angeles Regional Water Quality Control Board](http://www.waterboards.ca.gov/losangeles/)
http://www.waterboards.ca.gov/losangeles/

ORDER R4-2023-0181
NPDES NUMBER CA0053813

WASTE DISCHARGE REQUIREMENTS AND NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT FOR THE JOINT OUTFALL SYSTEM JOINT WATER POLLUTION CONTROL PLANT

The following Discharger is subject to waste discharge requirements (WDRs) and federal National Pollutant Discharge Elimination System (NPDES) permit requirements, as set forth in this Order:

Table 1. Discharger Information

Discharger	Joint Outfall System (JOS, Discharger, or Permittee)
Name of Facility	Joint Water Pollution Control Plant (JWPCP or Facility) and its associated wastewater collection system and outfalls
Facility Address	24501 South Figueroa Street Carson, CA 90745 Los Angeles County

Table 2. Discharge Location

Discharge Point	Effluent Description	Discharge Point Latitude (North)	Discharge Point Longitude (West)	Receiving Water
001	Secondary treated wastewater	33.6892º	-118.3167º	Pacific Ocean
002	Secondary treated wastewater	33.7008º	-118.3381º	Pacific Ocean
003	Secondary treated wastewater	33.7008º	-118.3300º	Pacific Ocean
004	Secondary treated wastewater	33.7061º	-118.3283º	Pacific Ocean

Table 3. Administrative Information

This Order was adopted on:	May 25, 2023
This Order shall become effective on:	July 1, 2023
This Order shall expire on:	June 30, 2028

The Discharger shall file a Report of Waste Discharge as an application for reissuance of WDRs in accordance with title 23, California Code of Regulations, and an application for reissuance of a NPDES permit no later than:	180 days prior to the Order expiration date.
The U.S. Environmental Protection Agency (USEPA) and the California Regional Water Quality Control Board, Los Angeles Region have classified this discharge as follows:	Major

I, Susana Arredondo, Executive Officer, do hereby certify that this Order with all attachments is a full, true, and correct copy of the Order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on the date indicated above.

Jenny Newman

Digitally signed by Jenny Newman
Date: 2023.06.13 16:59:50 -07'00'

Susana Arredondo, Executive Officer

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TABLE OF ATTACHMENTS

1. FACILITY INFORMATION

Information describing the Joint Water Pollution Control Plant (JWPCP or Facility) is summarized on the cover page and in sections 1 and 2 of the Fact Sheet (Attachment F). Section 1 of the Fact Sheet also includes information regarding the Facility's permit application.

2. FINDINGS

The California Regional Water Quality Control Board, Los Angeles Region (Los Angeles Water Board), finds:

2.1. Legal Authorities. This Order serves as waste discharge requirements (WDRs) pursuant to article 4, chapter 4, division 7 of the California Water Code (Water Code) (commencing with section 13260). This Order is also issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the USEPA and chapter 5.5, division 7 of the Water Code (commencing with section 13370). It shall serve as a National Pollutant Discharge Elimination System (NPDES) permit authorizing the Discharger to discharge into waters of the United States at the discharge location described in Table 2 subject to the WDRs in this Order.

2.2. Background and Rationale for Requirements. The Los Angeles Water Board developed the requirements in this Order based on information submitted as part of the application, through monitoring and reporting programs, and other available information. The Fact Sheet (Attachment F), which contains background information and rationale for the requirements in this Order, is hereby incorporated into and constitutes Findings for this Order. Attachments A through E, G, H, I, and J are also incorporated into this Order.

2.3. Provisions and Requirements Implementing State Law. The provisions and requirements implementing state law are not required or authorized under the federal CWA; consequently, violations of these provisions/requirements are not subject to the enforcement remedies that are available for NPDES violations.

2.4. Notification of Interested Parties. The Los Angeles Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe WDRs and NPDES permit requirements for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Details of the notification are provided in the Fact Sheet.

2.5. Consideration of Public Comment. The Los Angeles Water Board, in a public meeting, heard and considered all comments pertaining to this Order. Details of the Public Hearing are provided in the Fact Sheet.

THEREFORE, IT IS HEREBY ORDERED that Order Number R4-2017-0180 is rescinded upon the effective date of this order except for enforcement purposes, and, in order to meet the provisions contained in Division 7 of the Water Code (commencing with section 13000) and regulations adopted thereunder, and the provisions of the CWA and regulations and guidelines adopted thereunder, the Discharger shall comply with the requirements in this Order. This action in no way prevents the Los Angeles Water Board from taking enforcement action for past violations of the previous Order.

3. DISCHARGE PROHIBITIONS

3.1. Discharge of treated wastewater at a location different from that described in this Order is prohibited.

3.2. Discharges to Discharge Points 003 and 004 are prohibited, except during the following situations, provided that the use of Discharge Points 001 and 002 are maximized, and that the Los Angeles Water Board is notified, as described below:

3.2.1. Emergency discharge of disinfected secondary effluent when the flow rate approaches the hydraulic capacity of Discharge Points 001 and 002 as determined by JWPCP Operations staff;

3.2.2. Emergency discharge of disinfected secondary effluent during power outages in which back-up power supplies are inoperable or insufficient to pump all the secondary effluent through Discharge Points 001 and 002;

3.2.3. Discharge of disinfected secondary effluent during planned preventative maintenance such as routine opening and closing of the outfall gate valves for exercising and lubrication; or,

3.2.4. Discharge of disinfected secondary effluent and/or brine during major planned capital improvement projects when there is no other feasible alternative. Projects warranting such a diversion will be considered on a case-by-case basis and must be approved by the Executive Officer of the Los Angeles Water Board prior to diverting flow to Discharge Points 003 and 004.

The Permittee shall notify the Los Angeles Water Board a minimum of 30 days prior to discharging final effluent from Discharge Points 003 and 004 during a planned diversion such as preventative maintenance or capital improvement projects. This notification shall include the rationale for the discharge, the expected time, date, and the duration of the discharge.

3.3. The bypass or overflow of untreated wastewater or wastes to surface waters or surface water drainage courses is prohibited, except as allowed in Standard Provision 1.7. of Attachment D, Standard Provisions.

3.4. The monthly average effluent dry weather discharge flow rate from the Facility shall not exceed the dry weather flow capacity of 400 MGD.

3.5. The Discharger shall not cause degradation of any water body, except as consistent with State Water Resources Control Board (State Water Board) Resolution Number 68-16.

3.6. The treatment or disposal of wastes from the Facility shall not cause pollution or nuisance as defined in section 13050, subdivisions (l) and (m), of the Water Code.

3.7. The discharge of any toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, animal, plant, or aquatic life is prohibited.

3.8. The discharge of trash to surface waters of the State or the deposition of trash where it may be discharged into surface waters of the State is prohibited.

3.9. The discharge of any radiological, chemical, or biological warfare agent or high-level radiological waste is prohibited.

3.10. Discharge to designated Areas of Special Biological Significance is prohibited.

3.11. Pipeline discharge of sludge to the ocean is prohibited by federal law. The discharge of municipal and industrial waste sludge directly to the ocean, or into a waste stream that discharges to the ocean, is prohibited by the California Ocean Plan. The discharge of sludge digester supernatant directly to the ocean, or to a waste stream that discharges to the ocean without further treatment, is prohibited.

3.12. The discharge of any waste resulting from the combustion of toxic or hazardous wastes to any waste stream that ultimately discharges to waters of the United States is prohibited, unless specifically authorized elsewhere in this Order.

4. EFFLUENT LIMITATIONS, PERFORMANCE GOALS AND DISCHARGE SPECIFICATIONS

4.1. Effluent Limitations and Performance Goals – Discharge Points 001, 002, 003, and 004

Effluent limitations for Discharge Points 001, 002, 003 and 004 are specified below.

The performance goals for Discharge Points 001 and 002 are prescribed below in this Order. Performance goals are based upon actual performance data, test method minimum levels, and effluent limits, and are specified only as an indication of the treatment efficiency of the JWPCP (Refer to Fact Sheet section 5). Performance goals are not enforceable values but are used to evaluate the Facility's treatment efficiency. The Permittee shall maintain, if not improve, the effluent quality at or below the performance goal concentrations. Any two consecutive exceedances of a single performance goal shall trigger an investigation into the cause of the exceedance. If the exceedance persists in three successive monitoring periods, the Permittee shall submit a written report to the Los Angeles Water Board on the nature of the exceedance, the results of the investigation including the cause of the exceedance, the corrective actions taken, any proposed corrective measures, and a timetable for implementation, if necessary.

4.1.1. Final Effluent Limitations and Performance Goals – Discharge Points 001 and 002

a. The Discharger shall maintain compliance with the following effluent limitations in Table 4 at Discharge Points 001 and 002 into Pacific Ocean, with compliance measured at Monitoring Locations EFF-001, EFF-002A and EFF-002B as described in the Monitoring and Reporting Program (MRP), Attachment E.

Table 4. Effluent Limitations and Performance Goals at Discharge Points 001 and 002

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Annual Average	Performance Goals Average Monthly	Notes
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	30	45	--	--	--	--	a
Biochemical Oxygen Demand 5-day @ 20°C	lbs/day	96,300	145,000	--	--	--	--	b
Total Suspended Solids	mg/L	30	45	--	--	--	--	a
Total Suspended Solids	lbs/day	96,300	145,000	--	--	--	--	b
Oil and Grease	mg/L	15	22.5	45	75	--	--	a, d
Oil and Grease	lbs/day	48,200	72,200	144,500	240,800	--	--	b
Settleable Solids	mL/L	0.5	0.75	1.5	3.0	--	--	a, d
Turbidity	NTU	75	100	--	225	--	--	a, d
Arsenic	µg/L	--	--	--	--	--	2.6	c
Cadmium	µg/L	--	--	--	--	--	1	c
Chromium (VI)	µg/L	--	--	--	--	--	0.12	c
Copper	µg/L	--	--	--	--	--	3	c
Lead	µg/L	--	--	--	--	--	2.5	c
Mercury	µg/L	--	--	--	--	--	1	c
Nickel	µg/L	--	--	--	--	--	5	c
Selenium	µg/L	--	--	--	--	--	6.1	c
Silver	µg/L	--	--	--	--	--	0.21	c
Zinc	µg/L	--	--	--	--	--	18	c
Cyanide	µg/L	--	--	--	--	--	7.4	--
Chlorine Residual	µg/L	330	--	1,300	10,000	--	--	a, d, e
Chlorine Residual	lbs/day	1,100	--	4,300	32,200	--	--	b

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Performance Goals Average Monthly	Notes
Ammonia as N	mg/L	--	--	--	--	--	49	--
Phenolic compounds (non-chlorinated)	µg/L	--	--	--	--	--	2.2	f
Phenolic compounds (chlorinated)	µg/L	--	--	--	--	--	1	f
Endosulfan	µg/L	--	--	--	--	--	0.05	f
Endrin	µg/L	--	--	--	--	--	0.05	--
Hexachlorocyclohexane (HCH)	µg/L	--	--	--	--	--	0.02	f
Chronic toxicity *Macrocystis pyrifera*	Pass or Fail (TST)	--	--	Pass	--	--	--	a, e, g
Radioactivity, Gross alpha	pCi/L	--	--	--	--	--	10.9	--
Radioactivity, Gross beta	pCi/L	--	--	--	--	--	30.5	--
Acrolein	µg/L	--	--	--	--	--	10	--
Antimony	µg/L	--	--	--	--	--	2.7	c
Bis(2-chloroethoxy) methane	µg/L	--	--	--	--	--	25	--
Bis(2-chloroisopropyl) ether	µg/L	--	--	--	--	--	10	--
Chlorobenzene	µg/L	--	--	--	--	--	2.5	--
Chromium (III)	µg/L	--	--	--	--	--	2.4	c
Di-n-butyl-phthalate	µg/L	--	--	--	--	--	50	--
Dichlorobenzenes	µg/L	--	--	--	--	--	10	f
Diethyl phthalate	µg/L	--	--	--	--	--	10	--

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Performance Goals Average Monthly	Notes
Dimethyl phthalate	μg/L	--	--	--	--	--	10	--
2-Methyl-4,6-dinitrophenol	μg/L	--	--	--	--	--	25	--
2,4-Dinitrophenol	μg/L	--	--	--	--	--	25	--
Ethylbenzene	μg/L	--	--	--	--	--	2.5	--
Fluoranthene	μg/L	--	--	--	--	--	5	--
Hexachlorocyclopentadiene	μg/L	--	--	--	--	--	25	--
Nitrobenzene	μg/L	--	--	--	--	--	5	--
Thallium	μg/L	--	--	--	--	--	5	c
Toluene	μg/L	--	--	--	--	--	0.74	--
Tributyltin	μg/L	--	--	--	--	--	0.01	--
1,1,1-Trichloroethane	μg/L	--	--	--	--	--	2.5	--
Acrylonitrile	μg/L	--	--	--	--	--	10	--
Aldrin	μg/L	0.0037	--	--	--	--	--	a, e
Aldrin	lbs/day	0.012	--	--	--	--	--	b
Benzene	μg/L	--	--	--	--	--	2.5	--
Benzidine	μg/L	0.012	--	--	--	--	--	a, e
Benzidine	lbs/day	0.039	--	--	--	--	--	b
Beryllium	μg/L	--	--	--	--	--	2.5	c
Bis(2-chloroethyl) ether	μg/L	--	--	--	--	--	5	--
Bis(2-ethylhexyl) phthalate	μg/L	--	--	--	--	--	25	--
Carbon tetrachloride	μg/L	--	--	--	--	--	2.5	--
Chlordane	μg/L	0.0038	--	--	--	--	--	a, e, f
Chlordane	lbs/day	0.012	--	--	--	--	--	b

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Performance Goals Average Monthly	Notes
Chlorodibromomethane	μg/L	--	--	--	--	--	0.56	--
Chloroform	μg/L	--	--	--	--	--	20	--
DDT	μg/L	0.0158	--	--	--	--	0.00017	a, f
DDT	g/yr	--	--	--	--	8,717	--	f, h
1,4-Dichlorobenzene	μg/L	--	--	--	--	--	2.5	--
3,3'-Dichlorobenzidine	μg/L	1.4	--	--	--	--	--	a, e
3,3'-Dichlorobenzidine	lbs/day	4.5	--	--	--	--	--	b
1,2-Dichloroethane	μg/L	--	--	--	--	--	2.5	--
1,1-Dichloroethylene	μg/L	--	--	--	--	--	2.5	--
Bromodichloromethane	μg/L	--	--	--	--	--	1.1	--
Dichloromethane	μg/L	--	--	--	--	--	2.8	--
1,3-Dichloropropene	μg/L	--	--	--	--	--	25	--
Dieldrin	μg/L	0.0067	--	--	--	--	--	a, e
Dieldrin	lbs/day	0.021	--	--	--	--	--	b
2,4-Dinitrotoluene	μg/L	--	--	--	--	--	25	--
1,2-Diphenylhydrazine	μg/L	--	--	--	--	--	5	--
Halomethanes	μg/L	--	--	--	--	--	10	f
Heptachlor	μg/L	--	--	--	--	--	0.05	--
Heptachlor epoxide	μg/L	--	--	--	--	--	0.05	--
Hexachlorobenzene	μg/L	0.035	--	--	--	--	--	a, e
Hexachlorobenzene	lbs/day	0.11	--	--	--	--	--	b
Hexachlorobutadiene	μg/L	--	--	--	--	--	5	--
Hexachloroethane	μg/L	--	--	--	--	--	5	--

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Performance Goals Average Monthly	Notes
Isophorone	µg/L	--	--	--	--	--	5	--
N-Nitrosodimethylamine	µg/L	--	--	--	--	--	0.33	--
N-Nitrosodi-N-propylamine	µg/L	--	--	--	--	--	25	--
N-Nitrosodiphenylamine	µg/L	--	--	--	--	--	5	--
PAHs	µg/L	--	--	--	--	--	0.95	f
PCBs as aroclors	µg/L	0.00035	--	--	--	--	--	a, f
PCBs as aroclors	g/yr	--	--	--	--	194	--	f, h
TCDD equivalents	pg/L	0.65	--	--	--	--	--	a, e, f
TCDD equivalents	lbs/day	2.1×10^{-6}	--	--	--	--	--	b
1,1,2,2-Tetrachloroethane	µg/L	--	--	--	--	--	2.5	--
Tetrachloroethylene	µg/L	--	--	--	--	--	0.55	--
Toxaphene	µg/L	0.035	--	--	--	--	--	a, e
Toxaphene	lbs/day	0.11	--	--	--	--	--	b
Trichloroethylene	µg/L	--	--	--	--	--	2.5	--
1,1,2-Trichloroethane	µg/L	--	--	--	--	--	2.5	--
2,4,6-Trichlorophenol	µg/L	--	--	--	--	--	0.29	--
Vinyl chloride	µg/L	--	--	--	--	--	2.5	--

Footnotes for Table 4

a. The maximum daily, average weekly and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

b. The mass emission rates are calculated using 385 MGD, consistent with the water-quality based limits in the previous permit: lbs/day = 0.00834 x Ce (effluent concentration in µg/L) x Q (flow rate in MGD).

c. Values are expressed as total recoverable concentrations.

d. The instantaneous maximum effluent limitations shall apply to grab samples.

e. The minimum dilution ratios used to calculate effluent limitations for nonconventional and toxic pollutants for Discharge Points 001 and 002 are 166:1 (i.e., 166-parts seawater to one-part effluent) for all pollutants.

f. See section 8 of this Order and Attachment A for definitions of terms.

g. The Chronic Toxicity final effluent limitation is protective of both the numeric acute and chronic toxicity 2019 Ocean Plan water quality objectives. The final effluent limitation will be implemented using *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995), current USEPA guidance in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, June 2010) (http://www3.epa.gov/npdes/pubs/wet_final_tst_implementation2010.pdf) and *EPA Regions 8, 9, and 10, Toxicity Training Tool* (January 2010).

h. Consistent with the *Santa Monica Bay TMDL for DDTs and PCBs*, the calculation of the annual mass emissions shall be calculated using the arithmetic average of available monthly mass emissions as follows:

$$Annual\ Mass\ Emission, g/year = \left(\frac{\sum Monthly\ Mass\ Emission,\ g/month}{Number\ of\ Monthly\ Mass\ Emissions\ Calculated}\right) * 12\ months/year$$

$$Monthly\ Mass\ Emission, kg/month = \left(\frac{3{,}785}{N}\right) * \left(\sum_{i=1}^{N} Q_i C_i\right) * 30.5 = \frac{0.1154425}{N} * \left(\sum_{i=1}^{N} Q_i C_i\right)$$

C_i = DDT or PCB concentration of each individual sample (ng/L)
Q_i = discharger flow rate on date of sample (mgd)
N = number of samples collected during the month

The total mass load for DDT and PCB from the Joint Water Pollution Control Plant, Hyperion Treatment Plant, and West Basin's Water Reclamation Plant shall not be more than 14,567 g/yr for DDT and 351 g/yr for PCB. The Permittee is deemed in compliance with these group water-quality-based effluent limitations for DDT and PCBs if it is in compliance with the individual mass-based Annual Average Effluent Limitations for DDT and PCBs.

<u>End of Footnotes for Table 4</u>

4.1.2. Effluent Limitations – Discharge Point 003

a. The Discharger shall maintain compliance with the following effluent limitations in Table 5 at Discharge Point 003 into Pacific Ocean, with compliance measured at Monitoring Locations EFF-001 and EFF-002A as described in the MRP, Attachment E.

Table 5. Effluent Limitations at Discharge Point 003

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Notes
Chlorine Residual	µg/L	300	--	1,200	9,100	--	a, b, c, d
Chlorine Residual	lbs/day	960	--	3,900	29,200	--	e
Aldrin	µg/L	0.0033	--	--	--	--	a, b, d
Aldrin	lbs/day	0.011	--	--	--	--	e
Benzidine	µg/L	0.01	--	--	--	--	a, b, d
Benzidine	lbs/day	0.033	--	--	--	--	e
Chlordane	µg/L	0.003	--	--	--	--	a, b, d, f
Chlordane	lbs/day	0.011	--	--	--	--	e
DDT	µg/L	0.0158	--	--	--	--	a, b, f
DDT	g/yr	--	--	--	--	8,717	f, g
3,3’-Dichlorobenzidine	µg/L	1.2	--	--	--	--	a, b, d
3,3’-Dichlorobenzidine	lbs/day	3.9	--	--	--	--	e
Dieldrin	µg/L	0.0060	--	--	--	--	a, b, d
Dieldrin	lbs/day	0.019	--	--	--	--	e
Hexachlorobenzene	µg/L	0.032	--	--	--	--	a, b, d
Hexachlorobenzene	lbs/day	0.10	--	--	--	--	e
PCBs as aroclors	µg/L	0.00351	--	--	--	--	a, b, f
PCBs as aroclors	g/yr	--	--	--	--	194	f, g

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Notes
TCDD equivalents	pg/L	0.59	--	--	--	--	a, b, d, f
TCDD equivalents	lbs/day	1.9×10^{-6}	--	--	--	--	e
Toxaphene	µg/L	0.032	--	--	--	--	a, b, d
Toxaphene	lbs/day	0.10	--	--	--	--	e

Footnotes for Table 5

a. For intermittent discharges, the daily value used to calculate these average monthly and average weekly values shall be considered to equal zero for days on which no discharge occurred.

b. The maximum daily, average weekly, and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

c. The instantaneous maximum effluent limitations shall apply to grab samples.

d. The minimum dilution ratios used to calculate effluent limitations for nonconventional and toxic pollutants for Discharge Point 003 is 150:1 for all (i.e., 150-parts seawater to one-part effluent).

e. The mass emission rates are calculated using 385 MGD, consistent with the water-quality based limits in the previous permit: lbs/day = 0.00834 x Ce (effluent concentration in µg/L) x Q (flow rate in MGD).

f. See section 8 of this Order and Attachment A for definitions of terms.

g. Consistent with the *Santa Monica Bay TMDL for DDTs and PCBs*, the calculation of the annual mass emissions shall be calculated using the arithmetic average of available monthly mass emissions as follows:

$$Annual\ Mass\ Emission, g/year = \left(\frac{\sum Monthly\ Mass\ Emission,\ g/month}{Number\ of\ Monthly\ Mass\ Emissions\ Calculated}\right) * 12\ months/year$$

$$Monthly\ Mass\ Emission, kg/month = \left(\frac{3{,}785}{N}\right) * \left(\sum_{i=1}^{N} Q_i C_i\right) * 30.5 = \frac{0.1154425}{N} * \left(\sum_{i=1}^{N} Q_i C_i\right)$$

C_i = DDT or PCB concentration of each individual sample (ng/L)

Q_i = discharger flow rate on date of sample (mgd)
N = number of samples collected during the month

The total mass load for DDT and PCB from the Joint Water Pollution Control Plant, Hyperion Treatment Plant, and West Basin's Water Reclamation Plant shall not be more than 14,567 g/yr for DDT and 351 g/yr for PCB. The Permittee is deemed in compliance with these group water-quality-based effluent limitations for DDT and PCBs if it is in compliance with the individual mass-based Annual Average Effluent Limitations for DDT and PCBs.

End Footnotes for Table 5

4.1.3. Effluent Limitations – Discharge Point 004

a. The Discharger shall maintain compliance with the following effluent limitations in Table 6 at Discharge Point 004 into Pacific Ocean, with compliance measured at Monitoring Locations EFF-001 and EFF-002B as described in the MRP, Attachment E.

Table 6. Effluent Limitations at Discharge Point 004

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Notes
Chlorine Residual	µg/L	230	--	930	7,000	--	a, b, c, d
Chlorine Residual	lbs/day	740	--	3,000	22,500	--	e
Aldrin	µg/L	0.0026	--	--	--	--	a, b, d
Aldrin	lbs/day	0.0083	--	--	--	--	e
Benzidine	µg/L	0.008	--	--	--	--	a, b, d
Benzidine	lbs/day	0.026	--	--	--	--	e
Chlordane	µg/L	0.003	--	--	--	--	a, b, d, f
Chlordane	lbs/day	0.0086	--	--	--	--	e
DDT	µg/L	0.0158	--	--	--	--	a, b, f
DDT	g/yr	--	--	--	--	8,717	f, g
3,3'-Dichlorobenzidine	µg/L	0.93	--	--	--	--	a, b, d

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Maximum	Annual Average	Notes
3,3’-Dichlorobenzidine	lbs/day	3.0	--	--	--	--	e
Dieldrin	µg/L	0.0046	--	--	--	--	a, b, d
Dieldrin	lbs/day	0.0015	--	--	--	--	e
Hexachlorobenzene	µg/L	0.024	--	--	--	--	a, b, d
Hexachlorobenzene	lbs/day	0.078	--	--	--	--	e
PCBs as aroclors	µg/L	0.00351	--	--	--	--	a, b, f
PCBs as aroclors	g/yr	--	--	--	--	194	f, g
TCDD equivalents	pg/L	0.45	--	--	--	--	a, b, d, f
TCDD equivalents	lbs/day	1.5×10^{-6}	--	--	--	--	e
Toxaphene	µg/L	0.024	--	--	--	--	a, b, d
Toxaphene	lbs/day	0.078	--	--	--	--	e

Footnotes for Table 6

a. For intermittent discharges, the daily value used to calculate these average monthly and average weekly values shall be considered to equal zero for days on which no discharge occurred.

b. The maximum daily, average weekly, and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

c. The instantaneous maximum effluent limitations shall apply to grab samples.

d. The minimum dilution ratios used to calculate effluent limitations for nonconventional and toxic pollutants for Discharge Point 004 is 115:1 for all (i.e., 115-parts seawater to one-part effluent).

e. The mass emission rates are calculated using 385 MGD, consistent with the water-quality based limits in the previous permit: lbs/day = 0.00834 x Ce (effluent concentration in µg/L) x Q (flow rate in MGD).

f. See section 8 of this Order and Attachment A for definitions of terms.

g. Consistent with the *Santa Monica Bay TMDL for DDTs and PCBs*, the calculation of the annual mass emissions shall be calculated using the arithmetic average of available monthly mass emissions as follows:

$$Annual\ Mass\ Emission, g/year = \left(\frac{\sum Monthly\ Mass\ Emission,\ \ g/month}{Number\ of\ Monthly\ Mass\ Emissions\ Calculated}\right) * 12\ months/year$$

$$Monthly\ Mass\ Emission, kg/month = \left(\frac{3{,}785}{N}\right) * \left(\sum_{i=1}^{N} Q_i\,C_i\right) * 30.5 = \frac{0.1154425}{N} * \left(\sum_{i=1}^{N} Q_i C_i\right)$$

C_i = DDT or PCB concentration of each individual sample (ng/L)
Q_i = discharger flow rate on date of sample (mgd)
N = number of samples collected during the month

The total mass load for DDT and PCB from the Joint Water Pollution Control Plant, Hyperion Treatment Plant, and West Basin's Water Reclamation Plant shall not be more than 14,567 g/yr for DDT and 351 g/yr for PCB. The Permittee is deemed in compliance with these group water-quality-based effluent limitations for DDT and PCBs if it is in compliance with the individual mass-based Annual Average Effluent Limitations for DDT and PCBs.

<u>End Footnotes for Table 6</u>

4.1.4. Other Effluent Limitations – Discharge Point 001, 002, 003, and 004

a. **Percent Removal:** The average monthly percent removal of $BOD_5$20°C and TSS shall not be less than 85 percent.

b. **Temperature:** The temperature of wastes discharged shall not exceed 100°F.

c. **pH:** The effluent values for pH shall be maintained within the limits of 6.0 standard units and 9.0 standard units at all times.

d. **Radioactivity:** Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30253 of the California Code of Regulations. Reference to section 30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.

e. The Discharger shall ensure that bacterial concentrations in the effluent do not cause or contribute to exceedances at shoreline monitoring points or bacteriological objectives contained in Chapter 3 of the Water Quality Control Plan – Los Angeles Region (*Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*; hereinafter, Basin Plan) during summer dry weather, winter dry weather and wet weather, as specified in section 7-4 of the Basin Plan.

f. Waste discharged to the ocean must be essentially free of

    i. Material that is floatable or will become floatable upon discharge.

    ii. Settleable material or substances that may form sediments which will degrade benthic communities or other aquatic life.

    iii. Substances that will accumulate to toxic levels in marine waters, sediments or biota.

    iv. Substances that significantly decrease the natural light to benthic communities and other marine life.

    v. Materials that result in aesthetically undesirable discoloration of the ocean surface.

4.1.5. Interim Effluent Limitations – Not Applicable

4.2. Land Discharge Specifications – Not Applicable

4.3. Recycling Specifications

The Discharger has partnered with Metropolitan Water District on Pure Water Southern California, a program that will ultimately lead to recycling of about 150mgd of JWPCP secondary effluent. The Discharger shall continue to investigate the feasibility of recycling, conservation, and/or alternative disposal methods for wastewater (such as groundwater injection), and/or capture and treatment of dry-weather urban runoff and stormwater on a permissive basis for beneficial reuse. The Discharger shall submit an update to this feasibility study as part of the submittal of the Report of Waste Discharge for the next permit renewal.

5. MASS EMISSION BENCHMARKS

The following mass emission benchmarks, in metric tons per year (MT/yr), have been established for the discharge through Discharge Points 001 and 002. The Discharger shall monitor and report the mass emission rate for all constituents that have mass emission benchmarks. These mass emission benchmarks are not enforceable water quality-based effluent limitations. The mass emission benchmarks (in MT/yr) for the JWPCP discharge were determined using November 2017 through June 2022 effluent concentrations, the performance goal, and the 1997 average design dry weather flow of 385 MGD.

Table 7. Twelve Month Average Effluent Mass Emission Benchmarks

Ocean Plan Constituent	12-month Average Mass Emission Benchmarks (MT/yr)	Notes
Arsenic	1.4	a
Cadmium	0.53	a
Chromium VI	0.064	a
Copper	1.6	a
Lead	1.3	a
Mercury	0.53	a
Nickel	2.7	a
Selenium	3.2	a
Silver	0.11	a
Zinc	9.7	a
Cyanide	4.0	--
Ammonia as N	26,000	--
Phenolic Compounds (non-chlorinated)	1.2	b
Phenolic Compounds (chlorinated)	0.53	b
Endosulfan	0.027	b
Endrin	0.027	--
Hexachlorocyclohexane (HCH)	0.011	b
Acrolein	5.3	--
Antimony	1.4	--
Bis(2-chloroethoxy) methane	13	--
Bis(2-chloroisopropyl) ether	5.3	--
Chlorobenzene	1.3	--
Chromium (III)	1.3	a
Di-n-butyl phthalate	27	--
Dichlorobenzenes	5.3	b

Ocean Plan Constituent	12-month Average Mass Emission Benchmarks (MT/yr)	Notes
Diethyl phthalate	5.3	--
Dimethyl phthalate	5.3	--
4,6-dinitro-2-methylphenol	13	--
2,4-dinitrophenol	13	--
Ethylbenzene	1.3	--
Fluoranthene	2.7	--
Hexachlorocyclopentadiene	13	--
Nitrobenzene	2.7	--
Thallium	2.7	a
Toluene	0.39	--
Tributyltin	0.0053	--
1,1,1-trichloroethane	1.3	--
Acrylonitrile	5.3	--
Benzene	1.3	--
Beryllium	1.3	a
Bis(2-chloroethyl) ether	2.7	--
Bis(2-ethylhexyl) phthalate	13	--
Carbon tetrachloride	1.3	--
Chlorodibromomethane	0.30	--
Chloroform	11	--
DDT total	0.00009	b
1,4-dichlorobenzene	1.3	--
1,2-dichloroethane	1.3	--
1,1-dichloroethylene	1.3	--
Dichlorobromomethane	0.59	--
Dichloromethane	1.5	--
1,3-dichloropropene	13	--
2,4-dinitrotoluene	13	--
1,2-diphenylhydrazine	2.7	--
Halomethanes	5.3	b
Heptachlor	0.027	--
Heptachlor epoxide	0.027	--
Hexachlorobutadiene	2.7	--
Hexachloroethane	2.7	--

Ocean Plan Constituent	12-month Average Mass Emission Benchmarks (MT/yr)	Notes
Isophorone	2.7	--
N-nitrosodimethylamine	0.18	--
N-nitrosodi-n-propylamine	13	--
N-nitrosodiphenylamine	2.7	--
PAHs	0.51	b
1,1,2,2-tetrachloroethane	1.3	--
Tetrachloroethylene	0.29	--
Trichloroethylene	1.3	--
1,1,2-trichloroethane	1.3	--
2,4,6-trichlorophenol	0.15	--
Vinyl chloride	1.3	--

Footnotes for Table 7

a. Values reflect the mass of total recoverable metals.

b. See Attachment A for definitions of terms.

End Footnotes for Table 7

6. RECEIVING WATER LIMITATIONS

The Discharger shall not cause a violation of the following water quality objectives. Compliance with these water quality objectives shall be determined by samples collected at stations outside the zone of initial dilution as specified in the MRP. Offshore station 2903 is the only station within the zone of initial dilution.

6.1. Surface Water Limitations

6.1.1. Bacterial Characteristics

a. State/Regional Water Contact Standards

Within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas outside this zone used for water contact sports, as determined by the Los Angeles Water Board (i.e., waters designated as REC-1), but including all kelp beds, the following bacterial objectives shall be maintained throughout the water column.

i. **Fecal coliform**: A 30-day geometric mean (GM) of fecal coliform density not to exceed 200 per 100 milliliters (mL), calculated based on the five most recent samples from each site, and a single sample maximum (SSM) not to exceed 400 per 100 mL.

ii. ***Enterococci***: A six-week rolling GM of *Enterococci* not to exceed 30 colony forming units (cfu) or most probable number (MPN) per 100 mL, calculated weekly, and a statistical threshold value (STV) of 110 cfu/100 mL not to be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner. USEPA recommends using USEPA Method 1600 or other equivalent method to measure culturable *Enterococci*.

b. The Initial Dilution Zone for any wastewater outfall shall be excluded from designation as kelp beds for purposes of bacterial standards. Adventitious assemblages of kelp plants on waste discharge structures (e.g., outfall pipes and diffusers) do not constitute kelp beds for purposes of bacterial standards.

c. Shellfish Harvesting Standards

At all areas where shellfish may be harvested for human consumption, as determined by the Los Angeles Water Board, the following bacterial objectives shall be maintained throughout the water column: The median total coliform density for any 6-month period shall not exceed 70 per 100 mL, and not more than 10 percent of the samples shall exceed 230 per 100 mL for any six-month period.

6.1.2. Physical Characteristics

The waste discharged shall not:

a. result in floating particulates and oil and grease to be visible;

b. cause aesthetically undesirable discoloration on the ocean surface;

c. significantly reduce the transmittance of natural light at any point outside the initial dilution zone;

d. change the rate of deposition of inert solids and the characteristics of inert solids in ocean sediments such that benthic communities are degraded; and

e. cause trash to be present in ocean waters, along shorelines or adjacent areas in amounts that adversely affect beneficial uses or cause nuisance.

6.1.3. Chemical Characteristics

The waste discharged shall not:

a. cause the dissolved oxygen concentration at any time to be depressed more than 10 percent from that which occurs naturally, as a result of the discharge of oxygen demanding waste;

b. change the pH of the receiving waters at any time more than 0.2 units from that which occurs naturally;

c. cause the dissolved sulfide concentration of waters in and near sediments to be significantly increased above that present under natural conditions;

d. cause concentration of substances (as set forth in Chapter II, Table 3 of the 2019 Ocean Plan) in marine sediments to be increased to levels that would degrade indigenous biota;

e. cause the concentration of organic materials in marine sediments to be increased to levels that would degrade marine life;

f. contain nutrients at levels that will cause objectionable aquatic growths or degrade indigenous biota;

g. cause total chlorine residual to persist in the receiving water and shall not persist in the receiving water at any concentration that causes impairment of beneficial uses;

h. produce concentrations of substances in the receiving water that are toxic to or cause detrimental physiological responses, in human, animal, or aquatic life; and

i. contain individual pesticides or combinations of pesticides in concentrations that adversely affect beneficial uses.

6.1.4. Biological Characteristics

The waste discharged shall not:

a. degrade marine communities, including vertebrate, invertebrate, and plant species;

b. alter the natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption;

c. cause the concentration of organic materials in fish, shellfish or other marine resources used for human consumption to bioaccumulate to levels that are harmful to human health; and

d. contain substances that result in biochemical oxygen demand that adversely affects the beneficial uses of the receiving water.

6.1.5. Radioactivity

Discharge of radioactive waste shall not degrade marine life.

6.2. Groundwater Limitations – Not Applicable

7. PROVISIONS

7.1. Standard Provisions

7.1.1. The Permittee shall comply with all Standard Provisions included in Attachment D of this Order.

7.1.2. **Los Angeles Water Board Standard Provisions**. The Discharger shall comply with the following provisions. If there is any conflict, duplication, or overlap between provisions specified by this Order, the more stringent provision shall apply:

a. Neither the treatment nor the discharge of pollutants shall create pollution, contamination, or nuisance as defined by section 13050 of the Water Code.

b. Odors, vectors, and other nuisances of sewage or sludge origin beyond the limits of the treatment plant site or the sewage collection system due to improper operation of facilities (such as failure to implement appropriate best management practices) and/or spills, bypass, or overflow of sewage or sludge, as determined by the Los Angeles Water Board, are prohibited.

c. All facilities used for collection, transport, treatment, or disposal of wastes shall be adequately protected against damage resulting from overflow, washout, or inundation from a storm or flood having a 1-percent chance of occurring in a 24-hour period in any given year.

d. Collection, treatment, and disposal systems shall be operated in a manner that precludes or impedes public contact with wastewater.

e. Collected screenings, sludges, and other solids removed from liquid wastes shall be disposed of in a manner approved by the Executive Officer of the Los Angeles Water Board.

f. The provisions of this Order are severable. If any provision of this Order or the application of any provision of this Order is found invalid, the remainder of this Order shall not be affected.

g. Nothing in this Order shall be construed to preclude the institution of any legal action or relieve the Discharger from any responsibilities, liabilities or penalties established pursuant to any applicable state law or regulation under authority preserved by section 510 of the CWA.

h. Nothing in this Order shall be construed to preclude the institution of any legal action or relieve the Discharger from any responsibilities, liabilities or penalties to which the Discharger is or may be subject to under section 311 of the CWA, related to oil and hazardous substances liability.

i. The Discharger shall comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies regarding discharges of stormwater to storm drain systems or other water courses under their jurisdiction, including applicable requirements in municipal stormwater management programs developed to comply with the NPDES permit(s) issued by the Los Angeles Water Board to local agencies.

j. The Discharger shall comply with all applicable effluent limitations, national standards of performance, toxic effluent standards, and all federal regulations established pursuant to sections 301, 302, 303(d), 304, 306, 307, 316, 403, and 405 of the federal CWA and amendments thereto.

k. These requirements do not exempt the Discharger from compliance with any other laws, regulations, or ordinances which may be applicable; they do not legalize this Facility; and they leave unaffected any further restraints on the disposal of wastes at this site which may be contained in other statutes or required by other agencies.

l. The Discharger shall make diligent, proactive efforts to reduce Facility infrastructure vulnerability to current and future impacts resulting from climate change, including but not limited to extreme wet weather events, flooding, storm surges, and projected sea level rise when the facility is located near the ocean or discharges to the ocean.

m. Oil or oily material, chemicals, refuse, or other polluting materials shall not be stored or deposited in areas where they may be picked up by rainfall and carried off the property and/or discharged to surface waters. Any such spill of such materials shall be contained and removed immediately.

n. A copy of these waste discharge specifications shall be maintained at the discharge Facility and be available at all times to operating personnel.

o. If there is any storage of hazardous or toxic materials or hydrocarbons at this Facility and if the Facility is not manned at all times, a 24-hour emergency response telephone number shall be prominently posted where it can easily be read from the outside.

p. The Discharger shall file with the Los Angeles Water Board a report of waste discharge at least 120 days before making any proposed change in the character, location or volume of the discharge.

q. In the event of any change in name, ownership, or control of these waste disposal facilities, the Discharger shall notify the Los Angeles Water Board of such change and shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to the Los Angeles Water Board and USEPA, 30 days prior to taking effect.

r. The Discharger shall notify the Los Angeles Water Board Executive Officer in writing no later than 6 months prior to planned discharge of any chemical, other than the products previously reported to the Los Angeles Water Board Executive Officer, which may be toxic to aquatic life. Such notification shall include:

   i. Name and general composition of the chemical,

   ii. Frequency of use,

   iii. Quantities to be used,

   iv. Proposed discharge concentrations, and

   v. USEPA registration number, if applicable.

s. Failure to comply with provisions or requirements of this Order, or violation of other applicable laws or regulations governing discharges from this Facility, may subject the Discharger to administrative or civil liabilities, criminal penalties, and/or other enforcement remedies to ensure compliance. Additionally, certain violations may subject the Discharger to civil or criminal enforcement from appropriate local, state, or federal law enforcement entities.

t. Water Code section 13385(h)(i) requires the Los Angeles Water Board to assess a mandatory minimum penalty of three-thousand dollars ($3,000) for each serious violation. Pursuant to Water Code section 13385(h)(2), a “serious violation” is defined as any waste discharge that violates the effluent limitations contained in the applicable waste discharge requirements for a Group II pollutant by 20 percent or more, or for a Group I pollutant by 40 percent or more. Appendix A in title 40 of the Code of Federal Regulations (40 CFR) section 123.45 specifies the Group I and II pollutants. Pursuant to Water Code section

13385.1(a)(1), a "serious violation" is also defined as "a failure to file a discharge monitoring report required pursuant to section 13383 for each complete period of 30 days following the deadline for submitting the report, if the report is designed to ensure compliance with limitations contained in waste discharge requirements that contain effluent limitations."

u. Water Code section 13385(i) requires the Los Angeles Water Board to assess a mandatory minimum penalty of three-thousand dollars ($3,000) for each violation whenever a person violates a waste discharge requirement effluent limitation four or more times in any period of six consecutive months, except that the requirement to assess the mandatory minimum penalty shall not be applicable to the first three non-serious violations within that time period.

v. The CWC provides that any person who violates a waste discharge requirement or a provision of the CWC is subject to civil penalties of up to $5,000 per day, $10,000 per day, or $25,000 per day of violation, or when the violation involves the discharge of pollutants, is subject to civil penalties of up to $10 per gallon per day or $25 per gallon per day of violation, or some combination thereof, depending on the violation, or upon the combination of violations. Violation of any of the provisions of the applicable statutes and regulations or any provisions of this Order may subject the violator to any of the penalties described herein, or any combinations thereof, at the discretion of the prosecuting authority; except that only one kind of penalty may be applied for each kind of violation.

w. Pursuant to Water Code section 13385.1(d), for the purposes of section 13385.1 and subdivisions (h), (i), and (j) of section 13385, "effluent limitation" means a numeric restriction or a numerically expressed narrative restriction, on the quantity, discharge rate, concentration, or toxicity units of a pollutant or pollutants that may be discharged from an authorized location. An effluent limitation may be final or interim and may be expressed as a prohibition. An effluent limitation, for these purposes, does not include a receiving water limitation, a compliance schedule, or a best management practice.

x. Water Code section 13387(e) provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this Order, including monitoring reports or reports of compliance or noncompliance, or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained in this Order is subject to a fine of not more than twenty-five thousand dollars ($25,000), by imprisonment pursuant to subdivision (h) of Section 1170 of the Penal Code for 16, 20, or 24 months, or by both that fine and imprisonment. For a subsequent conviction, such a person shall be punished by a fine of not more than twenty-five thousand dollars ($25,000) per day of violation, by imprisonment pursuant to subdivision (h) of Section 1170 of the Penal Code for two, three, or four years, or by both that fine and imprisonment.

y. In the event the Discharger does not comply or will be unable to comply for any reason, with any prohibition, effluent limitation, or receiving water limitation of this

Order that may endanger health or the environment, the Discharger shall notify the Manager of the Watershed Regulatory Section at the Los Angeles Water Board by telephone (213) 576-6616 or by fax at (213) 576-6660 within 24 hours of having knowledge of such noncompliance, and shall confirm this notification in writing to the Los Angeles Water Board within five days, unless the Los Angeles Water Board waives confirmation. The written notification shall state the nature, time, duration, and cause of noncompliance, and shall describe the measures being taken to remedy the current noncompliance and prevent recurrence including, where applicable, a schedule of implementation. The written notification shall also be submitted via email with reference to CI-1758 to losangeles@waterboards.ca.gov. Other noncompliance requires written notification as above at the time of the normal monitoring report.

7.2. Monitoring and Reporting Program (MRP) Requirements

The Discharger shall comply with the MRP, and future revisions thereto, in Attachment E of this Order.

7.3. Special Provisions

7.3.1. Reopener Provisions

a. This Order may be modified, revoked and reissued, or terminated for cause, including, but not limited to:

   i. Violation of any term or condition contained in this Order;

   ii. Obtaining this Order by misrepresentation, or by failure to disclose fully all relevant facts; or

   iii. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

b. The filing of a request by the Discharger for an Order modification, revocation, issuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

c. This Order may be reopened and modified to incorporate new limits based on future reasonable potential analyses to be conducted based on on-going monitoring data collected by the Discharger and evaluated by the Los Angeles Water Board.

d. This Order may be reopened and modified to incorporate new mass emission rates based on JWPCP’s current design capacity of 400 MGD provided that the Discharger requests and conducts an antidegradation analysis to demonstrate that the change is consistent with the state and federal antidegradation policies.

e. This Order may be modified, in accordance with the provisions set forth in 40 CFR parts 122 and 124 to incorporate requirements for the implementation of a watershed protection management approach.

f. The Los Angeles Water Board may modify, or revoke and reissue this Order if present or future investigations demonstrate that the discharge(s) governed by this Order will cause, have the potential to cause, or will contribute to adverse impacts on water quality or beneficial uses of the receiving waters.

g. This Order may also be modified, revoked, and reissued or terminated in accordance with the provisions of 40 CFR sections 122.44, 122.62 to 122.64, 125.62, and 125.64. Causes for taking such actions include, but are not limited to, failure to comply with any condition of this Order, endangerment to human health or the environment resulting from the permitted activity, or acquisition of newly obtained information which would have justified the application of different conditions if known at the time of Order adoption and issuance. The filing of a request by the Discharger for an Order modification, revocation, issuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

h. This Order may be reopened and modified to incorporate conforming monitoring requirements and schedule dates for implementation of the Comprehensive Monitoring Program for Santa Monica Bay (Commission with Santa Monica Bay National Estuary Program, April 2021).

i. This Order may be modified, in accordance with the provisions set forth in 40 CFR parts 122 to 124, to include new minimum levels (MLs).

j. If an applicable toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under section 307(a) of the CWA for a toxic pollutant and that standard or prohibition is more stringent than any limitation on the pollutant in this Order, the Los Angeles Water Board may institute proceedings under these regulations to modify or revoke and reissue the Order to conform to the toxic effluent standard or prohibition.

k. The filing of a request by the Permittee for an Order modification, revocation, issuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

l. If more stringent applicable water quality standards are promulgated or approved pursuant to section 303 of the CWA, or amendments, thereto, the Los Angeles Water Board will revise and modify this Order in accordance with such standards.

m. This Order may be reopened and modified to revise effluent limitations as a result of future Basin Plan amendments or the adoption or revision of a TMDL associated with the Santa Monica Bay Watershed Management Areas.

n. This Order will be reopened and modified to the extent necessary, to be consistent with new or revised policies, new or revised state-wide plans, new laws, or new regulations.

o. This Order may be reopened and modified to revise any of the performance goals or mass emission benchmarks if the Discharger submits a request and demonstrates to the satisfaction of the Los Angeles Water Board that the change is warranted, and will not adversely impact the beneficial uses of the receiving water.

7.3.2. Special Studies, Technical Reports and Additional Monitoring Requirements

a. Toxicity Reduction Requirements

The Discharger shall prepare and submit a copy of the Discharger’s initial investigation Toxicity Reduction Evaluation (TRE) workplan in accordance with MRP section 5.8.

b. Treatment Plant Capacity

The Discharger shall submit a written report to the Executive Officer of the Los Angeles Water Board within 90 days after the “30-day (monthly) average” daily dry-weather flow equals or exceeds 75 percent of the design capacity (0.75 x 400 MGD = 300 MGD) of waste treatment and/or disposal facilities. The Discharger's senior administrative officer shall sign a letter, which transmits that report and certifies that the Discharger's policy-making body is adequately informed of the report's contents. The report shall include the following:

i. The average daily flow for the calendar month, the date on which the peak flow occurred, the rate of that peak flow, and the total flow for the day;

ii. The best estimate of when the monthly average daily dry-weather flow rate will equal or exceed the design capacity of the POTW; and

iii. A schedule for studies, design, and other steps needed to provide additional capacity for waste treatment and/or disposal facilities before the waste flow rate equals the capacity of present units.

This requirement is applicable in the case where the facility has not reached 75 percent of capacity as of the effective date of this Order. If the facility has reached 75 percent of capacity by that date but has not previously submitted such report, such a report shall be filed within 90 days of the issuance of this Order.

7.3.3. Best Management Practices and Pollution Prevention

a. Stormwater Pollution Prevention Plan (SWPPP)

The JWPCP is regulated under the State Water Board Water Quality Order Number 2014-0057-DWQ amended by Order 2015-0122-DWQ and Order 2018-0028-DWQ, NPDES Number CAS000001, *General Permit for Storm Water Discharges Associated with Industrial Activities*.

b. Spill Clean-up Contingency Plan (SCCP)

Within 90 days of the effective date of this Order, the Discharger is required to update and submit an SCCP. The SCCP shall describe the activities and protocols to address the cleanup of spills, overflows, and bypasses of untreated or partially treated wastewater from the Discharger’s collection system or treatment facilities. At a minimum, the SCCP shall include sections on spill clean-up and containment measures, public notifications, monitoring, nuisance and odor control measures, and the procedures to be carried out if floatable material is visible on the water surface near the discharge point or has been washed ashore. The Discharger shall review and amend the SCCP as appropriate after each spill from the Facility or in the service area of the Facility. The Discharger shall include a discussion in the annual summary report of any modifications to the SCCP and the application of the SCCP to all spills during the year.

c. Pollutant Minimization Program (PMP)

Reporting protocols in MRP section 10.2.4 describe sample results that are to be reported as Detected but Not Quantified (DNQ) or Not Detected (ND). Definitions for a reported Minimum Level (ML) and Method Detection Limit (MDL) are provided in Attachment A. These reporting protocols and definitions are used in determining the need to conduct a PMP as follows:

The Discharger shall develop and conduct a PMP as further described below when there is evidence (e.g., sample results reported as DNQ when the effluent limitation is less than the MDL; sample results from analytical methods more sensitive than those methods required by this Order; presence of whole effluent toxicity; health advisories for fish consumption; beach posting by the local health officer per California Code of Regulations, Title 17, section 7958 et seq.; or, results of benthic or aquatic organism tissue sampling) that a pollutant is present in the effluent above an effluent limitation and either of the following is true:

i. The concentration of the pollutant is reported as DNQ and the effluent limitation is less than the reported ML; or,

ii. The concentration of the pollutant is reported as ND and the effluent limitation is less than the MDL, using definitions described in Attachment A and reporting protocols described in the MRP section 10.2.4.

The goal of the PMP shall be to reduce all potential sources of a pollutant through pollutant minimization (control) strategies, including pollution prevention measures as appropriate, to maintain the effluent concentration at or below the effluent limitation. Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The Los Angeles Water Board may consider cost-effectiveness when establishing the requirements of a PMP. The completion and implementation of a Pollution Prevention Plan (PPP), if required pursuant to Water Code section 13263.3(d), shall be considered to fulfill the PMP requirements.

The PMP shall include, but not be limited to, the following actions and submittals acceptable to the Los Angeles Water Board:

i. An annual review and semi-annual monitoring of potential sources of the reportable pollutant(s), which may include fish tissue monitoring and other bio-uptake sampling.

ii. Quarterly monitoring for the reportable pollutant(s) in the influent to the wastewater treatment system.

iii. Submittal of a control strategy designed to proceed toward the goal of maintaining concentrations of the reportable pollutant(s) in the effluent at or below the effluent limitation.

iv. Implementation of appropriate cost-effective control measures for the reportable pollutant(s), consistent with the control strategy; and

v. An annual status report that shall be sent to the Los Angeles Water Board including:

1) All PMP monitoring results for the previous year;

2) A list of potential sources of the reportable pollutant(s);

3) A summary of all actions undertaken pursuant to the control strategy; and

4) A description of actions to be taken in the following year.

7.3.4. Construction, Operation and Maintenance Specifications

a. Certified Wastewater Treatment Plant Operator: Wastewater treatment facilities subject to this Order shall be supervised and operated by persons possessing certificates of appropriate grade pursuant to California Code of Regulations (CCR), title 23, division 3, chapter 26 (Water Code sections 13625 – 13633). All treatment plant operators shall also be trained in emergency response.

b. Climate Change Effects Vulnerability Assessment and Mitigation Plan: The Discharger shall consider the impacts of climate change as they affect the operation of the treatment facility due to flooding, wildfires, or other climate-related changes. The Discharger shall develop a Climate Change Effects Vulnerability Assessment and Mitigation Plan (Climate Change Plan) to assess and manage climate change-related effects that may impact the wastewater treatment facility's operation, water supplies, its collection system, and water quality, including any projected changes to the influent water temperature and pollutant concentrations, and beneficial uses. The permittee shall also identify new or increased threats to the sewer system resulting from climate change that may impact desired levels of service in the next 50 years. The permittee shall project upgrades to existing assets or new infrastructure projects, and associated costs, necessary to meet desired levels of service. Climate change research also indicates the overarching driver of climate change is increased atmospheric carbon dioxide from human activity. The increased carbon dioxide emissions trigger changes to climatic patterns, which increase the intensity of sea level rise and coastal storm surges, lead to more erratic rainfall and local weather patterns, trigger a gradual warming of freshwater and ocean temperatures, and trigger changes to ocean water chemistry. As such, the Climate Change Plan shall also identify steps being taken or planned to address greenhouse gas emissions attributable to wastewater treatment plants, solids handling, and effluent discharge processes. For facilities that discharge to the ocean including desalination plants and advanced water treatment facilities, the Climate Change Plan shall also include the impacts from sea level rise. The Climate Change Plan is due 12 months after effective date of this Order.

c. **Alternate Power Source**: The Discharger shall maintain in good working order a sufficient alternate power source for operating the wastewater treatment and disposal facilities. All equipment shall be located and secured to minimize failure due to moisture, liquid spray, flooding, wildfires, and other physical phenomena. The alternate power source shall be designed to allow inspection and maintenance and shall provide for periodic testing. If such alternate power source is not in existence, the discharger shall halt, reduce, or otherwise control all discharges upon the reduction, loss, or failure of the primary source of power. The Discharger shall provide standby or emergency power facilities and/or storage capacity or other means so that in the event of plant upset or outage due to power failure or other cause, discharge of raw or inadequately treated sewage does not occur. If the existing alternate power source is insufficient to prevent the discharge of raw or inadequately treated sewage, the Permittee shall develop a plan to provide additional back-up power to the facility.

d. **Routine Maintenance and Operational Testing for Emergency Infrastructure/ Equipment**: The Permittee shall perform monthly maintenance for all emergency infrastructure and equipment at the facility, including but not limited to any bypass gate/weir in the headworks, alarm systems, backup pumps, standby power generators, and other critical emergency pump station components. The Permittee shall also perform monthly operational testing of emergency infrastructure and equipment if operation of such infrastructure and equipment does not result in a violation of this permit or cause a safety hazard. The Permittee shall update the Operation and Maintenance Plan to include monthly maintenance and operational testing of emergency infrastructure and equipment, and shall keep the records of all operational testing for emergency systems, repairs, and modifications.

e. **Outfalls:** The Discharger shall properly operate and maintain the Outfall structures to ensure they (or its replacement, in whole or part) are in good working order and are consistent with or can achieve better mixing than 166:1 at Discharge Points 001 and 002, 150 at Discharge Point 003, and 115 at Discharge Point 004.

f. **Clearwater Project:** The Discharger uses an 8-foot diameter tunnel constructed in 1937 and a 12-foot tunnel constructed in 1958 to convey the secondary-treated effluent to the ocean. A new 18-foot tunnel is being constructed under the Clearwater Project. The Clearwater Project construction started at the JWPCP in 2019 and will be completed in 2027 at White Point near Royal Palms Beach. This new 18-foot diameter tunnel will connect to the current manifold located at White Point. The Discharger shall notify the Executive Officer of the Los Angeles Water Board three months before the new 18-foot diameter tunnel is in service.

7.3.5. Special Provisions for Publicly Owned Treatment Works (POTWs)

a. Biosolids Disposal Requirements – Refer to Attachment H

i. All sewage sludge (including biosolids) generated at the wastewater treatment plant must be disposed of, treated, or applied to land in accordance with federal regulations contained in 40 Code of Federal Regulations (CFR) § 503. These requirements are enforceable by USEPA.

ii. The Discharger is separately required to comply with the requirements in State Water Board Water Quality Order Number 2004-0012-DWQ, *General WDRs for the Discharge of Biosolids to Land for Use as a Soil Amendment in Agricultural, Silvicultural, Horticultural and Land Reclamation Activities (General Order)*, for those sites receiving the Permittee's biosolids which a regional water board has placed under this general order, and with the requirements in individual WDRs issued by a regional water board for sites receiving the Permittee's biosolids.

iii. The Discharger shall separately comply, if applicable, with WDRs issued by other regional water boards to which jurisdiction the biosolids are transported and applied.

iv. The Discharger shall ensure that haulers transporting biosolids within the JOS's jurisdiction for treatment, storage, use, or disposal take all necessary measures to keep the biosolids contained. The Discharger shall maintain and have haulers adhere to a spill clean-up plan. Any spills shall be reported to USEPA and the Los Angeles Water Board or state agency in which the spill occurred. All trucks hauling sludge shall be thoroughly washed after unloading at the field or at the receiving facility.

b. Pretreatment Requirements – Refer to Attachment I

i. The Discharger has developed and implemented an approved Pretreatment Program that was submitted to the Los Angeles Water Board. This Order requires implementation of the approved Pretreatment Program. Any violation of the Pretreatment Program will be considered a violation of this Order.

ii. In 1972, the County Sanitation Districts of Los Angeles County's (Sanitation Districts') Board of Directors adopted the Wastewater Ordinance. The purpose of this Ordinance is to establish controls on users of the Sanitation Districts sewerage system in order to protect the environment and public health, and to provide for the maximum beneficial use of the Sanitation Districts' facilities. This Wastewater Ordinance, as amended July 1, 1998, superseded all previous regulations and policies of the Sanitation Districts' governing items covered in this Ordinance. Specifically, the provisions of this Ordinance superseded the Sanitation Districts' "Policy Governing Use of District Trunk Sewers" dated December 6, 1961 and amended the Sanitation Districts' "An Ordinance Regulating Sewer Construction, Sewer Use and Industrial Wastewater Discharges," dated April 1, 1972, and as amended July 1, 1975, July 1, 1980, July 1, 1983, and November 1, 1989. The Wastewater Ordinance provides the Sanitation Districts with the authority to develop local limits, which are site-specific limits developed by the POTW to enforce general and specific prohibitions on industrial users. The regulations at 40 CFR 403.8(f)(4) require POTWs to develop local limits when developing a pretreatment program and the regulations at 40 CFR 403.5(c)(1) require POTWs that have approved pretreatment programs to develop and revise local limits as necessary. An extensive review of the JOS local limits was completed in November 2006; the report outlining the full evaluation was forwarded to the Los Angeles RWQCB on November 5, 2006. On April 26, 2018, JOS submitted a local limit evaluation to the Los Angeles Water Board following the NPDES permit adoption of the JWPCP. In that evaluation, JOS found that changes to existing local limits did not appear to be necessary to meet the limitations.

iii. Any change to the Pretreatment Program shall be reported to the Los Angeles Water Board in writing and shall not become effective until approved by the Executive Officer in accordance with procedures established in 40 CFR section 403.18.

iv. Applications for renewal or modification of this Order must contain information about industrial discharges to the POTW pursuant to 40 CFR section 122.21(j)(6). Pursuant to 40 CFR section 122.42(b) and section 7.1 of Attachment D, Standard Provisions, of this Order, the Discharger shall provide adequate notice of any new introduction of pollutants or substantial change in the volume or character of pollutants from industrial discharges which were not included in the permit application. Pursuant to 40 CFR section 122.44(j)(1), the Discharger shall annually identify and report, in terms of character and volume of pollutants, any Significant Industrial Users discharging to the POTW subject to Pretreatment Standards under section 307(b) of the CWA and 40 CFR part 403.

v. The Discharger shall evaluate whether its pretreatment local limits are adequate to meet the requirements of this Order (including mass emission benchmarks) and shall submit a written technical report as required under section 2 of Attachment I. The Discharger shall submit revised local limits to the Los Angeles Water Board for approval, as necessary. In addition, the Discharger shall consider collection system overflow protection from constituents such as large debris, oil and grease, etc.

vi. The Discharger shall comply with requirements contained in Attachment I – Pretreatment Reporting Requirements.

c. Collection System Requirements

The Discharger’s collection system is part of the system that is subject to this Order. As such, the Discharger must properly operate and maintain its collection system (40 CFR section 122.41(e)). The Discharger must report any non-compliance (40 CFR section 122.41(*l*)(6) and (7)) and mitigate any discharge from the collection system in violation of this Order (40 CFR section 122.41(d)). On October 20, 2006, the Discharger submitted a Notice of Intent to enroll under the *Statewide General Waste Discharge Requirements for Sanitary Sewer Systems*, Water Quality Order Number 2006-0003-DWQ, including monitoring and reporting requirements as amended by State Water Board Order WQ 2013-0058-EXEC.

7.3.6. Spill Reporting Requirements for POTWs

a. Initial Notification

Although State and Los Angeles Water Board staff do not have duties as first responders, this requirement is an appropriate mechanism to ensure that the agencies that do have first responder duties are notified in a timely manner to protect public health and beneficial uses. For certain spills, overflows and bypasses, the Discharger shall make notifications as required below:

i. In accordance with the requirements of Health and Safety Code section 5411.5, the Discharger shall provide notification to the local health officer or the director of environmental health with jurisdiction over the affected water body of any unauthorized release of sewage or other waste that causes, or probably will cause, a discharge to any waters of the state as soon as possible, but no later than two hours after becoming aware of the release.

ii. In accordance with the requirements of Water Code section 13271, the Discharger shall provide notification to the California Office of Emergency Services (Cal OES) of the release of reportable amounts of hazardous substances or sewage that causes, or probably will cause, a discharge to any waters of the state as soon as possible, but not later than two hours after becoming aware of the release. The CCR, Title 23, section 2250, defines a reportable amount of sewage as being 1,000 gallons. The phone number for reporting these releases to the Cal OES is (800) 852-7550. In addition, the Discharger shall notify other interested persons of any such sewage spill, including but not limited to the South Coast Air Quality Management District (AQMD), cities within the jurisdiction of the spill, and Heal the Bay, by maintaining an email list of those interested persons that have requested such notification. The Discharger shall also include public outreach in their emergency communications protocols, which may include media updates, social media postings, and community notices. The Permittee shall submit an emergency communications protocol to the Los Angeles Water Board within 60 days of the effective date of the Order/Permit for Executive Officer approval including specific outreach elements, such as mass emails and telephone calls to residents in the communities surrounding the plant.

iii. The Discharger shall notify the Los Angeles Water Board of any unauthorized release of sewage from its POTW that causes, or probably will cause, a discharge to a water of the state or odors, vectors, and other nuisances of sewage or sludge origin beyond the limits of the treatment plant site or the sewage collection system as soon as possible, but not later than two hours after becoming aware of the release. This initial notification does not need to be made if the Discharger has notified Cal OES and the local health officer or the director of environmental health with jurisdiction over the affected waterbody. The phone number for reporting these releases of sewage to the Los Angeles Water Board is (213) 576-6657. The phone numbers for after hours and weekend reporting of releases of sewage to the Los Angeles Water Board are (213) 305-2284 and (213) 305-2253.

iv. At a minimum, the following information shall be provided to the Los Angeles Water Board:

- The location, date, and time of the release.
- The route of the spill including the water body that received or will receive the discharge.
- An estimate of the amount of sewage or other waste released and the amount that reached a surface water at the time of notification.
- If ongoing, the estimated flow rate of the release at the time of the notification.
- The name, organization, phone number and email address of the reporting representative.

b. Monitoring

For spills, overflows and bypasses reported under section 7.3.6.a, the Discharger shall monitor as required below:

To define the geographical extent of the spill's impact, the Discharger shall obtain grab samples for all spills, overflows or bypasses of any volume that reach any waters of the state (including shoreline, surface, groundwaters, etc.). If a grab sample cannot be obtained due to accessibility or safety concerns that cannot be addressed with the appropriate personal protective equipment or following proper sampling procedures, the sample shall be obtained as soon as it becomes safe to do so. The Discharger shall analyze the samples for total coliform, fecal coliform, *E. coli* (if fecal coliform tests positive), *Enterococcus*, and relevant pollutants of concern, upstream and downstream of the point of entry of the spill (if feasible, accessible, and safe). Rapid fecal monitoring is preferred in these situations, as long as a State Water Board's Environmental Laboratory Accreditation Program (ELAP)-certified lab is available to conduct the analyses. Daily monitoring shall be conducted from the time the spill is known until the results of two consecutive sets of bacteriological monitoring indicate the return to the background level or the Los Angeles County Department of Public Health authorizes cessation of monitoring.

c. Reporting

The initial notification required under section 7.3.6.a shall include the following:

i. As soon as possible, but not later than twenty-four (24) hours after becoming aware of an unauthorized discharge of sewage or other waste from its wastewater treatment plant to a water of the state, or a spill, bypass or upset that results in odors, vectors, and other nuisances of sewage or sludge origin beyond the limits of the treatment plant site or the sewage collection system, the Discharger shall submit a statement to the Los Angeles Water Board by email at augustine.anijielo@waterboards.ca.gov. If the discharge is 1,000 gallons or more, this statement shall certify that Cal OES has been notified of the discharge in accordance with Water Code section 13271. The statement shall also certify that the local health officer or director of environmental health with jurisdiction over the affected water bodies has been notified of the discharge in accordance with Health and Safety Code section 5411.5. The statement shall also include at a minimum the following information:

- Agency, NPDES Number, Order Number, and MRP CI Number, if applicable.
- The location, date, and time of the discharge.
- The water body that received the discharge.
- A description of the level of treatment of the sewage or other waste discharged.
- An initial estimate of the amount of sewage or other waste released and the amount that reached a surface water.
- The Cal OES control number and the date and time that notification of the incident was provided to Cal OES.
- The name of the local health officer or director of environmental health representative notified (if contacted directly); the date and time of notification; and the method of notification (e.g., phone, fax, email).

ii. A written preliminary report five (5) business days after disclosure of the incident is required. Submission to the Los Angeles Water Board of the California Integrated Water Quality System (CIWQS) Sanitary Sewer Overflow (SSO) event number shall satisfy this requirement. Within 30 days after submitting the preliminary report, the Discharger shall submit the final written report to the Los Angeles Water Board. (A copy of the final written report for a given incident, already submitted pursuant to *Statewide General WDRs for Sanitary Sewer Systems* (SSS WDRs, State Water Board Order No. WQ 2022-0103-DWQ), may be submitted to the Los Angeles Water Board to satisfy this requirement). The written report shall document the information required in paragraph 7.3.6.d below, monitoring results and any other information required in provisions of the Standard Provisions document including corrective measures implemented or proposed to be implemented to prevent/minimize future occurrences. The Los Angeles Water Board Executive Officer for just cause can grant an extension for submittal of the final written report.

iii. The Discharger shall include a certification in the annual summary report (due according to the schedule in the MRP) that states that the sewer system emergency equipment, including alarm systems, backup pumps, standby power generators, and other critical emergency pump station components were maintained and tested in accordance with the Discharger’s preventive maintenance plan. Any deviations from or modifications to the plan shall be discussed.

d. Records

The Discharger shall develop and maintain a record of all spills, overflows or bypasses of raw or partially treated sewage from its collection system or treatment plant. This record shall be made available to the Los Angeles Water Board upon request and a spill summary shall be included in the annual summary report. The records shall contain:

i. The date and time of each spill, overflow, or bypass.

ii. The location of each spill, overflow, or bypass.

iii. The estimated volume of each spill, overflow, and bypass including gross volume, amount recovered and amount not recovered, monitoring results as required by section 7.3.6.b.

iv. The cause of each spill, overflow, or bypass.

v. Whether each spill, overflow, or bypass entered a receiving water and, if so, the name of the water body and whether it entered via storm drains or other man-made conveyances.

vi. Any mitigation measures implemented.

vii. Any corrective measures implemented or proposed to be implemented to prevent/minimize future occurrences.

viii. The mandatory information included in SSO online reporting for finalizing and certifying the SSO report for each spill, overflow, or bypass under the SSS WDRs.

ix. Evaluation of the discharge plume pathway using high frequency radar ocean current data collected by the Southern California Coastal Ocean Observing System if a spill impacts the beach or the ocean.

e. Activities Coordination

Although not required by this Order, Los Angeles Water Board expects the POTW’s owners/operators will coordinate their compliance activities for consistency and efficiency with other entities that have responsibilities to implement: (i) this NPDES permit, including the Pretreatment Program, (ii) a Municipal Separate Storm Sewer Systems (MS4) NPDES permit that may contain spill prevention, sewer maintenance, reporting requirements and (iii) the SSS WDRs or subsequent updates. The Los Angeles Water Board also expects that POTW’s owners/operators to consider coordination with other agencies regarding the potential for the permissive integration of the MS4 with the wastewater collection system.

f. Consistency with SSS WDRs

The CWA prohibits the discharge of pollutants from point sources to surface waters of the United States unless authorized under an NPDES permit. (33 United States Code sections 1311, 1342). The Permittee must separately comply with the SSS WDRs . The SSS WDRs require public agencies that own or operate sanitary sewer systems with greater than one mile of sewer lines to enroll for coverage and comply with requirements, to develop and implement sewer system management plans, and report all SSOs to the State Water Board's online SSOs database. The Permittee enrolled in the SSS WDRs in October 2006, so the Permittee's collection system is covered under the SSS WDRs. The Permittee must properly operate and maintain its collection system (40 CFR § 122.41(e)), report any non-compliance (40 CFR § 122.41(1)(6) and (7)), and mitigate any discharge from the collection system in violation of this NPDES permit (40 CFR § 122.41(d)).

The requirements contained in this Order in sections 7.3.3.b (SCCP Plan section), 7.3.4. (Construction, Operation and Maintenance Specifications section), and 7.3.6. (Spill Reporting Requirements section) are intended to be consistent with the requirements of the SSS WDRs. The Los Angeles Water Board recognizes that there may be some overlap between these NPDES permit provisions and requirements in the SSS WDRs, related to the collection systems. The requirements of the SSS WDRs are considered the minimum thresholds. To encourage efficiency, the Los Angeles Water Board will accept the documentation prepared by the Discharger under the SSS WDRs for compliance purposes as satisfying the requirements in sections 7.3.3.b, 7.3.4, and 7.3.6 provided the more stringent provisions contained in this NPDES permit are also addressed. Pursuant to the SSS WDRs (Order No. WQ 2022-0103-DWQ section 6.2), the provisions of this NPDES permit supersede the SSS WDRs, for all purposes, including enforcement, to the extent the requirements may be deemed duplicative.

7.3.7. Other Special Provisions – Not Applicable

7.3.8. Compliance Schedule – Not Applicable

8. COMPLIANCE DETERMINATION

Compliance with the effluent limitations contained in section 4 of this Order will be determined as specified below:

8.1. General

Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined in the MRP and Attachment A of this Order. For purposes of reporting and administrative enforcement by the Regional and State Water Boards, the Discharger shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reporting level (RL) or minimum level (ML).

8.2. Multiple Sample Data

When determining compliance with a measure of central tendency (arithmetic mean, geometric mean, median, etc.) of multiple sample analyses and the data set contains one or more reported determinations of DNQ or ND. In those cases, the Discharger shall compute the median in place of the arithmetic mean in accordance with the following procedure:

8.2.1. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The Order of the individual ND or DNQ determinations is unimportant.

8.2.2. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

8.3. Average Monthly Effluent Limitation (AMEL)

If the average (or when applicable, the median determined by Section 8.2 above for multiple sample data) of daily discharges over a calendar month exceeds the AMEL for a given parameter, this will represent a single violation for the purpose of calculating mandatory minimum penalties, though the Discharger may be considered out of compliance for each day of that month for that parameter (e.g., resulting in 31 days of non-compliance in a 31-day month) in cases where discretionary administrative civil liabilities are appropriate. If only a single sample is taken during the calendar month and the analytical result for that sample exceeds the AMEL, the Discharger may be considered out of compliance for that calendar month. For those average monthly effluent limitations that are based on the 6-month median water quality objectives in the 2019 Ocean Plan, the daily value used to calculate these average monthly values for intermittent discharges, shall be considered to equal zero for days on which no discharge occurred. The Discharger will only be considered out of compliance for days when the discharge occurs. For any one calendar month during which no sample (daily discharge) is collected, no compliance determination can be made for that calendar month with respect to the AMEL.

If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, does not exceed the AMEL for a given parameter, the Discharger will have demonstrated compliance with the AMEL for each day of that month for that parameter.

If the analytical result of any single sample, monitored monthly, quarterly, semiannually, or annually, exceeds the AMEL for any parameter, the Discharger may collect up to four additional samples within the same calendar month. All analytical results shall be reported in the monitoring report for that month. The concentration of pollutants (an arithmetic mean or a median) in these samples estimated from the “Multiple Sample Data Reduction” section above, will be used for compliance determination.

In the event of noncompliance with an AMEL, the sampling frequency for that parameter shall be increased to weekly and shall continue at this level until compliance with the AMEL has been demonstrated.

8.4. Average Weekly Effluent Limitation (AWEL)

If the average of daily discharges over a calendar week exceeds the AWEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for each day of that week for that parameter, resulting in 7 days of non-compliance. The average of daily discharges over the calendar week that exceeds the AWEL for a parameter will be considered out of compliance for that week only. If only a single sample is taken during the calendar week and the analytical result for that sample exceeds the AWEL, the Discharger will be considered out of compliance for that calendar week. For any one calendar week during which no sample (daily discharge) is collected, no compliance determination can be made for that calendar week with respect to the AWEL.

A calendar week will begin on Sunday and end on Saturday. Partial calendar weeks at the end of calendar month will be carried forward to the next month in order to calculate and report a consecutive seven-day average value on Saturday.

8.5. Maximum Daily Effluent Limitation (MDEL)

If a 24-hour composite sample exceeds the MDEL for a given parameter, an alleged violation will be flagged, and the Discharger will be considered out of compliance for that day for that parameter. If no sample (daily discharge) is collected over a calendar day, no compliance determination can be made for that day with respect to an effluent violation determination, but compliance determination can be made for that day with respect to a reporting violation determination.

8.6. Instantaneous Minimum Effluent Limitation

If the analytical result of a single grab sample is lower than the instantaneous minimum effluent limitation for a parameter, a potential violation will be flagged, and the Discharger will be considered out of compliance for that parameter for that single sample. Non-compliance for each sample will be considered separately (e.g., the results of two grab samples collected within a calendar day that both are lower than the instantaneous minimum effluent limitation would result in two instances of non-compliance with the instantaneous minimum effluent limitation).

8.7. Instantaneous Maximum Effluent Limitation

If the analytical result of a single grab sample is higher than the instantaneous maximum effluent limitation for a parameter, a potential violation will be flagged, and the Discharger will be considered out of compliance for that parameter for that single sample. Non-compliance for each sample will be considered separately (e.g., the results of two grab samples collected within a calendar day that both exceed the instantaneous maximum effluent limitation would result in two instances of non-compliance with the instantaneous maximum effluent limitation).

8.8. Six-month Median Effluent Limitation

If the median of daily discharges over any 180-day period exceeds the six-month median effluent limitation for a given parameter, a potential violation will be flagged, and the Discharger will be considered out of compliance for each day of that 180-day period for that parameter. The next assessment of compliance will occur after the next sample is collected. If only a single sample is collected during a given 180-day period and the analytical result for that sample exceeds the six-month median, the Discharger will be considered out of compliance for the 180-day period. For any 180-period during which no sample is collected, no compliance determination can be made for the six-month median effluent limitation.

8.9. Annual Average Effluent Limitation

If the annual average of monthly discharges over a calendar year exceeds the annual average effluent limitation for a given parameter, a potential violation will be flagged and the Discharger will be considered out of compliance for each month of that year for that parameter. However, a potential violation of the annual average effluent limitation will be considered one violation for the purpose of assessing State mandatory minimum penalties. If no sample (daily discharge) is collected over a calendar year, no compliance determination can be made for that year with respect to an effluent violation determination, but compliance determination can be made for that month with respect to a reporting violation determination.

8.10. Chronic Toxicity

The discharge is subject to determination of “Pass” or “Fail” from a chronic toxicity test using the Test of Significant Toxicity (TST) statistical t-test approach described in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (USEPA 833-R-10-003, 2010), Appendix A, Figure A-1, Table A-1, and Appendix B, Table B-1. The null hypothesis (Ho) for the TST statistical approach is: Mean discharge In-stream Waste Concentration (IWC) response ≤0.75 × Mean control response. A test result that rejects this null hypothesis is reported as “Pass.” A test result that does not reject this null hypothesis is reported as “Fail.” This is a t-test (formally Student’s t-test), a statistical analysis comparing two sets of replicate observations – in the case of a Whole Effluent Toxicity (WET) test, only two test concentrations (i.e. a control and IWC). The purpose of this statistical test is to determine if the means of the two sets of observations are different (i.e. if the IWC or receiving water concentration differs from the control (the test result is “Pass” or “Fail”)). The Welch’s t-test employed by the TST statistical approach is an adaptation of Student’s t-test and is used with two samples having unequal variances.

The MDEL for chronic toxicity is exceeded and a violation will be flagged when a chronic toxicity test, analyzed using the TST statistical approach, results in “Fail”.

The chronic toxicity MDEL is set at the IWC for the discharge (0.60% effluent for Discharge Point 001 and Point 002) and expressed in units of the TST statistical approach (“Pass” or “Fail”). All NPDES effluent compliance monitoring for the chronic toxicity MDEL shall be reported using only the IWC effluent concentration and negative control, expressed in units of the TST. The TST hypothesis (Ho) (see above) is statistically analyzed using the IWC and a negative control. Effluent toxicity tests shall be run using *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995). The Los Angeles Water Board’s review of reported toxicity test results will include review of concentration-response patterns as appropriate (see Fact Sheet discussion at 4.3.6). As described in bioassay laboratory audit correspondence from the State Water Resources Control Board dated August 07, 2014, and from USEPA dated December 24, 2013, the Percent Minimum Significant Difference (PMSD) criteria only apply to compliance reporting for the No Observed Effect Concentration (NOEC) and the sublethal statistical endpoints of the NOEC, and therefore are not used to interpret results using the TST statistical approach. Standard Operating Procedures used by the toxicity testing laboratory to identify and report valid, invalid, anomalous, or inconclusive effluent (and receiving water) toxicity test measurement results from the TST statistical approach, including those that incorporate a consideration of concentration-response patterns, must be submitted to the Los Angeles Water Board (40 CFR § 122.41(h)). The Los Angeles Water Board will make a final determination as to whether a toxicity test result is valid, and may consult with the Discharger, USEPA, the State Water Board's Quality Assurance Officer, or the State Water Board's Environmental Laboratory Accreditation Program as needed. The Los Angeles Water Board may consider the results of any TIE/TRE studies in an enforcement action.

8.11. Percent Removal

The average monthly percent removal is the removal efficiency expressed as a percentage across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of pollutant concentrations (C in mg/L) of influent and effluent samples collected at about the same time using the following equation:

$$\text{Percent Removal (\%)} = [1-(C_{Effluent}/C_{Influent})] \times 100\%$$

When preferred, the Permittee may substitute mass loadings and mass emissions for the concentrations.

8.12. Mass and Concentration Limitations

Compliance with mass and concentration effluent limitations for the same parameter shall be determined separately with their respective limitations. When the concentration of a constituent in an effluent sample is determined to be ND or DNQ, the corresponding mass emission rate determined from that sample concentration shall also be reported as ND or DNQ.

8.13. Compliance with Single Constituent Effluent Limitations

Permittees may be considered out of compliance with the effluent limitation if the concentration of the pollutant (see Section 8.2 "Multiple Sample Data Reduction" above) in the monitoring sample is greater than the effluent limitation and greater than or equal to the RL.

8.14. Compliance with Effluent Limitations Expressed as a Sum of Several Constituents

Permittees are out of compliance with an effluent limitation which applies to the sum of a group of chemicals (e.g., PCB's) if the sum of the individual pollutant concentrations is greater than the effluent limitation. Individual pollutants of the group will be considered to have a concentration of zero if the constituent is reported as ND or DNQ.

8.15. Compliance with TCDD Equivalents

TCDD equivalents shall be monitored and calculated using the following formula, where the MLs, and toxicity equivalency factors (TEFs) are as provided in the table below. The Permittee shall report all measured values of individual congeners, including data qualifiers. When calculating TCDD equivalents, the Permittee shall set congener concentrations below the minimum levels to zero. USEPA method 1613 may be used to analyze dioxin and furan congeners.

$$Dioxin\ Concentration = \sum_{1}^{17}(TEQi) = \sum_{1}^{17}(Ci)(TEFi)$$

where:

Ci = individual concentration of a dioxin or furan congener

TEFi = individual TEF for a congener

MLs and TEFs

Congeners	MLs (pg/L)	TEFs
2,3,7,8-TetraCDD	10	1.0
1,2,3,7,8-PentaCDD	50	1.0
1,2,3,4,7,8-HexaCDD	50	0.1
1,2,3,6,7,8-HexaCDD	50	0.1
1,2,3,7,8,9-HexaCDD	50	0.1
1,2,3,4,6,7,8-HeptaCDD	50	0.01
OctaCDD	100	0.0001
2,3,7,8-TetraCDF	10	0.1
1,2,3,7,8-PentaCDF	50	0.05
2,3,4,7,8-PentaCDF	50	0.5
1,2,3,4,7,8-HexaCDF	50	0.1
1,2,3,6,7,8-HexaCDF	50	0.1
1,2,3,7,8,9-HexaCDF	50	0.1
2,3,4,6,7,8-HexaCDF	50	0.1
1,2,3,4,6,7,8-HeptaCDF	50	0.01
1,2,3,4,7,8,9-HeptaCDF	50	0.01
OctaCDF	100	0.0001

8.16. Mass Emission Rate

The mass emission rate shall be obtained from the following calculation for any calendar day:

$$\text{Mass emission rate (lb/day)} = \frac{8.34}{N}\sum_{i=1}^{N} Q_i C_i$$

$$\text{Mass emission rate (kg/day)} = \frac{3.79}{N}\sum_{i=1}^{N} Q_i C_i$$

in which 'N' is the number of samples analyzed in any calendar day. 'Q_i' and 'C_i' are the flow rate (MGD) and the constituent concentration (mg/L), respectively, which are associated with each of the 'N' grab samples, which may be collected in any calendar day. If a composite sample is collected, 'C_i' is the concentration measured in the composite sample and 'Q_i' is the average flow rate occurring during the period over which samples are composited.

The daily concentration of all constituents shall be determined from the flow-weighted average of the same constituents in the combined waste streams as follows:

$$\text{Daily concentration} = \frac{1}{Q_t}\sum_{i=1}^{N} Q_i C_i$$

in which 'N' is the number of component waste streams. 'Q_i' and 'C_i' are the flow rate (MGD) and the constituent concentration (mg/L), respectively, which are associated with each of the 'N' waste streams. 'Q_t' is the total flow rate of the combined waste streams.

8.17. Bacterial Standards and Analysis

8.18.1. The geometric mean (GM) is a type of mean or average that indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum). The geometric mean is defined as the nth root of the product of n numbers. The formula is expressed as:

$$GM = \sqrt[n]{(x_1)(x_2)(x_3)\cdots(x_n)}$$

where x is the sample value and n is the number of samples collected.

8.17.2. The STV for the bacteria water quality objective is a set value that approximates the 90th percentile of the water quality distribution of a bacterial population.

8.17.3. For bacterial analyses, sample dilutions should be performed so the expected range of values is bracketed (for example, with multiple tube fermentation method or membrane filtration method, 2 to 16,000 per 100 ml for total and fecal coliform, at a minimum, and 1 to 1000 per 100 ml for enterococcus). The detection methods used for each analysis shall be reported with the results of the analyses.

8.17.4. Detection methods used for coliforms (total and fecal) shall be those presented in Table 1A of 40 CFR part 136, unless alternate methods have been approved by USEPA pursuant to 40 CFR part 136, or improved methods have been determined by the Los Angeles Water Board Executive Officer and/or USEPA Water Division Director.

8.17.5. Detection methods used for *Enterococcus* shall be those presented in Table 1A of 40 CFR part 136 or in the USEPA publication EPA 600/4-85/076, *Test Methods for* Escherichia coli *and* Enterococci *in Water By Membrane Filter Procedure* or any improved method determined by the Executive Officer and/or USEPA to be appropriate.

8.18. Single Operational Upset (SOU)

An SOU that leads to simultaneous violations of more than one pollutant parameter shall be treated as a single violation and limits the Permittee's liability in accordance with the following conditions:

8.18.1. An SOU is broadly defined as a single unusual event that temporarily disrupts the usually satisfactory operation of a system in such a way that it results in violation of multiple pollutant parameters.

8.18.2. A Permittee may assert SOU to limit liability only for those violations which the Permittee submitted notice of the upset as required in Provision 5.5.2(b) of Attachment D – Standard Provisions.

8.18.3. For purpose outside of Water Code section 13385 subdivisions (h) and (i), determination of compliance and civil liability (including any more specific definition of SOU, the requirements for Permittees to assert the SOU limitation of liability, and the manner of counting violations) shall be in accordance with USEPA Memorandum *Issuance of Guidance Interpreting Single Operational Upset* (September 27, 1989).

8.18.4. For purpose of Water Code section 13385 (h) and (i), determination of compliance and civil liability (including any more specific definition of SOU, the requirements for Permittees to assert the SOU limitation of liability, and the manner of counting violations) shall be in accordance with Water Code section 13385 (f)(2).

ATTACHMENT A. DEFINITIONS

Areas of Special Biological Significance (ASBS)
Those areas designated by the State Water Resources Control Board (State Water Board) as ocean areas requiring protection of species or biological communities to the extent that alteration of natural water quality is undesirable. All Areas of Special Biological Significance are also classified as a subset of STATE WATER QUALITY PROTECTION AREAS.

Arithmetic Mean (μ)
Also called the average, is the sum of measured values divided by the number of samples. For ambient water concentrations, the arithmetic mean is calculated as follows:

$$Arithmetic\ mean = \mu = (\sum x)/n$$

Where: $\sum x$ is the sum of the measured ambient water concentrations, and n is the number of samples.

Average Monthly Effluent Limitation (AMEL)
The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Effluent Limitation (AWEL)
The highest allowable average of daily discharges over a calendar week (Sunday through Saturday), calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Bioaccumulative
Those substances taken up by an organism from its surrounding medium through gill membranes, epithelial tissue, or from food and subsequently concentrated and retained in the body of the organism.

Biosolids
Biosolids refer to sewage sludge that has been treated and tested and shown to be capable of being beneficially and legally used pursuant to federal and state regulations as a soil amendment for agricultural, silvicultural, horticultural, and land reclamation activities as specified under 40 CFR part 503.

Carcinogenic
Carcinogenic pollutants are substances that are known to cause cancer in living organisms.

Chlordane
Shall mean the sum of chlordane-alpha, chlordane-gamma, chlordene-alpha, chlordene-gamma, nonachlor-alpha, nonachlor-gamma, and oxychlordane.

Coefficient of Variation (CV)
CV is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

Composite Sample, 24-hour
For flow rate measurements, the arithmetic mean of no fewer than eight individual measurements taken at equal intervals for 24 hours or for the duration of discharge, whichever is shorter.

Composite sample, for other than flow rate measurements:

a. No fewer than eight individual sample portions collected at equal time intervals for 24 hours. The volume of each individual sample portion shall be directly proportional to the discharge flow rate at the time of sampling; or,

b. No fewer than eight individual sample portions collected of equal volume collected over a 24-hour period. The time interval between each individual sample portion shall vary such that the volume of the discharge between each individual sample portion remains constant.

The compositing period shall equal the specified sampling period, or 24 hours, if no period is specified.

The composite sample result shall be reported for the calendar day during which composite sampling ends.

Daily Discharge
Daily Discharge is defined as either: (1) the total mass of the constituent discharged over the calendar day (12:00 am through 11:59 pm) or any 24-hour period that reasonably represents a calendar day for purposes of sampling (as specified in the permit), for a constituent with limitations expressed in units of mass or; (2) the unweighted arithmetic mean measurement of the constituent over the day for a constituent with limitations expressed in other units of measurement (e.g., concentration).

The daily discharge may be determined by the analytical results of a composite sample taken over the course of one day (a calendar day or other 24-hour period defined as a day) or by the arithmetic mean of analytical results from one or more grab samples taken over the course of the day.

For composite sampling, if 1 day is defined as a 24-hour period other than a calendar day, the analytical result for the 24-hour period will be considered as the result for the calendar day in which the 24-hour period ends.

DDT
Shall mean the sum of 4,4’-DDT, 2,4’-DDT, 4,4’-DDE, 2,4’-DDE, 4,4’-DDD, and 2,4’-DDD.

Degrade
Degradation shall be determined by comparison of the waste field and reference site(s) for characteristic species diversity, population density, contamination, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species. Degradation occurs if there are significant differences in any of three major biotic groups, namely, demersal fish, benthic invertebrates, or attached algae. Other groups may be evaluated where benthic species are not affected or are not the only ones affected.

Detected, but Not Quantified (DNQ)
DNQ are those sample results less than the RL, but greater than or equal to the laboratory’s MDL. Sample results reported as DNQ are estimated concentrations.

Dichlorobenzenes
The sum of 1,2- and 1,3-dichlorobenzene.

Dilution Credit
Dilution Credit is the amount of dilution granted to a discharge in the calculation of a water quality-based effluent limitation, based on the allowance of a specified mixing zone. It is calculated from the dilution ratio or determined through conducting a mixing zone study or modeling of the discharge and receiving water.

Downstream Ocean Waters
Waters downstream with respect to ocean currents.

Dredged Material
Any material excavated or dredged from the navigable waters of the United States, including material otherwise referred to as "spoil."

Enclosed Bays
Enclosed Bays means indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay. Enclosed bays do not include inland surface waters or ocean waters.

Endosulfan
The sum of endosulfan-alpha and -beta and endosulfan sulfate.

Estimated Chemical Concentration
The estimated chemical concentration that results from the confirmed detection of the substance by the analytical method below the ML value.

Estuaries and Coastal Lagoons
Waters at the mouths of streams that serve as mixing zones for fresh and ocean waters during a major portion of the year. Mouths of streams that are temporarily separated from the ocean by sandbars shall be considered estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and saltwater occurs in the open coastal waters. Waters described by this definition include but are not limited to, the Sacramento-San Joaquin Delta, as defined in Water Code section 12220, Suisun Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay rivers. Estuaries do not include inland surface waters or ocean waters.

Grab Sample
An individual sample collected during a period not to exceed 15 minutes. Grab samples shall be collected during normal peak loading conditions for the parameter of interest, which may or may not occur during hydraulic peaks.

Halomethanes
The sum of bromoform, bromomethane (methyl bromide) and chloromethane (methyl chloride).

Hexachlorocyclohexane (HCH)
The sum of the alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.

Initial Dilution
The process that results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge.

For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from the submarine outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.

For shallow water submerged discharges, surface discharges, and non-buoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Los Angeles Regional Water Quality Control Board, whichever results in the lower estimate for initial dilution.

Instantaneous Maximum Effluent Limitation
The highest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous maximum limitation).

Instantaneous Minimum Effluent Limitation
The lowest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous minimum limitation).

In-stream Waste Concentration (IWC)
The concentration of a toxicant or the parameter of toxicity in the receiving water after mixing.

Kelp Beds
For purposes of the bacteriological standards of the Ocean Plan, are significant aggregations of marine algae of the genera *Macrocystis* and *Nereocystis*. Kelp beds include the total foliage canopy of *Macrocystis* and *Nereocystis* plants throughout the water column.

Mariculture
The culture of plants and animals in marine waters independent of any pollution source.

Material
(a) In common usage: (1) the substance or substances of which a thing is made or composed (2) substantial; (b) For purposes of the Ocean Plan relating to waste disposal, dredging and the disposal of dredged material and fill, MATERIAL means matter of any kind or description which is subject to regulation as waste, or any material dredged from the navigable waters of the United States. See also, DREDGED MATERIAL.

Maximum Daily Effluent Limitation (MDEL)
The highest allowable daily discharge of a pollutant.

Median
The middle measurement in a set of data. The median of a set of data is found by first arranging the measurements in order of magnitude (either increasing or decreasing order). If the number of measurements (n) is odd, then the median = $X_{(n+1)/2}$. If n is even, then the median = $(X_{n/2} + X_{(n/2)+1})/2$ (i.e., the midpoint between the n/2 and n/2+1).

Method Detection Limit (MDL)
The minimum measured concentration of a substance that can be reported with 99 percent confidence that the measured concentration is distinguishable from method blank results, as defined in 40 CFR part 136, Attachment B.

Minimum Level (ML)
The concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming all the method specified sample weights, volumes, and processing steps have been followed.

Natural Light
Reduction of natural light may be determined by the Los Angeles Water Board by measurement of light transmissivity or total irradiance, or both, according to the monitoring needs of the Los Angeles Water Board.

Not Detected (ND)
Sample results which are less than the laboratory's MDL.

Ocean Waters
The territorial marine waters of the state as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. If a discharge outside the territorial waters of the state could affect the quality of the waters of the state, the discharge may be regulated to assure no violation of the Ocean Plan will occur in ocean waters.

PAHs (polycyclic aromatic hydrocarbons)
The sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

PCBs (polychlorinated biphenyls) as Aroclors
The sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260.

PCBs as Congeners
The sum of the following 41 individually quantified PCB congeners or mixtures of isomers of single congeners in a co-elution: PCB-18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

Persistent Pollutants
Persistent pollutants are substances for which degradation or decomposition in the environment is nonexistent or very slow.

Phenolic Compounds (chlorinated)
The sum of 2-chlorophenol, 2,4-dichlorophenol, 4-chloro-3-methylphenol, 2,4,6-trichlorophenol, and pentachlorophenol.

Phenolic Compounds (non-chlorinated)
The sum of 2,4-dimethylphenol, 2-nitrophenol, 4-nitrophenol, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, and phenol.

Pollutant Minimization Program (PMP)
PMP means waste minimization and pollution prevention actions that include, but are not limited to, product substitution, waste stream recycling, alternative waste management methods, and education of the public and businesses. The goal of the PMP shall be to reduce all potential sources of a priority pollutant(s) through pollutant minimization (control) strategies, including pollution prevention measures as appropriate, to maintain the effluent concentration at or below the water quality-based effluent limitation. Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The Los Angeles Water Board may consider cost effectiveness when establishing the requirements of a PMP. The completion and implementation of a Pollution Prevention Plan, if required pursuant to Water Code section 13263.3(d), shall be considered to fulfill the PMP requirements.

Pollution Prevention
Any action that causes a net reduction in the use or generation of a hazardous substance or other pollutant that is discharged into water and includes, but is not limited to, input change, operational improvement, production process change, and product reformulation (as defined in Water Code section 13263.3). Pollution prevention does not include actions that merely shift a pollutant in wastewater from one environmental medium to another environmental medium, unless clear environmental benefits of such an approach are identified to the satisfaction of the State Water Resources Control Board (State Water Board) or Los Angeles Water Board.

Publicly Owned Treatment Works
A treatment works as defined by section 212 of the CWA, which is owned by a State or municipality (as defined by section 502(4) of the Act). This definition includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a POTW Treatment Plant. The term also means the municipality which has jurisdiction over the Indirect Discharges to and the discharges from such treatment works. (40 CFR § 403.3(q).)

Reporting Minimum Level
The reported ML (also known as the Reporting Level or RL) is the ML (and its associated analytical method) chosen by the Discharger for reporting and compliance determination from the MLs included in this Order, including an additional factor if applicable as discussed herein. The MLs included in this Order correspond to approved analytical methods for reporting a sample result that are selected by the Los Angeles Water Board either from Appendix II of the Ocean Plan in accordance with section III.C.5.a. of the Ocean Plan or established in accordance with section III.C.5.b. of the Ocean Plan. The ML is based on the proper application of method-based analytical procedures for sample preparation and the absence of any matrix interferences. Other factors may be applied to the ML depending on the specific

sample preparation steps employed. For example, the treatment typically applied in cases where there are matrix-effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied to the ML in the computation of the reported ML. (See Ocean Plan section III.C.6.).

Satellite Collection System
The portion, if any, of a sanitary sewer system owned or operated by a different public agency than the agency that owns and operates the wastewater treatment facility to which a sanitary sewer system is tributary.

Shellfish
Organisms identified by the California Department of Health Services as shellfish for public health purposes (i.e., mussels, clams and oysters).

Significant Difference
Statistically significant difference in the means of two distributions of sampling results at the 95 percent confidence level.

Six-Month Median Effluent Limitation
The highest allowable moving median of all “daily discharges” for any 180-day period.

Standard Deviation (σ)
Standard Deviation is a measure of variability that is calculated as follows:

$$\sigma = \sqrt{\frac{\sum(x-\mu)^2}{n-1}}$$

where:

x is the observed value;

μ is the arithmetic mean of the observed values; and

n is the number of samples.

State Water Quality Protection Areas (SWQPAs)
Non-terrestrial marine or estuarine areas designated to protect marine species or biological communities from an undesirable alteration in natural water quality. All AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) that were previously designated by the State Water Board in Resolutions 74-28, 74-32, and 75-61 are now also classified as a subset of State Water Quality Protection Areas and require special protections afforded by the Ocean Plan.

Statistical Threshold Value (STV)
The STV for the bacteria water quality objectives is a set value that approximates the 90^{th} percentile of the water quality distribution of a bacterial population.

TCDD Equivalents
The sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below.

Congeners	MLs (pg/L)	TEFs
2,3,7,8-TetraCDD	10	1.0
1,2,3,7,8-PentaCDD	50	0.5

Congeners	MLs (pg/L)	TEFs
1,2,3,4,7,8-HexaCDD	50	0.1
1,2,3,6,7,8-HexaCDD	50	0.1
1,2,3,7,8,9-HexaCDD	50	0.1
1,2,3,4,6,7,8-HeptaCDD	50	0.01
OctaCDD	100	0.001
2,3,7,8-TetraCDF	10	0.1
1,2,3,7,8-PentaCDF	50	0.05
2,3,4,7,8-PentaCDF	50	0.5
1,2,3,4,7,8-HexaCDF	50	0.1
1,2,3,6,7,8-HexaCDF	50	0.1
1,2,3,7,8,9-HexaCDF	50	0.1
2,3,4,6,7,8-HexaCDF	50	0.1
1,2,3,4,6,7,8-HeptaCDF	50	0.01
1,2,3,4,7,8,9-HeptaCDF	50	0.01
OctaCDF	100	0.001

Test of Significant Toxicity (TST)
A statistical approach used to analyze toxicity test data. The TST incorporates a restated null hypothesis, Welch's t-test, and the biological effect thresholds for chronic and acute toxicity.

Total Nitrogen
The sum of nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, and total organic nitrogen.

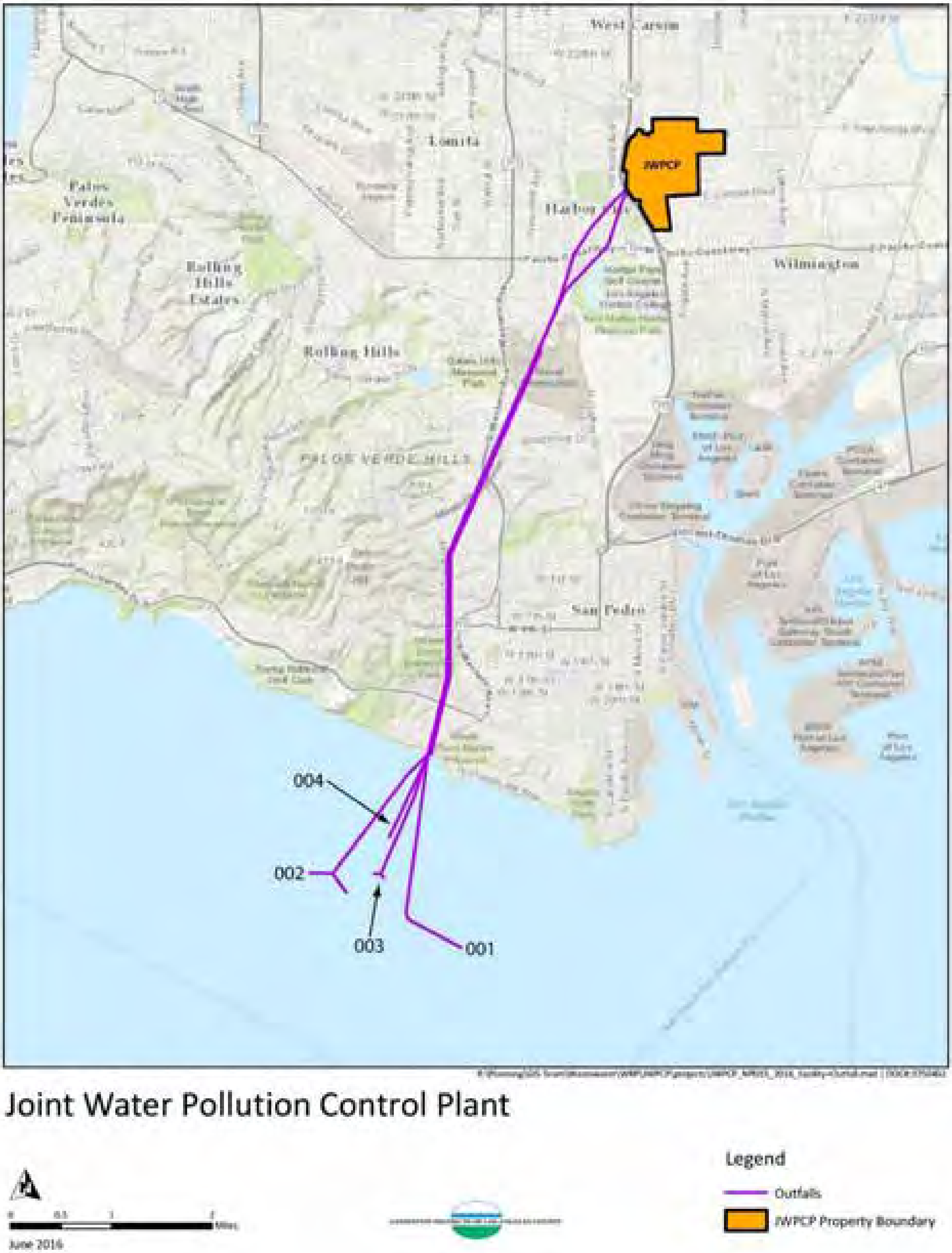
Toxicity Identification Evaluation (TIE)
Set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.

Toxicity Reduction Evaluation (TRE)
A study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices, and best management practices. A Toxicity Identification Evaluation (TIE) may be required as part of the TRE, if appropriate.

Waste
As used in the Ocean Plan, waste includes a Discharger's total discharge, of whatever origin, i.e., gross, not net, discharge.

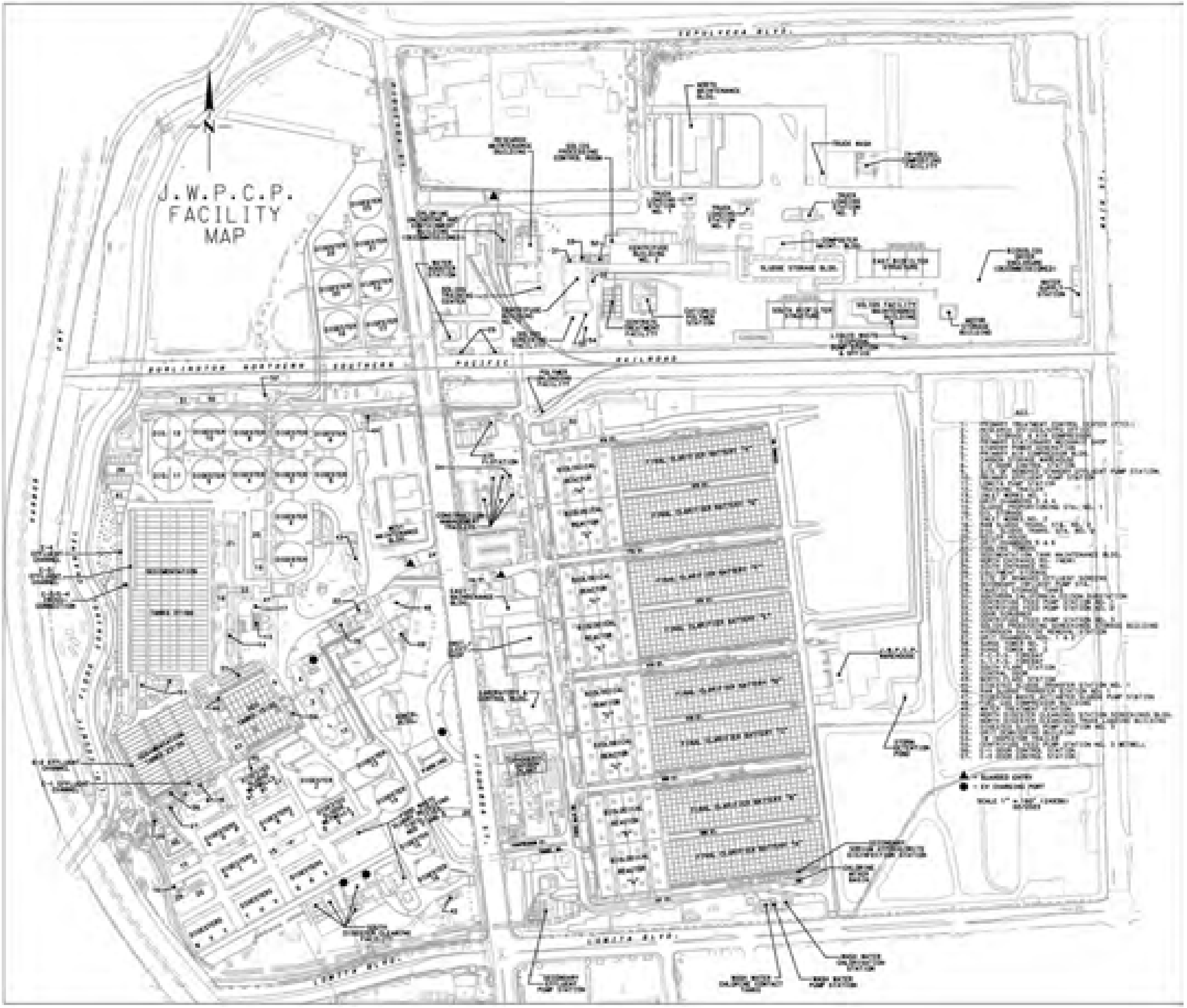
Water Recycling
The treatment of wastewater to render it suitable for reuse, the transportation of treated wastewater to the place of use, and the actual use of treated wastewater for a direct beneficial use or controlled use that would not otherwise occur.

ATTACHMENT B. 1. JWPCP AND OUTFALLS MAP

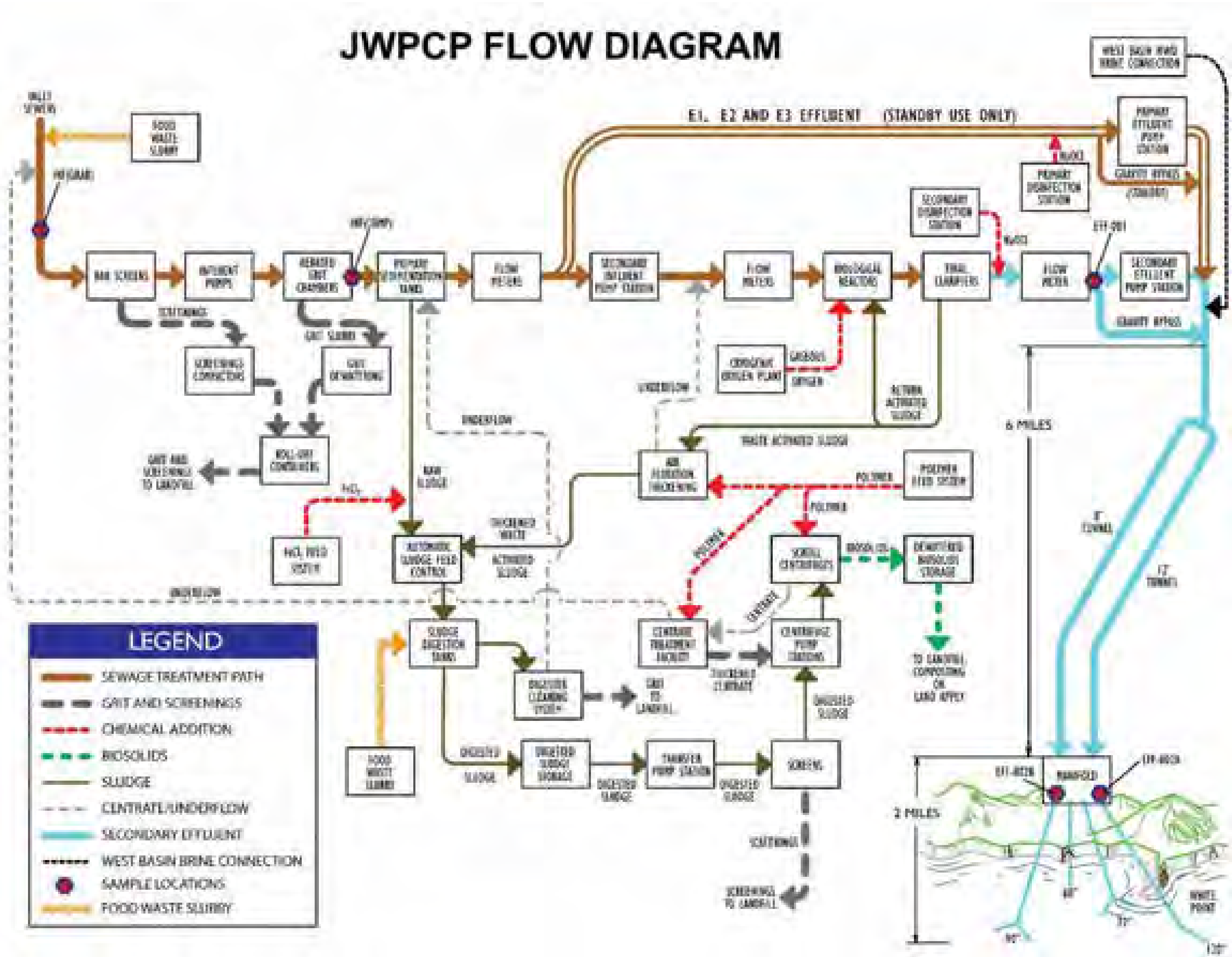


ATTACHMENT B. 2. NEW DISCHARGE TUNNEL MAP

ATTACHMENT B. 3. JWPCP SITE LAYOUT



ATTACHMENT C. FLOW SCHEMATIC



ATTACHMENT D. STANDARD PROVISIONS

1. STANDARD PROVISIONS – PERMIT COMPLIANCE

1.1. Duty to Comply

1.1.1. The Permittee must comply with all the terms, requirements, and conditions of this Order. Any noncompliance constitutes a violation of the Clean Water Act (CWA), its regulations, and the California Water Code (Water Code) and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification; denial of a permit renewal application; or a combination thereof. (40 CFR section 122.41(a); California Water Code (Water Code) sections 13261, 13263, 13265, 13268, 13000, 13001, 13304, 13350, 13385).

1.1.2. The Permittee shall comply with effluent standards or prohibitions established under Part 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. (Title 40 of the Code of Federal Regulations (40 CFR) section 122.41(a)(1).)

1.2. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order. (40 CFR section 122.41(c).)

1.3. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment. (40 CFR section 122.41(d).)

1.4. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Order. Proper operation and maintenance also include adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a Permittee only when necessary to achieve compliance with the conditions of this Order. (40 CFR section 122.41(e).)

1.5. Property Rights

1.5.1. This Order does not convey any property rights of any sort or any exclusive privileges. (40 CFR section 122.41(g).)

1.5.2. The issuance of this Order does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations. (40 CFR section 122.5(c).)

1.6. Inspection and Entry

The Permittee shall allow the Los Angeles Water Board, State Water Board, USEPA, and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials and other documents, as may be required by law, to (33 U.S.C. section 1318(a)(B); 40 CFR section 122.41(i); Water Code section 13383):

1.6.1. Enter upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order (33 U.S.C. section 1318(a)(4)(B)(i); 40 CFR section 122.41(i)(1); Water Code sections 13267 and 13383);

1.6.2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order (33 U.S.C. section 1318(a)(4)(B)(ii); 40 CFR section 122.41(i)(2); Water Code sections 13267 and 13383);

1.6.3. Inspect and photograph, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order (33 U.S.C. section 1318(a)(4)(B)(ii); 40 CFR section 122.41(i)(3); Water Code sections 13267 and 13383); and

1.6.4. Sample or monitor, at reasonable times, for the purposes of assuring Order compliance or as otherwise authorized by the CWA or the Water Code, any substances or parameters at any location. (33 U.S.C. section 1318(a)(4)(B); 40 CFR section 122.41(i)(4); Water Code sections 13267 and 13383)

1.7. Bypass

1.7.1. Definitions

a. “Bypass” means the intentional diversion of waste streams from any portion of a treatment facility. (40 CFR section 122.41(m)(1)(i).)

b. “Severe property damage” means substantial physical damage to property, damage to the treatment facilities, which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. (40 CFR section 122.41(m)(1)(ii).)

1.7.2. Bypass not exceeding limitations. The Permittee may allow any bypass to occur which does not cause exceedances of effluent limitations, but only if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions listed in Standard Provisions – Permit Compliance 1.7.3, 1.7.4, and 1.7.5 below. (40 CFR section 122.41(m)(2).)

1.7.3. Prohibition of bypass. Bypass is prohibited, and the Los Angeles Water Board may take enforcement action against a Permittee for bypass, unless (40 CFR section 122.41(m)(4)(i)):

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage (40 CFR section 122.41(m)(4)(i)(A));

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance (40 CFR section 122.41(m)(4)(i)(B)); and

c. The Permittee submitted notice to the Los Angeles Water Board as required under Standard Provisions – Permit Compliance 1.7.5 below. (40 CFR section 122.41(m)(4)(i)(C).)

1.7.4. The Los Angeles Water Board may approve an anticipated bypass, after considering its adverse effects, if the Los Angeles Water Board determines that it will meet the three conditions listed in Standard Provisions – Permit Compliance 1.7.3 above. (40 CFR section 122.41(m)(4)(ii).)

1.7.5. Notice

a. Anticipated bypass. If the Permittee knows in advance of the need for a bypass, it shall submit a notice to the Los Angeles Water Board, if possible, at least 10 days before the date of the bypass. As of December 21, 2025, all notices submitted in compliance with this section must be submitted electronically by the Discharger to the Los Angeles Water Board, or initial recipient as defined in 40 CFR section 127.2(b), in compliance with this section and 40 CFR part 3 (including, in all cases, subpart D to part 3), 122.22 and part 127. Part 127 is not intended to undo existing requirements for electronic reporting. Prior to this date, and independent of part 127, the Discharger may be required to report electronically if specified by a particular Order or if required to do so by State law. (40 CFR section 122.41(m)(3)(i).)

b. Unanticipated bypass. The Permittee shall submit notice of an unanticipated bypass as required in Standard Provisions - Reporting 5.5 below (24-hour notice). As of December 21, 2025, all notices submitted in compliance with this section must be submitted electronically by the Discharger to the Los Angeles Water Board or to the initial recipient as defined in 40 CFR section 127.2(b), in compliance with this section and 40 CFR part 3 (including, in all cases, subpart D to part 3), 122.22 and part 127. Part 127 is not intended to undo existing requirements for electronic reporting. Prior to this date, and independent of part 127, the Discharger may be required to report electronically If specified by a particular Order or if required to do so by State Law. (40 CFR section 122.41(m)(3)(ii).)

1.8. Upset

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. (40 CFR section 122.41(n)(1).)

1.8.1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of Standard Provisions – Permit Compliance 1.8.2 below are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review. (40 CFR section 122.41(n)(2).)

1.8.2. Conditions necessary for a demonstration of upset. A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that (40 CFR section 122.41(n)(3)):

a. An upset occurred and that the Permittee can identify the cause(s) of the upset (40 CFR section 122.41(n)(3)(i));

b. The permitted facility was, at the time, being properly operated (40 CFR section 122.41(n)(3)(ii));

c. The Permittee submitted notice of the upset as required in Standard Provisions – Reporting 5.5.2.b below (24-hour notice) (40 CFR section 122.41(n)(3)(iii)); and

d. The Permittee complied with any remedial measures required under Standard Provisions – Permit Compliance 1.3 above. (40 CFR section 122.41(n)(3)(iv).)

1.8.3. Burden of proof. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof. (40 CFR section 122.41(n)(4).)

2. STANDARD PROVISIONS – PERMIT ACTION

2.1. General

This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any Order condition. (40 CFR section 122.41(f).)

2.2. Duty to Reapply

If the Permittee wishes to continue an activity regulated by this Order after the expiration date of this Order, the Permittee must apply for and obtain a new permit. (40 CFR section 122.41(b).)

2.3. Transfers

This Order is not transferable to any person except after notice to the Los Angeles Water Board. The Los Angeles Water Board may require modification or revocation and reissuance of the Order to change the name of the Permittee and incorporate such other requirements as may be necessary under the CWA and the Water Code. (40

CFR sections 122.41(l)(3); and 122.61.). STANDARD PROVISIONS – MONITORING

3.1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 CFR section 122.41(j)(1).)

3.2. Monitoring must be conducted according to test procedures approved under 40 CFR part 136 for the analyses of pollutants unless another method is required under 40 CFR chapter 1, subchapter N. Monitoring must be conducted according to sufficiently sensitive test methods approved under 40 CFR part 136 for the analysis of pollutants or pollutant parameters or as required under 40 CFR chapter 1, subchapter N. For the purposes of this paragraph, a method is sufficiently sensitive when:

3.2.1. The method minimum level (ML) is at or below the level of the most stringent effluent limitation established in the permit for the measured pollutant or pollutant parameter, and either the method ML is at or below the level of the most stringent applicable water quality criterion for the measured pollutant or pollutant parameter or the method ML is above the applicable water quality criterion but the amount of the pollutant or pollutant parameter in the facility's discharge is high enough that the method detects and quantifies the level of the pollutant or pollutant parameter in the discharge; or

3.2.2. The method has the lowest ML of the analytical methods approved under 40 CFR part 136 or required under 40 CFR chapter 1, subchapter N for the measured pollutant or pollutant parameter. In the case of pollutants or pollutant parameters for which there are no approved methods under 40 CFR part 136 or otherwise required under 40 CFR chapter 1, subchapter N, monitoring must be conducted according to a test procedure specified in this Order for such pollutants or pollutant parameters. (40 CFR §§ 122.21(e)(3), 122.41(j)(4), 122.44(i)(1)(iv).)

4. STANDARD PROVISIONS – RECORDS

4.1. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Los Angeles Water Board Executive Officer at any time. (40 CFR part 122.41(j)(2).)

4.2. Records of monitoring information shall include:

4.2.1. The date, exact place, and time of sampling or measurements (40 CFR section 122.41(j)(3)(i));

4.2.2. The individual(s) who performed the sampling or measurements (40 CFR section 122.41(j)(3)(ii));

4.2.3. The date(s) analyses were performed (40 CFR section 122.41(j)(3)(iii));

4.2.4. The individual(s) who performed the analyses (40 CFR section 122.41(j)(3)(iv));

4.2.5. The analytical techniques or methods used (40 CFR section 122.41(j)(3)(v)); and

4.2.6. The results of such analyses. (40 CFR section 122.41(j)(3)(vi).)

4.3. Claims of confidentiality for the following information will be denied (40 CFR section 122.7(b)):

4.3.1. The name and address of any permit applicant or Permittee (40 CFR section 122.7(b)(1)); and

4.3.2. Permit applications and attachments, permits and effluent data. (40 CFR section 122.7(b)(2).)

5. STANDARD PROVISIONS – REPORTING

5.1. Duty to Provide Information

The Permittee shall furnish to the Los Angeles Water Board, State Water Board, or USEPA within a reasonable time, any information which the Los Angeles Water Board, State Water Board, or USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order or to determine compliance with this Order. Upon request, the Permittee shall also furnish to the Los Angeles Water Board, State Water Board, or USEPA copies of records required to be kept by this Order. (40 CFR section 122.41(h); Water Code sections 13267 and 13383.)

5.2. Signatory and Certification Requirements

5.2.1. All applications, reports, or information submitted to the Los Angeles Water Board, State Water Board, and/or USEPA shall be signed and certified in accordance with Standard Provisions – Reporting 5.2.2, 5.2.3, 5.2.4, 5.2.5, and 5.2.6 below. (40 CFR section 122.41(k).)

5.2.2. All permit applications shall be signed by either a principal executive officer or ranking elected official. For purposes of this provision, a principal executive officer of a federal agency includes: (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of USEPA). (40 CFR section 122.22(a)(3).).

5.2.3. All reports required by this Order and other information requested by the Los Angeles Water Board, State Water Board, or USEPA shall be signed by a person described in Standard Provisions – Reporting 5.2.2 above, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Standard Provisions – Reporting 5.2.2 above (40 CFR section 122.22(b)(1));

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) (40 CFR section 122.22(b)(2)); and

c. The written authorization is submitted to the Los Angeles Water Board and State Water Board. (40 CFR section 122.22(b)(3).)

5.2.4. If an authorization under Standard Provisions – Reporting 5.2.3 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Standard Provisions – Reporting 5.2.3 above must be submitted to the Los Angeles Water Board and State Water Board prior to or together with any reports, information, or applications, to be signed by an authorized representative. (40 CFR section 122.22(c).)

5.2.5. Any person signing a document under Standard Provisions – Reporting 5.2.2 or 5.2.3 above shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (40 CFR section 122.22(d).)

5.2.6. Any person providing the electronic signature for documents described in Standard Provisions – 5.2.1, 5.2.2, or 5.2.3 that are submitted electronically shall meet all relevant requirements of Standard Provisions – Reporting 5.2, and shall ensure that all relevant requirements of 40 CFR section 3 (Cross-Media Electronic Reporting) and 40 CFR section 127 (NPDES Electronic Reporting Requirements) are met for that submission. (40 CFR section 122.22(e).)

5.3. Monitoring Reports

5.3.1. Monitoring results shall be reported at the intervals specified in the Monitoring and Reporting Program (Attachment E) in this Order. (40 CFR section 122.41(l)(4).)

5.3.2. Monitoring results must be reported on a Discharge Monitoring Report (DMR) form or forms provided or specified by the Los Angeles Water Board or State Water Board. As of December 21, 2016, all reports and forms must be submitted electronically to the initial recipient defined in Standard Provisions – Reporting 5.10 and comply with 40 CFR section 3, 40 CFR section 122.22, and 40 CFR section 127. (40 CFR section 122.41(*l*)(4)(i).)

5.3.3. If the Permittee monitors any pollutant more frequently than required by this Order using test procedures approved under 40 CFR part 136, or another method required for an industry-specific waste stream under 40 CFR chapter 1, subchapter N, the results of such monitoring shall be included in the calculation and reporting of the data submitted in the DMR or reporting form specified by the Los Angeles Water Board or State Water Board. (40 CFR section 122.41(*l*)(4)(ii).)

5.4.4. Calculations for all limitations, which require averaging of measurements, shall utilize an arithmetic mean unless otherwise specified in this Order. (40 CFR section 122.41(*l*)(4)(iii).)

5.4. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Order, shall be submitted no later than 14 days following each schedule date. (40 CFR section 122.41(l)(5).)

5.5. Twenty-Four Hour Reporting

5.5.1. The Discharger shall report any noncompliance which may endanger health or the environment to the Manager of the Watershed Regulatory Section of the Los Angeles Water Board at (213) 576-6616 and jeong-hee.lim@waterboards.ca.gov. Any information shall be provided orally within 24 hours from the time the Discharger becomes aware of the circumstances. A report shall also be provided within five (5) days of the time the Discharger becomes aware of the circumstances. The report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

For noncompliance events related to combined sewer overflows, sanitary sewer overflows, or bypass events, these reports must include the data described above (with the exception of time of discovery) as well as the type of event (i.e., combined sewer overflow, sanitary sewer overflow, or bypass event), type of overflow structure (e.g., manhole, combined sewer overflow outfall), discharge volume untreated by the treatment works treating domestic sewage, types of human health and environmental impacts of the event, and whether the noncompliance was related to wet weather.

As of December 21, 2025, all reports related to combined sewer overflows, sanitary sewer overflows, or bypass events must be submitted electronically to the initial recipient defined in Standard Provisions – Reporting 5.10. The reports shall comply with 40 CFR part 3, 40 CFR section 122.22, and 40 CFR section 127. The Los Angeles Water Board may also require the Discharger to electronically submit reports not related to combined sewer overflows, sanitary sewer overflows, or bypass events under this section. (40 CFR section 122.41(l)(6)(i).)

5.5.2. The following shall be included as information that must be reported within 24 hours:

a. Any unanticipated bypass that exceeds any effluent limitation in this Order. (40 CFR section 122.41(l)(6)(ii)(A).)

b. Any upset that exceeds any effluent limitation in this Order. (40 CFR section 122.41(l)(6)(ii)(B).)

5.5.3. The Los Angeles Water Board may waive the above-required written report under this provision on a case-by-case basis if an oral report has been received within 24 hours. (40 CFR section 122.41(l)(6)(iii).)

5.6. Planned Changes

The Permittee shall give notice to the Los Angeles Water Board as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required under this provision only when (40 CFR section 122.41(l)(1)):

5.6.1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in section 122.29(b) (40 CFR section 122.41(l)(1)(i)); or

5.6.2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this Order. (40 CFR section 122.41(l)(1)(ii).)

5.6.3. The alteration or addition results in a significant change in the Permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan. (40 CFR section 122.41(l)(1)(iii).)

5.7. Anticipated Noncompliance

The Permittee shall give advance notice to the Los Angeles Water Board of any planned changes in the permitted facility or activity that may result in noncompliance with this Order’s requirements. (40 CFR section 122.41(l)(2).)

5.8. Other Noncompliance

The Permittee shall report all instances of noncompliance not reported under Standard Provisions – Reporting 5.3, 5.4, and 5.5 above at the time monitoring reports are submitted. The reports shall contain the information listed in Standard Provision – Reporting 5.5 above. For noncompliance events related to combined sewer overflows, sanitary sewer overflows, or bypass events, these reports shall contain the information described in Standard Provision – Reporting 5.5 and the applicable required data in appendix A to 40 CFR part 127. As of December 21, 2025, all reports related to combined sewer overflows, sanitary sewer overflows or bypass events submitted in compliance with this section must be submitted electronically by the Discharger to the Los Angeles Water Board/USEPA Region 9 or initial recipient, as defined in 40 CFR § 127.2(b), in compliance with this section and 40 CFR § 3 (including, in all cases, subpart D to 3), 122.22, and 40 CFR § 127. (40 CFR § 122.41(l)(7).)

5.9. Other Information

When the Permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Los Angeles Water Board, State Water Board, or USEPA, the Permittee shall promptly submit such facts or information. (40 CFR section 122.41(l)(8).)

5.10. Initial Recipient for Electronic Reporting Data

The owner, operator, or the duly authorized representative is required to electronically submit NPDES information specified in appendix A to 40 CFR part 127 to the initial recipient defined in 40 CFR section 127.2(b). USEPA will identify and publish the list of initial recipients on its website and in the Federal Register, by state and by NPDES data group [see 40 CFR section 127.2(c)]. USEPA will update and maintain this listing. (40 CFR section 122.41(l)(9).)

6. STANDARD PROVISIONS – ENFORCEMENT

6.1. The Los Angeles Water Board is authorized to enforce the terms of this Order under several provisions of the Water Code, including, but not limited to, sections 13268, 13385, 13386, and 13387.

6.2. The CWA provides that any person who violates section 301, 302, 306, 307, 308, 318 or 405 of the CWA, or any permit condition or limitation implementing any such sections in a permit issued under section 402, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the CWA, is subject to a civil penalty not to exceed $25,000 per day for each violation. The CWA provides that any person who *negligently* violates sections 301, 302, 306, 307, 308, 318, or 405 of the CWA, or any condition or limitation implementing any of such sections in a permit issued under section 402 of the CWA, or any requirement imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the CWA, is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment of not more than one year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than $50,000 per day of violation, or by imprisonment of not more than two years, or both. Any person who *knowingly* violates such conditions or limitations is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than three years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both. Any person who *knowingly* violates section 301, 302, 303, 306, 307, 308, 318 or 405 of the CWA, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the CWA, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than $500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in section 309(c)(3)(B)(iii) of the CWA, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than $1,000,000 and can be fined up to $2,000,000 for second or subsequent convictions (40 CFR section 122.41(a)(2); Water Code sections 13385 and 13387).

6.3. Any person may be assessed an administrative penalty by the Administrator of USEPA, the Los Angeles Water Board, or State Water Board for violating section 301, 302, 306, 307, 308, 318 or 405 of this CWA, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the CWA. Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000. Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000. (40 CFR section 122.41(a)(3))

6.4. The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both. (40 CFR section 122.41(j)(5)).

6.5. The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both. (40 CFR section 122.41(k)(2)).

7. ADDITIONAL PROVISIONS – NOTIFICATION LEVELS

7.1. Publicly Owned Treatment Works (POTWs)

All POTWs shall provide adequate notice to the Los Angeles Water Board of the following (40 CFR section 122.42(b)):

7.1.1. Any new introduction of pollutants into the POTW from an indirect Permittee that would be subject to sections 301 or 306 of the CWA if it were directly discharging those pollutants (40 CFR section 122.42(b)(1)); and

7.1.2. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of adoption of the Order. (40 CFR section 122.42(b)(2).)

7.1.3. Adequate notice shall include information on the quality and quantity of effluent introduced into the POTW as well as any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW. (40 CFR section 122.42(b)(3).)

ATTACHMENT E. MONITORING AND REPORTING PROGRAM

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ATTACHMENT E – MONITORING AND REPORTING PROGRAM (MRP), (CI-1758)

Section 308(a) of the federal Clean Water Act and sections 122.41(h), (j)-(l), 122,44(i), and 122.48 of Title 40 of the Code of Federal Regulations (40 CFR) requires that all National Pollutant Discharge Elimination System (NPDES) permits specify monitoring and reporting requirements. California Water Code (Water Code) section 13383 also authorizes the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) to establish monitoring, reporting, and recordkeeping requirements. This MRP establishes monitoring, reporting, and recordkeeping requirements that implement federal and California laws and/or regulations.

1. GENERAL MONITORING PROVISIONS

1.1. All samples shall be representative of the waste discharge under conditions of peak load. Results of monthly, quarterly, semiannual, and annual analyses shall be reported by the due date specified in Table E-21 of the MRP. The Discharger shall make every effort to schedule monitoring so that the different seasons are represented in the quarterly and semiannual monitoring throughout the year.

1.2. Pollutants, except those analyzed in the field, shall be analyzed using the analytical methods described in 40 CFR parts 136.3, 136.4, and 136.5; or where no methods are specified for a given pollutant, by methods approved by the Los Angeles Water Board or the State Water Resources Control Board (State Water Board).

1.3. **Laboratory Certification.** Laboratories analyzing effluent samples and receiving water samples shall be certified by the State Water Board, Division of Drinking Water (DDW) Environmental Laboratory Accreditation Program (ELAP) in accordance with Water Code 13176, or approved by the Los Angeles Water Board Executive Officer, and must include quality assurance/quality control (QA/QC) data in their reports. A copy of the laboratory certification shall be provided in the Annual Report due to the Los Angeles Water Board each time a new certification and/or renewal of the certification is obtained.

1.4. Water/wastewater samples must be analyzed within allowable holding time limits as specified in 40 CFR part 136.3. All QA/QC analyses must be run on the same dates that samples are actually analyzed. The Permittee shall retain the QA/QC documentation in its files and make available for inspection and/or submit them when requested by the Los Angeles Water Board. Proper chain of custody procedures must be followed, and a copy of that documentation shall be submitted with the monthly report.

1.5. The Discharger shall ensure all monitoring instruments are calibrated and maintained to ensure accuracy of measurements.

1.6. For any analyses performed for which no procedure is specified in the United States Environmental Protection Agency (USEPA) guidelines, or in the MRP, the constituent or parameter analyzed, and the method or procedure used must be specified in the monitoring report.

1.7. Each monitoring report must affirm in writing that “with the exception of field tests, all analyses were conducted at a laboratory certified for such analyses under the ELAP or approved by the Executive Officer in accordance with current USEPA guideline procedures or as specified in this Monitoring and Reporting Program."

1.8. The monitoring report shall specify the USEPA analytical method used, the Method Detection Limit (MDL), and the Reporting Level (RL) [the applicable minimum level (ML) or reported Minimum Level (RML)] for each pollutant. The MLs are those published by the State Water Board in Appendix II of the 2019 Ocean Plan. The ML represents the lowest quantifiable concentration in a sample based on the proper application of all method-based analytical procedures and the absence of any matrix interference. When all specific analytical steps are followed and after appropriate application of method specific factors, the ML also represents the lowest standard in the calibration curve for that specific analytical technique. When there is deviation from the method analytical procedures, such as dilution or concentration of samples, other factors may be applied to the ML depending on the sample preparation. The resulting value is the RML.

1.9. The Discharger shall select the analytical method that provides an ML lower than the effluent limitation or performance goal established for a given parameter or where no such requirement exists, the lowest applicable water quality objective in the Ocean Plan. If the effluent limitation, performance goal, or the lowest applicable water quality objective is lower than all the MLs in Appendix II of the 2019 Ocean Plan, the Discharger must select the method with the lowest ML for compliance purposes. The Discharger shall include in the Annual Summary Report a list of the analytical methods employed for each test.

1.10. The Discharger shall instruct its laboratories to establish calibration standards so that the ML (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Discharger to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.

1.11. If the Discharger samples and performs analyses (other than for process/operational control, startup, research, or equipment testing) on any influent, effluent, or receiving water constituent more frequently than required by this MRP using approved analytical methods, the results of those analyses shall be included in the report. These results shall be reflected in the calculation of the average (or median) used in demonstrating compliance with limitations set forth in this Order.

1.12. The Discharger shall develop and maintain a record of all spills or bypasses of raw or partially treated sewage from its collection system or treatment plant according to the requirements in the Waste Discharge Requirements (WDRs) of this Order. This record shall be made available to the Los Angeles Water Board upon request and a spill summary shall be included in the annual summary report.

1.13. For all bacteriological analyses, sample dilutions should be performed so the expected range of values is bracketed (for example, with multiple tube fermentation method or membrane filtration method, 2 to 16,000 per 100 ml for total coliform, at a minimum, and 1 to 1000 per 100 ml for *Enterococcus*). The detection methods used for each analysis shall be reported with the results of the analyses.

1.13.1. Detection methods used for coliforms (total and fecal) shall be those presented in Table 1A of 40 CFR part 136 unless alternate methods have been approved in advance by the USEPA pursuant to 40 CFR part 136.

1.13.2. Detection methods used for *E. coli* and *Enterococcus* shall be those presented in Table 1A of 40 CFR part 136 or in the USEPA publication EPA 600/4-85/076, *Test Methods for* Escherichia coli *and* Enterococci *in Water By Membrane Filter Procedure*, or any improved method determined by the Los Angeles Water Board to be appropriate.

1.14. All receiving and ambient water monitoring conducted in compliance with the MRP must be comparable with the Quality Assurance requirements of the Surface Water Ambient Monitoring Program (SWAMP).

1.15. NPDES compliance monitoring focuses on the effects of a specific point source discharge. Generally, it is not designed to assess impacts from other sources of pollution (e.g., nonpoint source runoff, aerial fallout) or to evaluate the current status of important ecological resources in the water body. The scale of existing compliance monitoring programs does not match the spatial and, to some extent, temporal boundaries of the important physical and biological processes in the ocean. In addition, the spatial coverage provided by compliance monitoring programs is less than ten percent of the nearshore ocean environment. Better technical information is needed about status and trends in ocean waters to guide management and regulatory decisions, to verify the effectiveness of existing programs, and to shape policy on marine environmental protection.

1.16. The Los Angeles Water Board and USEPA Region 9, working with other groups, have developed a comprehensive basis for effluent and receiving water monitoring appropriate to large publicly owned treatment works (POTWs) discharging to waters of the Southern California Bight. This effort has culminated in the publication by the Southern California Coastal Water Research Project (SCCWRP) of the Model Monitoring Program guidance document (Schiff, K.C., J.S. Brown and S.B. Weisberg. 2001*. Model Monitoring Program for Large Ocean Dischargers in Southern California.* SCCWRP Tech. Rep. #357. Southern California Coastal Water Research Project, Westminster, CA. 101 pp.). This guidance provides the principles, framework and recommended design for effluent and receiving water monitoring elements that have guided development of the monitoring program described below.

1.17. In July 2000, the Santa Monica Bay Restoration Project (SMBRP) published "*An Assessment of the Compliance Monitoring System in Santa Monica Bay*" to set forth recommendations and priorities for compliance monitoring in Santa Monica Bay. This report reasoned that a reduced level of receiving water monitoring is justified for large POTWs discharging to Santa Monica Bay due to improvements in effluent quality and associated decreases in receiving water impacts. Like the Model Monitoring Program developed by SCCWRP, the SMBRP recommendations are focused on providing answers to management questions and allowing a reduction in POTW receiving water monitoring where discharge effects are well understood. The monitoring plan set forth here has been guided by SMBRP recommendations.

1.18. The conceptual framework for the Model Monitoring Program has three components that comprise a range of spatial and temporal scales: (1) core monitoring; (2) regional monitoring; and (3) special studies.

1.18.1. Core monitoring is local in nature and focused on monitoring trends in quality and effects of the point source discharge. This includes effluent monitoring as well as some aspects of receiving water monitoring. In the monitoring program described below, these core components are typically referred to as local monitoring.

1.18.2. Regional monitoring is focused on questions that are best answered by a region-wide approach that incorporates coordinated survey design and sampling techniques. The major objective of regional monitoring is to collect information required to assess how safe it is to swim in the ocean, how safe it is to eat seafood from the ocean, and whether the marine ecosystem is being protected. Key components of regional monitoring include elements to address pollutant mass emission estimations, public health concerns, monitoring of trends in natural resources, assessment of regional impacts from all contaminant sources, and protection of beneficial uses. The final design of regional monitoring programs is developed by means of steering committees and technical committees comprised of participating agencies and organizations and is not specified in this Order. Instead, for each regional component, the degree and nature of participation of the Permittee is specified. For this Order, these levels of effort are based upon past participation of the Permittee in regional monitoring programs.

The Discharger shall participate in regional monitoring activities coordinated by the SCCWRP or any other appropriate agency approved by the Los Angeles Water Board. The procedures and timelines for the Los Angeles Water Board approval shall be the same as detailed for special studies, below.

1.18.3. Special studies are focused on refined questions regarding specific effects or development of monitoring techniques and are anticipated to be of short duration and/or small scale, although multiyear studies also may be needed. Questions regarding effluent or receiving water quality, discharge impacts, ocean processes in the area of the discharge, or development of techniques for monitoring the same, arising out of the results of core or regional monitoring, may be pursued through special studies. These studies are by nature ad hoc and cannot be typically anticipated in advance of the five-year permit cycle.

The Discharger and the Los Angeles Water Board shall consult annually to determine the need for special studies. Each year, the Discharger shall submit proposals for any proposed special studies to the Los Angeles Water Board by December 31st for the following year's monitoring effort (July through June). The following year, detailed scopes of work for proposals, including reporting schedules, shall be presented by the Discharger at a Spring Los Angeles Water Board meeting, to obtain the Los Angeles Water Board approval and to inform the public. Upon approval by the Los Angeles Water Board, the Discharger shall implement its special study or studies.

1.19. Every five years SCCWRP coordinates regional monitoring within the Southern California Bight and compiles monitoring data collected by the dischargers and other participating entities. In 2018, the sixth regional monitoring program (Bight ’18) took place primarily during the summer of 2018. The next (seventh) regional monitoring program (Bight ’23) is expected to take place during 2023. While participation in regional monitoring programs is required under this Order, revisions to the Discharger’s monitoring program at the direction of the Los Angeles Water Board may be necessary to accomplish the goals of regional monitoring or to allow the performance of special studies to investigate regional or site-specific water issues of concern. These revisions may include a reduction or increase in the number of parameters to be monitored, the frequency of monitoring, or the number and size of samples to be collected, except for effluent monitoring. Such changes may be authorized by the Los Angeles Water Board Executive Officer upon written notification to the Discharger. Proposed changes to the effluent monitoring frequency shall not be considered with respect to these regional monitoring requirements.

Discharger participation in regional monitoring programs is required as a condition of this Order. The Discharger shall complete collection and analysis of samples in accordance with the schedule established by the Steering Committee directing the Bight-wide regional monitoring surveys. The level of participation shall be similar to that provided by the Discharger in previous regional surveys conducted in 1994, 1998, 2003, 2008, 2013, and 2018.

1.20. Bay Comprehensive Monitoring Program. The Santa Monica Bay National Estuary Program (SMBNEP) updated the comprehensive monitoring program for Santa Monica Bay in April 2021. This new monitoring program, developed by the Commission’s Technical Advisory Committee, culminates efforts that began in the mid-1990s with the identification of key management questions and monitoring priorities. It lays out new monitoring designs for seven major habitats within the Bay:

1.20.1. Pelagic Ecosystem;

1.20.2. Soft Bottom Ecosystem;

1.20.3. Rocky Reefs Bottom Ecosystem;

1.20.4. Rocky Intertidal Ecosystems;

1.20.5. Sandy Shores Ecosystems

1.20.6. Coastal Wetlands Ecosystem; and

1.20.7. Fresh/Riparian Ecosystem.

Design for each habitat includes a core motivating question, several related objectives, specific monitoring approaches, indicators, data products, and sampling designs detailing number and locations of stations, sampling frequency, and measurements to be collected.

The Bay Monitoring Program also includes an implementation plan that includes a detailed schedule, cost estimates for individual Program elements, and recommendations on the Program’s management structure, including data management and assessment strategies. The Bay Monitoring Program is designed to be implemented in part through modifications to existing receiving water monitoring programs for major NPDES dischargers into coastal ocean waters. Some elements of this monitoring program already have been implemented, for example, through establishment of periodic Bight-wide regional monitoring surveys (Southern California Bight Pilot Project ’94, Bight ’98, Bight ’03, Bight ’08, Bight ’13, and Bight ’18) and kelp bed monitoring. However, other elements of the program have yet to be implemented.

The SMBNEP, USEPA Region 9, the Los Angeles Water Board, the Discharger, affected NPDES permit holders, and other interested agencies and stakeholders will develop plans to collaboratively fund these elements of the program and determine each party’s level of participation. It is anticipated that funding for the program from the Joint Outfall System will be supplied through a combination of modifications to the Joint Water Pollution Control Plant’s (JWPCP’s) MRP, including redirection of existing effort and new monitoring efforts relevant to the JWPCP’s discharge. When necessary, redirection of existing monitoring requirements and/or the imposition of additional monitoring efforts conducted under the terms of this Order are subject to a public hearing before the Los Angeles Water Board. This Order may be reopened and modified by the Los Angeles Water Board to incorporate conforming monitoring requirements and schedule dates for implementation of the Comprehensive Monitoring Program for Santa Monica Bay (SMNEP, April 2021).

By March 31 of each year, the Permittee shall provide an informational report summarizing to date its contributing activities towards coordinated implementation of the Comprehensive Monitoring Program for Santa Monica Bay National Estuary Program (SMBNEP, April 2021) to the Los Angeles Water Board.

1.21. This monitoring program for JWPCP includes requirements to demonstrate compliance with the conditions of the NPDES permit, ensure compliance with State water quality standards, and mandate participation in regional monitoring and/or area-wide studies.

1.22. The Discharger shall ensure that the results of the Discharge Monitoring Report-Quality Assurance (DMR-QA) Study or the most recent Water Pollution Performance Evaluation Study are submitted annually to the State Water Board at the following address:

State Water Resources Control Board
Quality Assurance Program Officer
Office of Information Management and Analysis
1001 I Street, Sacramento, CA 95814

2. MONITORING LOCATIONS

The Discharger shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order. The North latitude and West longitude information in Tables E-1 to E-8 are approximate for administrative purposes. The asterisk (*) shows the ammonia sampling locations.

Table E-1. Influent and Effluent Monitoring Stations

Discharge Point Name	Monitoring Location Name	Monitoring Location Description
--	**INF-001**	Collected at sampling stations located upstream of any in-plant return flows and/or where representative samples of the influent can be obtained.
001, 002, 003, and 004	**EFF-001**	The effluent sampling station shall be located downstream of any in-plant return flows but before entering the discharge tunnel where representative samples of the effluent can be obtained. Latitude: 33.79878º, Longitude: -118.28213º
001, 002, 003, and 004	**EFF-002A, EFF-002B**	These effluent sampling stations shall be located at the outfall manifold at White Point. Samples collected at monitoring location EFF-002A (Latitude: 33.71806º, Longitude: -118.32179º) shall be considered representative of discharges from Discharge Points 001 & 003. Samples collected at EFF-002B (Latitude: 33.71806º, Longitude: -118.32179º) shall be considered representative of discharges from Discharge Points 002 & 004.

Table E-2. Inshore Microbiological Receiving Water Monitoring Stations (Figure E-1)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
001, 002, 003, and 004	RW-IS- IL2	Long Point	33.73667º, -118.40250º
	RW-IS-IL3	Portuguese Point	33.73750º, -118.37783º
	RW-IS-IL4	Bunker Point	33.72522º, -118.35175º
	RW-IS-IL5	Royal Palms	33.71733º, -118.32998º
	RW-IS-IL6	West of Point Fermin	33.70820º, -118.30848º
	RW-IS -IL7	Cabrillo Beach	33.70333º, -118.28400º

Table E-3. Offshore Microbiological Receiving Water Monitoring Stations (Figure E-1)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
001, 002, 003, and 004	RW-OS-6C	6C	33.70783º, -118.35400º
	RW-OS-8C	8C	33.69850º, -118.33567º
	RW-OS-9C	9C	33.68867º, -118.31833º

Table E-4. Nearshore/Offshore Water Quality Receiving Water Monitoring Stations (Figure E-2)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
001, 002, 003, and 004	RW-OS-2501	10-meter depth	33.72783º, -118.12017º
	RW-OS-2502	20-meter depth	33.69900º, -118.12783º
	RW-OS-2503	26-meter depth	33.67017º, -118.13533º
	RW-OS-2504*	33-meter depth	33.64133º, -118.14283º
	RW-OS-2505*	44-meter depth	33.61250º, -118.15033º
	RW-OS-2506*	60-meter depth	33.58100º, -118.15900º
	RW-OS-2601	19-meter depth	33.72050º, -118.18433º
	RW-OS-2602	23-meter depth	33.69400º, -118.19050º
	RW-OS-2603	23-meter depth	33.66750º, -118.19667º
	RW-OS-2604*	32-meter depth	33.64100º, -118.20300º
	RW-OS-2605*	47-meter depth	33.61467º, -118.20917º
	RW-OS-2606*	62-meter depth	33.58817º, -118.21550º
	RW-OS-2701	26-meter depth	33.70767º, -118.24667º
	RW-OS-2702	26-meter depth	33.68867º, -118.25117º
	RW-OS-2703	28-meter depth	33.66950º, -118.25567º
	RW-OS-2704*	50-meter depth	33.65050º, -118.26000º
	RW-OS-2705*	100-meter depth	33.63133º, -118.26450º
	RW-OS-2706*	80-meter depth	33.61217º, -118.26900º
	RW-OS-2801	10-meter depth	33.70283º, -118.28433º
	RW-OS-2802*	30-meter depth	33.69333º, -118.28900º
	RW-OS-2803*	60-meter depth	33.66850º, -118.29683º
	RW-OS-2804*	100-meter depth	33.65767º, -118.30133º
	RW-OS-2805	100-meter depth	33.64850º, -118.30400º
	RW-OS-2806	100-meter depth	33.63700º, -118.30917º
	RW-OS-2901	10-meter depth	33.71433º, -118.32350º
	RW-OS-2902*	30-meter depth	33.70700º, -118.32983º
	RW-OS-2903*	60-meter depth	33.69850º, -118.33567º
	RW-OS-2904*	100-meter depth	33.68783º, -118.33900º
	RW-OS-2905	100-meter depth	33.67100º, -118.34617º
	RW-OS-2906	100-meter depth	33.65417º, -118.35433º
	RW-OS-3001	10-meter depth	33.73217º, -118.36033º
	RW-OS-3002*	30-meter depth	33.72233º, -118.36317º
	RW-OS-3003*	60-meter depth	33.71467º, -118.36600º
	RW-OS-3004*	100-meter depth	33.70100º, -118.37133º
	RW-OS-3005	100-meter depth	33.68500º, -118.38100º

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
	RW-OS-3006	100-meter depth	33.66683º, -118.39067º
	RW-OS-3051	13-meter depth	33.73633º, -118.39433º
	RW-OS-3052*	30-meter depth	33.73317º, -118.40050º
	RW-OS-3053*	60-meter depth	33.73000º, -118.40250º
	RW-OS-3054*	100-meter depth	33.71900º, -118.41100º
	RW-OS-3055	100-meter depth	33.70500º, -118.42200º
	RW-OS-3056	100-meter depth	33.68967º, -118.43317º
	RW-OS-3101	10-meter depth	33.77100º, -118.43017º
	RW-OS-3102*	30-meter depth	33.76500º, -118.43533º
	RW-OS-3103*	60-meter depth	33.75733º, -118.44100º
	RW-OS-3104*	100-meter depth	33.74533º, -118.44983º
	RW-OS-3105	100-meter depth	33.72883º,-118.46117º
	RW-OS-3106	100-meter depth	33.71250º, -118.47550º

Table E-5. Nearshore Light Energy Receiving Water Monitoring Stations (Figure E-3)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
001, 002, 003, and 004	RW-NS-L1	Palos Verdes Point	33.76833º, -118.43033º
	RW-NS-L2	Long Point	33.73500º, -118.40367º
	RW-NS-L3	Portuguese Point	33.73483º, -118.37783º
	RW-NS-L4	Bunker Point	33.72367º, -118.35183º
	RW-NS-L5	Royal Palms	33.71400º, -118.33167º
	RW-NS-L6	West of Point Fermin	33.70600º, -118.30933º
	RW-NS-L7	Cabrillo Beach	33.69733º, -118.28533º

Table E-6. Benthic Sediment Chemistry Receiving Water Monitoring Stations (Figure E-4)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
001, 002, 003, and 004	RW-B-0A	305-meter depth	33.81833º, -118.45417º
	RW-B-0B	152-meter depth	33.81167º, -118.44167º
	RW-B-0C	61-meter depth	33.80717º, -118.43050º
	RW-B-0D	30-meter depth	33.80283º, -118.42267º
	RW-B-1A	305-meter depth	33.74533º, -118.44983º
	RW-B-1B	152-meter depth	33.74950º, -118.44683º
	RW-B-1C	61-meter depth	33.75733º, -118.44100º
	RW-B-1D	30-meter depth	33.76500º, -118.43533º

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
	RW-B-2A	305-meter depth	33.72700º, -118.42867º
	RW-B-2B	152-meter depth	33.73250º, -118.42583º
	RW-B-2C	61-meter depth	33.73767º, -118.42317º
	RW-B-2D	30-meter depth	33.74117º, -118.42133º
	RW-B-3A	305-meter depth	33.71900º, -118.41100º
	RW-B-3B	152-meter depth	33.72383º, -118.40733º
	RW-B-3C	61-meter depth	33.73000º, -118.40250º
	RW-B-3D	30-meter depth	33.73317º, -118.40050º
	RW-B-4A	305-meter depth	33.71167º, -118.38967º
	RW-B-4B	152-meter depth	33.71667º, -118.38733º
	RW-B-4C	61-meter depth	33.72333º, -118.38467º
	RW-B-4D	30-meter depth	33.73183º, -118.38050º
	RW-B-5A	305-meter depth	33.70100º, -118.37133º
	RW-B-5B	152-meter depth	33.70900º, -118.36800º
	RW-B-5C	61-meter depth	33.71467º, -118.36600º
	RW-B-5D	30-meter depth	33.72233º, -118.36317º
	RW-B-6A	305-meter depth	33.69983º, -118.35933º
	RW-B-6B	152-meter depth	33.70300º, -118.35583º
	RW-B-6C	61-meter depth	33.70783º, -118.35400º
	RW-B-6D	30-meter depth	33.71633º, -118.34850º
	RW-B-7A	305-meter depth	33.69767º, -118.35317º
	RW-B-7B	152-meter depth	33.70083º, -118.35150º
	RW-B-7C	61-meter depth	33.70517º, -118.34867º
	RW-B-7D	30-meter depth	33.71267º, -118.34350º
	RW-B-8A	305-meter depth	33.68783º, -118.33900º
	RW-B-8B	152-meter depth	33.69217º, -118.33733º
	RW-B-8C	61-meter depth	33.69850º, -118.33567º
	RW-B-8D	30-meter depth	33.70700º, -118.32983º
	RW-B-9A	305-meter depth	33.67633º, -118.32433º
	RW-B-9B	152-meter depth	33.68150º, -118.32183º
	RW-B-9C	61-meter depth	33.68867º, -118.31833º
	RW-B-9D	30-meter depth	33.69950º, -118.31300º
	RW-B-10A	305-meter depth	33.65767º, -118.30133º
	RW-B-10B	152-meter depth	33.66217º, -118.29833º
	RW-B-10C	61-meter depth	33.66850º, -118.29683º
	RW-B-10D	30-meter depth	33.69333º, -118.28900º

Table E-7. Bioaccumulation Receiving Water Monitoring Stations (Figure E-5)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name
001, 002, 003, and 004	RW-BA-Z1	**Outfall zone**: inshore of the 150 meters depth contour between a line bearing 150° magnetic of White Point and a line bearing 180° magnetic off Bunker Point.
	RW-BA-Z2	**Intermediate zone**: inshore of the 150 meters depth contour between a line bearing 180º (true) magnetic of Portuguese Point (33.73733º, -118.37500º) and a line bearing 270 (true) off 33.74667º, -118.41367º
	RW-BA-Z3	**Distant zone**: inshore of the 150 meters depth contour and between a line bearing 225º magnetic off the southern face of Palos Verdes Point and a line bearing 235º magnetic off the south end of the Redondo Beach Pier.

Table E-8. Fish and Invertebrate Trawl Receiving Water Monitoring Stations (Figure E-6)

Discharge Point Name	Monitoring Station Name	Monitoring Location Name	Coordinates
001, 002, 003, and 004	RW-T-T0/23	23-meter depth	33.80317º, -118.41733º
	RW-T-T0/61	61-meter depth	33.80950º, -118.43067º
	RW-T-T0/137	137-meter depth	33.81383º, -118.43933º
	RW-T-T0/305	305-meter depth	33.82050º, -118.45150º
	RW-T-T1/23	26-meter depth	33.74417º, -118.41817º
	RW-T-T1/61	61-meter depth	33.73600º, -118.42050º
	RW-T-T1/137	137-meter depth	33.73067º, -118.42233º
	RW-T-T1/305	305-meter depth	33.72583º, -118.42733º
	RW-T-T4/23	27-meter depth	33.71317º, -118.34133º
	RW-T-T4/61	61-meter depth	33.70550º, -118.34867º
	RW-T-T4/137	137-meter depth	33.70100º, -118.35083º
	RW-T-T4/305	305-meter depth	33.70000º, -118.35817º
	RW-T-T5/23	23-meter depth	33.70483º, -118.31633º
	RW-T-T5/61	61-meter depth	33.69083º, -118.32183º
	RW-T-T5/137	137-meter depth	33.68517º, -118.32683º
	RW-T-T5/305	305-meter depth	33.68083º, -118.33083º

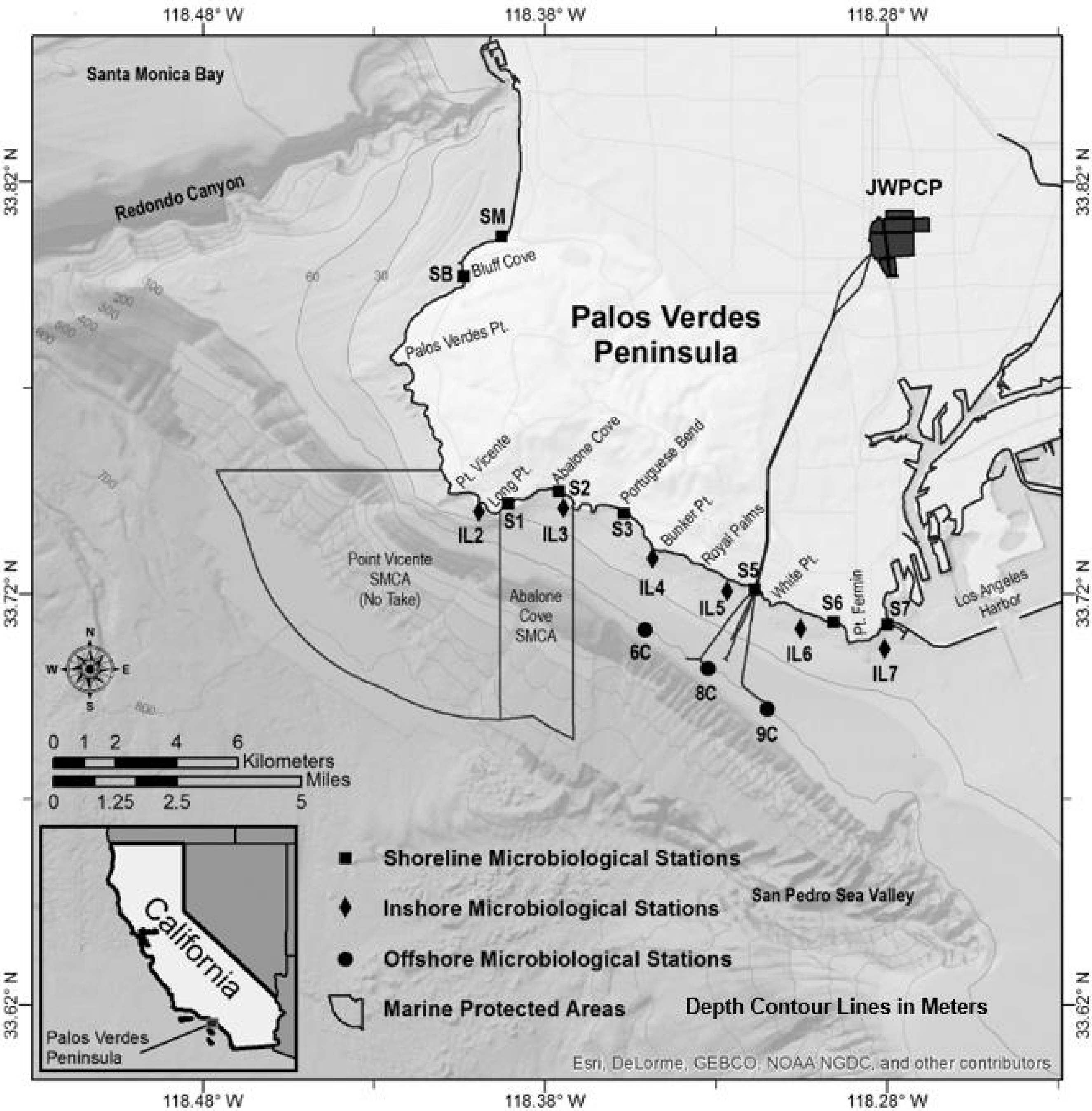

Figure E-1. Shoreline, Inshore and Offshore Microbiological Receiving Water Monitoring Locations

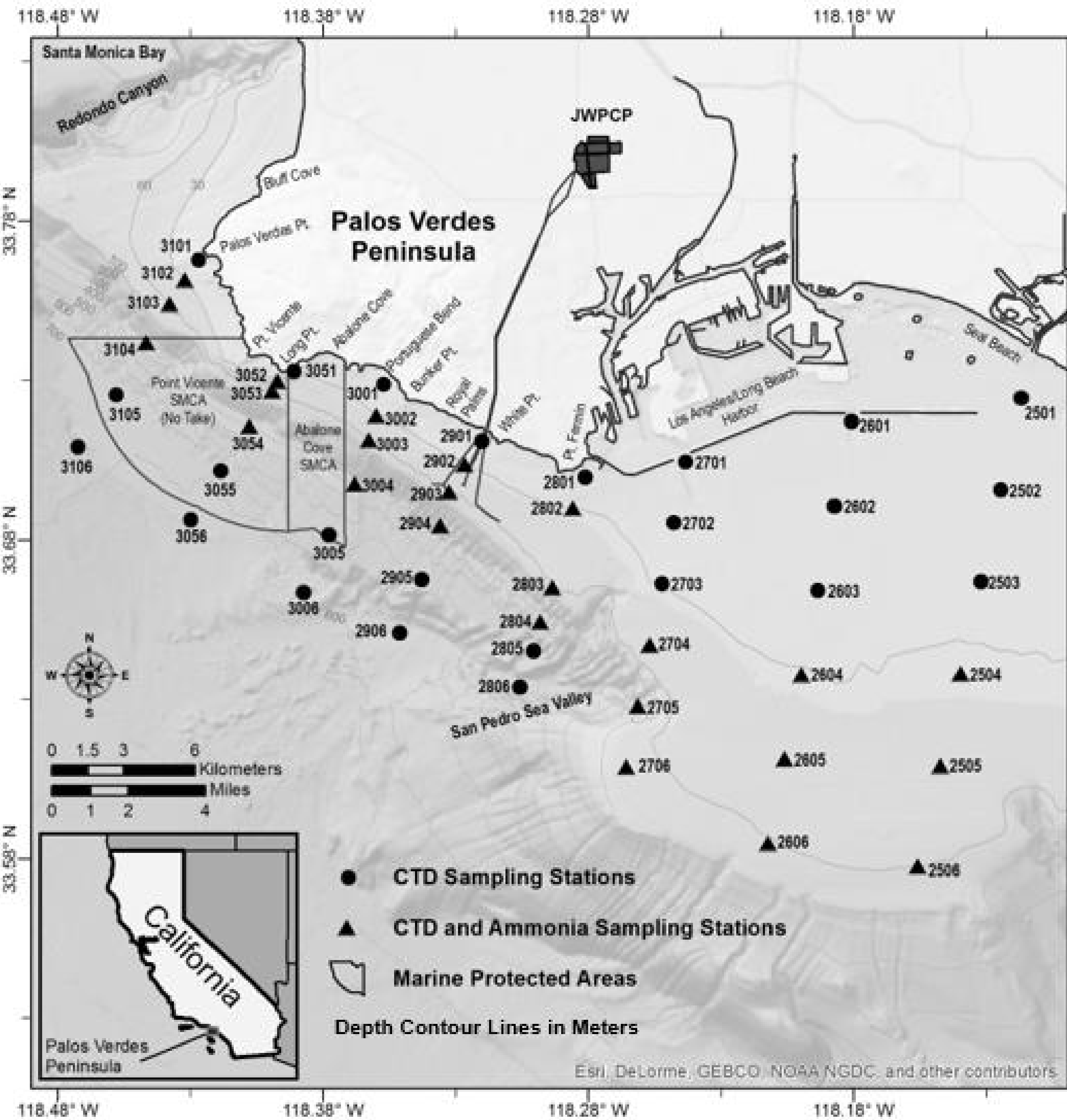

Figure E-2. Nearshore/Offshore Water Quality and Ammonia Receiving Water Monitoring Stations

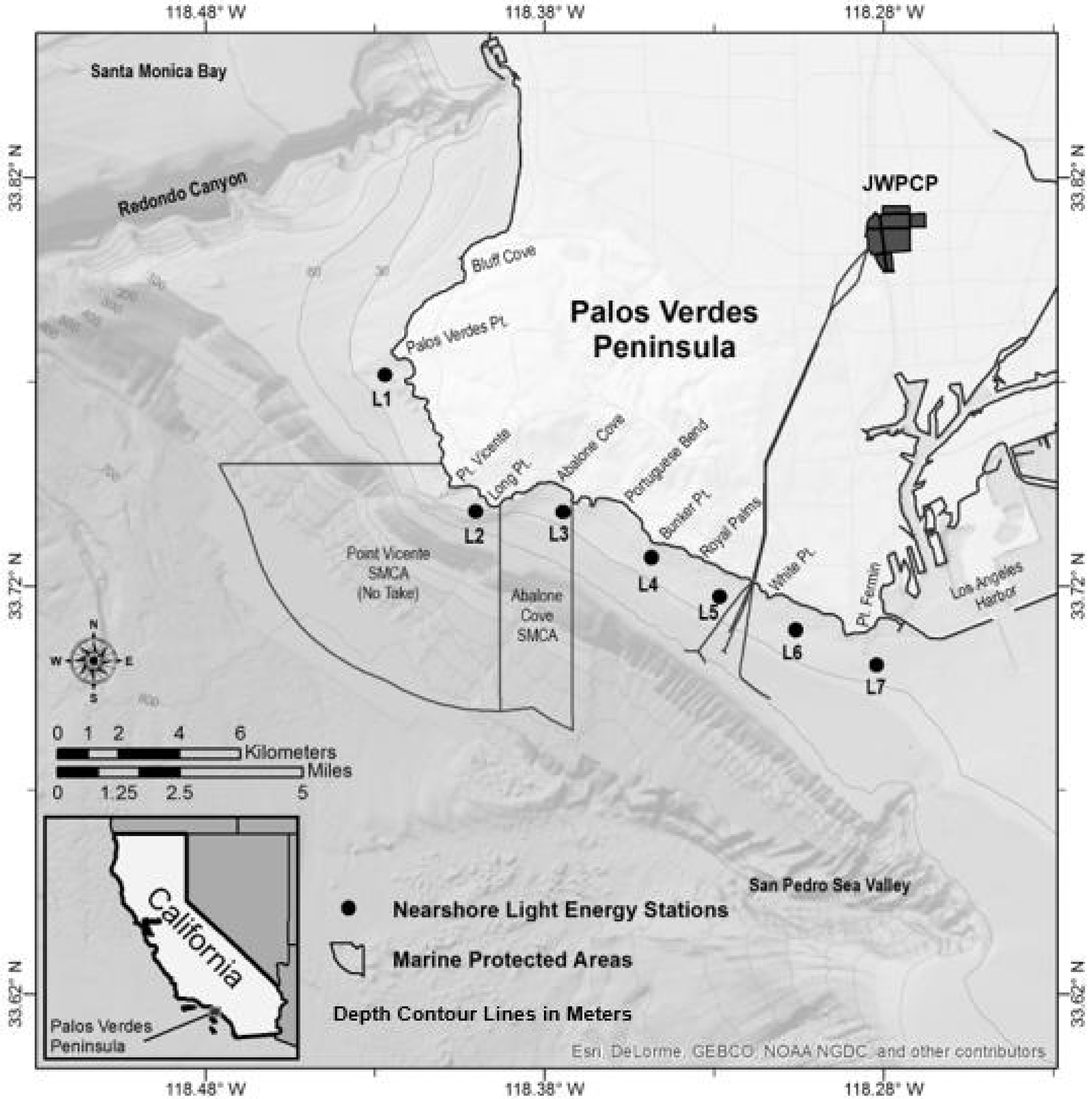

Figure E-3. JWPCP Nearshore Light Receiving Water Monitoring Stations

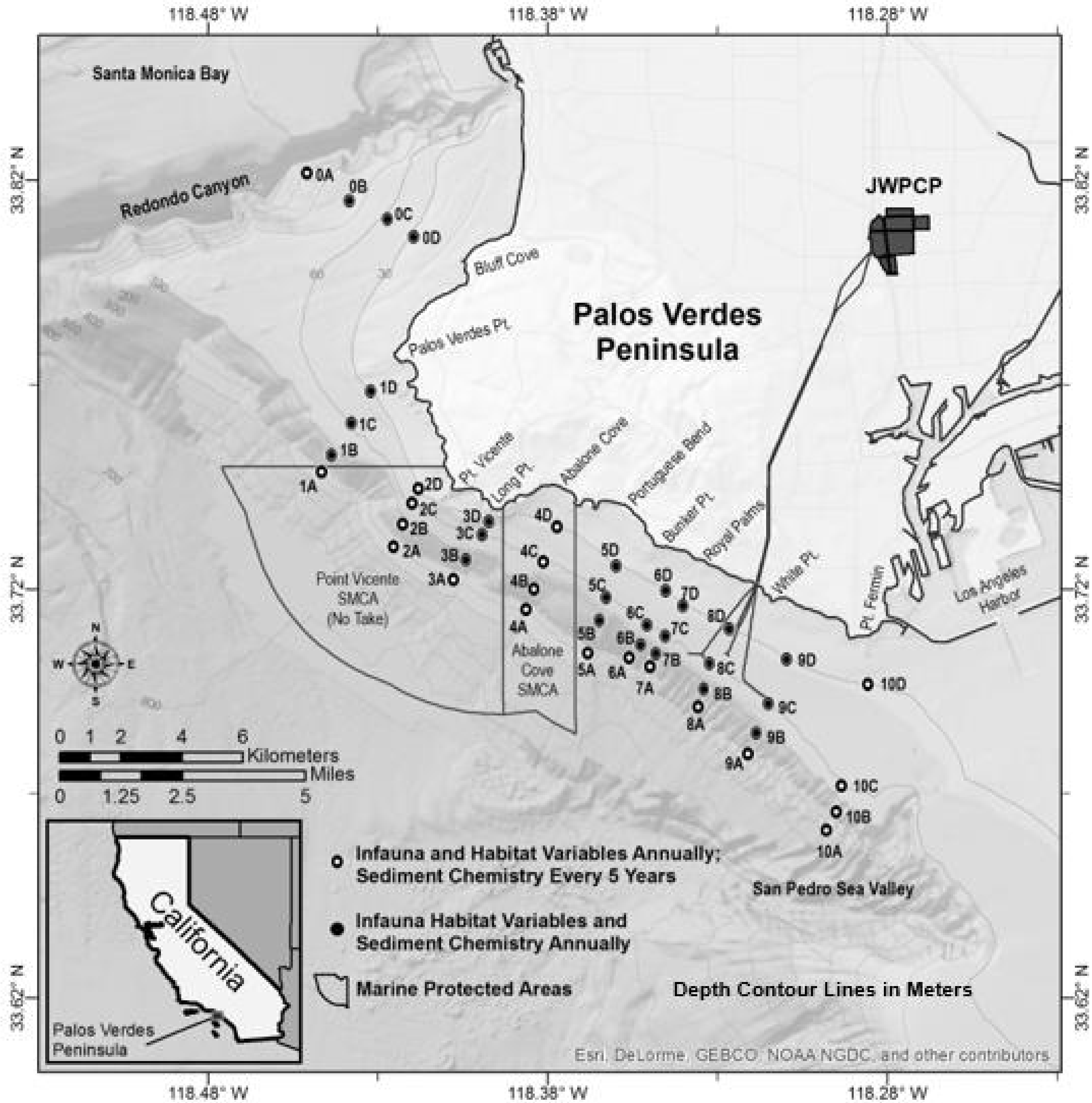

Figure E-4. Benthic Infauna and Sediment Chemistry Receiving Water Monitoring Stations

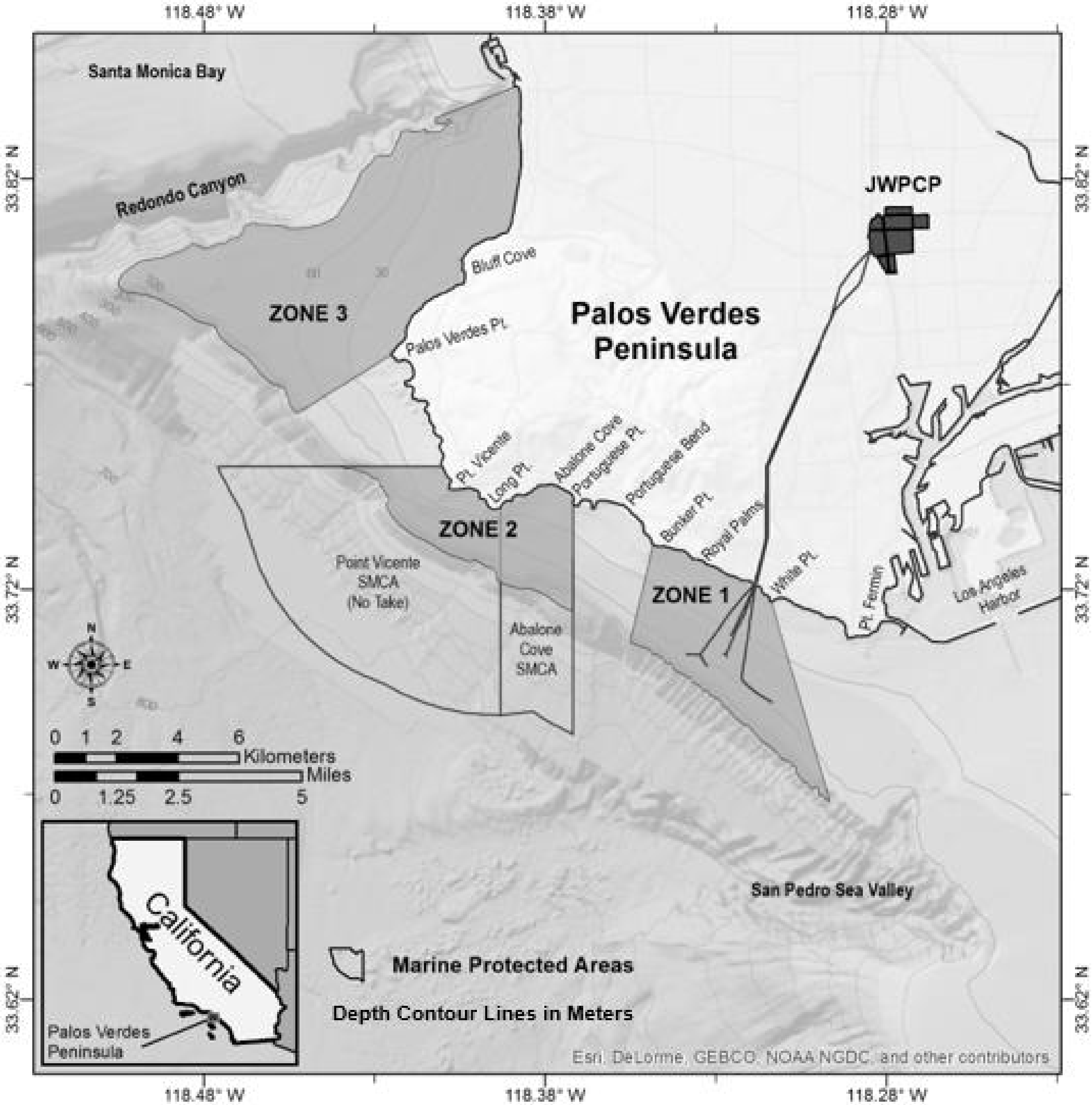

Figure E-5. Local Bioaccumulation Receiving Water Sampling Zones

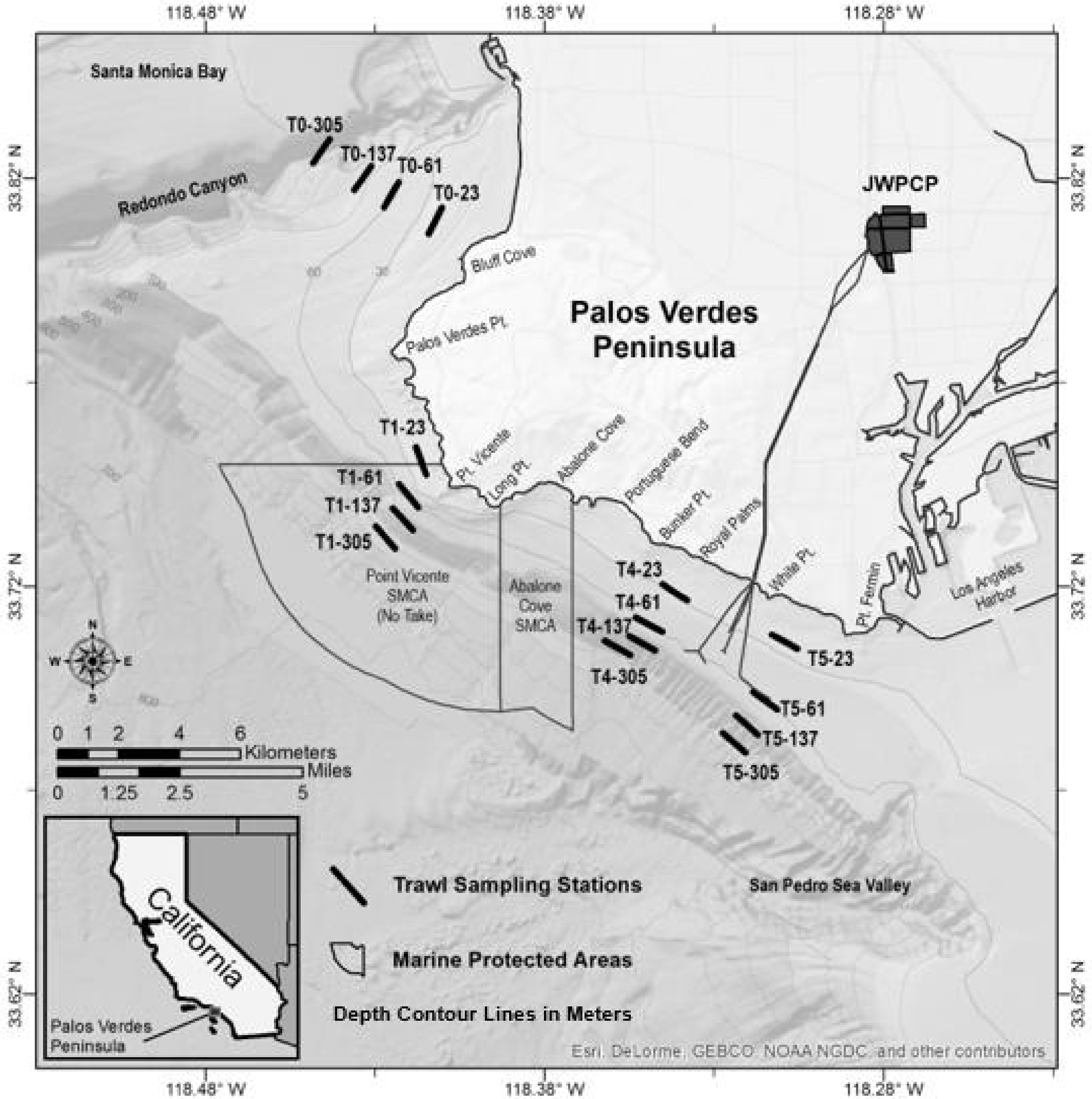

Figure E-6. Trawl Sampling Stations

3. INFLUENT MONITORING REQUIREMENTS

Influent monitoring is required to:

- Determine compliance with NPDES permit conditions.
- Assess treatment plant performance.
- Assess effectiveness of the Pretreatment Program.

3.1. Monitoring Location INF-001

Influent grab samples (except for VOCs and oil and grease) are collected from three influent sewers upstream of the bar screens, composited, and analyzed as a single grab sample. Influent VOCs are collected from the three influent sewers upstream of the bar screens and analyzed as three separate grab samples. Influent grab samples for oil and grease are collected from each of the five grit chambers and analyzed as five separate grab samples. Individual VOC and Oil and Grease results are combined into one flow weighted value.

A representative 24-hour composite sample cannot be collected from the three influent sewers due to high levels of solids that tend to clog the autosamplers, so 24-hour composite influent samples are collected from the five grit chambers. Because the grit chambers do not flow into a central influent sampling point, flow-weighted 24-hour composite samples (except for total suspended solids) are collected from each of the five grit chambers and analyzed as a single 24-hour composite sample. Influent 24-hour composite samples for total suspended solids are collected in each of the five grit chambers, but analyzed as five separate samples.

The Discharger shall monitor influent to the facility at INF-001 as follows:

Table E-9. Influent Monitoring

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Flow	MGD	recorder/totalizer	continuous	a
Biochemical Oxygen Demand (BOD_5 20°C)	mg/L	24-hr composite	weekly	b
Total Suspended Solids (TSS)	mg/L	24-hr composite	weekly	b
pH	pH units	grab	weekly	b
Oil and Grease	mg/L	grab	weekly	b, c
Total Organic Carbon (TOC)	mg/L	24-hour composite	monthly	b
Total Nitrogen (as N)	mg/L	calculated	quarterly	b
Nitrate Nitrogen	mg/L	24-hour composite	quarterly	b
Nitrite Nitrogen	mg/L	24-hour composite	quarterly	b
Organic Nitrogen	mg/L	24-hour composite	quarterly	b
Total phosphorus (as P)	mg/L	24-hr composite	quarterly	b

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Arsenic	µg/L	24-hr composite	quarterly	b, d
Cadmium	µg/L	24-hr composite	quarterly	b, d
Chromium (VI)	µg/L	grab	quarterly	b
Copper	µg/L	24-hr composite	quarterly	b, d
Lead	µg/L	24-hr composite	semiannually	b, d
Mercury	µg/L	24-hr composite	semiannually	d, e
Nickel	µg/L	24-hr composite	quarterly	b, d
Selenium	µg/L	24-hr composite	quarterly	b, d
Silver	µg/L	24-hr composite	quarterly	b, d
Zinc	µg/L	24-hr composite	quarterly	b, d
Cyanide	µg/L	grab	quarterly	b
Ammonia Nitrogen	mg/L	24-hr composite	weekly	b
Phenolic Compounds (non-chlorinated)	µg/L	24-hr composite	quarterly	b, f
Phenolic Compounds (chlorinated)	µg/L	24-hr composite	quarterly	b, f
Endosulfan	µg/L	24-hr composite	semiannually	b, f
Endrin	µg/L	24-hr composite	semiannually	b
Hexachlorocyclohexane (HCH)	µg/L	24-hr composite	quarterly	b, f
Radioactivity (including gross alpha, gross, beta, combined radium-226 & radium-228, tritium, strontium-90 and uranium)	pCi/L	24-hr composite	quarterly	g
Acrolein	µg/L	grab	semiannually	b
Antimony	µg/L	24-hr composite	quarterly	b, d
Bis(2-chloroethoxy) methane	µg/L	24-hr composite	semiannually	b
Bis(2-chloroisopropyl) ether	µg/L	24-hr composite	semiannually	b
Chlorobenzene	µg/L	grab	semiannually	b
Chromium (III)	µg/L	calculated	quarterly	b
Di-n-butyl phthalate	µg/L	24-hr composite	semiannually	b
Dichlorobenzenes	µg/L	grab	semiannually	b, f
Diethyl phthalate	µg/L	24-hr composite	semiannually	b
Dimethyl phthalate	µg/L	24-hr composite	semiannually	b

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
4,6-dinitro-2-methylphenol	µg/L	24-hr composite	semiannually	b
2,4-dinitrophenol	µg/L	24-hr composite	semiannually	b
Ethylbenzene	µg/L	grab	semiannually	b
Fluoranthene	µg/L	24-hr composite	semiannually	b
Hexachlorocyclopentadiene	µg/L	24-hr composite	semiannually	b
Nitrobenzene	µg/L	24-hr composite	semiannually	b
Thallium	µg/L	24-hr composite	semiannually	b, d
Toluene	µg/L	grab	quarterly	b
Tributyltin	µg/L	24-hour composite	semiannually	b
1,1,1-Trichloroethane	µg/L	grab	semiannually	b
Acrylonitrile	µg/L	grab	semiannually	b
Aldrin	µg/L	24-hr composite	monthly	b
Benzene	µg/L	grab	semiannually	b
Benzidine	µg/L	24-hr composite	semiannually	b
Beryllium	µg/L	24-hr composite	semiannually	b, d
Bis(2-chloroethyl) ether	µg/L	24-hr composite	semiannually	b
Bis(2-ethylhexyl) phthalate	µg/L	24-hr composite	quarterly	h
Carbon tetrachloride	µg/L	grab	semiannually	b
Chlordane	µg/L	24-hr composite	semiannually	b, f, k
Chlorodibromomethane	µg/L	grab	quarterly	b
Chloroform	µg/L	grab	quarterly	b
DDT	µg/L	24-hr composite	quarterly	b, f
1,4-dichlorobenzene	µg/L	grab	semiannually	b
3,3’-dichlorobenzidine	µg/L	24-hr composite	semiannually	b
1,2-Dichloroethane	µg/L	grab	semiannually	b
1,1-Dichloroethylene	µg/L	grab	semiannually	b
Dichlorobromomethane	µg/L	grab	quarterly	b
Dichloromethane	µg/L	grab	quarterly	b
1,3-Dichloropropene	µg/L	grab	semiannually	b
Dieldrin	µg/L	24-hr composite	monthly	b
2,4-dinitrotoluene	µg/L	24-hr composite	semiannually	b
1,2-diphenylhydrazine	µg/L	24-hr composite	semiannually	b
Halomethanes	µg/L	grab	semiannually	b, f
Heptachlor	µg/L	24-hr composite	semiannually	b

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Heptachlor epoxide	µg/L	24-hr composite	semiannually	b
Hexachlorobenzene	µg/L	24-hr composite	semiannually	b
Hexachlorobutadiene	µg/L	24-hr composite	semiannually	b
Hexachloroethane	µg/L	24-hr composite	semiannually	b
Isophorone	µg/L	24-hr composite	semiannually	b
N-nitrosodimethylamine	µg/L	24-hr composite	quarterly	b
N-nitrosodi-n-propylamine	µg/L	24-hr composite	semiannually	b
N-nitrosodiphenylamine	µg/L	24-hr composite	semiannually	b
Polycyclic Aromatic Hydrocarbons (PAHs)	µg/L	24-hr composite	quarterly	b, f
Polychlorinated Biphenyls (PCBs) as aroclors	µg/L	24-hr composite	quarterly	f, i
TCDD Equivalents	pg/L	24-hr composite	quarterly	f, h, j
1,1,2,2-Tetrachloroethane	µg/L	grab	semiannually	b
Tetrachloroethylene	µg/L	grab	quarterly	b
Toxaphene	µg/L	24-hr composite	semiannually	b
Trichloroethylene	µg/L	grab	semiannually	b
1,1,2-Trichloroethane	µg/L	grab	semiannually	b
2,4,6-Trichlorophenol	µg/L	24-hr composite	semiannually	b
Vinyl chloride	µg/L	grab	semiannually	b
Methyl-tert-butyl-ether	µg/L	grab	semiannually	b
Total Chromium	µg/L	grab	quarterly	b, d

Footnotes for Table E-9

a. Total daily flow, the monthly average flow, and instantaneous peak daily flow (24-hr basis) shall be reported. The actual monitored flow shall also be reported (not the design capacity).

b. Pollutants shall be analyzed using the analytical methods described in 40 CFR part 136; where no methods are specified for a given pollutant, those methods shall be approved by the Los Angeles Water Board or State Water Board. For any pollutant whose effluent limitation is lower than all the MLs specified in Appendix II of the 2019 Ocean Plan, the analytical method with the lowest ML must be selected.

c. Oil and grease monitoring shall consist of a single grab sample at peak flow over a 24-hour period.

d. Concentrations shall be expressed as total recoverable.

e. USEPA Method 1631E, with a quantification level of 0.5 ng/L, shall be used to analyze total mercury, unless another 40 CFR 136 method is sufficiently sensitive (ex. influent concentrations exceed the quantification level in the approved method).

f. See section 8 of this Order and Attachment A for definition of terms.

g. Analyze these radiochemicals by the following USEPA methods: method 900.0 for gross alpha and gross beta, method 903.0 or 903.1 for radium-226, method 904.0 for radium-228, method 906.0 for tritium, method 905.0 for strontium-90, and method 908.0 for uranium. Analysis for combined radium-226 & 228 shall be conducted only if gross alpha and gross beta results for the same sample exceed 15 pCi/L or 50 pCi/L, respectively. If radium-226 & 228 exceeds 5 pCi/L, then analyze for tritium, strontium-90, and uranium.

h. The 40 CFR Part 136 method for phthalate esters including bis (2-ethylhexyl) phthalate and TCDD equivalents requires samples to be collected in glass sample containers to avoid interference, which can lead to artifacts and/or elevated baselines in gas chromatograms. Sample collection must be done using glass sample containers for all phthalate esters including bis (2-ethylhexyl) phthalate and TCDD equivalents unless analytical methods for these pollutants in 40 CFR Part 136 specify that other means of sample collection are approved. Grab sample type is recommended, but an automatic sampler (composite sample) can be used to collect samples for all phthalate esters including bis (2-ethylhexyl) phthalate and TCDD equivalents as long as the sample bottles are glassware.

i. PCBs as aroclors shall be analyzed using USEPA method 608.3.

j. USEPA Method 1613 shall be used to analyze TCDD equivalents.

k. The standards required to analyze chlordene-alpha and chlordene-gamma may not always be readily available; therefore, if the Discharger provides documentation in the self-monitoring report to the Los Angeles Water Board that the standards for these pollutants were not available during the monitoring period, monitoring results for chlordene-alpha and/or chlordene-gamma are waived for that monitoring period only. If monitoring for chlordene-alpha and/or chlordene-gamma is waived for a monitoring period, all other components included in the definition of chlordane must still be analyzed.

End of Footnotes for Table E-9

4. EFFLUENT MONITORING REQUIREMENTS

Effluent monitoring is required to:

- Determine compliance with NPDES permit conditions and water quality standards.
- Assess and improve plant performance and identify operational problems.
- Provide information on wastewater characteristics and flows for use in interpreting water quality and biological data.
- Conduct reasonable potential analysis for toxic pollutants.
- Determine waste load allocation compliance and TMDL effectiveness.

4.1. Monitoring Location EFF-001, EFF-002A and EFF-002B

The Discharger shall monitor at effluent monitoring location EFF-001 for all parameters in Table E-10, except chlorine residual and bacteria. The chlorine residual and bacteria samples shall be collected at effluent manifold monitoring locations EFF-002A and EFF-002B. Effluent limitations for chlorine residual and bacteria applicable to discharges through Discharge Points 001 and 003 shall apply at manifold monitoring location EFF-002A. Effluent limitations for chlorine residual and bacteria applicable to discharges through Discharge Points 002 and 004 shall apply at manifold monitoring location EFF-002B. If more than one analytical test method is listed for a given parameter, the Discharger must select from the listed methods and corresponding ML.

Table E-10. Effluent Monitoring

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Flow	MGD	recorder/totalizer	continuous	a, b
BOD_5 20°C	mg/L	24-hr composite	weekly	a, c
Total Suspended solids	mg/L	24-hr composite	weekly	a, c
pH	pH units	grab	weekly	a, c
Oil and grease	mg/L	grab	weekly	a, c, d
Temperature	°F	recorder	continuous	a, b, c
Settleable solids	mL/L	grab	weekly	a, c, d
Turbidity	NTU	24-hr composite and grab	weekly	a, c
Total coliform (at manifold stations)	CFU/100 ml or MPN/100 ml	grab	daily	a, c
Fecal coliform (at manifold stations)	CFU/100 ml or MPN/100 ml	grab	5 times/month	a, c
Enterococcus (at manifold stations)	CFU/100 ml or MPN/100 ml	grab	daily	a, c
Total Organic Carbon	mg/L	24-hr composite	monthly	a, c
Nitrate nitrogen	mg/L	24-hr composite	quarterly	a, c
Nitrite Nitrogen	mg/L	24-hr composite	quarterly	a, c
Organic nitrogen	mg/L	24-hr composite	quarterly	a, c
Total Nitrogen (as N)	mg/L	calculated	quarterly	a, c
Total Phosphorus (as P)	mg/L	24-hr composite	quarterly	a, c

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Arsenic	µg/L	24-hr composite	quarterly	a, c, e
Cadmium	µg/L	24-hr composite	quarterly	a, c, e
Chromium (VI)	µg/L	grab	quarterly	a, c
Copper	µg/L	24-hr composite	quarterly	a, c, e
Lead	µg/L	24-hr composite	semiannually	a, c, e
Mercury	µg/L	24-hr composite	semiannually	a, e, f
Nickel	µg/L	24-hr composite	quarterly	a, c, e
Selenium	µg/L	24-hr composite	quarterly	a, c, e
Silver	µg/L	24-hr composite	quarterly	a, c, e
Zinc	µg/L	24-hr composite	quarterly	a, c, e
Cyanide	µg/L	grab	quarterly	a, c
Total chlorine residual (at manifold stations)	mg/L	grab	daily	a, c
Ammonia nitrogen	mg/L	24-hr composite	weekly	a, c
Toxicity, chronic	Pass or Fail, % Effect (TST)	24-hr composite	monthly	a, c, g
Phenolic compounds (non-chlorinated)	µg/L	24-hr composite	quarterly	a, c, h
Phenolic compounds (chlorinated)	µg/L	24-hr composite	quarterly	a, c, h
Endosulfan	µg/L	24-hr composite	semiannually	a, c, h
Endrin	µg/L	24-hr composite	semiannually	a, c
HCH	µg/L	24-hr composite	quarterly	a, c, h
Radioactivity (Including gross alpha, gross beta, combined radium-226 and radium-228, tritium, strontium-90 and uranium)	pCi/L	24-hr composite	quarterly	a, i
Acrolein	µg/L	grab	semiannually	a, c
Antimony	µg/L	24-hr composite	quarterly	a, c, e
Bis(2-chloroethoxy) methane	µg/L	24-hr composite	semiannually	a, c
Bis(2-chloroisopropyl) ether	µg/L	24-hr composite	semiannually	a, c
Chlorobenzene	µg/L	grab	semiannually	a, c

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Chromium (III)	µg/L	calculated	quarterly	a, c
Di-n-butyl phthalate	µg/L	24-hr composite	semiannually	a, c
Dichlorobenzenes	µg/L	grab	semiannually	a, c, h
Diethyl phthalate	µg/L	24-hr composite	semiannually	a, c
Dimethyl phthalate	µg/L	24-hr composite	semiannually	a, c
2-Methyl-4,6-dinitrophenol	µg/L	24-hr composite	semiannually	a, c
2,4-Dinitrophenol	µg/L	24-hr composite	semiannually	a, c
Ethylbenzene	µg/L	grab	semiannually	a, c
Fluoranthene	µg/L	24-hr composite	semiannually	a, c
Hexachlorocyclo-pentadiene	µg/L	24-hr composite	semiannually	a, c
Nitrobenzene	µg/L	24-hr composite	semiannually	a, c
Thallium	µg/L	24-hr composite	semiannually	a, c, e
Toluene	µg/L	grab	quarterly	a, c
Tributyltin	µg/L	24-hr composite	semiannually	a, c
1,1,1-Trichloroethane	µg/L	grab	semiannually	a, c
Acrylonitrile	µg/L	grab	semiannually	a, c
Aldrin	µg/L	24-hr composite	monthly	a, c
Benzene	µg/L	grab	semiannually	a, c
Benzidine	µg/L	24-hr composite	quarterly	a, c
Beryllium	µg/L	24-hr composite	semiannually	a, c, e
Bis(2-chloroethyl) ether	µg/L	24-hr composite	semiannually	a, c
Bis(2-ethylhexyl) phthalate	µg/L	24-hr composite	quarterly	a, c, j
Carbon tetrachloride	µg/L	grab	semiannually	a, c
Chlordane	µg/L	24-hr composite	quarterly	a, c, h, o
Chlorodibromomethane	µg/L	grab	quarterly	a, c
Chloroform	µg/L	grab	quarterly	a, c
DDT	µg/L	24-hr composite	quarterly	a, c, h
1,4-Dichlorobenzene	µg/L	grab	semiannually	a, c
3,3’-Dichlorobenzidine	µg/L	24-hr composite	quarterly	a, c
1,2-Dichloroethane	µg/L	grab	semiannually	a, c
1,1-Dichloroethylene	µg/L	grab	semiannually	a, c
Dichlorobromomethane	µg/L	grab	quarterly	a, c
Dichloromethane	µg/L	grab	quarterly	a, c

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
1,3-Dichloropropene	μg/L	grab	semiannually	a, c
Dieldrin	μg/L	24-hr composite	monthly	a, c
2,4-Dinitrotoluene	μg/L	24-hr composite	semiannually	a, c
1,2-Diphenylhydrazine	μg/L	24-hr composite	semiannually	a, c
Halomethanes	μg/L	grab	semiannually	a, c, h
Heptachlor	μg/L	24-hr composite	semiannually	a, c
Heptachlor epoxide	μg/L	24-hr composite	semiannually	a, c
Hexachlorobenzene	μg/L	24-hr composite	quarterly	a, c
Hexachlorobutadiene	μg/L	24-hr composite	semiannually	a, c
Hexachloroethane	μg/L	24-hr composite	semiannually	a, c
Isophorone	μg/L	24-hr composite	semiannually	a, c
N-Nitrosodimethylamine	μg/L	24-hr composite	quarterly	a, c
N-Nitrosodi-n-propylamine	μg/L	24-hr composite	semiannually	a, c
N-Nitrosodiphenylamine	μg/L	24-hr composite	semiannually	a, c
PAHs	μg/L	24-hr composite	quarterly	a, c, h
PCBs as aroclors	μg/L	24-hr composite	quarterly	a, h, k
PCBs as congeners	pg/L	24-hr composite	annually	a, l
TCDD equivalents	pg/L	24-hr composite	quarterly	a, h, j, m
1,1,2,2-Tetrachloroethane	μg/L	grab	semiannually	a, c
Tetrachloroethylene	μg/L	grab	quarterly	a, c
Toxaphene	μg/L	24-hr composite	quarterly	a, c
Trichloroethylene	μg/L	grab	semiannually	a, c
1,1,2-Trichloroethane	μg/L	grab	semiannually	a, c
2,4,6-Trichlorophenol	μg/L	24-hr composite	semiannually	a, c
Vinyl chloride	μg/L	grab	semiannually	a, c
Methyl-tert-butyl-ether	μg/L	grab	semiannually	a, c
Total Chromium	μg/L	grab	quarterly	a, c, e
PFAS	ng/L	grab	annually	n

Footnotes for Table E-10

a. For Discharge Points 001 and 002 the minimum frequency of analysis shall be once per discharge day, but no more than one analysis is required during the indicated sampling period for those constituents that are monitored less frequently. During routine maintenance activities lasting less than 24 hours at Outfalls 001 and 002, sampling and analyses are not required except for parameters with instantaneous maximum effluent limitations: pH, oil and grease, settleable solids, turbidity, and total chlorine residuals. Compliance with the instantaneous maximum final effluent limitations (with the exception of total residual chlorine) for Outfalls 001 and 002 may be determined at the compliance location for Discharge Points 003 and 004 during routine maintenance as long as there is no plant upset during maintenance and the sample is representative of the final effluent discharged through all points. The maximum daily, average weekly, and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

b. When continuous monitoring of flow is required, total daily flow, monthly average flow, and instantaneous peak daily flow (24-hour basis) shall be reported. Actual monitored flow shall be reported (not design capacity). When continuous monitoring of temperature is required, the minimum, maximum, and average temperatures recorded over the course of each day and month shall be reported.

c. Pollutants shall be analyzed using the analytical methods described in 40 CFR part 136; where no methods are specified for a given pollutant, those methods shall be approved by the Los Angeles Water Board, State Water Board, and USEPA Region 9. For any pollutant whose effluent limitation is lower than all the MLs specified in Appendix II of the 2019 Ocean Plan, the analytical method with the lowest ML must be selected.

d. Oil and grease, and settleable solids monitoring shall consist of a single grab sample at peak flow over a 24-hour period.

e. Total recoverable concentrations shall be reported.

f. USEPA Method 1631E, with a quantification level of 0.5 ng/L, shall be used to analyze total mercury, unless another 40 CFR 136 method is sufficiently sensitive (ex. the quantification limit is less than or equal to the most stringent water quality objective).

g. Whole effluent toxicity monitoring is required for Discharge Points 001 and 002 using the most sensitive species as the test species, as outlined in section 5 of the MRP.

h. See section 8 of this Order and Attachment A for definition of terms.

i. Analyze these radiochemicals by the following USEPA methods: method 900.0 for gross alpha and gross beta, method 903.0 or 903.1 for radium-226, method 904.0 for radium-228, method 906.0 for tritium, method 905.0 for strontium-90, and method 908.0 for uranium. Analysis for combined radium-226 & 228 shall be conducted only if gross alpha and gross beta results for the same sample exceed 15 pCi/L or 50 pCi/L, respectively. If radium-226 & 228 exceeds 5 pCi/L, then analyze for tritium, strontium-90, and uranium.

j. The 40 CFR Part 136 method for phthalate esters including bis (2-ethylhexyl) phthalate and for TCDD equivalents requires samples to be collected in glass sample containers to avoid interference, which can lead to artifacts and/or elevated baselines in gas chromatograms. Sample collection must be done using glass sample containers for all phthalate esters including bis (2-ethylhexyl) phthalate and TCDD equivalents unless analytical methods for these pollutants in 40 CFR Part 136 specify that other means of sample collection are approved. Grab sample type is recommended, but an automatic sampler (composite sample) can be used to collect samples for all phthalate esters including bis (2-ethylhexyl) phthalate and TCDD equivalents as long as the sample bottles are glassware.

k. PCBs as aroclors shall be analyzed using USEPA method 608.3.

l. PCBs as congeners shall be individually quantified (or quantified as mixtures of isomers of a single congener in co-elutions as appropriate) using USEPA proposed method 1668c. PCBs as congeners shall be analyzed using method EPA 1668c for three years and an alternate method may be used if none of the PCB congeners are detected for three years using method EPA 1668c. USEPA recommends that until USEPA proposed method 1668c for PCBs is incorporated into 40 CFR § 136, permittees should use for discharge monitoring reports/State monitoring reports: (1) USEPA method 608.3 for monitoring data, reported as aroclor results, that will be used for assessing compliance with WQBELs (if applicable) and (2) USEPA proposed method 1668c for monitoring data, reported as 41 congener results, that will be used for informational purposes to help assess concentrations in the receiving water.

m. USEPA Method 1613 shall be used to analyze TCDD equivalents.

n. Department of Defense’s Quality System Manual (DOD QSM version 5.1 or higher) or other ELAP-accredited methodologies for the analysis of PFAS in wastewaters shall be used to meet the required reporting limit of 50 ng/L. The ELAP accredited method for each group of compounds will specify which specific analytes can be measured. All analytes that can be measured using the selected ELAP-accredited method shall be analyzed.

o. The standards required to analyze chlordene-alpha and chlordene-gamma may not always be readily available; therefore, if the Discharger provides documentation in the self-monitoring report to the Los Angeles Water Board that the standards for these pollutants were not available during the monitoring period, monitoring results for chlordene-alpha and/or chlordene-gamma are waived for that monitoring period only. If monitoring for chlordene-alpha and/or chlordene-gamma is waived for a monitoring period, all other components included in the definition of chlordane must still be analyzed.

End of Footnotes for Table E-10

4.2. Mass Emission Benchmarks

Constituents that have been assigned Mass Emission Benchmarks are listed in the NPDES Order under Section 5. The Mass Emission Benchmarks have been established for the discharge through Discharge Points 001 and 002 and shall be reported in metric tons per year (MT/yr). The Discharger shall monitor and report the mass emission rate for all constituents that have mass emission benchmarks. For each constituent, the 12-month average mass emission rate and the concentration and flow used to calculate that mass emission rate shall be reported in the annual NPDES summary report. Mass emission benchmarks are not established for Discharge Points 003 and 004.

5. CHRONIC WHOLE EFFLUENT TOXICITY TESTING REQUIREMENTS

5.1. Discharge In-stream Waste Concentration (IWC) for Chronic Toxicity

The chronic IWC is the concentration of a pollutant or the parameter toxicity in the receiving water after mixing. The chronic toxicity IWC for Outfalls 001 and 002 is 0.60 percent effluent; for Outfall 003 is 0.66 percent and for Outfall 004 is 0.86 percent.

5.2. Sample Volume and Holding Time

The total sample volume shall be determined by the specific toxicity test method used. Sufficient sample volume shall be collected to perform the required toxicity test. For the receiving water, sufficient sample volume shall also be collected during accelerated monitoring for subsequent TIE studies, if necessary, at each sampling event. All toxicity tests shall be conducted as soon as possible following sample collection. No more than 36 hours shall elapse before the conclusion of sample collection and test initiation**.**

5.3. Chronic Marine Species and Test Methods

If effluent samples are collected from outfalls discharging to receiving waters with salinity >1 ppt, the Permittee shall conduct the following chronic toxicity tests on effluent samples, at the in-stream waste concentration for the discharge, in accordance with species and test methods in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995). Artificial sea salts or hypersaline brine shall be used to increase sample salinity if needed. In no case shall these species be substituted with another test species unless written authorization from the Los Angeles Water Board Executive Officer is received.

5.3.1. A static renewal toxicity test with the topsmelt, *Atherinops affinis* (Larval Survival and Growth Test Method 1006.0).

5.3.2. A static non-renewal toxicity test with the purple sea urchin, *Strongylocentrotus purpuratus*, and the sand dollar, *Dendraster excentricus* (Fertilization Test Method 1008.0), or a static non-renewal toxicity test with the red abalone, *Haliotis rufescens* (Larval Shell Development Test Method).

5.3.3. A static non-renewal toxicity test with the giant kelp, *Macrocystis pyrifera* (Germination and Growth Test Method 1009.0).

5.4. Species Sensitivity Screening

The Permittee may begin a species sensitivity screening for chronic aquatic toxicity at least 18 months prior to the expiration date of this Order. For continuous dischargers, species sensitivity screening includes four sets of valid tests completed in the span of one year, with one set collected in each of the four quarters. In each of the four sets, the Permittee shall collect a single effluent sample to initiate and concurrently conduct three toxicity tests using the fish, an invertebrate, and the alga species previously referenced. This sample shall also be analyzed for the parameters required on a monthly frequency for the discharge, during that given month. As required in the test method for *Atherinops affinis* for off-site tests, a minimum of three samples shall be collected preferably on days one, three, and five with a maximum holding time of 36 hours before the first use. Since the Permittee has conducted a species sensitivity screening prior to the effective date of this Order, the most sensitive species selected during that screening process shall be used for the toxicity testing until a new species sensitivity screening is conducted.

If the results of all 12 valid tests conducted during the species sensitivity screening is "Pass," then the species that exhibited the highest percent effect in any single test shall be used for routine monitoring during the following permit cycle. Likewise, if the results of all 12 valid tests conducted during the species sensitivity screening is “Fail,” then the species that exhibited the highest percent effect in any single test shall be used for routine monitoring during the following permit cycle. If the result of only one of the 12 valid tests conducted during the species sensitivity screening is “Fail,” then the species used in that test shall be used for routine monitoring during the following permit cycle. If there are multiple valid tests conducted during the species sensitivity screening that result in “Fail,” the species that resulted in a “Fail” the most often during the species sensitivity screening shall be used in routine monitoring during the following permit cycle. If two species had the same number of tests that result in “Fail” the species that exhibited the highest percent effect in any single test that resulted in “Fail” shall be used during routine monitoring during the following permit cycle.

During the calendar month, toxicity tests used to determine the most sensitive test species shall be reported as effluent compliance monitoring results for the chronic toxicity MDEL.

5.5. Quality Assurance and Additional Requirements

Quality assurance measures, instructions, and other recommendations and requirements are found in the test methods manual previously referenced. Additional requirements are specified below:

5.5.1. The discharge is subject to determination of “Pass” or “Fail” from a chronic toxicity test using the Test of Significant Toxicity (TST) statistical t-test approach described in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, 2010), Appendix A, Figure A-1, Table A-1 and Appendix B, Table B-1. The null hypothesis (H_o) for the TST statistical approach is: Mean discharge IWC response ≤0.75 × Mean control response. A test result that rejects this null hypothesis is reported as “Pass.” A test result that does not reject this null hypothesis is reported as “Fail.” The relative “Percent Effect” at the discharge IWC is defined and reported as: [(Mean control response - Mean discharge IWC response) ÷ Mean control response] × 100. This is a t-test (formally Student’s t-Test), a statistical analysis comparing two sets of replicate observations - in the case of WET, only two test concentrations (i.e., a control and IWC). The purpose of this statistical test is to determine if the means of the two sets of observations are different (i.e., if the IWC or receiving water concentration differs from the control (the test result is “Pass” or “Fail”)). The Welch’s t-test employed by the TST statistical approach is an adaptation of Student’s t-test and is used with two samples having unequal variances.

5.5.2. If the effluent toxicity test does not meet all test acceptability criteria (TAC) and all required test conditions specified in the referenced *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (See Table E-11 for TAC below), the Permittee must re-sample and re-test within 14 days. Deviations from recommended test conditions, specified in the referenced *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*, must be evaluated on a case-by-case basis to determine the validity of test results. The Discharger shall consider the degree of the deviation and the potential or observed impact of the deviation on the test results in consultation with Los Angeles Water Board staff before rejecting or accepting a test result as valid, and shall report the results of the validity determination with supporting evidence for that decision in their monthly report.

Table E-11. USEPA Test Methods and Test Acceptability Criteria

Species & USEPA Test Method Number	Test Acceptability Criteria (TAC)
Topsmelt, *Atherinops affinis*, Larval Survival and Growth Test Method 1006.01. (Table 3 of test method)	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.85 mg. LC50 with copper must be ≤205 µg/L, <25% MSD for survival and <50% MSD for growth. If the test starts with 9-day old larvae, the mean weight per larva must exceed 0.85 milligrams in the reference and brine controls; the mean weight of preserved larvae must exceed 0.72 milligrams. (required)
Purple Sea Urchin, *Strongylocentrotus purpuratus*, and the Sand Dollar, *Dendraster excentricus*, Fertilization Test Method 1008.0 (Table 7 of test method)	70% or greater egg fertilization in controls, must achieve an MSD of <25%, and appropriate sperm counts. (required)
Red Abalone, *Haliotis rufescens*, Larval Shell Development Test Method (Table 3 of test method)	80% or greater normal shell development in the controls; must have statistically significant effect at 56 µg/L zinc and achieve an MSD of <20%. (required)
Giant Kelp, *Macrocystis pyrifera*, Germination and Growth Test Method 1009.0 (Table 3 of test method)	70% or greater germination in controls, ≥10 µm germ-tube length in controls, No Observed Effect Concentration (NOEC) must be below 35 µg/L in the reference toxicant test, and must achieve an MSD of <20% for both germination and germ-tube length in the reference toxicant. (required)

5.5.3. Dilution water and control water, including brine controls, shall be 1-µm-filtered uncontaminated natural seawater, hypersaline brine prepared using uncontaminated natural seawater, or laboratory water prepared and used as specified in the test methods manual. If dilution water and control water is different from test organism culture water, then a second control using culture water shall also be used.

5.5.4. Monthly reference toxicant testing is sufficient. All reference toxicant test results should be reviewed and reported using EC25. EC25 is a point estimate of the toxicant concentration that would cause an observable adverse effect (e.g., death, immobilization, or serious incapacitation) in 25 percent of the test organisms.

5.5.5. The Permittee shall perform toxicity tests on final effluent samples. Chlorine and ammonia shall not be removed from the effluent sample prior to toxicity testing, unless explicitly authorized under this section of the Monitoring and Reporting Program and the rationale is explained in the Fact Sheet (Attachment F).

5.6. Preparation of an Initial Investigation Toxicity Reduction Evaluation (TRE) Work Plan

The Permittee shall prepare and submit a copy of the Permittee's initial investigation TRE work plan to the Los Angeles Water Board Executive Officer for approval within 90 days of the effective date of this permit. If the Executive Officer does not disapprove the work plan within 60 days of being submitted, the work plan shall become effective. The Permittee shall use USEPA manual EPA/833B-99/002 (municipal) as guidance, or most current version, or USEPA manual *Generalized Methodology for Conducting Industrial Toxicity Reduction Evaluations* (EPA/600/2-88/070, April 1989). At a minimum, the TRE Work Plan must contain the provisions in Attachment G. This work plan shall describe the steps that the Permittee intends to follow if toxicity is detected. At minimum, the work plan shall include:

5.6.1. A description of the investigation and evaluation techniques that will be used to identify potential causes and sources of toxicity, effluent variability, and treatment system efficiency;

5.6.2. A description of the Facility's methods of maximizing in-house treatment efficiency and good housekeeping practices, and a list of all chemicals used in the operation of the Facility; and

5.6.3. If a TIE is necessary, an indication of the person who would conduct the TIEs (i.e., an in-house expert or an outside contractor).

5.7. Accelerated Monitoring Schedule for Maximum Daily Single Result: "Fail."

The Maximum Daily single result shall be used to determine if accelerated testing needs to be conducted.

Once the Permittee becomes aware of this result, the Permittee shall implement an accelerated monitoring schedule within 5 calendar days of the receipt of the result. However, if the sample is contracted out to a commercial laboratory, the Permittee shall ensure that the first of six accelerated monitoring tests is initiated within seven calendar days of the Permittee becoming aware of the result. The accelerated monitoring schedule shall consist of six toxicity tests (including the discharge IWC), conducted at approximately two-week intervals, over a twelve-week period; in preparation for the TRE process and associated reporting, these results shall also be reported using the EC25. If each of the accelerated toxicity tests results in "Pass," the Permittee shall return to routine monitoring for the next monitoring period. If one of the accelerated toxicity tests results in "Fail," the Permittee shall immediately implement the TRE Process conditions set forth below. During accelerated monitoring schedules, only TST results ("Pass" or "Fail") for chronic toxicity tests shall be reported as effluent compliance monitoring results for the chronic toxicity MDEL.

5.8. Toxicity Reduction Evaluation (TRE) Process

The Discharger shall conduct a TRE in accordance with a TRE Work Plan as approved by Los Angeles Water Board. Routine monitoring shall continue during the TRE process and TST results ("Pass" or "Fail") for chronic toxicity tests shall be reported as effluent compliance monitoring results for the chronic toxicity MDEL.

5.8.1. **Preparation and Implementation of Detailed TRE Work Plan.** The Discharger shall immediately initiate a TRE using, according to the type of treatment facility, USEPA manual Toxicity *Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants* (EPA/833/B-99/002, 1999) or USEPA manual *Generalized Methodology for Conducting Industrial Toxicity Reduction Evaluations* (EPA/600/2-88/070, April 1989) and, within 30 days of a toxicity event, submit to the Los Angeles Water Board Executive Officer a Detailed TRE Work Plan, which shall follow the initial investigation TRE Work Plan revised as appropriate for this toxicity event. It shall include the following information, and comply with additional conditions set by the Los Angeles Water Board Executive Officer:

a. Further actions by the Discharger to investigate, identify, and correct the causes of toxicity;

b. Actions the Discharger will take to mitigate the effects of the discharge and prevent the recurrence of toxicity; and

c. A schedule for these actions, progress reports, and the final report.

5.8.2. **TIE Implementation.** The Discharger may initiate a TIE as part of a TRE to identify the causes of toxicity using the same species and test method and, as guidance, USEPA manuals: *Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures* (EPA/600/6-91/003, 1991); Chronic TIE Manual: *Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I (*EPA/600/6-91/005F, 1992); *Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/080, 1993); *Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/081, 1993); and *Marine Toxicity Identification Evaluation (TIE): Phase I Guidance Document* (EPA/600/R-96-054, 1996). The TIE shall be conducted on the species demonstrating the most sensitive toxicity response.

5.8.3. Many recommended TRE elements parallel required or recommended efforts for source control, pollution prevention, and stormwater control programs. TRE efforts should be coordinated with such efforts. As toxic substances are identified or characterized, the Discharger shall continue the TRE by determining the sources and evaluating alternative strategies for reducing or eliminating the substances from the discharge. All reasonable steps shall be taken to reduce toxicity to levels consistent with toxicity evaluation parameters.

5.8.4. The Discharger shall continue to conduct routine effluent monitoring while the TIE and/or TRE process is taking place. Additional accelerated monitoring and TRE work plans are not required once a TRE has begun.

5.8.5. The Los Angeles Water Board recognizes that toxicity may be episodic and identification of causes and reduction of sources of toxicity may not be successful in all cases. However, TREs shall be carried out in accordance with the Executive Officer-approved TRE Work Plan.

5.8.6. The Los Angeles Water Board may consider the results of any TIE/TRE studies in an enforcement action.

5.9. Reporting

The Self-Monitoring Report (SMR) shall include a full laboratory report for each toxicity test. This report shall be prepared using the format and content of the test methods manual chapter called Report Preparation, including:

5.9.1. The valid toxicity test results for the TST statistical approach, reported as “Pass” or “Fail” and “Percent Effect” at the chronic toxicity IWC for the discharge, using the most sensitive species. All toxicity test results (whether identified as valid or otherwise) conducted during the calendar month shall be reported on the SMR due date specified in Table E-21.

5.9.2. A summary of water quality measurements for each toxicity test (e.g., pH, dissolved oxygen, temperature, conductivity, total hardness, salinity, chlorine, and ammonia).

5.9.3. The statistical analysis used in *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, 2010) Appendix A, Figure A-1, Table A-1, and Appendix B, Table B-1.

5.9.4. TRE/TIE results. The Los Angeles Water Board Executive Officer shall be notified no later than 30 days from completion of each aspect of TRE/TIE analyses. Prior to the completion of the final TIE/TRE report, the Permittee shall provide status updates in the monthly monitoring reports, indicating which TIE/TRE steps are underway and which steps have been completed.

5.9.5. Statistical program (e.g., TST calculator, CETIS, etc.) output results, including graphical plots, for each toxicity test.

5.9.6. Tabular data and graphical plots clearly showing the laboratory’s performance for the reference toxicant, for each solution, for the previous 20 tests and the laboratory’s performance for the control mean, control standard deviation, and control coefficient of variation, for each solution, for the previous 12-month period.

5.9.7. Any additional QA/QC documentation or any additional chronic toxicity-related information, upon request from the Los Angeles Water Board Chief Deputy Executive Officer or the Executive Officer.

5.10. Ammonia Removal

5.10.1. Except with prior approval from the Executive Officer of the Los Angeles Water Board, ammonia shall not be removed from bioassay samples. The Discharger must demonstrate the effluent toxicity is caused by ammonia because of increasing test pH when conducting the toxicity test. It is important to distinguish the potential toxic effects of ammonia from other pH sensitive chemicals, such as certain heavy metals, sulfide, and cyanide. The following indicators and actions may be used to demonstrate that the toxicity is caused by ammonia and not other toxicants before the Executive Officer would allow for control of pH in the test.

a. There is consistent toxicity in the effluent and the maximum pH in the toxicity test is in the range to cause toxicity due to increased pH.

b. Chronic ammonia concentrations in the effluent are greater than 4 mg/L total ammonia.

c. Conduct graduated pH tests as specified in the toxicity identification evaluation methods. For example, mortality should be higher at pH 8 and lower at pH 6.

d. Treat the effluent with a zeolite column to remove ammonia. Mortality in the zeolite treated effluent should be lower than the non-zeolite treated effluent. Then add ammonia back to the zeolite-treated samples to confirm toxicity due to ammonia.

5.10.2. When it has been demonstrated that toxicity is due to ammonia because of increasing test pH, pH may be controlled using appropriate procedures which do not significantly alter the nature of the effluent, after submitting a written request to the Los Angeles Water Board, and receiving written permission expressing approval from the Executive Officer of the Los Angeles Water Board.

5.11. Chlorine Removal

Chlorine may be removed from the JWPCP effluent bioassay sampled from EFF-001 because there are no appropriate sampling locations that reflect dechlorinated conditions at the outfall.

6. LAND DISCHARGE MONITORING REQUIREMENTS (NOT APPLICABLE)

7. RECYCLING MONITORING REQUIREMENTS (NOT APPLICABLE)

8. RECEIVING WATER MONITORING REQUIREMENTS

All receiving water stations shall be located by state-of-the-art navigational methods (e.g., Global Positioning System [GPS]); other means (e.g., visual triangulation, fathometer readings) may be used to improve the accuracy of locating stations. Water quality measurements are made with a Conductivity, Temperature and Depth Instrument (CTD), which also measures other parameters such as pH and light transmissivity.

8.1. Inshore/Offshore Microbiological Monitoring

The inshore and offshore monitoring addresses the question: Are Ocean Plan and Santa Monica Bacteria TMDL compliance standards for bacteriological contamination being met? The data collected at inshore stations will provide the means to determine whether bacteriological standards for water contact and shellfish harvesting are being met in the area of greatest potential water contact and shellfish harvesting most proximal to the point of discharge. The data collected at the offshore sites will provide the means to determine whether bacteriological standards for water contact are being met in the area around the discharge point. Data from both inshore and offshore compliance sampling sites are augmented by the frequent (typical daily) manifold bacterial monitoring collected for plant operational purposes and which provides effluent bacterial densities discharged through the outfall system.

The Discharger shall monitor bacteria at six inshore monitoring stations, IL2, IL3, IL4, IL5, IL6 and IL7, and three offshore monitoring stations, RW-OS-6C, RW-OS-8C and RW-OS-9C, located along the 200-foot (60-meter) depth contour (Figure E-1) for the constituents listed in Table E-12 below:

Table E-12. Inshore/Offshore Microbiological Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Total coliform	CFU/100 ml (or MPN/100 ml)	grab at 0.5 meters below the surface	monthly	a, b
Fecal coliform	CFU/100 ml (or MPN/100 ml)	grab at 0.5 meters below the surface	monthly	a, b
Enterococcus	CFU/100 ml (or MPN/100 ml)	grab at 0.5 meters below the surface	monthly	a, b
Visual observation	--	--	monthly	b, c

Footnotes for Table E-12

a. Pollutants shall be analyzed using the analytical methods described in 40 CFR part 136; where no methods are specified for a given pollutant, by methods approved by this Los Angeles Water Board or State Water Board. The analytical method with the lowest ML must be selected.
b. Sampling may be conducted along a deeper depth contour during periods of adverse weather. If a kelp bed is present at any of the six inshore stations, sampling shall be conducted at the outer edge of the kelp bed rather than at the 30-foot (9.1-meter) depth contour.
c. Receiving water observations shall be recorded concurrently with bacteriological sample collection and shall include a description of any discoloration, turbidity, odor, and unusual or abnormal amounts of floating or suspended matter in the water shall be made and recorded at all stations. The dates, times, and depths of sampling and these observations shall also be reported. Recreational uses (ex. swimming, wading, water skiing, skin diving, surfing, fishing, etc.) at the time of sampling and within a 100-meter radius of each offshore sample location, shall also be recorded and submitted with results.

End of Footnotes for Table E-12

8.2. Nearshore/Offshore Water Quality Monitoring

This monitoring is designed to determine if Ocean Plan objectives for physical and chemical parameters and bacteria (including shellfish standards) are being met. The data collected will provide the information necessary to demonstrate compliance with the standards. In addition, the data collected by the Discharger contribute to the Central Bight Cooperative Water Quality Survey. This regionally coordinated survey provides quarterly integrated water quality surveys and covers more than 200 kilometers of coast in Ventura, Los Angeles, Orange and San Diego Counties from the nearshore zone to approximately 10 kilometers offshore. This cooperative program contributes to a regional understanding of seasonal patterns in the nearshore water column structure. The regional view provides context for determining the significance and causes of locally observed patterns in the area of wastewater outfalls.

8.2.1. Nearshore/Offshore Water Quality Monitoring

The Discharger shall monitor the 48 nearshore/offshore stations on the Palos Verdes and San Pedro Shelf (Figure E-2) listed in Table E-4, for the constituents listed in Table E-13 below:

Table E-13. Nearshore/Offshore Water Quality Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Ammonia (Figure E-2, Table E-1)	μg/L	grab samples from surface to bottom (or maximum depth of 45 meters)	quarterly	a, b, c, d
Dissolved oxygen	mg/L	continuous profile from surface to bottom (or maximum depth of 100 meters)	quarterly	b, c
Temperature	^{o}C	continuous profile from surface to bottom (or maximum depth of 100 meters)	quarterly	b, c
Salinity	ppt	continuous profile from surface to bottom (or maximum depth of 100 meters)	quarterly	b, c
Transmissivity	% trans-mission	continuous profile from surface to bottom (or maximum depth of 100 meters)	quarterly	b, c
Chlorophyll a	μg/L	continuous profile from surface to bottom (or maximum depth of 100 meters)	quarterly	b, c
pH	pH units	continuous profile from surface to bottom (or maximum depth of 100 meters)	quarterly	b, c
Visual observations	--	--	quarterly	e

Footnotes for Table E-13

a. Pollutants shall be analyzed using the analytical methods described in 40 CFR part 136; where no methods are specified for a given pollutant, by methods approved by the Los

Angeles Water Board or State Water Board. The analytical method with the lowest ML must be selected.

b. Depth profile measurements shall be obtained using multiple sensors to measure parameters through the entire water column (from the surface to as close to the bottom as practicable).
c. Water quality methods and protocols shall follow those described in the most current Bight Regional Monitoring Program.
d. Discrete sampling for ammonia nitrogen shall be performed below the surface within 1 meter (3.1 feet) and at 15 meters (49.2 feet), 30 meters (98.4 feet), and 45 meters (147.6 feet), or as deep as practicable for those stations located in depths less than 45 meters.
e. Receiving water observations shall include a description of any discoloration, turbidity, odor, and unusual or abnormal amounts of floating or suspended matter in the water shall be made and recorded at all stations. The dates, times, and depths of sampling and these observations shall also be reported. Recreational uses (ex. swimming, wading, water skiing, skin diving, surfing, fishing, etc.) at the time of sampling and within a 100-meter radius of each offshore sample location, shall also be recorded and submitted with results.

End of Footnotes for Table E-13

The Discharger shall participate in the Central Bight Cooperative Water Quality Survey steering and technical committees. Recommendations for changes in survey design that significantly alter the Water Quality Survey design described above in Table E-13 shall be submitted to the Executive Officer for approval prior to implementation.

8.2.2. Nearshore Light Energy Survey

The Discharger shall monitor the seven nearshore stations (L1, L2, L3, L4, L5, L6, and L7) along the 60-foot (18.3-meter) depth contour (Figure E-3) for the constituent listed in Table E-14 below:

Table E-14. Nearshore Light Energy Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Photosynthetic light energy	Quanta/sec/cm	underwater sensor	monthly	a

Footnotes for Table E-14

a. All samples shall be taken between 10 a.m. and 2 p.m., ideally when the sun is not obscured by clouds (a slight haze is permissible). Sampling during a uniform cloud cover is permissible if sampling during clear weather cannot be completed during the month. Measurement of photosynthetic light energy shall be made with a spherical underwater sensor and hemispherical reference cell on deck, both having equal quantum response from 400-700 nanometers.

End of Footnotes for Table E-14

8.3. Benthic Infauna and Sediment Chemistry Monitoring

8.3.1. Local Benthic Trends Survey

This survey is designed to determine if benthic conditions under the influence of the discharge are changing over time. The data collected are used for regular assessment of trends in sediment contamination and biological response along a fixed grid of sites within the influence (or historical influence) of the discharge. The resulting physical and chemical data will be used for assessment of trends in sediment contamination and to draw inferences concerning the relationship between effluent-derived alteration of the benthic habitat and patterns in infaunal community structure.

a. Infaunal Community and Habitat Variables Survey

The Discharger shall monitor the 44 bottom stations (Figure E-4) for the constituents listed in Table E-15 below:

Table E-15. Infauna Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Benthic infauna community	--	0.1 square meter Van Veen grab	annually	a, b
Total organic carbon	mg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	c
Organic nitrogen	mg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	c
Grain size	Phi size	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	d

Footnotes for Table E-15

a. Community analysis of benthic infauna shall include the number of species, the number of individuals per species, total numerical abundance per station, benthic response index (BRI) and biological indices, plus utilize appropriate regression analyses, parametric and nonparametric statistics, and multivariate techniques or other appropriate analytical techniques.
b. One sample shall be collected at each station for benthic infaunal community analysis. The entire contents of each sample shall be passed through a 1.0-millimeter screen to retrieve the benthic organisms. Sampling methods and protocols shall follow those described in the most current Bight Regional Monitoring Program. The following determinations shall be made at each station, where appropriate: Identification of all organisms to the lowest possible taxon based on morphological taxonomy and community analysis including the mean, range, standard deviation, and 95% confidence limits. The resulting data shall be used to describe community structure at each station.
c. Pollutants shall be analyzed using the analytical methods appropriate for solid matrices such as ELAP-accredited methods from USEPA SW-846 or other methods approved by the

Los Angeles Water Board, State Water Board, or USEPA Region 9. The analytical method with the lowest ML must be selected.

d. Sufficiently detailed to calculate percent weight in relation to phi size.

End of Footnotes for Table E-15

b. Sediment Chemistry Survey

The Discharger shall monitor the 24 Bottom Benthic Sediment Monitoring Stations at the specified depth listed in Table E-16 for the Sediment Chemistry Monitoring Requirements included in Table E-17 for every year of the permit. The remaining Bottom Benthic Sediment Monitoring Stations listed in Table E-6 shall also be monitored, in the third year following the effective date of this Order for the constituents which are listed below in Table E-17.

Table E-16. Bottom Benthic Sediment Monitoring Stations

Station Type	Monitoring Location Name	Location
Bottom Station	RW-B-0B	152-meter depth
Bottom Station	RW-B-0C	61-meter depth
Bottom Station	RW-B-0D	30-meter depth
Bottom Station	RW-B-1B	152-meter depth
Bottom Station	RW-B-1C	61-meter depth
Bottom Station	RW-B-1D	30-meter depth
Bottom Station	RW-B-3B	152-meter depth
Bottom Station	RW-B-3C	61-meter depth
Bottom Station	RW-B-3D	30-meter depth
Bottom Station	RW-B-5B	152-meter depth
Bottom Station	RW-B-5C	61-meter depth
Bottom Station	RW-B-5D	30-meter depth
Bottom Station	RW-B-6B	152-meter depth
Bottom Station	RW-B-6C	61-meter depth
Bottom Station	RW-B-6D	30-meter depth
Bottom Station	RW-B-7B	152-meter depth
Bottom Station	RW-B-7C	61-meter depth
Bottom Station	RW-B-7D	30-meter depth
Bottom Station	RW-B-8B	152-meter depth
Bottom Station	RW-B-8C	61-meter depth
Bottom Station	RW-B-8D	30-meter depth
Bottom Station	RW-B-9B	152-meter depth
Bottom Station	RW-B-9C	61-meter depth
Bottom Station	RW-B-9D	30-meter depth

Table E-17. Sediment Chemistry Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Acid volatile sulfides	mg/L	0.1 square meter Van Veen grab (upper 2 centimeters, porewater)	annually	a, b
Total organic carbon	% dry wt	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Organic nitrogen	mg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Grain size	Phi size	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, c
Arsenic	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Cadmium	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Chromium	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Copper	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Lead	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Mercury	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Nickel	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Silver	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Zinc	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
DDT	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b, d
PCBs as Aroclors	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b, d
PCBs as Congeners	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, b
Acute Sediment Toxicity	% survival	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a, e
Compounds on 303(d) list for Santa Monica Bay	µg/kg	0.1 square meter Van Veen grab (upper 2 centimeters)	annually	a

Footnotes for Table E-17

a. A separate grab sample shall be collected at each station whenever a biological sample is collected. Sub-samples (upper two centimeters) shall be taken from the grab for sediment chemistry analyses.

b. Pollutants shall be analyzed using the analytical methods appropriate for solid matrices such as ELAP-accredited methods from USEPA SW-846 or other methods approved by the Los Angeles Water Board, State Water Board, or USEPA Region 9. For any pollutant whose effluent limitation is lower than all the minimum levels (MLs) specified in Appendix II of the 2019 Ocean Plan, the analytical method with the lowest ML must be selected.

c. Sufficiently detailed to calculate percent weight in relation to phi size.

d. See section 8 of this Order and Attachment A for definition of terms.

e. Refer to section 8.3.1.c. below.

End of Footnotes for Table E-17

c. Acute Sediment Toxicity Monitoring

The Discharger shall conduct acute sediment toxicity monitoring as described in Table E-17 at the bottom stations in Table E-16. Testing shall be conducted using one of the three amphipod species *Eohaustorius estuarius, Leptocheirus plumulosus,* and *Rhepoxynius abronius* in accordance with EPA 600/R-94/0925 (USEPA, 1994*), Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods,* and the Southern California Bight Project sediment toxicity testing guidelines (Bight '13 Toxicology Committee, 2013). Test results shall be reported in percent survival, assessed for the presence of persistent toxicity, and the results shall be included in the annual monitoring report. If persistent toxicity is observed at a sediment sampling location, a Phase I Toxicity Identification Evaluation (TIE) shall be conducted as defined in the *Sediment Toxicity Identification (TIE) Phase I, II, and III Guidance Document* (EPA/R-07/080). The Discharger shall submit a Sediment Toxicity TIE Work Plan within 90 days of the effective date of this Order. The work plan shall define persistent toxicity and outline the procedures that will take place if persistent toxicity is observed.

8.3.2. Regional Benthic Survey

This regional survey is designed to determine the extent, distribution, magnitude and trend of ecological change in soft-bottom benthic habitats within the Southern California Bight and the relationship between biological response and contaminant exposure. The data collected will be used to assess the condition of the sea-floor environment and the health of the biological resources in the Bight.

Sampling Design - The most recent regional survey of benthic conditions within the Southern California Bight took place in 2018 (Bight'18). The final survey design was determined cooperatively by the participants represented on the Regional Steering Committee. The Discharger provided support to the Bight'18 benthic survey by participating in or performing the following activities:

a. Participation on the Steering Committee

b. Participation on the relevant Technical Committees (e.g., Information Management, Field Methods and Logistics, Benthos and Chemistry)

c. Field sampling at sea

d. Infaunal sample analysis

e. Sediment chemistry analysis

f. Data management

This level of participation was consistent with that provided by the Discharger during the 1994, 1998, 2003, 2008, and 2013 Regional Benthic Surveys. The next regional survey is expected to take place in 2023 and the Discharger's level of participation shall be consistent with that provided in previous survey.

8.4. Fish and Macroinvertebrate (Trawl and Rig Fishing) Monitoring

8.4.1. Local Demersal Fish and Macroinvertebrate Survey

This survey is designed to determine if the health of demersal fish and epibenthic invertebrate communities in the vicinity of the discharge is changing over time. The data collected will be used for regular assessment of temporal trends in community structure along a fixed grid of sites within the influence of the discharge. Data will also be collected on trash and debris for the Santa Monica Bay Restoration Project's Sources and Loadings program.

The Discharger shall monitor 16 trawling stations along four transects parallel to the shoreline (Table E-8 and Figure E-6) for the constituent listed in Table E-18 below:

Table E-18. Demersal Fish and Invertebrates Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
Demersal fish and invertebrates	--	10-minute otter trawl	semiannually (summer and winter)	a, b

<u>Footnotes for Table E-18</u>

a. Single otter trawls shall be collected at each station, with each trawl running along a line approximately parallel to the isobath. All organisms captured shall be identified to the lowest possible taxon and counted. Fish shall be size classed. Wet-weight biomass shall be estimated for all species. Each individual captured shall be examined for the presence of externally evident signs of disease or anomaly. Estimates of type and quantity of trash in each trawl shall be made. Sampling methods and protocols shall follow those described in the most current Bight Regional Monitoring Program. The resulting data shall be used to describe community structure, stated at Footnote b below, at each station.

b. Community analysis (including mean, range, standard deviation, and 95% confidence limits) of demersal fish and macroinvertebrate communities shall include wet weight of fish and macroinvertebrate species (when combined weight of individuals of a species is greater than or equal to 0.1 kilogram), number of species, number of individuals per species, total numerical abundance per station, number of individuals in each 1-centimeter size class for each species of fish, species diversity, species evenness, cluster analyses, or other appropriate multivariate statistical techniques approved by the Executive Officer.

End of Footnotes for Table E-18

8.4.2. Regional Demersal Fish and Invertebrate Survey

This regional survey is designed to determine the extent, distribution, magnitude and trend of ecological change in demersal fish and epibenthic invertebrate communities within the Southern California Bight and the relationship between biological response and contaminant exposure. The data collected will be used to assess the condition of the seafloor environment and health of biological resources in the Bight.

Sampling Design - The most recent regional survey of trawl-caught demersal fish and epibenthic invertebrates within the Southern California Bight took place in 2018 (Bight'18). The final survey design was determined cooperatively by the participants as represented on the Regional Steering Committee. The Discharger provided support to the Bight'18 surveys by participating in or performing the following activities:

a. Participation on the Steering Committee
b. Participation on the relevant Technical Committees (e.g., Information Management, Field Methods and Logistics, Fish and Invertebrates)
c. Field sampling at sea
d. Trawl sample analysis
e. Data management

The level of participation was consistent with that provided by the Discharger during the 1998, 2003, 2008, and 2013 Regional Surveys. The next regional survey is expected to take place in 2023 and the Discharger's level of participation shall be consistent with that provided in previous surveys.

8.4.3. Bioaccumulation and Seafood Safety Monitoring

a. Local Bioaccumulation Survey

This survey is designed to determine if fish tissue contamination in the vicinity of the outfall is changing over time. The data collected will be used for regular assessment of temporal trends in Hornyhead Turbot and White Croaker. The Hornyhead Turbot and White Croaker are the preferred species; however, if the required numbers and sizes of Hornyhead Turbot are not available, the Discharger may substitute English Sole (*Parophrys vetulus*). Hornyhead Turbot and White Croaker within a consistent size shall be targeted.

The Discharger shall monitor 3 zones, listed as Bottom Bioaccumulation Zones in Figure E-5 and Table E-7 for the constituents listed in Table E-19 below:

Table E-19. Bioaccumulation Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
DDT	μg/kg	composite of liver tissue from 10 individuals of hornyhead turbot	annually	a, b
DDT	μg/kg	composite of muscle tissue from 10 individuals of hornyhead turbot	annually	a, b
DDT	μg/kg	composite of muscle tissue from 10 individuals of white croaker	annually	a, b
PCB as aroclors	μg/kg	composite of liver tissue from 10 individuals of hornyhead turbot	annually	a, b
PCB as aroclors	μg/kg	composite of muscle tissue from 10 individuals of hornyhead turbot	annually	a, b
PCB as aroclors	μg/kg	composite of muscle tissue from 10 individuals of white croaker	annually	a, b
PCB as congeners	μg/kg	composite of liver tissue from 10 individuals of hornyhead turbot	annually	b
PCB as congeners	μg/kg	composite of muscle tissue from 10 individuals of hornyhead turbot	annually	b
PCB as congeners	μg/kg	composite of muscle tissue from 10 individuals of white croaker	annually	b
% moisture	%	composite of liver tissue from 10 individuals of hornyhead turbot	annually	b
% moisture	%	composite of muscle tissue from 10 individuals of hornyhead turbot	annually	b
% moisture	%	composite of muscle tissue from 10 individuals of white croaker	annually	b
% lipid	%	composite of liver tissue from 10 individuals of hornyhead turbot	annually	b
% lipid	%	composite of muscle tissue from 10 individuals of hornyhead turbot	annually	b
% lipid	%	composite of muscle tissue from 10 individuals of white croaker	annually	b

Footnotes for Table E-19

a. See section 8 of this Order and Attachment A for definition of terms.

b. Pollutants shall be analyzed using the analytical methods appropriate for solid matrices such as ELAP-accredited methods from USEPA SW-846 or other methods approved by this Los Angeles Water Board, State Water Board, or USEPA Region 9. For any pollutant whose effluent limitation is lower than all the minimum levels (MLs) specified in Appendix II of the 2019 Ocean Plan, the analytical method with the lowest ML must be selected.

End of Footnotes for Table E-19

b. Local Seafood Safety Survey

This survey is designed to determine 1) if tissue concentrations of contaminants continue to exceed the Advisory Tissue Concentration (ATC) where seafood consumption advisories exist locally, and 2) tissue contaminant trends relative to the ATC in other species and for other contaminants not currently subject to local consumption advisories. The data collected will be used to provide information necessary for the management of local seafood consumption advisories.

A regionally coordinated survey shall be conducted covering Santa Monica Bay, the Palos Verdes shelf and slope, and Los Angeles Harbor employing the sampling design proposed by the Santa Monica Bay Restoration Commission (SMBRC). The Discharger shall provide field sampling and analysis of tissue from the 3 zones, listed as Bottom Bioaccumulation Stations in Table E-7:

One species from each of five groups of fish (rockfish, kelpbass, sandbass, surfperches and whiter croakers) shall be sampled from each of the three zones in years one, three and five of the permit. For rockfishes, scorpionfish *(Scorpaena guttata*) is the preferred species, followed by bocaccio *(Sebastes paucispinis*) and then by any other abundant and preferably benthic rockfish species. For surfperches, black surfperch (*Embiotoca jacksoni)* is the preferred species, followed by white seaperch (*Phanerodon furcatus*) and then by walleye surfperch (*Hyperprosopon argenteum*). For croaker, white croaker (*Genyonemus lineatus*) is the preferred species, followed by black croaker (*Cheilotrema saturnum*), and then by white seabass (*Atractoscion nobilis*). If an insufficient number of croakers are collected and a significant effort has been made to collect the appropriate number of croakers, one of the following alternative species may be substitutes: ocean whitefish (*Caulolatilus princeps*), opaleye (*Girella nigricans*), blacksmith (*Chromis punctipinnis*), or pacific chub mackerel (*Scomber japonicus*).

For fish tissue analysis, one composite sample of ten individuals of each target shall be collected within each of the three zones. Sampling should take place within the same season of the year (preferably late summer/early fall) and should focus upon a consistent size class of fish. All tissue samples shall be analyzed for the constituents listed in Table E-20 below:

Table E-20. Seafood Safety Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Notes
% moisture	%	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b, c
% lipid	%	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b, c
Arsenic	µg/kg	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b, c
Mercury	µg/kg	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b, c
Selenium	µg/kg	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b
DDT	µg/kg	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b
PCB as aroclors	µg/kg	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a, b, c
PCB as congeners	µg/kg	composite of muscle tissue from 10 individuals of each of 5 species	annually every other year	a

Footnotes for Table E-20

a. The year one sampling shall be collected in 2024.
b. Pollutants shall be analyzed using the analytical methods appropriate for solid matrices such as ELAP-accredited methods from USEPA SW-846 or other methods approved by the Los Angeles Water Board or State Water Board. For any pollutant whose effluent limitation is lower than all the minimum levels (MLs) specified in Appendix II of the 2019 Ocean Plan, the analytical method with the lowest ML must be selected.
c. See section 8 of this Order and Attachment A for definition of terms.

End of Footnotes for Table E-20

c. Regional Seafood Safety Survey

This regional survey is designed to determine if seafood tissue levels within the Southern California Bight are below levels that ensure public safety. The data collected will be used to assess levels of contaminants in the edible tissue of commercial or recreationally important fish within the Bight relative to Advisory Tissue Concentrations.

A regional survey of edible tissue contaminant levels in fish within the Southern California Bight shall be conducted at least once every ten years, encompassing a broader set of sampling sites and target species than those addressed in the local seafood survey. The objective is to determine whether any unexpected increases or decreases in contaminant levels have occurred in non-target species and/or at unsampled sites. The final survey design may be determined cooperatively by participants represented on a Regional Steering Committee or by the State of California's Office of Environmental Health and Hazard Assessment. The last regional seafood safety survey within the Southern California Bight took place in 2018 (Bight'18). The Discharger provided support to a regional Seafood Safety Survey by participating in or performing the following activities:

i. Participation on a Steering Committee;

ii. Participation on relevant Technical Committees (e.g., Information Management, Field Methods & Logistics, and Chemistry);

iii. Field sampling at sea;

iv. Tissue chemical analysis; and

v. Data management.

The Discharger's level of participation shall be consistent with that provided in previous regional seafood safety surveys.

d. Regional Bioaccumulation/Predator Risk Survey

This regional survey is designed to determine if fish body burdens within the Southern California Bight are a health risk to higher trophic levels in the marine food web. The data collected will be used to estimate health risk to marine birds, mammals and wildlife from the consumption of fish tissue.

The most recent regional survey of contaminant bioaccumulation in seabird eggs of the Southern California Bight took place in 2018 (Bight'18). The final survey design was determined cooperatively by participants represented on the Regional Steering Committee. The Discharger provided support to the regional Bight '18 Predator Risk Surveys and the regional Bight '18 Bioaccumulation Survey by participating in the following activities:

i. participation in the Steering Committee;

ii. Participation in relevant technical committees (e.g. information management, field methods and logistics, and chemistry); and

iii. tissue and chemical analyses.

The level of participation was consistent with that provided by the Discharger in previous Regional Bioaccumulation/ Predator Risk Surveys. The next regional survey is expected to occur in 2023 and the Discharger's level of participation shall be consistent with that provided in previous surveys.

8.5. Kelp Bed Monitoring

This regional survey is designed to determine if the extent of kelp beds in the Southern California Bight is changing over time and are some beds changing at rates different than others. The data collected in this regional survey will be used to assess status and trends in kelp bed health and spatial extent. The regional nature of the survey will allow the status of beds local to the discharge to be compared to regional trends.

The Discharger shall participate in the Central Region Kelp Survey Consortium (CRKSC) to conduct regional kelp bed monitoring in Southern California coastal waters. The CRKSC design is based upon measures of kelp canopy using aerial imagery, satellite imagery, or other appropriate remote sensing method as determined appropriate by the CRKSC. The Discharger shall provide up to $10,000 per year in financial support to the CRKSC (annual level of support will depend on the number of participants in the program). The Discharger shall participate in the regional management and technical committees responsible for the development of the survey design and implementation of the assessment of kelp bed resources in the Bight.

Participation in this survey provides data to the SMBRC's Kelp Beds program.

9. OTHER MONITORING REQUIREMENTS

9.1. Outfall and Diffuser Inspection

This survey is designed to ensure that the outfall structures are in serviceable condition and that they can continue to be operated safely. The data collected will be used for a periodic assessment of the integrity of the outfall pipes and ballasting system.

Each ocean outfall (001, 002, 003 and 004) shall be inspected externally a minimum of once per year. Inspections shall include general observations and photographic/videographic records of the exterior outfall pipes and adjacent ballast ocean bottom. The pipes shall be visually inspected by a diver, manned submarine, or remotely operated vehicle. A summary report of the inspection findings shall be submitted by August 1st following the year of inspection. This written report, augmented with videographic and/or photographic images, will provide a description of the observed condition of the outfall structures from shallow water to their respective termini.

9.2 Biosolids and Sludge Management

The Discharger must comply with all Clean Water Act and regulatory requirements of 40 CFR § 257, 258, 501, and 503, including all applicable monitoring, record keeping, and reporting requirements. The Discharger must comply with the requirements in Attachment H of this Order.

9.3. Monitoring of Volumetric Data for Wastewater and Recycled Water

The State Water Board adopted the "Water Quality Control Policy for Recycled Water" (Recycled Water Policy) on February 3, 2009 and amended the Recycled Water Policy on January 22, 2013 and December 11, 2018. The most recent amendment became effective on April 8, 2019. The Recycled Water Policy requires wastewater and recycled water dischargers to annually report monthly volumes of influent, wastewater produced, and effluent, including treatment level and discharge type. As applicable, dischargers are additionally required to annually report recycled water use by volume and category of reuse. The State Water Board issued a Water Code Section 13267 and 13383 Order, Order WQ 2019-0037-EXEC, on July 24, 2019 to amend MRPs for all permits of NPDES permits, WDRs, WRRs, Master Recycling permits, and General WDRs. Annual reports are due by April 30 of each year, and the report must be submitted to GeoTracker. This Order implements the Recycled Water Policy by incorporating the volumetric monitoring reporting requirements in accordance with Section 3 of the Recycled Water Policy (https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/121118_7_final_amendment_oal.pdf). The State Water Board's Order WQ 2019-0037-EXEC will no longer be applicable to the Discharger upon the effective date of this Order.

9.3.1. Influent: The Discharger shall monitor monthly total volume of wastewater collected and treated by the wastewater treatment plant.

9.3.2. Production: The Discharger shall monitor monthly volume of wastewater treated, specifying level of treatment.

9.3.3. Discharge: The Discharger shall monitor monthly volume of treated wastewater discharged to specific water bodies as categorized in the Section 3.2.3 of the Recycled Water Policy. The level of treatment shall also be specified.

9.3.4. Reuse: The Discharger shall monitor monthly volume of recycled water distributed, and annual volume of treated wastewater distributed for beneficial use in compliance with California Code of Regulations, title 22 in each of the use categories specified in Section 3.2.4 of the Recycled Water Policy.

10. REPORTING REQUIREMENTS

10.1. General Monitoring and Reporting Requirements

10.1.1. The Permittee shall comply with all Standard Provisions (Attachment D) related to monitoring, reporting, and recordkeeping.

10.1.2. If there is no discharge during any reporting period, the report shall so state.

10.1.3. Each monitoring report shall contain a separate section titled Summary of Non-Compliance which discusses the compliance record and the corrective actions taken or planned that may be needed to bring the discharge into full compliance with waste discharge requirements. This section shall clearly list all non-compliance with discharge requirements, all excursions of effluent limitations, and other noncompliance issues, including, but not limited to a report of any unresolved odor complaints that demonstrate noncompliance with odor prohibitions (section 7.1.2.b of the Order), a report of any power outage or use or failure of alternate power source (section 7.3.4 of the Order), and the resolution of any non-compliance.

10.1.4. The Permittee shall inform the Los Angeles Water Board well in advance of any proposed construction or maintenance activity, or modification to the POTW, including any outfall port modifications, that could potentially affect compliance with applicable requirements.

10.1.5. The date and time of sampling (as appropriate) shall be reported with the analytical values determined.

10.1.6. The laboratory conducting analyses shall be certified by the State Water Resources Control Board, Division of Drinking Water, Environmental Laboratory Accreditation Program (ELAP), in accordance with CWC section 13176, or approved by the Los Angeles Water Board Executive Officer, in consultation with the State

Water Board's Quality Assurance Program, and USEPA for that particular parameter and must include quality assurance/quality control (QA/QC) data in their reports. A copy of the laboratory certification shall be provided each time a new/renewal certification is obtained from ELAP and must be submitted with the annual summary report. Each monitoring report must affirm in writing that: "All analyses were conducted at a laboratory certified for such analyses by the State Water Resources Control Board's Environmental Laboratory Accreditation Program (ELAP) or approved by the Los Angeles Water Board Executive Officer (in consultation with the State Water Board's Quality Assurance Program) and USEPA, and in accordance with current USEPA guideline procedures or as specified in this MRP."

10.1.7. The Discharger shall strive for lower analytical detection levels than those specified in Appendix II of the 2019 Ocean Plan to facilitate pollutant load quantification for future DDT and PCBs TMDLs.

10.1.8. Upon request by the Discharger, the Los Angeles Water Board, in consultation with the State Water Board's Quality Assurance Program and/or USEPA, may establish an ML that is not contained in Appendix II of the 2019 Ocean Plan, to be included in the Discharger's NPDES permit, in any of the following situations:

a. When the pollutant under consideration is not included in Appendix II;

b. When the Discharger agrees to use a test method that is more sensitive than those specified in 40 CFR § 136 (most recent revision);

c. When the Discharger agrees to use an ML lower than those listed in Appendix II;

d. When the Discharger demonstrates that the calibration standard matrix is sufficiently different from that used to establish the ML in Appendix II and proposes an appropriate ML for their matrix; or

e. When the Discharger uses a method whose quantification practices are not consistent with the definition of an ML. Examples of such methods are the USEPA-approved method 1613 for dioxins and furans, method 1624 for volatile organic substances, and method 1625 for semi-volatile organic substances. In such cases, the Discharger, Los Angeles Water Board, State Water Board and USEPA shall agree on a lowest quantifiable limit, and that limit will substitute for the ML for reporting and compliance determination purposes.

10.1.9. Records and reports of marine monitoring surveys conducted to meet receiving water monitoring requirements shall include, at a minimum, the following information:

a. A description of climatic and receiving water characteristics at the time of sampling (weather observations, unusual or abnormal amounts of floating debris, discoloration, wind speed and direction, swell or wave action, time of sampling or measurements, tidal stage and height, etc.).

b. The date, exact place and description of sampling stations, including differences unique to each station (e.g., date, time, station location, depth, and sample type).

c. A list of the individuals participating in field collection of samples or data and description of the sample collection and preservation procedures used in the various surveys.

d. A description of the specific method used for laboratory analysis, the date(s) the analyses were performed and the individuals participating in these analyses.

e. An in-depth discussion of the results of the survey. All tabulations and computations shall be explained.

10.1.10. The Discharger shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with this Order.

10.1.11. The Discharger shall attach a cover letter to the monitoring reports. The information contained in the cover letter shall clearly identify violations of the Order; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation.

10.2. Self-Monitoring Reports (SMRs)

10.2.1. The Permittee shall electronically submit SMRs using the State Water Board's California Integrated Water Quality System (CIWQS) Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). The CIWQS website will provide additional information for SMR submittal in the event there will be a planned service interruption for electronic submittal.

10.2.2. The Permittee shall report in the SMR the results for all monitoring specified in this MRP under sections 3 through 9. The Permittee shall submit monthly, quarterly, semiannual, and annual SMRs including the results of all required monitoring using USEPA-approved test methods or other test methods specified in this Order. SMRs must include all new monitoring results obtained since the last SMR was submitted. If the Permittee monitors any pollutant more frequently than required by this Order (other than for process/operational control, startup, research, or equipment testing), the results of this monitoring shall be included in the calculations and reporting of the data submitted in the SMR.

10.2.3. Monitoring periods and reporting for all required monitoring shall be completed according to the following schedule, except where specific monitoring periods and reporting dates are required elsewhere in the Order:

Table E-21. Monitoring Periods and Reporting Schedule

Sampling Frequency	Monitoring Period Begins On	Monitoring Period	SMR Due Date
Continuous	Order effective date	All	Submit with monthly SMR

Sampling Frequency	Monitoring Period Begins On	Monitoring Period	SMR Due Date
Daily	Order effective date	(Midnight through 11:59 PM) or any 24-hour period that reasonably represents a calendar day for purposes of sampling.	Submit with monthly SMR
Weekly	Sunday following Order effective date or on permit effective date if on a Sunday	Sunday through Saturday	Submit with monthly SMR
Monthly	First day of calendar month following Order effective date or on permit effective date if that date is first day of the month	1st day of calendar month through last day of calendar month	By the 15th day of the third month after the month of sampling
Quarterly	Closest of January 1, April 1, July 1, or October 1 following (or on) Order effective date	January 1 to March 31 April 1 to June 30 July 1 to September 30 October 1 to December 31	June 15 September 15 December 15 March 15
Semiannually	Closest of January 1 or July 1 following (or on) Order effective date	January 1 to June 30 July 1 to December 31	September 15 March 15
Annually	January 1 following (or on) Order effective date	January 1 to December 31	April 30
Annually (Volumetric Reporting)	Order effective date	January 1 to December 31	April 30
Annually (Pretreatment Program)	Order effective date	January 1 to December 31	April 30
Receiving Water Summary Report	Order effective date	January 1 to December 31	August 1
Receiving Water Biennial Report	Order effective date	January 1 to December 31 of the following year	August 1
Outfall Inspection Report	Order effective date	January 1 to December 31	August 1

10.2.4. **Reporting Protocols.** The Permittee shall report with each sample result the applicable Minimum Level (ML) and the current Method Detection Limit (MDL), as determined by the procedure in 40 CFR part 136. The Permittee shall report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

a. Sample results greater than or equal to the ML shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

b. Sample results less than the ML, but greater than or equal to the laboratory's MDL, shall be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported. For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ. The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (± a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

c. Sample results less than the laboratory's MDL shall be reported as "Not Detected," or "ND."

d. Permittees are to instruct laboratories to establish calibration standards so that the ML value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Permittee to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.

10.2.5. **Compliance Determination.** Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined above and Section 8 of this Order. For purposes of reporting and administrative enforcement by the Los Angeles Water Board and State Water Board, the Permittee shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported ML.

10.2.6. **Multiple Sample Data.** When determining compliance with a measure of central tendency (arithmetic mean, geometric mean, median, etc.) of multiple sample analyses the data set contains one or more reported determinations of "DNQ" or "ND," the Permittee shall compute the median in place of the arithmetic mean in accordance with the following procedure:

a. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The Order of the individual ND or DNQ determinations is unimportant.

b. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

10.2.7. The Permittee shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with interim and/or final effluent limitations. The Permittee is not required to duplicate the submittal of data that is entered in a tabular format within CIWQS. When electronic submittal of data is required and CIWQS does not provide for entry into a tabular format within the system, the Permittee shall electronically submit the data in a tabular format as an attachment.

10.3. Discharge Monitoring Reports (DMRs)

DMRs are USEPA reporting requirements. The Discharger shall electronically certify and submit DMRs together with SMRs using Electronic Self-Monitoring Reports module eSMR 2.5 or any upgraded version. Electronic DMR submittal shall be in addition to electronic SMR submittal. Information about electronic DMR submittal is available at the DMR website at:
http://www.waterboards.ca.gov/water_issues/programs/discharge_monitoring.

10.4. Other Reports

10.4.1. Annual Pretreatment Report

The Discharger shall electronically submit annual pretreatment reports via CIWQS to the Los Angeles Water Board and to USEPA Region 9 via email (r9pretreatment@epa.gov) by April 30 of each year, covering data collected during the previous calendar year, in accordance with Pretreatment Reporting Requirements (Attachment I).

10.4.2. The Permittee shall report the results of any special studies, chronic toxicity testing, TRE/TIE, PMP, and Pollution Prevention Plan required by Special Provisions – section 7.3 of this Order. The Permittee shall submit reports in compliance with SMR reporting requirements described in subsection 10.2. above.

10.4.3. Hauling Reports

a. In the event wastes are transported to a different disposal site during the reporting period, the following shall be reported:

i. Types of wastes and quantity of each type;

ii. Name and either the address or the State registration number for each hauler of wastes (or the method of transport if other than by hauling); and

iii. Location of the final point(s) of disposal for each type of wastes.

b. If no wastes are transported off site during the reporting period, a statement to that effect shall be submitted.

10.4.4. Annual Summary Report

By April 30 of each year, the Permittee shall submit an annual report containing a discussion of the previous year's influent/effluent analytical results, a summary of the Palos Verdes Peninsula and Santa Monica Bay Shoreline bacteria monitoring conducted by the Palos Verdes Peninsula and Santa Monica Bay JG7 Coordinated Integrated Monitoring Programs, a recycled water progress report describing any updates to the development of increased recycled water production, and food waste slurry report describing hauler and quantities treated at the JWPCP. The annual report shall contain an overview of any plans for upgrades to the treatment plant's collection system, the treatment processes, the outfall system, or any changes that may affect the quality of the final effluent. The Permittee shall submit annual report to the Los Angeles Water Board in accordance with the requirements described in subsection 10.2.7 above.

Each annual monitoring report shall contain a separate section titled *Reasonable Potential Analysis* which discusses whether reasonable potential was triggered for pollutants which do not have a final effluent limitation in the NPDES permit. This section shall contain the following statement: “The analytical results for this sampling period did/did not trigger reasonable potential.” If reasonable potential was triggered, then the following information should also be provided:

a. A list of the pollutant(s) that triggered reasonable potential.
b. The Ocean Plan criteria that was exceeded for each given pollutant.
c. The concentration of the pollutant(s).
d. The test method used to analyze the sample.
e. The date and time of sample collection.

10.4.5. Receiving Water Monitoring Report

An annual summary of the receiving water monitoring data collected during each sampling year (January-December) shall be prepared and submitted so that it is received by the Los Angeles Water Board by August 1st of the following year. This annual summary shall include a compliance summary and discussion of plant performance over the year as well as a brief discussion of the monitoring results.

A detailed Receiving Water Monitoring Biennial Assessment Report of the data collected during the two previous calendar sampling years (January-December) shall be prepared and submitted so that it is received by the Los Angeles Water Board by August 1st of every other year. Any effluent compliance issues during that period shall also be discussed. This report shall include a description of the nearfield zone and an in-depth analysis of the biological and chemical data following recommendations in the *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Water* (USEPA, November 1982; 430/982-010; pages 74-91) and the Model Monitoring Program Guidance Document (Schiff, K.C., J.S. Brown and S.B. Weisberg, 2001. *Model Monitoring Program for Large Ocean Dischargers in Southern California.* SCCWRP Tech. Rep #357. Southern California Coastal Water Research Project, Westminster, CA. 101 pp.). Data shall be tabulated, summarized, graphed where appropriate, analyzed, interpreted, and generally presented in such a way as to facilitate ready understanding of its significance. Spatial and temporal trends shall be examined and compared. The relationship of physical and chemical parameters shall be evaluated. See also Section VIII of this MRP. All receiving water monitoring data (including bioassessment/taxonomic data, continuous data, etc.) shall be submitted in a format compatible with the California Environmental Data Exchange Network (CEDEN) when feasible.

The first assessment report shall be due September 1, 2024, and cover the sampling periods of January-December 2022 and January-December 2023. Subsequent reports shall be due September 1, 2026, and September 1, 2028, to cover sampling periods from January 2024 to December 2025, and January 2026 to December 2027, respectively.

10.4.6. The Permittee shall submit to the Los Angeles Water Board, together with the first monitoring report required by this Order, a list of all chemicals and proprietary additives which could affect this waste discharge, including quantities of each. Any subsequent changes in types and/or quantities shall be reported promptly.

10.4.7. Santa Monica Bay Bacteria Total Maximum Daily Load Reporting Requirement

The Discharger monitors bacteria at the Santa Monica Bay shoreline stations described in the *Santa Monica Bay Beaches Bacteria TMDLs,* as required under the Los Angeles County MS4 permit (Order Number R4-2012-0175, NPDES Number CAS004001). This monitoring requirement is necessary to meet the requirements outlined in the Santa Monica Bay Beaches Bacteria TMDLs. Although duplicative sampling is not required, the Permittee shall upload monthly and annual Portable Document Format (PDF) reports to the California Integrated Water Quality System (CIWQS) summarizing the Santa Monica Bay Beaches Bacteria TMDL-based monitoring results and confirming that the final effluent has not contributed to any shoreline exceedances. The PDF reports shall be submitted concurrently with the NPDES monthly and annual reports.

10.4.8. Outfall Inspection Report

By August 1 of each year, a summary report of the outfall Inspection findings for the previous calendar year shall be prepared and submitted to the Los Angeles Water Board. This written report, augmented with videographic and/or photographic images, shall provide a description of the observed external condition of the discharge pipes from shallow water to their respective termini.

The first summary report shall be due August 1, 2023, covering the monitoring period from January 2022 – December 2022.

10.4.9. Technical Report on Preventive and Contingency Plans

The Los Angeles Water Board requires the Discharger to file with the Los Angeles Water Board, within 90 days after the effective date of this Order, a technical report on its preventive (failsafe) and contingency (cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events. The technical report shall:

a. Identify the possible sources of accidental loss, untreated waste bypass, and contaminated drainage. Loading and storage areas, power outage, waste treatment unit outage, and failure of process equipment, tanks, and pipes should be considered.

b. Evaluate the effectiveness of present facilities and procedures and state when they become operational.

c. Describe facilities and procedures needed for effective preventive and contingency plans.

d. Predict the effectiveness of the proposed facilities and procedures and provide an implementation schedule contingent interim and final dates when they will be constructed, implemented, or operational.

10.4.10. Discharge Points 003 and 004 Outfall Reports

The Discharger shall electronically submit to the Los Angeles Water Board a report summarizing flows conveyed to Discharge Points 003 and 004 within 5 days of the completion of the discharge. Each report shall include at a minimum, the rationale for the discharge; the date, time, and duration of the discharge; the flow rate and volume discharged; the type of water discharged; and confirmation that the required monitoring was conducted during the discharge event. If the discharge endangers human health or the environment, the report shall be submitted within 24 hours of the completion of the discharge.

10.4.11. Climate Change Effects Vulnerability Assessment and Mitigation Plan:

The Permittee shall consider the impact of climate change as they affect the operation of the treatment facility due to flooding, wildfires, or other climate-related changes. The Permittee shall develop a Climate Change Effects Vulnerability Assessment and Mitigation Plan (Climate Change Plan) to assess and manage climate change-related effects that may impact the wastewater treatment facility's operation, water supplies, its collection system, and water quality, including any projected changes to the influent water temperature and pollutant concentrations, and beneficial uses. The permittee shall also identify new or increased threats to the sewer system resulting from climate change that may impact desired levels of service in the next 50 years. The permittee shall project upgrades to existing assets or new infrastructure projects, and associated costs, necessary to meet desired levels of service. Climate change research also indicates the overarching driver of climate change is increased atmospheric carbon dioxide from human activity. The increased carbon dioxide emissions trigger changes to climatic patterns, which increase the intensity of sea level rise and coastal storm surges, lead to more erratic rainfall and local weather patterns, trigger a gradual warming of freshwater and ocean temperatures, and trigger changes to ocean water chemistry. As such, the Climate Change Plan shall also identify steps being taken or planned to address greenhouse gas emissions attributable to wastewater treatment plants, solids handling, and effluent discharge processes. For facilities that discharge to the ocean including desalination plants, the Climate Change Plan shall also include the impacts from sea level rise. The Climate Change Plan is due 12 months after the effective date of this Order.

10.4.12. Annual Volumetric Reporting of Wastewater and Recycled Water

The Discharger shall electronically submit annual volumetric reports to the State Water Board by April 30 each year covering data collected during the previous calendar year using the State Water Board's GeoTracker website (geotracker.waterboards.ca.gov) under site-specific global identification number NPD100051648. The annual volumetric report shall include information specified in section 9.4, above. A report upload confirmation from the GeoTracker data system, or other indication of completed submittals, shall be included in the annual report, which shall be submitted into CIWQS, by the annual volumetric report due date, to demonstrate compliance with this reporting requirement.

10.4.13. Initial Investigation TRE Work Plan

The Permittee shall prepare and submit a copy of the Permittee's initial investigation TRE work plan to the Executive Officer of the Los Angeles Water Board for approval within 90 days of the effective date of this permit. If the Executive Officer does not disapprove the work plan within 60 days, the work plan shall become effective. The Permittee shall use USEPA manual EPA/833B-99/002 (municipal) as guidance, or the most current version, or the USEPA manual *Generalized Methodology for Conducting Industrial Toxicity Reduction Evaluations* (EPA/600/2-88/070, April 1989). At a minimum, the TRE Work Plan must contain the provisions in Attachment G. This work plan shall describe the steps that the Permittee intends to follow if toxicity is detected. Refer to MRP section 5.6 for detailed requirements.

10.4.14. Sediment Toxicity TIE Work Plan

The Permittee shall conduct acute sediment toxicity monitoring. If persistent toxicity is observed at a sediment sampling location, a Phase I TIE shall be conducted as defined in the *Sediment Toxicity Identification (TIE) Phase I, II, and III Guidance Document* (EPA/R-07/080). The Permittee shall submit a Sediment Toxicity TIE Work Plan within 90 days of the effective date of this Order. Refer to MRP section 8.3.1.c for detailed requirements.

ATTACHMENT F. FACT SHEET

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ATTACHMENT F – FACT SHEET

As described in section 2.2 of this Order, the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) incorporates this Fact Sheet as findings of the Los Angeles Water Board supporting the issuance of this Order. This Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order.

This Order has been prepared under a standardized format to accommodate a broad range of discharge requirements for dischargers in California. Only those sections or subsections of this Order that are specifically identified as "not applicable" have been determined not to apply to this Discharger. Sections or subsections of this Order not specifically identified as "not applicable" are fully applicable to this Discharger.

1. PERMIT INFORMATION

The following table summarizes administrative information related to the facility.

Table F-1. Facility Information

WDID	4B190107013
Discharger	Joint Outfall System
Name of Facility	Joint Water Pollution Control Plant
Facility Address	24501 South Figueroa Street Carson, CA 90745 Los Angeles County
Facility Contact, Title and Phone	Lysa Gaboudian, Supervising Engineer, (562) 908-4288
Authorized Person to Sign and Submit Reports	Lysa Gaboudian, Supervising Engineer, (562) 908-4288
Mailing Address	1955 Workman Mill Road, Whittier, CA 90601
Billing Address	Same as Mailing Address
Type of Facility	Publicly-Owned Treatment Works
Major or Minor Facility	Major
Threat to Water Quality	1
Complexity	A
Pretreatment Program	Yes
Recycling Requirements	Producer
Facility Permitted Flow	400 million gallons per day
Facility Design Flow	400 million gallons per day
Watershed	Santa Monica Bay Watershed Management Area
Receiving Water	Pacific Ocean
Receiving Water Type	Ocean waters

1.1. The Joint Outfall System (hereinafter JOS, Discharger, or Permittee) owns and operates a Publicly Owned Treatment Works (POTW) comprised of the Joint Water

Pollution Control Plant (hereinafter JWPCP or Facility) and its associated wastewater collection system and outfalls. The JOS was formerly referred to as the County Sanitation Districts of Los Angeles County. Ownership and operation of the JOS is proportionally shared among the signatory parties to the amended Joint Outfall Agreement effective July 1, 1995. The parties include the County Sanitation Districts of Los Angeles County Nos. 1, 2, 3, 5, 8, 15, 16, 17, 18, 19, 21, 22, 23, 28, 29, and 34, and South Bay Cities Sanitation District of Los Angeles County. For the purposes of this Order, references to the "Discharger" or "Permittee" in applicable federal and state laws, regulations, plans, or policy are held to be equivalent to references to the Discharger herein.

1.2. The Facility discharges wastewater to the Pacific Ocean, a water of the United States. The Permittee was previously regulated by Order R4-2017-0180 and NPDES Permit Number CA0053813, adopted by the Los Angeles Water Board on September 7, 2017. This Order expired on October 31, 2022.

Regulations at 40 CFR section 122.46 limit the duration of NPDES permits to a fixed term not to exceed five years. Accordingly, Table 3 of this Order limits the duration of the discharge authorization. However, pursuant to California Code of Regulations, title 23, section 2235.4, the terms and conditions of an expired permit are automatically continued pending reissuance of the permit if the Discharger complies with all federal NPDES requirements for continuation of expired permits. The Permittee filed a report of waste discharge and applied for reissuance of its WDRs and NPDES permit on May 4, 2022. Supplemental information was requested on May 27, 2022 and received on June 30, 2022. The application was deemed complete on July 6, 2022. A site visit was conducted on January 6, 2023, to observe operations and collect additional data to develop permit limitations and conditions. The terms and conditions of the current NPDES order have been automatically continued and remain in effect until the new WDRs and NPDES permit are adopted pursuant to this Order. Attachment B provides a map of the area around the Facility. Attachment C provides a flow schematic of the Facility.

1.3. The Permittee is authorized to discharge subject to waste discharge requirements in this Order at the discharge location described in Table 1 of this Order.

1.4. **Dilution Credits.**

The most recent dilution study submitted in 2016 used water quality data from 2001 to 2011. Since there have not been any significant changes to the quality of the discharge or the ambient conditions since Order No. R4-2017-0180 was adopted on September 7, 2017, this Order includes the same dilution ratios included in Order No. R4-2017-0180: a dilution ratio of 166:1 for Discharge Points 001 and 002, a dilution ratio of 1:150 for Discharge Point 003, and a dilution ratio of 1:115 for Discharge Point 004.

2. FACILITY DESCRIPTION

2.1. Description of Wastewater and Biosolids Treatment and Controls

2.1.1. The Discharger owns and operates the JWPCP, located at 24501 South Figueroa Street in Carson, California. The JWPCP has a monthly average daily dry weather secondary treatment capacity of 400 million gallons per day (MGD) and a dry weather peak secondary treatment design capacity of 540 MGD. The wet weather peak hydraulic capacity is 675 MGD. During storms, peak flows at JWPCP approached the hydraulic capacity of 675 MGD, with maximum flows of 548 MGD and 539 MGD recorded on February 2, 2019 and December 30, 2021, respectively. For the period from November 2017 to June 2022, monthly secondary effluent discharge flow from JWPCP averaged 251 MGD (163 MGD at Outfall 001 and 88 MGD at Outfall 002).

JWPCP is part of an integrated network of facilities, known as the JOS, which incorporates JWPCP and six upstream water reclamation plants - La Cañada, Whittier Narrows, San Jose Creek, Pomona, Los Coyotes and Long Beach. The six upstream plants are connected to 1,241 miles of interceptors and a common sewer system, which allows for the diversion of flows into or around each upstream plant. The flow from the six upstream plants can be bypassed, to a limited extent, to JWPCP. Some stormwater flows and dry weather runoff from other cities are also directed to JWPCP's headworks for treatment. The biosolids generated from the upstream plants are returned to the joint outfall trunk sewers and conveyed to JWPCP for further treatment. The JOS serves an urban area of 656 square miles and includes all or part of 73 cities in addition to multiple communities and unincorporated areas. The JOS provides wastewater treatment services to much of Los Angeles County. There are approximately 4.87 million people in the JOS service area. In 2021, the JWPCP received 17.3% of the influent flow as industrial wastewater, the rest (82.7%) was from commercial/residential sources.

2.1.2. The treatment system at JWPCP consists of screening, grit removal, primary sedimentation, pure oxygen activated sludge reactors, secondary clarification, and chlorination (Attachment C). Effluent from the primary sedimentation tanks is biologically treated in pure oxygen activated sludge reactors. The secondary treated effluent is then clarified, chlorinated and pumped into the outfall manifold. The secondary treated effluent from JWPCP is routinely discharged through Discharge Points 001 and 002 to the Pacific Ocean, a water of the United States, at White Point within the Palos Verdes Peninsula Sub-Watershed that is part of the Santa Monica Bay Watershed.

Solid fractions recovered from wastewater treatment processes include grit, primary screenings, primary biosolids and skimmings, thickened waste activated sludge, digested sludge screenings and digester cleaning solids. The fine solids (grit, primary screenings, digested sludge screenings, digester cleaning solids) which are primarily inorganic materials are hauled away to a landfill. The remaining solid fractions (primary sludge and skimmings, thickened waste activated sludge) are anaerobically digested on-site. The digested solids are screened and dewatered using scroll centrifuges. JWPCP generates approximately 98,000 dry metric tons of Class B biosolids per year. The biosolids are hauled off-site for use in composting and land application, combined with municipal solid waste for co-disposal, or processed into a renewable fuel for cement kilns.

Methane gas generated in the anaerobic digestion process is used to produce power and digester heating steam in a total energy facility that utilizes gas turbines and waste-heat recovery steam generators. The on-site generation of electricity permits the JWPCP to produce its own electricity.

Each treatment process is described in more detail below:

a. Primary Treatment: Primary treatment begins with two inlet works that receive flow from three influent sewers. Inlet Works No. 1 receives approximately 70% of the total JWPCP flow and Inlet Works No. 2 receives the remaining 30%. Six bar screens for Inlet Works No. 1 and three bar screens for Inlet Works No. 2 remove solids by capturing large debris through bars spaced approximately 1 inch apart. Captured debris is continuously removed from each bar screen, by five equally spaced rakes, and deposited into a trough. The trough delivers the debris to one of two dewatering compactors. Water removed in the compactors is returned to the treatment process upstream of the bar screens while the dewatered debris is disposed of in a landfill. Wastewater effluent from the bar screens is directed to one of six grit chambers, which remove heavy inorganic material. Grit slurry is pumped from the chambers and dewatered with the use of cyclones and clarifiers. The water is returned to the inlet of the grit chambers and the dewatered grit is disposed of in a landfill. Wastewater from the grit chambers is then directed to the sedimentation tanks for settleable and floatable solids removal. The JWPCP has 52 primary sedimentation tanks arranged into three sedimentation tank batteries. The wastewater enters each tank through three inlet gates with diffusers. Flow is reduced from roughly 3 feet per second to 3 feet per minute to allow suspended solids to settle. Biosolids are directed through draw off lines and pumped to raw sludge transfer stations before transfer to anaerobic digesters. Floatable solids are pushed to the effluent end of the tank where they are pulled up into a skimmings trough, then conveyed to one of four skimmings wet wells. Ultimately the skimmings are directed to one of 24 circular anaerobic digesters, each with a volume of approximately 500,000 cubic feet, for final processing. Anaerobic digestion of the biosolids reduces the concentration of pathogens, offensive odors, and the overall amount of solids to be dewatered. It also produces methane as a by-product, which is used to power the JWPCP.

b. Secondary Treatment: A secondary influent pumping station pumps primary effluent to the secondary treatment facilities. Eight biological reactors, each with a design capacity of 50 MGD, convert finely divided and dissolved organic matter that passes through primary treatment into settleable solids that are removed by final clarification. Each reactor is subdivided into four stages, each stage with three aerators/mixers to facilitate oxygen dissolution and mixing. The first stage of the reactors is operated as an anaerobic selector, with limited exposure to oxygen to suppress the growth of certain organisms in the activated sludge. In the following three stages, the activated sludge consumes organic matter in the mixed liquor and produces more organisms. The fourth stage of some of the reactors also functions as a pH adjustment stage. The reactors are covered to retain the high purity oxygen gas introduced into the system and permit a high degree of oxygen utilization by the activated sludge.

After passing through the biological reactors, wastewater flows into the final clarifiers to separate the activated sludge solids from the biological reactor’s mixed liquor. Each reactor has a bank of 26 sedimentation tanks where floatable material is skimmed off the top, collected, and directed to a sewer line. Solids that settle to the bottom are scraped to two hoppers where the sludge is collected and drawn off to return sludge pumping stations. There is one pumping station per reactor, each consisting of three pumps, that pumps activated sludge to the inlet of the reactors to keep an effective concentration of microorganisms in the reactors. However, a portion of the activated sludge is wasted from the reactor/clarifier system to maintain the desired population of microorganisms in the reactors.

A dissolved air flotation thickening system is used to concentrate the waste activated biosolids produced in secondary treatment. Solids on the surface of the flotation tank are collected using skimmers and then pumped to the anaerobic digestion system, located with the primary treatment facilities. The clarified effluent is returned to the secondary influent force main. Secondary effluent is disinfected using a bleach solution to achieve a chlorine residual of approximately 1-2 mg/L and then is either pumped or gravity fed, depending on tidal conditions, to the Pacific Ocean.

c. Solids Processing: Discharge from the 24 circular digesters is diverted into three pump station wet wells, one of which is the central wet well for transfer of digested biosolids to solids processing. The central wet well consists of three individual structures, each with a capacity of 822,800 gallons and equipped with two gas blowers that pump digester gas into the wet well to provide mixing. Biosolids are pumped using three digested sludge pumps through rotary screens and into centrifuge feed pumping station wet wells, housing a total of five pumps. The pumps are used to deliver digested sludge to the centrifuges, which are used to separate water from the suspended solids. There are currently 31 low-speed and 8 high-speed centrifuges. The high-speed centrifuges are capable of increasing gravity up to a factor of 3,000, while the low-speed centrifuges increase gravity by a factor of approximately 1,000. Diluted cationic polymer is used in the process to enhance flocculation. The dewatered cake (biosolids) drops through a hopper below each elevated centrifuge onto a conveyor belt, while the waste concentrate is collected through a second hopper into a central drainage system. Eighteen storage silos, each of which can hold up to 510 tons, store the biosolids prior to conveyance to truck loading stations. Centrate from the centrifuges is collected and gravity flows to the Centrate Treatment System Facility, where solids are concentrated using dissolved air flotation. The clarified effluent from the Centrate Treatment Facility discharges to a wet well, where it flows by gravity to mix with the secondary effluent after the secondary influent pump station prior to entering the biological reactors.

d. Food Waste Slurry System: On July 16, 2021, the Discharger submitted a letter to the Los Angeles Water Board indicating that operation of the Food Waste Receiving and Co-Digestion System at JWPCP has commenced and standard operating procedures are in place. Separated food waste is unloaded at the

Puente Hills Materials Recovery Facility located in the City of Industry, California. The food waste is prescreened to remove large inert contaminants. The food waste is then loaded into a food waste slurry processor through a feeder/hopper. During processing, inorganic inert contaminants are separated from the food waste slurry. The inert contaminants are stored in bins and disposed as refuse. The main inert contaminants are plastic bags, containers, glass and metals. The food waste slurry is stored in tanks at the Material Recovery Facility. The solid food waste slurry is then transported to the JWPCP digestors where it is anaerobically digested, and liquid food waste slurry is added to the headworks.

e. Power Generation: The JWPCP is self-reliant with respect to power generation. All the power and most of the heating steam requirements for the JWPCP are provided by three digester gas fired turbines, each equipped with a 9.9 MW electric generator, and one steam turbine. Utility power is available whenever the on-site power facility is out of service.

   Digester gas must be dewatered and scrubbed of particulate matter prior to combustion. Digester gas is first scrubbed, using two Venturi scrubbers and non-potable water, and particulate matter is regularly blown down from the scrubber storage tanks. Two mist eliminators downstream of the Venturi scrubbers remove water droplets from the gas stream, and the digester gas is then further treated using two chillers that condense water vapor. From there, digester gas is directed to a surge tank prior to compression. Natural gas is used to boost the heat input during periods of low digester gas production. Three compressors are used to compress the digester gas, or a mixture of digester gas and natural gas, from approximately 10 inches of water column to approximately 350 pounds per square inch (psig). Prior to combustion in the gas turbine, the high-pressure digester gas is chilled to 40 degrees Fahrenheit, using a refrigeration system, to remove any remaining water vapor. Typically, only two gas turbines are in operation while one acts as a standby. During periods when the gas turbines are not operational, digester gas can be burned at two different flare stations, with the South Flare Station consisting of five waste gas flares and the North Flare Station consisting of seven waste gas flares. Waste heat from the gas turbine exhaust is used to produce steam, using heat recovery steam generators, and directed to a steam turbine for power production and digester heating steam. The gas turbines are operated without waste heat recovery. Digester heating steam is provided by means of four digester gas-fired boilers, along with an additional natural gas-fired boiler for emergencies. These boilers both supplement and serve as a backup to the waste heat steam generation.

2.1.3. **Recycled Water**: Approximately 20 MGD of JWPCP effluent is recycled for internal uses within the treatment processes and for maintenance. However, due to the plant's influent sources, salt levels are too high for reuse in irrigation for most industrial processes. More importantly, JWPCP serves a critical role in facilitating regional water reclamation by handling waste streams (e.g., solids and concentrates from reverse osmosis systems) from local and the upstream water recycling facilities (Whittier Narrows, San Jose Creek, Pomona, Los Coyotes and Long Beach). The recycled water from the upstream water reclamation plants is individually permitted.

The Metropolitan Water District (MWD) and the Discharger have been developing Pure Water Southern California since 2010. Pure Water Southern California provides an opportunity to develop a local and sustainable water supply for Los Angeles and Orange Counties, with the objective of providing water to replenish the Central, West Coast, Main San Gabriel, and Orange County Groundwater Basins. MWD and the Discharger plan to construct a new Advanced Water Treatment Facility (AWTF) including membrane bioreactors, reverse osmosis, and ultraviolet/advanced oxidation processes at the JWPCP to ultimately produce 150 MGD or 168,000 acre-feet per year (AFY) of purified water for beneficial reuse including replenishing groundwater basis, industrial uses, and eventually direct potable reuse.

The first step toward~~s~~ developing this project was pilot testing conducted between 2010 and 2012, which demonstrated that it is technically feasible for the secondary effluent from JWPCP to be advanced treated to meet the water quality required for groundwater recharge. In September 2019, the Sanitation Districts and the MWD completed construction of a 0.5 MGD advanced treatment demonstration plant to demonstrate the effectiveness of various treatment strategies. A Notice of Preparation for the full-scale system was distributed in September 2022 and the final Environmental Impact Report is expected to be complete in early 2024. Once approved, design and construction will follow with an estimated completion date of 2032 to produce up to 100 MGD purified water and 2036 to produce up to 150 MGD purified water.

2.2. Discharge Points and Receiving Waters

2.2.1. After chlorination, the secondary treated effluent travels about 6 miles through tunnels to the outfall manifold and then is discharged to the Pacific Ocean, at White Point off the Palos Verdes Peninsula. (Refer to the Flow Schematic, Attachment C).

2.2.2. The JWPCP has four outfalls (terminating at Discharge Points 001 through 004) located at White Point, off the Palos Verdes Peninsula. All effluent from the JWPCP travels through two tunnels under the Palos Verdes Peninsula to the shoreline of the Pacific Ocean, where an underground manifold system of valves connects the tunnels to four ocean outfalls. The manifold and the starting point for the four outfalls are located near White Point, on the Palos Verdes Peninsula. The 120-inch outfall (terminating at Discharge Point 001) lies to the south of the manifold and continuously discharges approximately 65% of the treated wastewater. The 90-inch outfall (terminating at Discharge Point 002) lies south-west of the manifold and continuously discharges approximately 35% of the treated wastewater. The 72-inch outfall (terminating at Discharge Point 003) is located between the 120-inch and 90-inch outfalls and is used during times of heavy rains to provide hydraulic relief for flow in the outfall system. The 60-inch outfall (terminating at Discharge Point 004) is also located between the 90-inch and 120-inch outfalls and serves as a standby outfall to provide additional hydraulic relief during the very heaviest flows. All four of these outfalls terminate in diffuser sections that contain multiple ports with opposing discharge direction from a minimum depth of 100 feet for the 60-inch diffuser to the maximum diffuser depth of

210 feet at the end of the 90-inch outfall. The diffusers lie at the outer edge of a narrow shelf offshore of the Palos Verdes peninsula.

These four outfalls are described as follows:

Table F-2 Outfall Descriptions

Discharge Point	Description
001	**White Point 120-inch ocean outfall** (33.6892º, -118.3167º) Approximately 65% of the effluent from JWPCP is discharged from this outfall. It discharges south of the shoreline off White Point, San Pedro. The outfall is 7440 ft. long to the beginning of a single L-shaped diffuser leg which is 4440 ft. long. Depth at the beginning of the diffuser is 167 ft. and at the end of the diffuser is 190 ft.
002	**White Point 90-inch ocean outfall** (33.7008º, -118.3381º) Approximately 35% of the effluent from JWPCP is discharged from this outfall. It discharges southwest of the shoreline off White Point, San Pedro. The outfall is 7982 ft. long to the beginning of a y-shaped diffuser with two legs. Each leg is 1208 ft. long. Depth at the beginning of the diffusers is 196 ft. and at the end of the diffusers is 210 ft.
003	**White Point 72-inch ocean outfall** (33.7008º, -118.3300º) This outfall is used only during times of heavy flow to provide hydraulic relief in the outfall system. When used, it discharges off the White Point shoreline between Discharge Points 001 and 002 and about 160 ft. below the ocean surface. The outfall is about 6500 ft. long and connects to a diffuser with two legs, each approximately 200 ft. long.
004	**White Point 60-inch ocean outfall** (33.7061º, -118.3283º) This outfall is used as a standby to provide additional hydraulic relief during the heaviest flow. When used, it discharges off the White Point shoreline between Discharge Serial Nos. 002 and 003 and about 110 ft. below the ocean surface. The outfall is about 5000 ft. long and connects to a single, very short diffuser.

2.2.3. In addition to the JWPCP effluent, the waste brine generated by the West Basin Municipal Water Districts' Carson Regional Water Recycling Plant is also discharged to the ocean through the JWPCP's outfalls via a waste brine line connected to the JWPCP effluent tunnel. The Royal Palms Restroom at the Royal Palms State Beach also discharges treated effluent to the JWPCP outfall at manhole J204. The discharge of waste brine from West Basin and treated effluent from the Royal Palms Restroom are regulated under separate waste discharge requirements and NPDES permits.

2.3. Summary of Existing Requirements and Self-Monitoring Report (SMR) Data

Effluent limitations contained in the previous Order No. R4-2017-0180 for discharges from Discharge Point 001 (Monitoring Locations EFF-001) and Discharge Point 002

(EFF-002) and representative monitoring data from the term of the previous Order collected from November 1, 2017 to June 30, 2022 are summarized in Tables F-3. There were four occasions during which discharge through Discharge Point 003 occurred during this timeframe.

Table F-3 Effluent Limitations in Order No. R4-2017-0180 and Historical Monitoring Data at EFF-001 and EFF-002

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Instantaneous Minimum & Maximum Limit	Maximum Monthly Average	Maximum Weekly Average	Maximum Daily	Instantaneous Minimum & Maximum	Note
Biochemical Oxygen Demand ($BOD_5 20^oC$)	mg/L	30	45	--	--	19.7	20.7	--	--	--
$BOD_5 20^oC$ Removal Percentage	%	85	--	--	--	>95%	--	--	--	a
Total Suspended Solids (TSS)	mg/L	30	45	--	--	17	37	--	--	--
TSS Removal Percentage	%	85	--	--	--	>95%	--	--	--	a
Oil & Grease	mg/L	15	22.5	45	75	3.0	19	38.1		--
Settleable Solids	mL/L	0.5	0.75	1.5	3.0	0.12	0.2	0.2	0.2	--
pH	pH Unit	--	--	--	6.0 – 9.0	--	--	--	6.7-7.4	--
Temperature	°F	--	--	100	--	--	--	88.2	--	--
Turbidity	NTU	75	100	--	225	6.5	--	--	14	--
Residual Chlorine	mg/L	0.33	--	1.34	10	<0.33	--	0.7	0.7	--
Chronic Toxicity	TUc	--	--	pass	--	pass	--	--	--	--
Benzidine	µg/L	0.012	--	--	--	<7.2	--	<7.2	--	--
Chlordane	µg/L	0.0038	--	--	--	<0.1	--	<0.1	--	--
DDT	µg/L	0.0158	--	--	--	--	--	0.01	--	--
3,3'-Dichlorobenzidine	µg/L	1.4	--	--	--	<5	--	<5	--	--
Hexachlorobenzene	µg/L	0.035	--	--	--	<2.4	--	<2.4	--	--
Total Polychlorinated Biphenyls (PCBs)	µg/L	0.00035	--	--	--	<0.5	--	<0.5	--	--
TCDD equivalents	pg/L	0.65	--	--	--	--	--	0.017	--	--
Toxaphene	µg/L	0.035	--	--	--	<0.3	--	<0.3	--	--

<u>Footnotes for Table F-3</u>

a. This is a minimum average monthly effluent limitation.

<u>End of Footnotes for Table F-3</u>

2.4. Compliance Summary

Data collected from November 1, 2017 to June 30, 2022 indicate that there were no exceedances of effluent limitations in Order Number R4-2017-0180. However, there were deficient monitoring violations due to quality control failures throughout the monitoring period. The Discharger conducted corrective actions to prevent deficient monitoring violations including: (1) providing additional staff training; (2) adding additional labels of samples; (3) reviewing backlog checking protocols; (4) updating laboratory QA/QC protocols; and (5) daily email update with details on which outfalls are used. Since implementation of these corrective actions, the Discharger has not reported any additional deficient monitoring violations related to those described above.

2.5. Receiving Water Description

JWPCP discharges to the Santa Monica Bay watershed, which is home to unique wetland, sand dune, and open ocean ecosystems that support a rich diversity of wildlife and serve as migration stopovers for marine mammals and birds. The Santa Monica Bay and its beaches are invaluable recreational resources and important sources of revenue for the region. The Santa Monica Bay is heavily used for fishing, swimming, surfing, diving, and other activities classified as water contact and noncontact recreation.

Over the years, the beneficial uses of the Santa Monica Bay have been impaired to various degrees due to pollution, resource over-exploitation, and habitat destruction. The primary problems of concern include acute health risk associated with swimming in runoff-contaminated surf zone waters, chronic (cancer) risk associated with consumption of certain sport fish species in areas impacted by DDT, contaminants of emerging concerns (CECs), harmful algal blooms (HABs), and PCBs contamination, pollutant loading from point sources, urban runoff, and other nonpoint sources in light of projected population increases and their impacts on marine ecosystem, health of fishery resources, and degradation of natural habitats, and population decline of key species. (SMBRC. 2004. “State of the Bay: 2004 Progress and Challenges”, 45 pages; Santa Monica Bay Restoration Project. 1998. “Taking the Pulse of the Bay - State of the Bay 1998”).

Section 403 of the Clean Water Act (CWA) requires dischargers to comply with specific Ocean Discharge Criteria established to address impacts on marine resources, including fisheries and endangered species. The Discharger submitted the *2018-2019 Biennial Receiving Water Monitoring Report* on August 27, 2020, to demonstrate compliance with the section 403 Ocean Discharge Criteria. Based upon an evaluation of previous receiving water monitoring data and reports from other agencies, the Discharger concluded that the environmental impacts associated with the current effluent discharge are insignificant and compliant with applicable numeric standards and narrative objectives as defined in the California Ocean Plan and the previous Order No. R4-2017-0180. The Discharger further concluded that the analysis of temporal trends also indicate that residual impacts from historical discharges are lessening in magnitude and spatial extent with time and clearly documents the dramatic improvements and continuing recovery of this ecosystem as a result of improvements in JWPCP effluent quality since the early 1970s. Los Angeles Water Board staff confirmed that concentrations of pollutants with water quality objectives listed in the 2021 annual report between the 1970s to 2021 are trending downward, except for ammonia. Although ammonia concentrations in effluent are trending upward, the discharge did not have reasonable potential to contribute to or exceed the water quality of objectives for ammonia in the Ocean Plan.

2.6. Planned Changes

Environmental planning for the full-scale system of the AWTF started in 2021 and is expected to end in 2024. Once approved, design and construction will follow with an estimated completion date of 2032 to produce up to 100 MGD purified water and 2036 to produce up to 150 MGD purified water.

In addition, JWPCP uses an 8-foot diameter tunnel constructed in 1937 and a 12-foot tunnel constructed in 1958 to convey the secondary-treated effluent to the ocean. A multi-year planning and environmental review effort began in 2006 and identified the need for a new 18-foot diameter tunnel to ensure the reliability and provide sufficient future capacity. A new 18-foot tunnel is being constructed under the Clearwater Project and it addresses the following concerns with the existing tunnels:

2.6.1. **Aging infrastructure concerns** – The existing tunnels cannot be taken out of service because they must continuously carry flow.

2.6.2. **Earthquake concerns** – The existing tunnels are not built to current earthquake standards, even though they cross two earthquake faults.

2.6.3. **Overflow concerns** – The capacity of the existing tunnels was almost exceeded twice during major rainstorms, including the rainstorm in January 2017. If the combined tunnel capacity is exceeded, partially treated or untreated wastewater would be discharged to surrounding waterways, resulting in degradation of water quality.

Attachment B.2. shows the alignment of the new and existing tunnels. The Clearwater Project construction started at the JWPCP in 2019 and will be competed in 2027 at White Point near Royal Palms Beach. This new 18-foot diameter tunnel will connect to the current manifold located at White Point, but the permitted discharge volume and dilution credits at Discharge Points 001 through 004 will remain the same.

3. APPLICABLE PLANS, POLICIES, AND REGULATIONS

The requirements contained in this Order are based on the requirements and authorities described in this section.

3.1. Legal Authorities

This Order serves as WDRs pursuant to article 4, chapter 4, division 7 of the California Water Code (commencing with section 13260). This Order is also issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the USEPA and chapter 5.5, division 7 of the Water Code (commencing with section 13370). It shall serve as an NPDES permit authorizing the Discharger to discharge into waters of the United States at the discharge locations described in Table 2 subject to the WDRs in this Order.

3.2. California Environmental Quality Act (CEQA)

Under Water Code section 13389, this action to adopt an NPDES permit for an existing facility is exempt from CEQA, (commencing with section 21100) of Division 13 of the Public Resources Code. Additionally, the Facility is exempt from CEQA pursuant to 14 Cal. Code Reg. § 15301, Existing Facilities.

3.3. State and Federal Laws, Regulations, Policies, and Plans

3.3.1. Water Quality Control Plan

The Water Quality Control Plan for the Los Angeles Region (Basin Plan) designates beneficial uses, establishes water quality objectives (WQOs), and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. Requirements in this Order implement the Basin Plan.

Beneficial uses applicable to the receiving water are as follows:

Table F-4. Basin Plan Beneficial Uses

Water Body Designation	Receiving Water Name	Beneficial Use(s)
180701040500 (Formerly Hydro. Unit No. 405.12)	Point Vicente Beach, Royal Palms Beach, and White Point County Beach	Existing: Navigation (NAV), contact water recreation (REC-1), non-contact water recreation (REC-2), commercial and sport fishing (COMM), marine habitat (MAR), wildlife habitat (WILD), and shellfish harvesting (SHELL). Potential: Spawning, reproduction, and/or early development of fish (SPWN).
---	Pacific Ocean Nearshore Zone (Note a)	Existing: Industrial service supply (IND), NAV, REC-1, REC-2, COMM, MAR, WILD, preservation of biological habitats (BIOL) (Note b), preservation of rare, threatened, or endangered species (RARE) (Note c), migration of aquatic organisms (MIGR) (Note d), SPWN (Note d), and SHELL (Note e).
---	Pacific Ocean Offshore Zone	Existing: IND, NAV, REC-1, REC-2, COMM, MAR, WILD, RARE (Note c), MIGR (Note d), SPWN (Note d), and SHELL.

Footnotes for Table F-4

a. The zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shoreline.

b. Areas of Special Biological Significance (along coast from Latigo Point to Laguna Point) and Big Sycamore Canyon and Abalone Cove Ecological Reserves and Point Fermin Marine Life Refuge.

c. One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

d. Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

e. Areas exhibiting large shellfish populations include Malibu, Point Dume, Point Fermin, White Point and Zuma Beach.

End of Footnotes for Table F-4

3.3.2. California Thermal Plan

The State Water Board adopted the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California* (Thermal Plan) on January 7, 1971 and amended this plan on September 18, 1975. This plan contains temperature objectives for coastal and inland surface waters. Requirements of this Order implement the Thermal Plan.

3.3.3. California Ocean Plan

The State Water Board adopted the *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) in 1972, as amended. The State Water Board adopted the latest amendment on August 7, 2018, and it became effective on February 4, 2019. The Ocean Plan is applicable, in its entirety, to point source discharges to the ocean waters of the State. The Ocean Plan identifies beneficial uses of ocean waters of the State to be protected as summarized below:

Table F-5 Ocean Plan Beneficial Uses

Discharge Point	Receiving Water	Beneficial Use(s)
001, 002, 003 and 004	Pacific Ocean	IND, REC-1 and REC-2 (including aesthetic enjoyment), NAV, COMM, mariculture, preservation and enhancement of designated Area of Special Biological Significance, RARE, MAR, MIGR, SPWN, and SHELL.

To protect the beneficial uses, the Ocean Plan establishes water quality objectives and a program of implementation. Requirements of this Order implement the Ocean Plan as amended in 2019 (2019 Ocean Plan).

3.3.4. Santa Monica Bay Comprehensive Conservation Management Plan

The JWPCP discharges to Santa Monica Bay, one of the most heavily used recreational areas in California. Recognizing the importance of the Bay as a national resource, the State of California and USEPA nominated Santa Monica Bay to the National Estuary Program, and Congress subsequently included Santa Monica Bay in the program. The Santa Monica Bay National Estuary Program, with support from the USEPA, developed a Comprehensive Conservation and Management Plan (CCMP), which serves as a blueprint for restoring and enhancing the Bay. The Los Angeles Water Board plays a lead role in the implementation of the plan through adoption and enforcement of NPDES permits. Three of the CCMP actions address reducing pollutants of concern at the source (including municipal wastewater treatment plants), recycling water at the City of Los Angeles' Hyperion WRP and the County Sanitation Districts of Los Angeles County's Joint Water Pollution Control Plant, and improving water quality (e.g., CECs and HABs)).

3.3.5. Compliance Schedule Policy

On April 15, 2008, the State Water Board adopted Resolution No. 2008-0025, Policy for Compliance Schedule in National Pollutant Discharge Elimination System Permits (Compliance Schedule Policy). The Compliance Schedule Policy became effective on December 17, 2008. Compliance Schedule Policy is a statewide water quality control policy that authorizes compliance schedules in NPDES permits that implement Clean Water Act section 301(b)(1)(C). The Compliance Schedule Policy supersedes all existing provisions authorizing NPDES compliance schedules with the exception of: (1) existing compliance schedule provisions in Total Maximum Daily Load (TMDL) implementation plans in Regional Water Quality Control Plans; and (2) the provisions authorizing compliance schedules for the 2019 Ocean Plan. Existing compliance schedules in NPDES permits are generally not required to be modified to comply with the Compliance Schedule Policy.

3.3.6. Alaska Rule

On March 30, 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards become effective for CWA purposes (40 CFR § 131.21, 65 Federal Register 24641 (April 27, 2000)). Under the revised regulation (also known as the Alaska Rule), new and revised standards submitted to USEPA after May 30, 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by May 30, 2000, may be used for CWA purposes, whether or not approved by USEPA.

3.3.7. Stringency of Requirements for Individual Pollutants.

This Order contains both technology-based effluent limitations (TBELs) and water quality-based effluent limitations (WQBELs) for individual pollutants. The TBELs consist of restrictions on BOD, TSS, and percent removal of BOD and TSS, which implement the minimum applicable federal technology-based requirements for POTWs. In addition, effluent limitations more stringent than federal technology-based requirements consisting of restrictions on oil and grease, settleable solids, turbidity, and pH are necessary to implement State treatment standards in Table 4 of the 2019 Ocean Plan. This Order's technology-based pollutant restrictions implement the minimum, applicable federal technology-based requirements.

WQBELs for chlorine residual, aldrin, and dieldrin have been scientifically derived to implement WQOs that protect beneficial uses. Both the beneficial uses and the WQOs have been approved pursuant to federal law and are the applicable federal water quality standards. All beneficial uses and WQOs contained in the Basin Plan and the 2019 Ocean Plan were approved under state law and submitted to and approved by USEPA prior to May 30, 2000. Any WQOs and beneficial uses submitted to USEPA prior to May 30, 2000, but not approved by USEPA before that date, are nonetheless “applicable water quality standards for purposes of the CWA” pursuant to 40 CFR section 131.21(c)(1).

WQBELs for DDT and PCBs as aroclors have also been established through the Santa Monica Bay TMDL for DDT and PCBs. Details can be found in section 3.5.8.c of this Fact Sheet.

3.3.8. Antidegradation Policy

Federal regulations at 40 CFR section 131.12 requires that the state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California’s antidegradation policy in State Water Board Resolution 68-16 (“Statement of Policy with Respect to Maintaining High Quality of Waters in California”). Resolution 68-16 is deemed to incorporate the federal antidegradation policy where the federal policy applies under federal law. Resolution 68-16 requires that existing water quality be maintained unless degradation is justified based on specific findings. The Los Angeles Water Board’s Basin Plan implements, and incorporates by reference, both the state and federal antidegradation policies. The permitted discharges are consistent with the antidegradation provision at 40 CFR section 131.12 and State Water Board Resolution 68-16 and is further described in section 4.4.2 of the Fact Sheet.

3.3.9. Anti-Backsliding Requirements

Sections 402(o) and 303(d)(4) of the CWA and federal regulations at 40 CFR section 122.44(l) restrict backsliding in NPDES permits. These anti-backsliding provisions require that effluent limitations in a reissued permit must be as stringent as those in the previous permit, with some exceptions in which limitations may be relaxed. The applicability of these requirements to this Order is discussed in detail in section 4.4.1 of this Fact Sheet.

3.3.10. Endangered Species Act Requirements

This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (ESA) (Fish and Game Code, sections 2050 to 2097) or the Federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). This Order requires compliance with effluent limits, receiving water limits, and other requirements to protect the beneficial uses of waters of the state, including protecting rare and endangered species. The Discharger is responsible for meeting all requirements of the applicable ESA.

3.3.11. Water Recycling

In accordance with statewide policies concerning water reclamation [See, e.g., CWC sections 13000 and 13550-13557, State Water Board Resolution Number 77-1 (Policy with Respect to Water Reclamation in California), and State Water Board Resolution Numbers. 2009-0011, 2013-0003, and 2018-0057 (*Water Quality Control Policy for Recycled Water* (Recycled Water Policy))], the Los Angeles Water Board strongly encourages, wherever practicable, water recycling, water conservation, and use of stormwater and dry-weather urban runoff. The Discharger shall investigate the feasibility of recycling, conservation, and/or alternative disposal methods of wastewater (such as groundwater injection), and/or the use of stormwater and dry-weather runoff.

Section 4.3 of the Order requires the Discharger to submit an update to this feasibility study as part of the submittal of the Report of Waste Discharge (ROWD) for the next permit renewal.

The State Water Board adopted the Recycled Water Policy on February 3, 2009 and amended it most recently on December 11, 2018. The most recent amendments became effective on April 8, 2019. The Recycled Water Policy requires wastewater and recycled water dischargers to annually report monthly volumes of influent, wastewater produced, and effluent, including treatment level and discharge type. As applicable, dischargers are additionally required to annually report recycled water use by volume and category of reuse. The State Water Board issued a Water Code Section 13267 and 13383 Order, Order WQ 2019-0037-EXEC, on July 24, 2019 to amend MRPs for all NPDES permits, WDRs, WRRs, Master Recycling permits, and General WDRs. Annual reports are due by April 30 of each year, and the report must be submitted to GeoTracker. This Order implements the Recycled Water Policy by incorporating the volumetric monitoring reporting requirements in accordance with Section 3 of the Recycled Water Policy (https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/121118_7_final_amendment_oal.pdf) in section 10.4.12 of the MRP in this Order. Accordingly, upon the effective date of this Order, the State Water Board's Order WQ 2019-0037-EXEC will no longer be applicable to the Discharger.

3.3.12. Monitoring and Reporting

40 CFR section 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. Water Code section 13383 authorizes the Los Angeles Water Board to require technical and monitoring reports. The Monitoring and Reporting Program (MRP) establishes monitoring and reporting requirements to implement federal and state requirements. This MRP is provided in Attachment E.

3.3.13. Sewage Sludge/Biosolids Requirements

This Order does not authorize any act that results in violation of requirements administered by USEPA to implement 40 CFR Part 503, Standards for the Use or Disposal of Sewage Sludge. These standards regulate the final use or disposal of sewage sludge that is generated during the treatment of domestic sewage in a municipal wastewater treatment facility. The Permittee Is responsible for meeting all applicable requirements of 40 CFR Part 503 that are under USEPA's enforcement authority.

3.3.14. Domestic Water Quality

In compliance with Water Code section 106.3, it is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.

3.3.15. Pretreatment Requirements

The application of pretreatment requirements is monitored by the Discharger and the permit will be reopened when additional pretreatment requirements are determined to be applicable to the discharge. The Discharger has developed and is implementing a Pretreatment Program that was previously approved by USEPA. This Order requires implementation of the approved Pretreatment Program. JWPCP receives wastewater from 183 categorical industrial user (CIU) permittees, 343 significant industrial user (SIU) permittees, and 667 other industrial users. Any change to the Pretreatment Program shall be reported to the Los Angeles Water Board in writing and shall be approved in accordance with procedures established in 40 CFR § 403.18. The Discharger shall comply with requirements contained in Attachment I – Pretreatment Reporting Requirements.

3.3.16. Standard and Special Provisions

Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR § 122.41, and additional conditions applicable to POTWs in accordance with 40 CFR § 122.42, are provided in Attachment D. The Los Angeles Water Board also included in this Order Special Provisions applicable to the Discharger. The rationale for the Special Provisions contained in this Order is provided in section 8 of this Fact Sheet.

3.4. Impaired Water Bodies on CWA Section 303(d) List

The State Water Board adopted the California 2020 – 2022 Integrated Report based on a compilation of the Regional Water Boards' Integrated Reports. These Integrated Report contain both the Clean Water Act (CWA) section 305(b) water quality assessment and section 303(d) list of impaired waters. In developing the Integrated Reports, the Water Boards solicit data, information, and comments from the public and other interested persons. On January 19, 2022, the State Water Board approved the CWA Section 303(d) List portion of the State's 2020 – 2022 Integrated Report (State Water Board Resolution Number 2022-0006). On May 11, 2022, USEPA approved California's 2020 – 2022 Integrated Report. The CWA section 303(d) list can be found at the following link:

https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2020_2022_integrated_report.html.

Santa Monica Bay (Offshore and Nearshore) is on the 303(d) list for the following pollutants/stressors from point and non-point sources: DDT (tissue & sediment), arsenic, mercury, PCBs (tissue & sediment), and trash. Arsenic and mercury are the only pollutants on the 303(d) list without Total Maximum Daily Loads (TMDLs). The Santa Monica Bay Beaches Bacteria TMDLs were approved by USEPA in 2003, as described in section 3.5.6.a. of this Fact Sheet. The Santa Monica Bay Nearshore and Offshore Debris TMDL was approved by USEPA on March 20, 2012, and more details are provided in section 3.5.8.b. of this Fact Sheet. The Santa Monica Bay TMDL for DDT and PCBs was approved and adopted by USEPA on March 26, 2012 and is further described in section 3.5.8.c of the Fact Sheet.

3.5. Other Plans, Polices and Regulations

3.5.1. Climate Change Adaptation and Mitigation

On March 7, 2017, the State Water Board adopted a resolution in recognition of the challenges posed by climate change that requires a proactive approach to climate change in all State Water Board actions, including drinking water regulation, water quality protection, and financial assistance (Resolution Number 2017-0012). The resolution lays the foundation for a response to climate change that is integrated into all State Water Board actions, by giving direction to the State Water Board divisions and encouraging coordination with the Los Angeles Water Board. The Los Angeles Water Board also adopted "A Resolution to Prioritize Actions to Adapt to and Mitigate the Impacts of Climate Change on the Los Angeles Region's Water Resources and Associated Beneficial Uses" (Resolution Number R18-004) on May 10, 2018. The resolution summarizes the steps taken so far to address the impacts of climate change within the Los Angeles Water Board's programs, and lists a series of additional steps, including the identification of potential regulatory adaptation and mitigation measures that could be implemented on a short-term and long-term basis by each of the Los Angeles Water Board's programs to mitigate the effects of climate change on water resources and associated beneficial uses where possible. This kind of study and management is an important part of planning for the future, as "[m]unicipalities across the country are facing the challenging obligation to manage their aging sewer and stormwater systems at a time of urban population growth, more stringent water quality protection requirements, and increased exposure to climate change-related risks." USEPA, *Asset Management: Incorporating Asset Management Planning Provisions into NPDES Permits* (December 2014). This Order contains provisions to require planning and actions to address climate change impacts in accordance with both the State and Los Angeles Water Board's resolutions.

The Permittee shall develop a Climate Change Effects Vulnerability Assessment and Management Plan (Climate Change Plan) and submit the Climate Change Plan to the Los Angeles Water Board for the Executive Officer's approval no later than 12 months after the effective date of this Order. The Climate Change Plan shall include an assessment of short and long term vulnerabilities of the facility and operations as well as plans to address vulnerabilities of collection systems, facilities, treatment systems, and outfalls for predicted impacts in order to ensure that facility operations are not disrupted, compliance with permit conditions is achieved, and receiving waters are not adversely impacted by discharges. Control measures shall include, but are not limited to, emergency procedures, contingency plans, alarm/notification systems, training, backup power and equipment, and the need for planned mitigations to ameliorate climate-induced impacts including, but not limited to, changing influent and receiving water quality and conditions, as well as the impact of rising sea level (where applicable), wildfires, storm surges and back-to-back severe storms, which are expected to become more frequent. The Permittee shall also identify new or increased threats to the sewer system resulting from climate change that may impact desired levels of service in the next 50 years. The permittee shall project upgrades to existing assets or new infrastructure projects, and associated costs, necessary to meet desired levels of service. Climate change research also indicates the overarching driver of climate change is increased atmospheric carbon dioxide from human activity. The increased carbon dioxide emissions trigger changes to climatic patterns, which increase the intensity of sea level rise and coastal storm surges, lead to more erratic rainfall and local weather patterns, trigger a gradual warming of freshwater and ocean temperatures, and trigger changes to ocean water chemistry. As such, the Climate Change Plan shall also identify steps being taken or planned to address greenhouse gas emissions attributable to wastewater treatment plants, solids handling, and effluent discharge processes.

These requirements are consistent with 40 CFR section 122.41(e), requiring permittees to ensure compliance through proper operation and maintenance of facilities, including installation and operation of appropriate auxiliary and backup facilities; and they are authorized pursuant to Water Code section 13383. (*In re the City of Oceanside, Fallbrook Public Utilities Dist. And the Southern California Alliance of Publicly Owned Treatment Works*, State Water Board Order WQ 2021-0005, February 12, 2021 at p. 26.) The Los Angeles Water Board understands that the cost of preparing such a plan could be significant (estimated cost range of $25,000-$60,000), but "the costs of ensuring resilient infrastructure to protect water quality against the effects of climate change is warranted." (*Fallbrook,* at p. 27.).

3.5.2. Secondary Treatment Regulations

40 CFR part 133 establishes the minimum levels of effluent quality to be achieved by secondary treatment. These limitations, established by USEPA, are incorporated into this Order, except where more stringent limitations are required by other applicable plans, policies, or regulations or to prevent backsliding.

3.5.3. Stormwater

CWA section 402(p), as amended by the Water Quality Act of 1987, requires NPDES permits for stormwater discharges. Pursuant to this requirement, in 1990, USEPA promulgated 40 CFR section 122.26 that established requirements for stormwater discharges under an NPDES program. To facilitate compliance with federal regulations, on November 1991, the State Water Board issued a statewide general permit, *General Permit for Storm Water Discharges Associated with Industrial Activities* (Order Number 2014-0057-DWQ amended by Order 2015-0122-DWQ and Order 2018-0028-DWQ, NPDES No. CAS000001). General NPDES Permit Number CAS000001 has been amended and reissued several times since 1991, and most recently on November 6, 2018. The latest amendment became effective on July 1, 2020.

General NPDES No. CAS000001 is applicable to stormwater discharges from JWPCP's premises. The Discharger certified a Notice of Intent (WDID 4 19I007080) to comply with the requirements of General NPDES No. CAS000001, which became effective July 1, 2015.

Stormwater runoff from JWPCP is collected and discharged to JWPCP's headworks or the sewer during normal operation and potentially to the Wilmington Drain flood control channel during heavy rainfall. The Discharger developed and currently implements a Storm Water Pollution Prevention Plan (SWPPP) to comply with the requirements of NPDES Permit No. CAS000001.

3.5.4. Sanitary Sewer Overflows (SSOs)

The CWA prohibits the discharge of pollutants from point sources to surface waters of the United States unless authorized under an NPDES permit. (33 United States Code (USC) sections 1311 and 1342). On December 6, 2022, the State Water Board issued the Statewide *General Waste Discharge Requirements for Sanitary Sewer Systems* (SSS WDRs, State Water Board Order No. WQ 2022-0103-DWQ). Order No. WQ 2022-0103-DWQ supersedes the previous SSS WDRs (Order 2006-0003-DWQ and its subsequent amendments). The SSS WDRs require public agencies that own or operate sanitary sewer systems with greater than one mile of sewer lines to enroll for coverage, comply with requirements to develop and implement sewer system management plans, and report all SSOs to the State Water Board's online SSO database. In October 2006, the Permittee enrolled in the SSS WDRs.

Regardless of the coverage obtained under the SSS WDRs, the Discharger's collection system is part of the POTW that is subject to this NPDES permit. As such, pursuant to federal regulations, the Discharger must properly operate and maintain its collection system (40 CFR section 122.41 (e)), report any noncompliance (40 CFR section 122.41(1)(6) and (7)), and mitigate any discharge from the collection system in violation of this NPDES permit (40 CFR section 122.41(d)).

The requirements contained in this Order in sections 7.3.3.b (Spill Cleanup Contingency Plan section), 7.3.4 (Construction, Operation and Maintenance Specifications section), and 7.3.6 (Spill Reporting Requirements section) are consistent with the requirements of the SSS WDRs. The Los Angeles Water Board recognizes that there may be some overlap between these NPDES permit provisions and SSS WDRs requirements, related to the collection systems. The requirements of the SSS WDRs are considered the minimum thresholds. To encourage efficiency, the Los Angeles Water Board will accept the documentation prepared by the permittees under the SSS WDRs for compliance purposes as satisfying the requirements in sections 7.3.3.b, 7.3.4, and 7.3.6, provided the more stringent provisions contained in this NPDES permit are also addressed in the SSS WDRs submission. Pursuant to the SSS WDRs, Order No. WQ 2022-0103-DWQ section 6.2, the provisions of this NPDES permit supersede the SSS WDRs, for all purposes, including enforcement, to the extent the requirements may be deemed duplicative. The requirements of this Order are more stringent than the SSS WDRs because in addition to the SSS WDRs requirements, this NPDES permit requires water quality monitoring of the receiving water when a spill reaches the surface water.

3.5.5. Watershed Management

This Los Angeles Water Board has been implementing a Watershed Management Approach (WMA) to address water quality protection in the Los Angeles Region, as detailed in the Watershed management initiative (WMI). The WMI is designed to integrate various surface and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed. It is also designed to focus limited resources on key issues and use sound science. Information about watersheds in the region can be obtained at the Los Angeles Water Board's website at http://www.waterboards.ca.gov/losangeles/water_issues/programs/regional_program/watershed/index.shtml. The WMA emphasizes cooperative relationships between regulatory agencies, the regulated community, environmental groups, and other stakeholders in the watershed to achieve the greatest environmental improvements with the resources available.

This Order fosters implementation of the WMA by protecting beneficial uses in the watershed and requiring the Discharger to participate with other stakeholders in the development and implementation of a watershed-wide monitoring program. The Monitoring and Reporting Program requires the discharger to participate in regional monitoring programs in the Southern California Bight.

3.5.6. Relevant TMDLs

Section 303(d) of the CWA requires states to identify water bodies that do not meet water quality standards and then to establish TMDLs for each waterbody for each pollutant of concern. TMDLs identify the maximum amount of pollutants that can be discharged to waterbodies without causing violations of water quality standards.

a. **Santa Monica Bay Beaches Bacteria Total Maximum Daily Loads (TMDLs).** The Los Angeles Water Board has adopted two TMDLs to reduce bacteria at Santa Monica Bay beaches during dry and wet weather. The Los Angeles Water Board adopted the Dry Weather and Wet Weather TMDLs on January 24, 2002 and December 12, 2002, respectively (Resolution Nos. 2002-004 and 2002-022). These TMDLs were approved by the State Water Board, State OAL and USEPA Region 9 and became effective on July 19, 2003. These TMDLs were revised by the Los Angeles Water Board on June 7, 2012. The revisions were approved by State Water Board, State OAL, and USEPA Region 9 and became effective on July 2, 2014. The TMDLs are included in Chapter 7-4 of the Basin Plan.

   In these TMDLs, waste load allocations (WLAs) are expressed as the number of sample days at a shoreline monitoring site that may exceed the single sample targets for total coliform, fecal coliform, and *Enterococcus* identified under "Numeric Target" in the TMDLs. WLAs are expressed as allowable exceedance days because the bacterial density and frequency of single sample exceedances are the most relevant to public health protection at beaches. The final shoreline compliance point for the WLAs in the TMDLs is the wave wash where there is a freshwater outlet (i.e., publicly owned storm drains or natural creek) to the beach, or at ankle depth at beaches without a freshwater outlet.

   The JOS, as the owner of JWPCP, is identified as a responsible jurisdiction in these TMDLs. In these TMDLs, JWPCP is assigned a WLA of zero days of exceedance of the single sample bacterial objectives during all three identified periods – summer dry weather, winter dry weather and wet weather. JWPCP's WLA of zero exceedance days requires that no discharge from its outfalls cause or contribute to any exceedances of the single sample bacteria objectives at the shoreline compliance points identified in the TMDL and subsequently approved Coordinated Shoreline Monitoring Plan (dated April 7, 2004) submitted by responsible agencies and jurisdictions under the TMDLs. The shoreline monitoring data collected as part of the Los Angeles County MS4 Order Number R4-2012-0175 will be used to demonstrate compliance with the WLAs in these TMDLs.

b. **Santa Monica Bay Inshore and Offshore Debris TMDL**. The Los Angeles Water Board adopted the Santa Monica Bay Inshore and Offshore Debris TMDL on November 04, 2010, to eliminate trash in the Santa Monica Bay. The WLAs assigned in this TMDL are applicable to Municipal Separate Storm Sewer System (MS4) permittees. These WLAs are implemented through the Regional MS4 Permit (Order Number R4-2021-0105).

c. **Santa Monica Bay TMDL for DDTs and PCBs**. The USEPA adopted the *Santa Monica Bay Total Maximum Daily Loads for DDT and PCBs* on March 26, 2012. The concentrations of DDT and PCBs in the wastewater effluent are currently at or near the detection limits; however, due to historic discharges of DDT and PCBs to the Santa Monica Bay, these constituents continue to persist in the environment, particularly in the ocean sediments. The concentrations of PCBs and DDT in surface sediments have decreased substantially since the 1970s as much of the contamination has been carried away by currents, buried below the active sediment layer, or degraded as a result of natural processes. Despite the decreasing trend, the concentrations of DDT and PCBs in surface sediments today are at levels that can still accumulate in fish tissues at levels of concern for safe human health consumption. JWPCP is identified as a responsible jurisdiction in this TMDL and as such, the TMDL sets Average Monthly and Average Annual WLAs for DDT and PCBs for JWPCP. These WLAs have been incorporated into this Order as final effluent limitations.

3.5.7. Environmental Justice and Advancing Racial Equity

When issuing or reissuing individual waste discharge requirements or waivers of waste discharge requirements that regulate activity or a facility that may impact a disadvantaged or tribal community, and that includes a time schedule in accordance with subdivision (c) of Section 13263 for achieving an applicable water quality objective, an alternative compliance path that allows time to come into compliance with water quality objectives, or a water quality variance, the regional board shall make a finding on potential environmental justice, tribal impact, and racial equity considerations. (Water Code § 13149.2, effective Jan. 1, 2023) This Order does not include a time schedule. Nevertheless, in accordance with the Water Boards' efforts to advance racial equity, the Order requires all Permittees to meet water quality standards to protect public health and the environment, thereby benefitting all persons and communities within the Region. The Los Angeles Water Board is committed to developing and implementing policies and programs to advance racial equity and environmental justice so that race can no longer be used to predict life outcomes, and outcomes for all groups are improved.

4. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. There are two principal bases for effluent limitations: 1) 40 CFR section 122.44(a) requires that permits include applicable technology-based limitations and standards (TBELs) and standards; and 2) 40 CFR section 122.44(d) requires that permits include WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water. Where numeric water quality objectives have not been established, 40 CFR § 122.44(d) specifies that WQBELs may be established using USEPA criteria guidance under CWA section 304(a); proposed State criteria or a State policy interpreting narrative criteria supplemented with other relevant information may be used; or an indicator parameter may be established.

The variety of potential pollutants present in the Facility discharge presents a potential for aggregate toxic effects to occur. Whole effluent toxicity (WET) is an indicator of the combined effect of pollutants contained in the discharge. Chronic toxicity is a more stringent requirement than acute toxicity. Therefore, chronic toxicity is considered a pollutant of concern for protection and evaluation of narrative Basin Plan Water Quality Objectives for toxicity.

4.1. Discharge Prohibitions

This permit implements discharge prohibitions that are applicable under section III.I of the 2019 Ocean Plan.

4.2. Technology-Based Effluent Limitations (TBELs)

4.2.1. Scope and Authority

Technology-based effluent limits require a minimum level of treatment for industrial/municipal point sources based on currently available treatment technologies while allowing the Permittee to use any available control techniques to meet the effluent limits. The 1972 CWA required POTWs to meet performance requirements based on available wastewater treatment technology. Section 301 of the CWA established a required performance level (referred to as “secondary treatment”) that all POTWs were required to meet by July 1, 1977. More specifically, section 301(b)(1)(B) of the CWA required that USEPA develop secondary treatment standards for POTWs as defined in section 304(d)(1). Based on this statutory requirement, USEPA developed national secondary treatment regulations which are specified in 40 CFR part 133. These technology-based regulations apply to all POTWs and identify the minimum level of effluent quality to be attained by secondary treatment in terms of $BOD_5$20°C, TSS, and pH.

4.2.2. Applicable TBELs

Section 301(b) of the CWA and implementing USEPA permit regulations at 40 CFR § 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and more stringent effluent limitations necessary to meet minimum federal technology-based requirements based on Secondary Standards at 40 CFR § 133 and Best Professional Judgment (BPJ) in accordance with 40 CFR § 125.3. Secondary treatment is defined in terms of three parameters – $BOD_5$20°C, TSS, and pH. The removal efficiency for $BOD_5$20°C and TSS is set at the minimum level attainable by secondary treatment technology. The following table summarizes the technology-based requirements for secondary treatment, which are applicable to the Facility:

Table F-6. Summary of TBELs in 40 CFR §133.102

Parameter	Units	30-Day Average	7-Day Average	Instan. Min.	Instan. Max.
$BOD_5$20°C	mg/L	30	45	--	--
TSS	mg/L	30	45	--	--
Removal Efficiency for BOD and TSS	%	≥85	--	--	--
pH	pH Unit	--	--	6.0	9.0

Also, Table 4 of the 2019 Ocean Plan establishes the following TBELs, which are applicable to JWPCP:

Table F-7. Summary of TBELs for POTWs Established by the 2019 Ocean Plan

Parameter	Units	AMEL	AWEL	Instan. Min.	Instan. Max.	Note
Oil & Grease	mg/L	25	40	--	75	--
Settleable Solids	mL/L	1.0	1.5	--	3.0	--
Turbidity	NTU	75	100	--	225	--
Removal Efficiency for TSS	%	75	--	--	--	a
pH	pH Unit	--	--	6.0	9.0	--

Footnotes for Table F-7

a. Dischargers shall, as a 30-day average, remove 75% of suspended solids from the influent stream before discharging wastewaters to the ocean, except that the effluent limitation to be met shall not be lower than 60 mg/L.

End of Footnotes for Table F-7

All TBELs from Order Number R4-2017-0180 for $BOD_5$20°C, TSS, oil and grease, settleable solids, pH, and turbidity, are retained in this Order. Limitations for $BOD_5$20°C, TSS, and pH are based on secondary treatment standards established by the USEPA at 40 CFR § 133. Limitations for oil and grease, settleable solids, pH and turbidity are based on requirements in the 2019 Ocean Plan. Since the average monthly, average weekly, and maximum daily limitations for settleable solids and oil and grease in Order No. R4-2017-0180 are more stringent than those established by the 2019 Ocean Plan, these limitations in Order No. R4-2017-0180 are carried over to this Order to prevent backsliding. All TBELs are independent of the dilution ratio for the discharge outfall. In addition to the concentration-based effluent limitations, mass-based effluent limitations based on a flow rate of 385 MGD, which was used in Orders R4-2011-0151 and R4-2017-0180, are also included in this Order to prevent backsliding.

The following table summarizes the TBELs for the discharger from the JWPCP:

Table F-8. Summary of TBELs for Discharge Point 001 and 002

Parameter	Units	AMEL	AWEL	MDEL	Instan. Min.	Instan. Max.	Note
$BOD_5 20^0C$	mg/L	30	45	--	--	--	--
$BOD_5 20^0C$	lbs/day	96,300	144,500	--	--	--	a
$BOD_5 20^0C$	% removal	85	--	--	--	--	--
TSS	mg/L	30	45	--	--	--	--
TSS	lbs/day	96,300	144,500	--	--	--	a
TSS	% removal	85	--	--	--	--	--
Oil and Grease	mg/L	15	22.5	45	--	75	--
Oil and Grease	lbs/day	48,200	72,200	144,500	--	240,800	a
Settleable Solids	mL/L	0.5	0.75	1.5	--	3.0	--
Turbidity	NTU	75	100	--	--	225	--
pH	pH unit	--	--	--	6.0	9.0	--

Footnotes for Table F-8

a. The mass emission rates are calculated using the 1997 average influent design flow of 385 MGD, consistent with the water quality-based limits in the previous permit: lbs/day = 0.00834 x C_e (effluent concentration, ug/L) x Q (flow rate, MGD).

End of Footnotes for Table F-8

4.3. Water Quality-Based Effluent Limitations (WQBELs)

4.3.1. Scope and Authority

CWA Section 301(b) and 40 CFR section 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards. This Order contains more stringent requirements than technology-based requirements, including secondary-treatment requirements, which are necessary to meet applicable water quality standards. The rationale for these requirements is discussed beginning in section 4.3.2. of this Fact Sheet.

40 CFR section 122.44(d)(1)(i) requires that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including

numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in section 122.44(d)(1)(vi). WQBELs must also be consistent with the assumptions and requirements of TMDL WLAs approved by USEPA.

The process for determining reasonable potential and calculating WQBELs when necessary is intended to protect the designated uses of the receiving water as specified in the Basin Plan and achieve applicable WQOs and criteria that are contained in other state plans and policies, or any applicable water quality criteria contained in the 2019 Ocean Plan.

4.3.2. Applicable Beneficial Uses and Water Quality Criteria and Objectives

The Basin Plan and Ocean Plan establish the beneficial uses and WQOs for ocean waters of the State. The beneficial uses of the receiving waters affected by the discharge have been described previously in this Fact Sheet. The Basin Plan contains Water Quality Objectives for bacteria for water bodies designated for water contact recreation and the Ocean Plan contains water quality objectives for bacterial, physical, chemical, and biological characteristics, and radioactivity. The WQOs from the Ocean Plan and Basin Plan were incorporated into this Order as either final effluent limitations (based on reasonable potential) or receiving water limitations.

4.3.3. Expression of WQBELs

Pursuant to 40 CFR § 122.45(d)(2) for POTW continuous discharges, all permit effluent limitations, standards, and prohibitions, including those necessary to achieve water quality standards, shall, unless impracticable, be stated as average weekly and average monthly discharge limitations. It is impracticable to include only average weekly and average monthly effluent limitations in the Order because a single daily discharge of certain pollutants, in excess amounts, can cause violations of WQOs. The effects of pollutants on aquatic organisms are often rapid. For many pollutants, an average weekly or average monthly effluent limitation alone is not sufficiently protective of beneficial uses. As a result, maximum daily effluent limitations, as referenced in 40 CFR § 122.45(d), are included in the Order for certain constituents.

The WQBELs for marine aquatic life toxics contained in this Order are based on Table 3 Water Quality Objectives contained in the 2019 Ocean Plan that are expressed as six-month median, daily maximum, and instantaneous maximum water quality objectives. However, in the existing Order (Order Number R4-2017-0180), many of the calculated effluent limitations based on 6-month median objectives for marine aquatic life toxics in the 2019 Ocean Plan were prescribed as monthly average limitations. Applying the anti-backsliding regulations, this Order retains the same approach and sets effluent limitations derived from six-month median water quality objectives for marine aquatic life toxics in the 2019 Ocean Plan as average monthly limitations for those pollutants that previously had average monthly limitations and continue to have reasonable potential to cause or contribute to exceedances of water quality objectives. In addition, the 2019 Ocean Plan specifies that for the six-month median for intermittent discharges, the daily value shall be considered to equal zero for days on which no discharge occurred. To be consistent with the 2019 Ocean Plan, maximum daily and instantaneous maximum limitations are also prescribed in this Order.

4.3.4. Determining the Need for WQBELs

Order Number R4-2017-0180 contains effluent limitations for non-conventional and toxic pollutant parameters in Table 3 of the 2019 Ocean Plan. For this Order, the need for effluent limitations based on water quality objectives in Table 3 of the 2019 Ocean Plan was reevaluated in accordance with the Reasonable Potential Analysis (RPA) procedures contained in Appendix VI of the 2019 Ocean Plan. This statistical RPA method (using RPcalc version 2.2) accounts for the averaging period of the water quality objective, accounts for and captures the long-term variability of the pollutant in the effluent, accounts for limitations associated with sparse data sets, accounts for uncertainty associated with censored data sets, and assumes a lognormal distribution of the facility-specific effluent data. RPcalc calculates the upper confidence bound (UCB) of an effluent population percentile after complete mixing. The UCB is calculated as the one-sided, upper 95 percent confidence bound for the 95th percentile of the effluent distribution after complete mixing. The calculated UCB95/95 is then compared to the appropriate objective to determine the potential for an exceedance of that objective and the need for an effluent limitation. For constituents that have an insufficient number of monitoring data or a substantial number of non-detected data with a reporting limit higher than the respective water quality objective, the RPA result is likely to be inconclusive. The 2019 Ocean Plan requires that the existing effluent limitations for these constituents be retained in the new Order, otherwise the permit shall include a reopener clause to allow for subsequent modification of the permit to include an effluent limitation if monitoring establishes that the discharge causes, has the reasonable potential to cause, or contributes to an excursion above a WQO.

For Discharge Points 001 and 002, all data was not detected and below the water quality objective; therefore inconclusive results were reported for endosulfan, endrin, HCH, acrolein, bis(2-chloroethoxy)methane, bis(2-chloroisopropyl)ether, chlorobenzene, di-n-butyl-phthalate, dichlorobenzenes, diethyl phthalate, dimethyl phthalate, 2-methyl-4,6-dinitrophenol, 2,4-dinitrophenol, ethylbenzene, fluoranthene, hexachlorocyclopentadiene, nitrobenzene, toluene, tributyltin, 1,1,1-trichloroethane, acrylonitrile, benzene, bis(2-chloroethyl)ether, bis(2-ethylexyl)phthalate, carbon tetrachloride, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethylene, 1,3-dichloropropene, 2,4-dinitrotoluene, 1,2-diphenylhydrazine, halomethanes, heptachlor, heptachlor epoxide, hexachlorobutadiene, hexachloroethane, isophorone, n-nitrosodiphenylamine, PAHs1,1,2,2-tetrachloroethane, tetrachloroethylene, trichloroethylene, 1,1,2-trichloroethane, 2,4,6-trichlorophenol, and vinyl chloride. Since the previous permit did not include effluent limits for these pollutants and this Order includes a reopener clause, no effluent limits were included in this Order for these pollutants. The final effluent limitations for benzidine, chlordanes, 3,3'dichlorobenzidine, hexachlorobenzene, TCDD equivalents, and toxaphene (Discharge Points 001 and 002) were carried over from the previous permit because all data was not detected, and the detection limits used for these pollutants were greater than their Ocean Plan water quality objectives. This is consistent with the Ocean Plan, Appendix VI. The pollutants have not been detected in the final effluent, and the Discharger has made, and continues to make, an effort to achieve lower detection limits than are required in the 2019 Ocean Plan or 40 CFR part 136. The Los Angeles Water Board developed WQBELs for DDT and PCBs as aroclors that have available wasteload allocations under the *Santa Monica Bay Total Maximum Daily Loads for DDTs and PCBs* established for the JWPCP. The Los Angeles Water Board developed WQBELs for these pollutants pursuant to 40 CFR section 122.44(d)(1)(vii), which does not require or contemplate a separate reasonable potential analysis at the permitting stage.

Los Angeles Water Board staff used RPCalc to calculate reasonable potential using the procedure described above. The analysis included effluent data provided by the Discharger from November 2017 to June 2022 for the four outfalls, and minimum initial dilution ratios of 166:1 for Outfalls 001 and 002, 150:1 for Outfall 003, and 115:1 for Outfall 004. Los Angeles Water Board staff determined that the following constituents have reasonable potential to exceed 2019 Ocean Plan Water Quality Objectives and therefore require effluent limitations for the following pollutants at each discharge point: chlorine residual, aldrin, total DDT, dieldrin, and PCBs as aroclors.

In general, for those constituents that have no reasonable potential to cause, or contribute to excursions of water quality objectives, no numeric limits are prescribed; instead, a narrative statement to comply with all 2019 Ocean Plan requirements is provided and the Discharger is required to monitor for these constituents to gather data for use in RPAs for future Order renewals and/or updates. Refer to Attachment H of this Order for more details about the RPA results.

4.3.5. WQBEL Calculations

From the Table 3 water quality objectives in the 2019 Ocean Plan, effluent limitations are calculated according to the following equation for all pollutants, except for acute toxicity (if applicable) and radioactivity:

Ce = Co + Dm (Co - Cs)

Where

Ce is the effluent limitation (µg/L);

Co is the WQO to be met at the completion of initial dilution (µg/L);

Cs is the background seawater concentration (µg/L) (see Table F-12 below); and

Dm is the minimum probable initial dilution expressed as parts seawater per part wastewater.

The Dm is based on observed waste flow characteristics, receiving water density structure, and the assumption that there are no currents of sufficient strength to influence the initial dilution process flow across the discharge structure. In this Order, dilution ratios of 166:1, 150:1, and 115:1 have been applied to Outfalls 001 and 002, Outfall 003, and Outfall 004, respectively.

Initial dilution is the process that results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge. For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from the submarine outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally. As site-specific water quality data is not available for pollutants without TMDLs, in accordance with 2019 Ocean Plan Table 3 implementing procedures, Cs equals zero for all pollutants, except the following:

Table F-9. Background Seawater Concentrations (Cs)

Waste Constituent	Background Seawater Concentrations (Cs)
Arsenic	3
Copper	2
Mercury	0.0005
Silver	0.16
Zinc	8
For all other Table 3 parameters	0

The *Santa Monica Bay Total Maximum Daily Loads for DDTs and PCBs* (USEPA, 2012) includes estimated background concentrations for DDTs and PCBs of 0.057 ng/L and 0.016 ng/L, respectively. These concentrations were used in the development of Waste Load Allocations for these pollutants.

The effluent data collected between November 2017 and June 2022 used for RPcalc indicated that chlorine residual, aldrin, and dieldrin contributed to an exceedance of the ocean water quality objectives specified in the 2019 California Ocean Plan. Effluent limitations must be developed for chlorine residual, aldrin, and dieldrin. Therefore, the calculation of WQBELs for chlorine residual, aldrin, and dieldrin are provided below for Discharge Points 001 and 002.

Table F-10. 2019 Ocean Plan WQOs (C_o)

Constituent	Unit	6-Month Median	30-Day Average	Daily Maximum	Instan. Maximum
Chlorine Residual	µg/L	2	--	8	60
Aldrin	µg/L	--	0.000022	--	--
Dieldrin	µg/L	--	0.00004	--	--

Using the equation, **Ce=Co + Dm (Co-Cs),** effluent limitations are calculated as follows for discharge through Discharge Points 001 and 002, with a dilution ratio

(Dm) of 166:1. A similar procedure is followed for calculating additional limits, when necessary, for Discharge Points 003 and 004.

Chlorine Residual

Ce = 2 + 166 (2 - 0) = 334 μg/L≈ 330 μg/L (6 Month Median as Monthly Average)

Ce = 8 + 166 (8 - 0) = 1,340 μg/L ≈ 1,300 μg/L (Daily Maximum)

Ce = 20 + 166 (60 - 0) = 10,020 ≈ 10,000 μg/L (Instantaneous Maximum)

Aldrin

Ce = 0.000022 + 166 × (0.000022 - 0) = 0.003674 μg/L ≈ 0.0037 μg/L (Monthly Average)

Dieldrin

Ce = 0.00004 + 166 × (0.00004 - 0) = 0.00668 μg/L ≈ 0.0067 μg/L (Monthly Average)

Based on the implementing procedures described above, effluent limitations have been calculated for all Table 3 pollutants (excluding radioactivity and chronic toxicity) from the 2019 Ocean Plan that have reasonable potential to cause, or contribute to an excursion above the WQOs, and the calculated effluent limitations are incorporated into this Order when applicable.

4.3.6. Whole Effluent Toxicity (WET)

Whole effluent toxicity (WET) testing protects receiving waters from the aggregate toxic effect of a mixture of pollutants in the effluent or pollutants that are not typically monitored. An acute toxicity test is conducted over a short time period and measures mortality. A chronic toxicity test is conducted over a longer time period and may measure mortality, reproduction, and growth. Chronic toxicity is a more stringent requirement than acute toxicity. A constituent present at low concentrations may exhibit a chronic effect; however, a higher concentration of the same constituent may be required to produce an acute effect.

A total of 56 chronic WET tests were conducted on JWPCP effluent between November 2017 and June 2022. No exceedances of the MDEL were reported for chronic toxicity. However, because of the nature of industrial discharges into the POTW sewershed, it is possible that toxic constituents could be present in the JWPCP influent or could have synergistic or additive effects. As previously stated in this Order, the JWPCP receives wastewater from 1,240 total industrial users with active permits, including 193 CIUs, 356 noncategorical SIUs, and 691 non-SIUs. Los Angeles Water Board staff determined that, pursuant to Step 13 of the RPA procedures in the 2019 Ocean Plan (i.e., best professional judgement), reasonable potential exists for chronic toxicity. Thus, this Order carries over the chronic toxicity MDEL for Discharge Point 001 and Discharge Point 002 from the existing permit.

The 2019 Ocean Plan addresses the application of chronic and acute toxicity requirements based on minimum probable dilutions (Dm) for ocean discharges. Following the 2019 Ocean Plan, dischargers are required to conduct chronic toxicity monitoring for ocean discharges with Dm factors ranging from 99 to 349 and the Los

Angeles Water Board may require acute toxicity monitoring in addition to chronic toxicity monitoring. Dischargers with D_m factors below 99 are required to conduct only chronic toxicity testing. The Dm for Discharge Points 001 and 002 is 166, for Discharge Point 003 is 150 and for Discharge Point 004 is 115. The Dm is more than 99 for all outfalls, and because the discharge does exhibit reasonable potential to exceed the water quality objectives for chronic toxicity, a chronic toxicity final effluent limitation has been assigned to Discharge Points 001 and 002. No acute toxicity final effluent limitations have been assigned to Discharge Point 001 or Discharge Point 002 consistent with 40 CFR § 122.44(d)(1)(v), and because the chronic toxicity final effluent limitation is protective of both chronic and acute toxicity.

The 2019 Ocean Plan establishes a daily maximum chronic toxicity objective of 1.0 TU_c (TU_c=100/(No Observed Effect Concentration (NOEC))), using a 5-concentration hypothesis test, and a daily maximum acute toxicity objective of 0.3 TU_a (TU_a = 100/LC50), using a point estimate model. This Order includes final effluent limitations using the Test of Significant Toxicity (TST) hypothesis testing approach. This statistical approach is consistent with the 2019 Ocean Plan in that it provides maximum protection to the environment since it more reliably identifies acute and chronic toxicity than the current NOEC hypothesis-testing approach (See 2019 California Ocean Plan, Section III.F and Appendix I).

Compliance with the chronic toxicity requirements contained in this Order shall be determined in accordance with section 8.10 of this Order. Nevertheless, this Order contains a reopener to allow the Los Angeles Water Board to modify the permit in the future, if necessary, to make it consistent with any new policy, plan, law, or regulation.

For this Order, chronic toxicity in the discharge is evaluated using a maximum daily effluent limitation that utilizes USEPA's 2010 TST hypothesis testing approach. The chronic toxicity effluent limitations are expressed as "Pass" for each maximum daily individual result.

In January 2010, USEPA published a guidance document titled *EPA Regions 8, 9 and 10 Toxicity Training Tool*, which among other things discusses permit limit expression for chronic toxicity. The document acknowledges that NPDES regulations at 40 CFR § 122.45(d) require that all permit limits be expressed, unless impracticable, as an Average Weekly Effluent Limitation (AWEL) and an Average Monthly Effluent Limitation (AMEL) for POTWs. Following Section 5.2.3 of the Technical Support Document (TSD), the use of an AWEL is not appropriate for WET. In lieu of an AWEL for POTWs, USEPA recommends establishing a Maximum Daily Effluent Limitation (MDEL) for toxic pollutants and pollutants in water quality permitting, including WET. For an ocean discharge, this is appropriate because the 2019 Ocean Plan only requires a MDEL and does not include AMELs or AWELs for chronic toxicity (See 2019 California Ocean Plan, section II.D.7.).

The MDEL is the highest allowable value for the discharge measured during a calendar day or 24-hour period representing a calendar day. The AMEL is the highest allowable value for the average of daily discharges obtained over a calendar month. For WET, this is the average of individual WET test results for that calendar month. In June 2010, USEPA published another guidance document titled *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, June 2010), in which they recommend the following: "*Permitting authorities should consider adding the TST approach to their implementation procedures for analyzing valid WET data for their current NPDES WET Program*." The TST approach is another statistical option for analyzing valid WET test data. Use of the TST approach does not result in any changes to USEPA's WET test methods. Section 9.4.1.2 of *USEPA's Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/0136,1995), recognizes that, "*the statistical methods recommended in this manual are not the only possible methods of statistical analysis*." The TST approach can be applied to acute (survival) and chronic (sublethal) endpoints and is appropriate to use for both freshwater and marine USEPA WET test methods.

The interpretation of the measurement result from USEPA's TST statistical approach (Pass/Fail) for effluent and receiving water samples is, by design, independent from the concentration-response patterns of the toxicity tests for samples when it is required. Therefore, when using the TST statistical approach, application of USEPA's 2000 guidance on effluent and receiving waters concentration-response patterns will not improve the appropriate interpretation of TST results as long as all Test Acceptability Criteria and other test review procedures – including those related to Quality Assurance for effluent and receiving water toxicity tests, reference toxicant tests, and control performance (mean, standard deviation, and coefficient of variation) – described by the WET test methods manual and TST guidance, are followed. The 2000 guidance may be used to identify reliable, anomalous, or inconclusive concentration-response patterns and associated statistical results to the extent that the guidance recommends review of test procedures and laboratory performance already recommended in the WET test methods manual. The guidance does not apply to single concentration (IWC) and control statistical t-tests and does not apply to the statistical assumptions on which the TST is based. The Los Angeles Water Board and USEPA will not consider a concentration-response pattern as sufficient basis to determine that a TST t-test result for a toxicity test is anything other than valid, absent other evidence. In a toxicity laboratory, unexpected concentration-response patterns should not occur with any regular frequency and consistent reports of anomalous or inconclusive concentration-response patterns or test results that are not valid will require an investigation of laboratory practices.

Any Data Quality Objectives or Standard Operating Procedure used by the toxicity testing laboratory to identify and report valid, invalid, anomalous, or inconclusive effluent or receiving water toxicity test measurement results from the TST statistical approach which include a consideration of concentration-response patterns and/or Percent Minimum Significant Differences (PMSDs) must be submitted for review by the Los Angeles Water Board, in consultation with USEPA and the State Water Board's Quality Assurance Officer and Environmental Laboratory Accreditations Program (40 CFR § 122.44(h)). The PMSD criteria only apply to compliance for NOEC and the sublethal endpoints of the NOEC, and therefore are not used to interpret TST results.

4.4. Final Effluent Limitation Considerations

4.4.1. Anti-Backsliding Requirements

In conformance with reasonable potential analysis procedures identified in State Water Board and USEPA documents, effluent limitations for some constituents are not carried forward in this Order because there is no reasonable potential for the constituents to cause or contribute to an exceedance of water quality standards. Without reasonable potential, there is no longer a need to maintain prior WQBELs under NPDES regulations, anti-backsliding provisions, and antidegradation policies. The accompanying monitoring and reporting program requires continued data collection and if monitoring data show reasonable potential for a constituent to cause or contribute to an exceedance of water quality standards, the Order may be reopened to incorporate WQBELs. Such an approach ensures that the discharge will adequately protect water quality standards for designated beneficial uses and conform with antidegradation policies and anti-backsliding provisions.

The final effluent limitations in this Order are at least as stringent as the effluent limitations in the previous Order, Order Number R4-2017-0180.

4.4.2. Antidegradation Policies

CWA section 403(c) and implementing regulations at 40 CFR part 125, subpart M, establish ocean discharge criteria for preventing unreasonable degradation of the marine environment of the territorial seas, contiguous zones, and oceans. The regulations at 40 CFR section 125.122(b) allow a permitting authority to presume that a discharge will not cause unreasonable degradation for specific pollutants or conditions if the discharge complies with state water quality standards. This Order implements State water quality standards for discharges from Discharge Points 001, 002, 003, and 004. This Order's requirements are consistent with the Ocean Plan, except for the units for chronic toxicity. In all other respects, the Los Angeles Water Board presumes that the discharge will not cause unreasonable degradation.

This Order includes both narrative and numeric final effluent limitations, receiving water limitations, performance goals, and mass emission benchmarks to maintain the chemical, physical, and biological characteristics, and to protect the beneficial uses of the receiving water. These requirements ensure that all water quality objectives are being met outside the zone of initial dilution, thereby maintaining the beneficial uses. The Ocean Plan allows for minimal degradation within the zone of initial dilution if the water quality objectives are maintained just outside the zone of initial dilution. The State Water Board has already determined that the minimal degradation permitted by the Ocean Plan is consistent with the antidegradation policy because it maintains maximum benefit to the people of the State, it will not unreasonably affect the present and anticipated beneficial uses, and it will not result in water quality less than that prescribed in the policies.

This Order includes a reopener provision that permits the Los Angeles Water Board to reopen the Order if the effluent exhibits reasonable potential to exceed the objectives during the Order cycle. The Los Angeles Water Board may modify the terms of this Order to prevent degradation of high-quality waters based on any change in the concentration of these constituents in the effluent or receiving water that indicates that a degradation of receiving water quality may occur. The treatment required by this Order is the best practicable treatment or control of the discharge necessary to assure that a pollution or nuisance will not occur and the highest water quality consistent with maximum benefit to the people of the State will be maintained.

The mass-based final effluent limitations and mass emission benchmarks continue to be based on the 1997 average design flow rate of 385 MGD, even though the design flow rate has been 400 MGD since full secondary treatment was implemented. The increased treatment capacity was accompanied by a significant improvement in the final effluent quality; therefore, the treatment plant was able to continue meeting the mass-based final effluent limitations. Since the mass-based final effluent limitations continue to be based on a lower flow rate than is permitted to be discharged, the quantity of pollutants discharged, and the quality of the discharge are expected to remain relatively constant or improve during the permit term. No additional degradation is expected based on the stringent limits in this Order.

The mass emission benchmarks are an additional incentive for the Discharger to maintain the current treatment quality since they set final effluent targets for the Discharger to meet based on current performance. Most mass emission benchmarks in this Order are more or as stringent due to improved performance; however, the mass emission benchmarks for some constituents have increased. Since the mass emission benchmarks are based on performance and do not exceed the water quality objectives for the receiving water, the increase of any mass emission benchmarks is not expected to result in additional degradation.

4.4.3. Stringency of Requirements for Individual Pollutants

This Order contains both technology-based and water quality-based effluent limitations for individual pollutants. The technology-based effluent limitations consist of restrictions on $BOD_5 20^0C$, TSS, and pH. Restrictions on $BOD_5 20^0C$, TSS, and pH are discussed in section 4.2.2 of this Fact Sheet. This Order's technology-based pollutant restrictions implement the minimum, applicable federal technology-based requirements.

Water quality-based effluent limitations have been scientifically derived to implement water quality objectives that protect beneficial uses. Both the beneficial uses and the water quality objectives have been approved pursuant to federal law and are the applicable federal water quality standards. The scientific procedures for calculating individual water quality-based effluent limitations for priority pollutants are based on the 2019 Ocean Plan, which became effective on February 4, 2019. All beneficial uses and water quality objectives contained in the Basin Plan and Ocean Plan were approved under State law and approved by USEPA. Collectively, this Order's restrictions on individual pollutants are no more stringent than required to implement the requirements of the CWA and applicable water quality standards.

Table F-11. Summary of Final Effluent Limitations for Discharge Points 001 and 002

Parameter	Units	AMEL	AWEL	MDEL	Instan. Min.	Instan. Max.	Annual Avg.	Performance Goal	Basis	Notes
$BOD_5 20^0C$	mg/L	30	45	--	--	--	--	--	Existing, Secondary treatment standard	a
$BOD_5 20^0C$	lbs/day	96,300	145,000	--	--	--	--	--	Existing, Secondary treatment standard	b
$BOD_5 20^0C$	% removal	≥85	--	--	--	--	--	--	Existing, Secondary treatment standard	--
TSS	mg/L	30	45	--	--	--	--	--	Existing, Secondary treatment standard	a
TSS	lbs/day	96,300	144,500	--	--	--	--	--	Existing, Secondary treatment standard	b
TSS	% removal	≥85	--	--	--	--	--	--	Existing, Secondary treatment standard	--
pH	pH Unit	--	--	--	6.0	9.0	--	--	Existing, Secondary treatment standard	c
Oil and Grease	mg/L	15	22.5	45	--	75	--	--	Existing, Ocean Plan	a, c
Oil and Grease	lbs/day	48,200	72,200	144,500	--	240,800	--	--	Existing, Ocean Plan	b
Settleable Solids	ml/L	0.5	0.75	1.5	--	3.0	--	--	Existing, Ocean Plan	a, c
Turbidity	NTU	75	100	--	--	225	--	--	Existing, Ocean Plan	a, c
Arsenic	µg/L	--	--	--	--	--	--	2.6	No RP	d, e
Cadmium	µg/L	--	--	--	--	--	--	1	No RP	d, e
Chromium (VI)	µg/L	--	--	--	--	--	--	0.12	No RP	d, e
Copper	µg/L	--	--	--	--	--	--	3	No RP	d, e
Lead	µg/L	--	--	--	--	--	--	2.5	No RP	d, e
Mercury	µg/L	--	--	--	--	--	--	1	No RP	d, e
Nickel	µg/L				--	--	--	5	No RP	d, e
Selenium	µg/L	--	--	--	--	--	--	6.1	No RP	d, e
Silver	µg/L	--	--	--	--	--	--	0.21	No RP	d, e

Parameter	Units	AMEL	AWEL	MDEL	Instan. Min.	Instan. Max.	Annual Avg.	Performance Goal	Basis	Notes
Zinc	µg/L	--	--	--	--	--	--	18	No RP	d, e
Cyanide	µg/L	--	--	--	--	--	--	7.4	No RP	d
Chlorine Residual	µg/L	330	--	1,300	--	10,000	--	-	RP, Ocean Plan	a, c, f
Chlorine Residual	lbs/day	1,100	--	4,300	--	32,200	--	--	RP, Ocean Plan	b
Ammonia as N	mg/L	--	--	--	--	--	--	49	No RP	d
Phenolic compounds (non-chlorinated)	µg/L	--	--	--	--	--	--	2.2	No RP	d, g
Phenolic compounds (chlorinated)	µg/L	--	--	--	--	--	--	1	No RP	d, g
Endosulfans	µg/L	--	--	--	--	--	--	0.05	No RP	d, g
Endrin	µg/L	--	--	--	--	--	--	0.05	No RP	d
Hexachlorocyclo-hexane (HCH)	µg/L	--	--	--	--	--	--	0.02	No RP	d, g
Chronic toxicity (TST) *Macrocystis pyrifera*	Pass or Fail	--	--	Pass	--	--	--	--	RP, Existing, Ocean Plan	f, h
Gross alpha	pCi/L	--	--	--	--	--	--	10.9	No RP	i
Gross beta	pCi/L	--	--	--	--	--	--	30.5	No RP	i
Acrolein	µg/L	--	--	--	--	--	--	10	No RP	d
Antimony	µg/L	--	--	--	--	--	--	2.7	No RP	d, e
Bis (2-chloroethoxy) methane	µg/L	--	--	--	--	--	--	25	No RP	d
Bis (2-chloro-isopropyl) ether	µg/L	--	--	--	--	--	--	10	No RP	d
Chlorobenzene	µg/L	--	--	--	--	--	--	2.5	No RP	d
Chromium (III)	µg/L				--	--	--	2.4	No RP	d, e
Di-n-butyl-phthalate	µg/L	--	--	--	--	--	--	50	No RP	d
Dichlorobenzenes	µg/L	--	--	--	--	--	--	10	No RP	d

Parameter	Units	AMEL	AWEL	MDEL	Instan. Min.	Instan. Max.	Annual Avg.	Performance Goal	Basis	Notes
Diethyl phthalate	µg/L	--	--	--	--	--	--	10	No RP	d
Dimethyl phthalate	µg/L	--	--	--	--	--	--	10	No RP	d
2-Methyl-4,6-dinitrophenol	µg/L	--	--	--	--	--	--	25	No RP	d
2,4-Dinitrophenol	µg/L	--	--	--	--	--	--	25	No RP	d
Ethylbenzene	µg/L	--	--	--	--	--	--	2.5	No RP	d
Fluoranthene	µg/L	--	--	--	--	--	--	5	No RP	d
Hexachlorocyclo-pentadiene	µg/L	--	--	--	--	--	--	25	No RP	d
Nitrobenzene	µg/L	--	--	--	--	--	--	5	No RP	d
Thallium	µg/L	--	--	--	--	--	--	5	No RP	d, e
Toluene	µg/L	--	--	--	--	--	--	0.74	No RP	d
Tributyltin	µg/L	--	--	--	--	--	--	0.01	No RP	d
1,1,1-Trichloroethane	µg/L	--	--	--	--	--	--	2.5	No RP	d
Acrylonitrile	µg/L	--	--	--	--	--	--	10	No RP	d
Aldrin	µg/L	0.0037	--	--	--	--	--	--	RP, Ocean Plan	a, f
Aldrin	lbs/day	0.012	--	--	--	--	--	--	RP, Ocean Plan	b
Benzene	µg/L	--	--	--	--	--	--	2.5	No RP	d
Benzidine	µg/L	0.012	--	--	--	--	--	--	Existing, Ocean Plan	a, f
Benzidine	lbs/day	0.039	--	--	--	--	--	--	Existing, Ocean Plan	b
Beryllium	µg/L	--	--	--	--	--	--	2.5	No RP	d
Bis (2-chloroethyl) ether	µg/L	--	--	--	--	--	--	5	No RP	d
Bis (2-ethylhexyl) phthalate	µg/L	--	--	--	--	--	--	25	No RP	d
Carbon tetrachloride	µg/L	--	--	--	--	--	--	2.5	No RP	d
Chlordane	µg/L	0.0038	--	--	--	--	--	--	Existing, Ocean Plan	a, f, g

Parameter	Units	AMEL	AWEL	MDEL	Instan. Min.	Instan. Max.	Annual Avg.	Performance Goal	Basis	Notes
Chlordane	lbs/day	0.012	--	--	--	--	--	--	Existing, Ocean Plan	b
Chlorodibromomethane	µg/L	--	--	--	--	--	--	0.56	No RP	d
Chloroform	µg/L	--	--	--	--	--	--	20	No RP	d
DDT	µg/L	0.0158	--	--	--	--	--	0.00017	TMDL	a, g
DDT	g/yr	--	--	--	--	--	8,717	--	TMDL	j
1,4-Dichlorobenzene	µg/L	--	--	--	--	--	--	2.5	No RP	d
3,3'dichlorobenzidine	µg/L	1.4	--	--	--	--	--	--	Existing, Ocean Plan	a, f
3,3'dichlorobenzidine	lbs/day	4.5	--	--	--	--	--	--	Existing, Ocean Plan	b
1,2-Dichloroethane	µg/L	--	--	--	--	--	--	2.5	No RP	d
1,1-Dichloroethylene	µg/L	--	--	--	--	--	--	2.5	No RP	d
Bromodichloroethane	µg/L	--	--	--	--	--	--	1.1	No RP	d
Dichloromethane	µg/L	--	--	--	--	--	--	2.8	No RP	d
1,3-Dichloropropene	µg/L	--	--	--	--	--	--	25	No RP	d
Dieldrin	µg/L	0.0067	--	--	--	--	--	--	RP, Ocean Plan	a, f
Dieldrin	lbs/day	0.021	--	--	--	--	--	--	RP, Ocean Plan	b
2,4-Dinitrotoluene	µg/L	--	--	--	--	--	--	25	No RP	d
1,2-Diphenylhydrazine	µg/L	--	--	--	--	--	--	5	No RP	d
Halomethanes	µg/L	--	--	--	--	--	--	10	No RP	d, g
Heptachlor	µg/L	--	--	--	--	--	--	0.05	No RP	d
Heptachlor epoxide	µg/L	--	--	--	--	--	--	0.05	No RP	d
Hexachlorobenzene	µg/L	0.035	--	--	--	--	--	--	Existing, Ocean Plan	a, f
Hexachlorobenzene	lbs/day	0.11	--	--	--	--	--	--	Existing, Ocean Plan	b
Hexachlorobutadiene	µg/L	--	--	--	--	--	--	5	No RP	d
Hexachloroethane	µg/L	--	--	--	--	--	--	5	No RP	d

Parameter	Units	AMEL	AWEL	MDEL	Instan. Min.	Instan. Max.	Annual Avg.	Performance Goal	Basis	Notes
Isophorone	µg/L	--	--	--	--	--	--	5	No RP	d
N-Nitrosodimethylamine	µg/L	--	--	--	--	--	--	25	No RP	d
N-Nitrosodi-N-propylamine	µg/L	--	--	--	--	--	--	0.33	No RP	d
N-Nitrosodiphenylamine	µg/L	--	--	--	--	--	--	5	No RP	d
PAHs	µg/L	--	--	--	--	--	--	0.95	No RP	d, g
PCBs	µg/L	0.000351	--	--	--	--	--	--	TMDL	a, g
PCBs	g/yr	--	--	--	--	--	194	--	TMDL	j
TCDD equivalents	pg/L	0.65	--	--	--	--	--	--	Existing, Ocean Plan	a, f, g
TCDD equivalents	lbs/day	2.1×10^{-6}	--	--	--	--	--	--	Existing, Ocean Plan	b
1,1,2,2-Tetrachloroethane	µg/L	--	--	--	--	--	--	2.5	No RP	d
Tetrachloroethylene	µg/L	--	--	--	--	--	--	0.55	No RP	d
Toxaphene	µg/L	0.035	--	--	--	--	--	--	Existing, Ocean Plan	a, f
Toxaphene	lbs/day	0.11	--	--	--	--	--	--	Existing, Ocean Plan	b
Trichloroethylene	µg/L	--	--	--	--	--	--	2.5	No RP	d
1,1,2-Trichloroethane	µg/L	--	--	--	--	--	--	2.5	No RP	d
2,4,6-Trichlorophenol	µg/L	--	--	--	--	--	--	0.29	No RP	d
Vinyl chloride	µg/L	--	--	--	--	--	--	2.5	No RP	d

<u>Footnotes for Tables F-11</u>

a. The maximum daily, average weekly and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

b. The mass emission rates are calculated using 385 MGD, consistent with the water-quality based limits in the previous permit: lbs/day = 0.00834 x Ce (effluent concentration in µg/L) x Q (flow rate in MGD).

c. The instantaneous effluent limitations shall apply to grab samples.

d. The performance goals are based upon the actual performance data from JWPCP and are specified only as an indication of treatment efficiency of the plant. They are not considered effluent limitations or standards for the treatment plant. The Permittee shall make best efforts to maintain, if not improve, the effluent quality at the level of these performance goals.

e. Values expressed as total recoverable concentrations.

f. The minimum dilution ratios used to calculate effluent limitations for nonconventional and toxic pollutants for Discharge Points 001 and 002 are 166:1 (i.e., 166 parts seawater to one-part effluent) for all pollutants.

g. See Attachment A for definitions of terms.

h. The Chronic Toxicity final effluent limitation is protective of both the numeric acute and chronic toxicity 2019 Ocean Plan water quality objectives. The final effluent limitation will be implemented using *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995), current USEPA guidance in the *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, June 2010) (http://www3.epa.gov/npdes/pubs/wet_final_tst_implementation2010.pdf) and *EPA Regions 8, 9, and 10, Toxicity Training Tool* (January 2010).

i. Not to exceed limits specified in Title 17, division 1, chapter 5, subchapter 4, group 3, article 3, section 30253 of the California Code of Regulations (CCR). Reference to section 30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.

j. Consistent with the *Santa Monica Bay TMDL for DDTs and PCBs*, the calculation of the annual mass emissions shall be calculated using the arithmetic average of available monthly mass emissions as follows:

$$Annual\ Mass\ Emission, g/year = \left(\frac{\sum Monthly\ Mass\ Emission,\ g/month}{Number\ of\ Monthly\ Mass\ Emissions\ Calculated}\right) * 12\ months/year$$

$$Monthly\ Mass\ Emission, kg/month = \left(\frac{3{,}785}{N}\right) * \left(\sum_{i=1}^{N} Q_i C_i\right) * 30.5 = \frac{0.1154425}{N} * \left(\sum_{i=1}^{N} Q_i C_i\right)$$

C_i = DDT or PCB concentration of each individual sample (ng/L)

Q_i = discharger flow rate on date of sample (mgd)

N = number of samples collected during the month.

<u>End of Footnotes for Tables F-11</u>

Table F-12. Summary of Final Effluent Limitations for Discharge Point 003

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Minimum	Instan-taneous Maximum	Annual Average	Basis	Notes
Chlorine Residual	µg/L	300	--	1,200	--	9,100	--	RP, Ocean Plan	a, b, c, d
Chlorine Residual	lbs/day	960	--	3,900	--	29,200	--	RP, Ocean Plan	e
Aldrin	µg/L	0.0033	--	--	--	--	--	RP, Ocean Plan	a, b, d
Aldrin	lbs/day	0.011	--	--	--	--	--	RP, Ocean Plan	e
Benzidine	µg/L	0.01	--	--	--	--	--	Existing, Ocean Plan	a, b, d
Benzidine	lbs/day	0.033	--	--	--	--	--	Existing, Ocean Plan	e
Chlordane	µg/L	0.003	--	--	--	--	--	Existing, Ocean Plan	a, b, d, f
Chlordane	lbs/day	0.011	--	--	--	--	--	Existing, Ocean Plan	e
DDT	µg/L	0.0158	--	--	--	--	--	TMDL	a, b, f
DDT	g/yr	--	--	--	--	--	8,717	TMDL	f, g
3,3'-Dichlorobenzidine	µg/L	1.2	--	--	--	--	--	Existing, Ocean Plan	a, b, d
3,3'-Dichlorobenzidine	lbs/day	3.9	--	--	--	--	--	Existing, Ocean Plan	e
Dieldrin	µg/L	0.0060	--	--	--	--	--	RP, Ocean Plan	a, b, d
Dieldrin	lbs/day	0.019	--	--	--	--	--	RP, Ocean Plan	e
Hexachlorobenzene	µg/L	0.032	--	--	--	--	--	Existing, Ocean Plan	a, b, d
Hexachlorobenzene	lbs/day	0.10	--	--	--	--	--	Existing, Ocean Plan	e
PCBs as aroclors	µg/L	0.00351	--	--	--	--	--	TMDL	a, b, f
PCBs as aroclors	g/yr	--	--	--	--	--	194	TMDL	f, g
TCDD equivalents	pg/L	0.59	--	--	--	--	--	Existing, Ocean Plan	a, b, d, f
TCDD equivalents	lbs/day	1.9×10^{-6}	--	--	--	--	--	Existing, Ocean Plan	e
Toxaphene	µg/L	0.032	--	--	--	--	--	Existing, Ocean Plan	a, b, d
Toxaphene	lbs/day	0.10	--	--	--	--	--	Existing, Ocean Plan	e

Footnotes for Tables F-12

a. For intermittent discharges, the daily value used to calculate these average monthly and average weekly values shall be considered to equal zero for days on which no discharge occurred.

b. The maximum daily, average weekly and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

c. The instantaneous effluent limitations shall apply to grab samples.

d. The minimum dilution ratios used to calculate effluent limitations for nonconventional and toxic pollutants for Discharge Point 003 is 150:1 for all (i.e., 150-parts seawater to one-part effluent).

e. The mass emission rates are calculated using 385 MGD, consistent with the water-quality based limits in the permit: lbs/day = 0.00834 x Ce (effluent concentration in µg/L) x Q (flow rate in MGD).

f. See Attachment A for definitions of terms.

g. Consistent with the *Santa Monica Bay TMDL for DDTs and PCBs*, the calculation of the annual mass emissions shall be calculated using the arithmetic average of available monthly mass emissions as follows:

$$Annual\ Mass\ Emission, g/year = \left(\frac{\sum Monthly\ Mass\ Emission,\ g/month}{Number\ of\ Monthly\ Mass\ Emissions\ Calculated}\right) * 12\ months/year$$

$$Monthly\ Mass\ Emission, kg/month = \left(\frac{3{,}785}{N}\right) * \left(\sum_{i=1}^{N} Q_i C_i\right) * 30.5 = \frac{0.1154425}{N} * \left(\sum_{i=1}^{N} Q_i C_i\right)$$

C_i = DDT or PCB concentration of each individual sample (ng/L)

Q_i = discharger flow rate on date of sample (mgd)

N = number of samples collected during the month.

End of Footnotes for Tables F-12

Table F-13. Summary of Final Effluent Limitations for Discharge Point 004

Parameter	Units	Average Monthly	Average Weekly	Maximum Daily	Instan-taneous Minimum	Instan-taneous Maximum	Annual Average	Basis	Notes
Chlorine Residual	µg/L	230	--	930	--	7,000	--	RP, Ocean Plan	a, b, c, d
Chlorine Residual	lbs/day	740	--	3,000	--	22,500	--	RP, Ocean Plan	e
Aldrin	µg/L	0.0026	--	--	--	--	--	RP, Ocean Plan	a, b, d
Aldrin	lbs/day	0.0083	--	--	--	--	--	RP, Ocean Plan	e
Benzidine	µg/L	0.008	--	--	--	--	--	Existing, Ocean Plan	a, b, d
Benzidine	lbs/day	0.026	--	--	--	--	--	Existing, Ocean Plan	e
Chlordane	µg/L	0.003	--	--	--	--	--	Existing, Ocean Plan	a, b, d, f
Chlordane	lbs/day	0.0086	--	--	--	--	--	Existing, Ocean Plan	e
DDT	µg/L	0.0158	--	--	--	--	--	TMDL	a, b, f
DDT	g/yr	--	--	--	--	--	8,717	TMDL	f, g
3,3’-Dichlorobenzidine	µg/L	0.93	--	--	--	--	--	Existing, Ocean Plan	a, b, d
3,3’-Dichlorobenzidine	lbs/day	3.0	--	--	--	--	--	Existing, Ocean Plan	e
Dieldrin	µg/L	0.0046	--	--	--	--	--	RP, Ocean Plan	a, b, d
Dieldrin	lbs/day	0.0015	--	--	--	--	--	RP, Ocean Plan	e
Hexachlorobenzene	µg/L	0.024	--	--	--	--	--	Existing, Ocean Plan	a, b, d
Hexachlorobenzene	lbs/day	0.078	--	--	--	--	--	Existing, Ocean Plan	e
PCBs as aroclors	µg/L	0.00351	--	--	--	--	--	TMDL	a, b, f
PCBs as aroclors	g/yr	--	--	--	--	--	194	TMDL	f, g
TCDD equivalents	pg/L	0.45	--	--	--	--	--	Existing, Ocean Plan	a, b, d, f
TCDD equivalents	lbs/day	1.5×10^{-6}	--	--	--	--	--	Existing, Ocean Plan	e
Toxaphene	µg/L	0.024	--	--	--	--	--	Existing, Ocean Plan	a, b, d
Toxaphene	lbs/day	0.078	--	--	--	--	--	Existing, Ocean Plan	e

Footnotes for Tables F-13

a. For intermittent discharges, the daily value used to calculate these average monthly and average weekly values shall be considered to equal zero for days on which no discharge occurred.

b. The maximum daily, average weekly and average monthly effluent limitations shall apply to flow weighted 24-hour composite samples. They may apply to grab samples if the collection of composite samples for those constituents is not appropriate because of the instability of the constituents.

c. The instantaneous effluent limitations shall apply to grab samples.

d. The minimum dilution ratios used to calculate effluent limitations for nonconventional and toxic pollutants for Discharge Point 004 is 115:1 for all (i.e., 115-parts seawater to one part effluent).

e. The mass emission rates are calculated using 385 MGD, consistent with the water-quality based limits in the permit: lbs/day = 0.00834 x Ce (effluent concentration in µg/L) x Q (flow rate in MGD).

f. See Attachment A for definitions of terms.

g. Consistent with the *Santa Monica Bay TMDL for DDTs and PCBs*, the calculation of the annual mass emissions shall be calculated using the arithmetic average of available monthly mass emissions as follows:

$$Annual\ Mass\ Emission, g/year = \left(\frac{\sum Monthly\ Mass\ Emission,\ g/month}{Number\ of\ Monthly\ Mass\ Emissions\ Calculated}\right) * 12\ months/year$$

$$Monthly\ Mass\ Emission, kg/month = \left(\frac{3{,}785}{N}\right) * \left(\sum_{i=1}^{N} Q_i C_i\right) * 30.5 = \frac{0.1154425}{N} * \left(\sum_{i=1}^{N} Q_i C_i\right)$$

C_i = DDT or PCB concentration of each individual sample (ng/L)

Q_i = discharger flow rate on date of sample (mgd)

N = number of samples collected during the month.

End of Footnotes for Tables F-13

4.5. Interim Effluent Limitations – Not Applicable

4.6. Land Discharge Specifications – Not Applicable

4.7. Recycling Specifications

Approximately 20 MGD of JWPCP effluent is recycled for internal uses for treatment processes and maintenance.

The Discharger has been developing Pure Water Southern California with the Metropolitan Water District (MWD) since 2010. This program includes construction of a new Advanced Water Treatment Facility (AWTF) with a membrane bioreactor, reverse osmosis, and ultraviolet/advanced oxidation processes at JWPCP and will produce 150 MGD or 168,000 acre-feet per year (AFY) of purified water recharged at the Central, West Coast, Main San Gabriel, and Orange County Groundwater Basins.

The Permittee shall continue to investigate the feasibility of recycling, conservation, and/or alternative disposal methods for wastewater (such as groundwater injection), and/or beneficial use of stormwater and dry-weather urban runoff. The Permittee shall submit an update to this feasibility study as part of the submittal of the Report of Waste Discharge (ROWD) for the next permit renewal.

5. PERFORMANCE GOALS

Section III.F.1, of the 2019 Ocean Plan allows the Los Angeles Water Board to establish more restrictive water quality objectives and effluent limitations than those set forth in the 2019 Ocean Plan as necessary for the protection of the beneficial uses of ocean waters.

Pursuant to this provision and to implement the recommendation of the Water Quality Advisory Task Force (*Working Together for an Affordable Clean Water Environment, A final report presented to the California Water Quality Control Board, Los Angeles Region by Water Quality Advisory Task Force, September 30, 1993*) that was adopted by the Los Angeles Water Board on November 1, 1993, performance goals that are more stringent than those based on Ocean Plan objectives are prescribed in this Order. This approach is consistent with the antidegradation policy in that it requires the Discharger to maintain its treatment level and effluent quality, recognizing normal variations in treatment efficiency and sampling and analytical techniques. However, this approach does not address substantial changes in treatment plant operations that could significantly affect the quality of the treated effluent.

While performance goals were previously placed in many POTW permits in the Region, they have been discontinued for inland surface water discharges. For inland surface waters, the California Toxics Rule (40 CFR § 131.38) has resulted in effluent limitations as stringent as many performance goals. However, the Ocean Plan allows for significant dilution, and the continued use of performance goals serves to maintain existing treatment levels and effluent quality and supports State and federal antidegradation policies.

The performance goals are based upon the actual performance of JWPCP and are specified only as an indication of the treatment efficiency of the Facility. Performance goals are intended to minimize pollutant loading (primarily for toxics), while maintaining the incentive for future voluntary improvement of water quality whenever feasible, without the imposition of more stringent limits based on improved performance. Performance goals for

Discharge Points 001 and 002 are prescribed in this Order. The performance goals are not enforceable effluent limitations or standards. The Discharger shall maintain, if not improve, its treatment efficiency. Any two exceedances of the performance goals shall trigger an investigation into the cause of the exceedance. If the exceedance persists in three successive monitoring periods, the Discharger shall submit a written report to the Los Angeles Water Board on the nature of the exceedance, the results of the investigation as to the cause of the exceedance, and the corrective actions taken or proposed corrective measures with timetable for implementation, if necessary.

5.1. Procedures for the Determination of Performance Goals (PGs)

For constituents that have been routinely detected in the effluent (at least 20 percent detectable data), performance goals are based on the one-sided, upper 95 percent confidence bound for the 95th percentile of the effluent performance data ($UCB_{95/95}$) from November 2017 through June 2022 using the RPA protocol contained in the 2019 Ocean Plan. Effluent data are assumed log normally distributed. Performance goals are calculated according to the equation $C_{PG} = C_o + D_m (C_o\text{-}C_s)$ and setting $C_o = UCB_{95/95}$.

5.1.1 If the maximum detected effluent concentration (MEC) is greater than the calculated performance goal, then the calculated performance goal is used as the performance goal;

5.1.2. If the maximum detected effluent concentration is less than the calculated performance goal, then the MEC is used as the performance goal; or

5.1.3. If the performance goal determined in part 1 or 2 is greater than the WQO in the 2019 Ocean Plan after considering dilution, then the WQO is used as the performance goal.

Table F-14 summarizes the performance goal determinations for Discharge Points 001 and 002, based on criteria section 5.1.1 to 5.1.3. specified above.

For example, the performance goals for arsenic, copper, and chromium III for Discharge Points 001 and 002 are calculated as follows:

Arsenic

$C_o = UCB_{95/95}$ = 2.9989 µg/L; D_m = 166; C_s = background seawater concentration = 3 µg/L; MEC = 2.62 µg/L; C_{PG} = Performance Goal = (2.9989 µg/L) + 166 × (2.9989 µg/L - 3 µg/L) = 2.8163 µg/L. Since the MEC of 2.62 µg/L is less than the calculated C_{PG} of 2.8163 µg/L and arsenic water quality objective of 8 µg/L, the prescribed performance goal for Arsenic is 2.6 µg/L.

Copper

$C_o = UCB_{95/95}$ = 2.0201 µg/L; D_m = 166; C_s = background seawater concentration = 2 µg/L; MEC = 4.96 µg/L; C_{PG} = Performance Goal = (2.0201 µg/L) + 166 × (2.0201 µg/L - 2 µg/L) = 5.3567 µg/L. Since the MEC of 4.96 µg/L and C_{PG} of 5.3567 µg/L are greater than the copper water quality objective of 3 µg/L, the prescribed performance goal for copper is 3 µg/L.

Chromium III

C_o = $UCB_{95/95}$ = 0.0143 μg/L; D_m = 166; C_s = background seawater concentration = 0 μg/L; MEC = 2.54 μg/L; C_{PG} = Performance Goal = (0.0143 μg/L) + 166 × (0.0143 μg/L - 0 μg/L) = 2.3881 μg/L. Since the MEC of 2.54 μg/L and chromium III water quality objective of 190,000 μg/L are greater than C_{PG} of 2.3881 μg/L, the prescribed performance goal for chromium III is 2.4 μg/L.

The three pollutants represent the lowest MEC, WQO, and C_{PG} as Performance Goal for arsenic, copper, and chromium, respectively.

Table F-14. Summary of Performance Goals for Discharge Points 001 and 002 (Detected Data with 20% at Least)

Pollutant	Detected Rate	$UCB_{95/95}$	C_s	WQO (µg/L)	MEC (µg/L)	Calculated PG (µg/L)	MEC > Calculated PG	MEC or Calculated PG > WQO	Final PG (µg/L)
Arsenic	100%	2.9989	3	8	2.62	2.8163	No	No	2.6
Chromium VI	30%	0.0008	0	2	0.12	0.1336	No	No	0.12
Copper	100%	2.0201	2	3	4.96	5.3567	No	Yes	3
Nickel	100%	0.0775	0	5	15.4	12.9425	Yes	Yes	5
Selenium	100%	0.0396	0	15	6.08	6.6132	No	No	6.1
Zinc	100%	8.0640	8	20	18.3	18.6880	No	No	18
Ammonia	100%	293.7517	0	600	50000	49056	Yes	Yes	49000
Nonchlorinated Phenols	80%	0.0226	0	30	2.17	3.7742	No	No	2.2
Chlorinated Phenols	60%	0.0167	0	1	1.7	2.7889	No	Yes	1
Antimony	100%	0.0191	0	1200	2.65	3.1897	No	No	2.7
Chromium III	95%	0.0143	0	190,000	2.54	2.4	Yes	No	2.4
Chloroform	100%	0.1584	0	130	20	26.4528	No	No	20
Dichlorobromomethane	33%	0.0088	0	6.2	1.1	1.4696	No	No	1.1
Dichloromethane	100%	0.0209	0	450	2.8	3.4903	No	No	2.8
N-Nitrosodimethylamine	56%	0.0024	0	7.3	0.33	0.4008	No	No	0.33

5.2. For constituents where monitoring data have consistently shown nondetectable levels (less than 20 percent detectable data), performance goals are set at five times the Minimum Levels (MLs) listed in the 2019 Ocean Plan for the specific method. If the maximum detected effluent concentration is less than the calculated value based on ML, then the MEC is used as the performance goal. If the Ocean Plan does not include an ML for the pollutant, the performance goal from the previous permit was carried over.

Table F-16 summarizes the performance goal determinations for Discharge Points 001 and 002, based on criteria section 5.2. specified above.

Table F-15. Summary of Performance Goals for Discharge Points 001 and 002 (Non-detected Data Greater Than 80%)

Pollutant	Non-Detected Rate	MEC (µg/L)	ML (µg/L)	5 X ML (µg/L)	Final PG (µg/L)	Notes
Cadmium	100%	--	0.2	1.0	1.0	--
Lead	100%	--	0.5	2.5	2.5	--
Mercury	100%	--	0.2	1	1	--
Silver	95%	0.21	0.2	1	0.21	--
Cyanide	89%	7.42	5	25	7.4	--
Residual Chlorine	98%	700	--	--	--	a
Endosulfans, Sum	100%	--	0.01	0.05	0.05	--
Endrin	100%	--	0.01	0.05	0.05	--
HCH	80%	0.02	0.005	0.025	0.02	--
Acrolein	100%	--	2	10	10	--
Bis(2-Chloroethoxy) methane	100%	--	5	25	25	--
Bis(2-Chloroisopropyl) ether	100%	--	2	10	10	--
Chlorobenzene	100%	--	0.5	2.5	2.5	--
Di-n-butyl Phthalate	100%	--	10	50	50	--
Dichlorobenzene	100%	--	2	10	10	--
Diethyl Phthalate	100%	--	2	10	10	--
Dimethyl Phthalate	100%	--	2	10	10	--
4,6-Dinitro-2-methylphenol	100%	--	5	25	25	--
2,4-Dinitrophenol	100%	--	5	25	25	--
Ethylbenzene	100%	--	0.5	2.5	2.5	--
Fluoranthene	100%	--	1	5	5	--
Hexachlorocyclopentadiene	100%	--	5	25	25	--
Nitrobenzene	100%	--	1	5	5	--
Thallium, Total Recoverable	100%	--	1	5	5	--
Toluene	92%	0.74	2	10	0.74	--

Pollutant	Non-Detected Rate	MEC (µg/L)	ML (µg/L)	5 X ML (µg/L)	Final PG (µg/L)	Notes
Tributyltin (TBT)	100%	--	--	--	0.01	b
1,1,1-Trichloroethane	100%	--	0.5	2.5	2.5	--
Acrylonitrile	100%	--	2	10	10	--
Aldrin	80%	0.008	0.005	0.025	--	a
Benzene	100%	--	0.5	2.5	2.5	--
Benzidine	100%	--	5	25	--	a
Beryllium, Total Recoverable	100%	--	0.5	2.5	2.5	--
Bis(2-Chloroethyl) ether	100%	--	1	5	5	--
Bis(2-Ethylhexyl) phthalate	90%	75	5	25	25	--
Carbon Tetrachloride	100%	--	0.5	2.5	2.5	--
Chlordane	100%	--	0.1	0.5	--	a
Chlorodibromomethane	89%	0.56	2	10	0.56	--
DDT	100%	--	0.01	0.05	0.00017	c
1,4-Dichlorobenze	100%	--	0.5	2.5	2.5	--
3,3-Dichlorobenzidine	100%	--	5	25	--	a
1,2-Dichloroethane	100%	--	0.5	2.5	2.5	--
1,1-Dichloroethylene	100%	--	0.5	2.5	2.5	--
1,3-Dichloropropene	100%	--	5	25	25	--
Dieldrin	90%	0.01	0.01	0.05	0.01	--
2,4-Dinitrotoluene	100%	--	5	25	25	--
1,2-Diphenylhydrazine	100%	--	1	5	5	--
Halomethanes	100%	--	2	10	10	--
Heptachlor	100%	--	0.01	0.05	0.05	--
Heptachlor Epoxide	100%	--	0.01	0.05	0.05	--
Hexachlorobenzene	100%	--	1	5	--	a
Hexachlorobutadiene	100%	--	1	5	5	--
Hexachloroethane	100%	--	1	5	5	--
Isophorone	100%	--	1	5	5	--
N-Nitrosodi-n-Propylamine	100%	--	5	25	25	--
N-Nitrosodiphenylamine	100%	--	1	5	5	--
PAHs	90%	0.021	--	--	0.95	b
PCBs	100%	--	0.5	2.5	--	a
TCDD Equivalent	90%	1.7×10^{-7}	--	--	--	a
1,1,2,2-Tetrachloroethane	100%	--	0.5	2.5	2.5	--

Pollutant	Non-Detected Rate	MEC (µg/L)	ML (µg/L)	5 X ML (µg/L)	Final PG (µg/L)	Notes
Tetrachloroethene	92%	0.55	2	10	0.55	--
Toxaphene	100%	--	0.5	2.5	--	a
Trichloroethene	100%	--	0.5	2.5	2.5	--
1,1,2-Trichloroethane	100%	--	0.5	2.5	2.5	--
2,4,6-Trichlorophenol	100%	--	10	50	0.29	c
Vinyl Chloride	100%	--	0.5	2.5	2.5	--

Footnotes for Tables F-15

a. There is no PG proposed, because the PG is greater than monthly average effluent limitation.

b. ML is not available in the Ocean Plan. PG is carried over from the previous Order Number R4-2017-0180.

c. The Ocean Plan water quality objective is used as the Performance Goal.

End of Footnotes for Tables F-15

6. RATIONALE FOR RECEIVING WATER LIMITATIONS

6.1. Surface Water

The Ocean Plan and Basin Plan contain numeric and narrative water quality standards applicable to surface waters within the Los Angeles Region. Water quality objectives include a policy to maintain high-quality waters pursuant to federal regulations (40 CFR § 131.12) and State Water Board Resolution No. 68-16. Receiving water limitations in section 6 of the Order are included to ensure protection of beneficial uses of the receiving water

6.2. Groundwater – Not Applicable

7. MASS EMISSION BENCHMARKS

To address the uncertainty due to potential increases in toxic pollutant loadings from the JWPCP discharge to the marine environment during the permit term and to establish a framework for evaluating the need for an antidegradation analysis to determine compliance with State and federal antidegradation requirements at the time of permit reissuance, 12-month average mass emission benchmarks have been established for effluent discharged through the 90-inch and 120-inch Outfalls (Discharge Points 001 and 002). These mass emission benchmarks are not enforceable water quality-based effluent limitations; however, they are a requirement of Section III of the Ocean Plan. They may be re-evaluated and revised during the five-year permit term. The mass emission benchmarks (in metric tons per year; MT/yr) for the JWPCP discharge were determined using the same procedure as described in section 5 of this Fact Sheet for the calculation of the Performance Goals. The concentration-based Performance Goals were calculated using data from November 2017 through June 2022 and were converted to mass-based Benchmarks using the 1997 average design flow rate of 385 MGD. The following equation was used for the calculation of the Mass Emission Benchmarks:

MT/yr = (Prescribed Performance Goal, μg/L) x (Flow, Q, 10^6 gal/day) x (3.785 L/gal) x (365 days/yr) x (1 MT/10^{12} μg/L).

8. RATIONALE FOR PROVISIONS

8.1. Standard Provisions

Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR section 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 CFR section 122.42, are provided in Attachment D of the Order. Sections 122.41(a)(1) and (b) through (n) of 40 CFR establish conditions that apply to all State-issued NPDES permits. These conditions must be incorporated into the permits either expressly or by reference. If incorporated by reference, a specific citation to the regulations must be included in the Order. Section 123.25(a)(12) of 40 CFR allows the state to omit or modify conditions to impose more stringent requirements. In accordance with 40 CFR section 123.25, this Order omits federal conditions that address enforcement authority specified in 40 CFR section 122.41(j)(5) and (k)(2) because the enforcement authority under the Water Code is more stringent. In lieu of these conditions, this Order incorporates by reference Water Code section 13387(e).

8.2. Special Provisions

8.2.1. Reopener Provisions

These provisions are based on 40 CFR part 123.25. The Los Angeles Water Board may reopen the permit to modify permit conditions and requirements. Causes for modifications include the promulgation of new regulations, modification in sludge/biosolids use or disposal practices, or adoption of new regulations by the State Water Board or Los Angeles Water Board, including revisions to the Ocean Plan and Basin Plan.

8.2.2. Special Studies and Additional Monitoring Requirements

a. **Antidegradation Analysis and Engineering Report for Any Proposed Plant Expansion.** This provision is based on the State Water Board Resolution Number 68-16, which requires the Los Angeles Water Board in regulating the discharge of waste to maintain high quality waters of the state. The Discharger must demonstrate that it has implemented adequate controls (e.g., adequate treatment capacity) to ensure that high quality waters will be maintained. This provision requires that if the Discharger increases plant capacity, the Discharger must demonstrate that treatment systems are effective in preventing violations of effluent limitations. This provision requires the Discharger to report specific time schedules for JWPCP's projects. This provision requires the Discharger to submit a report to the Los Angeles Water Board for approval.

b. **Operations Plan for Proposed Expansion.** This provision is based on section 13385(j)(1)(D) of the Water Code and allows a time period not to exceed 90 days in which the Discharger may adjust and test the treatment system(s). This provision requires the Permittee to submit an Operations Plan describing the actions the Discharger will take during the period of adjusting and testing to prevent violations.

c. **Treatment Plant Capacity.** The treatment plant capacity study required by this Order shall serve as an indicator for the Los Angeles Water Board regarding Facility's increasing hydraulic capacity and growth in the service area.

d. **Toxicity Reduction Evaluation (TRE) Requirements**. If the discharge consistently exceeds an effluent limitation for toxicity as specified in this Order, the Permittee shall conduct a TRE as detailed in section 5 of the MRP (Attachment E). The TRE will help the Permittee identify the possible source(s) of toxicity. The Permittee shall take all reasonable steps to reduce toxicity to the required level.

8.2.3. Best Management Practices and Pollution Prevention

a. **Spill Clean-Up Contingency Plan (SCCP):** Since spills or overflows are a common event at the POTW, this Order requires the Discharger to review and update, if necessary, its SCCP after each incident. The Discharger shall ensure that the up-to-date SCCP is readily available to the sewage system personnel at all times and that the sewage personnel are familiar with it.

b. **Pollutant Minimization Program (PMP).** This provision is based on the requirements of section III.C.9 of the 2019 Ocean Plan.

8.2.4. Construction, Operation, and Maintenance Specifications

This provision is based on the requirements of 40 CFR section 122.41(e) and the previous Order. 40 CFR section 122.41(e) also requires the operation of back-up or auxiliary facilities or similar systems when the operation is necessary to achieve compliance with the conditions of the Order. For proper and effective operation of such facilities or systems, routine maintenance and operational testing of emergency infrastructure/equipment is necessary. Major sewage spills can cause harm to residents of the Los Angeles Region, such as the closure of beaches, and harm to wildlife and benthic life. The impact of any such incident to the receiving waters can be minimized or prevented if the operation of emergency infrastructure occurs unimpeded by operational challenges and in a timely fashion. Thus, this Order contains requirements for routine maintenance and operational testing of emergency infrastructure/equipment in section 7.3.4.d.

8.2.5. Special Provisions for Municipal Facilities (POTWs Only)

a. **Biosolids Requirements.** To implement CWA section 405(d), on February 19, 1993, USEPA promulgated 40 CFR part 503 to regulate the use and disposal of municipal sewage sludge. This regulation was amended on September 3, 1999. The regulation requires that producers of sewage sludge meet certain reporting, handling, and disposal requirements. It is the responsibility of the Discharger to comply with said regulations that are enforceable by USEPA, because California has not been delegated the authority to implement this program. The Discharger is also responsible for compliance with WDRs and NPDES permits for the generation, transport and application of biosolids issued by the State Water Board, other Los Angeles Water Boards, Arizona Department of Environmental

Quality or USEPA, to whose jurisdiction the Facility's biosolids will be transported and applied.

b. **Pretreatment Requirements.** This Order contains pretreatment requirements consistent with applicable effluent limitations, national standards of performance, and toxic and performance effluent standards established pursuant to sections 208(b), 301, 302, 303(d), 304, 306, 307, 403, 404, 405, and 501 of the CWA, and amendments thereto. This permit contains requirements for the implementation of an effective pretreatment program pursuant to section 307 of the CWA; 40 CFR 35 and 403; and/or Title 23, CCR section 2233.

c. **Spill Reporting Requirements.** This Order establishes a reporting protocol for how different types of spills, overflow or bypasses of raw or partially treated sewage from its collection system or treatment plant covered by this Order shall be reported to regulatory agencies.

As discussed in section 3.5.4. of the Fact Sheet, the Permittee is required to comply with the SSS WDRs. The SSS WDRs require public agencies that own or operate sanitary sewer systems with greater than one mile of pipes or sewer lines to enroll for coverage under the SSS WDRs. The SSS WDRs requires agencies to develop sanitary sewer management plans (SSMPs) and report all sanitary sewer overflows (SSOs), among other requirements and prohibitions.

Furthermore, the SSS WDRs contain requirements for operation and maintenance of collection systems and for reporting and mitigating sanitary sewer overflows. Inasmuch that the Discharger's collection system is part of the system that is subject to this Order, certain standard provisions are applicable as specified in Provisions, section 7.3.5. For instance, the 24-hour reporting requirements in this Order are not included in the SSS WDRs. The Discharger must comply with both the SSS WDRs and this Order. The Discharger and public agencies that are discharging wastewater into the Facility were required to obtain enrollment for regulation under the SSS WDRs by December 1, 2006.

In the past, the Los Angeles Water Board has experienced loss of recreational use in coastal beaches and in recreational areas as a result of major sewage spills. The SSS WDRs requirements are intended to prevent or minimize impacts to receiving waters as a result of spills.

The requirements of this Order are more stringent that the SSS WDRs because in addition to the SSS WDRs requirements, this NPDES permit requires water quality monitoring of the receiving water when the spill reaches the surface water.

9. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

CWA section 308(a) and 40 CFR sections 122.41(h), (j)-(l), 122.44(i), and 122.48 require that all NPDES permits specify monitoring and reporting requirements. Water Code section 13383 also authorizes the Los Angeles Water Board to establish monitoring, reporting, and recordkeeping requirements. The MRP of this Order establishes monitoring, reporting, and recordkeeping requirements that implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements contained in the MRP for this Facility.

9.1. Influent Monitoring

Influent monitoring is required to determine compliance with the permit conditions, to assess treatment plant performance, and to assess the effectiveness of the Pretreatment Program. Influent monitoring in this Order follows the influent monitoring requirements in the previous Order with minor changes. The monitoring frequencies for some parameters have been increased due to RP for those parameters.

9.2. Effluent Monitoring

The Discharger is required to conduct monitoring of the permitted discharges in order to evaluate compliance with permit conditions. Monitoring requirements are given in the MRP Attachment E. This provision requires compliance with the MRP, and is based on 40 CFR sections 122.44(i), 122.62, 122.63, and 124.5. The MRP is a standard requirement in almost all NPDES permits (including this Order) issued by the Los Angeles Water Board. In addition to containing definition of terms, it specifies general sampling/analytical protocols and the requirements of reporting spills, violation, and routine monitoring data in accordance with NPDES regulations, the Water Code, and Los Angeles Water Board policies. The MRP also contains a sampling program specific for the Permittee’s wastewater treatment plant. It defines the sampling stations and frequency, pollutants to be monitored, and additional reporting requirements. Pollutants to be monitored include all pollutants for which effluent limitations are specified.

Monitoring for those pollutants expected to be present in the discharge from the Facility, will be required as set forth in the MRP and as required in the 2019 Ocean Plan.

Monitoring frequency for the constituents is based on historic monitoring frequency, Best Professional Judgment, and the following criteria:

<u>Criterion 1:</u> Monthly monitoring will be considered for those pollutants with reasonable potential to exceed water quality objectives (monitoring has shown an exceedance of the objectives);

<u>Criterion 2</u>: Quarterly monitoring will be considered for those pollutants in which some or all the historic effluent monitoring data detected the pollutants, but without reasonable potential to exceed water quality objectives; and

<u>Criterion 3</u>: Semiannual monitoring will be considered for those pollutants in which all the historic effluent monitoring data have had non-detected concentrations of the pollutants and without current reasonable potential to exceed water quality objectives.

The proposed monitoring requirements for PFAS compounds are consistent with EPA’s PFAS Action Plan (dated June 15, 2022), PFAS Strategic Roadmap (October 2021) that describe that EPA’s goals of reducing PFAS discharges to waterways, and USEPA’s memo dated December 5, 2022 updating guidance for addressing PFAS discharges in NPDES permits and/or in pretreatment programs.

Table F-16. Monitoring Frequency Comparison

Parameter	Monitoring Frequency (2017 Permit)	Monitoring Frequency (2023 Permit)	Notes
Flow	continuous	no change	--
$BOD_5$20°C	weekly	no change	--
Total Suspended Solids	weekly	no change	--
pH	weekly	no change	--
Oil and Grease	weekly	no change	--
Temperature	daily	continuous	a
Settleable Solids	weekly	no change	--
Total Residual Chlorine	daily	no change	--
Turbidity	weekly	no change	--
Total coliform	daily	no change	--
Enterococcus	daily	no change	--
Fecal coliform	5 times/month	no change	--
Total Organic Carbon	monthly	no change	--
Ammonia Nitrogen	weekly	no change	--
Toxicity, Chronic	monthly	no change	--
Cyanide	quarterly	no change	--
Nitrate Nitrogen	quarterly	no change	--
Nitrite Nitrogen	--	quarterly	b
Organic nitrogen	quarterly	no change	--
Total Nitrogen	--	quarterly	b
Total Phosphorus (as P)	quarterly	no change	--
Radioactivity (including gross alpha, gross beta, combined radium-226 & radium-228, tritium, strontium-90 and uranium)	quarterly	no change	--
Arsenic	quarterly	no change	--
Cadmium	quarterly	no change	--
Chromium (VI)	quarterly	no change	--
Copper	quarterly	no change	--
Lead	quarterly	semiannually	c
Mercury	quarterly	Semiannually	c
Nickel	quarterly	no change	--
Selenium	quarterly	no change	--
Silver	quarterly	no change	--
Zinc	quarterly	no change	--
Phenolic Compounds (non-chlorinated)	semiannually	quarterly	d
Phenolic Compounds (chlorinated)	semiannually	quarterly	d

Parameter	Monitoring Frequency (2017 Permit)	Monitoring Frequency (2023 Permit)	Notes
Endosulfan	semiannually	no change	--
Endrin	semiannually	no change	--
HCH	semiannually	quarterly	d
Acrolein	semiannually	no change	--
Antimony	quarterly	no change	--
Bis(2-chloroethoxy) methane	semiannually	no change	--
Bis(2-chloroisopropyl) ether	semiannually	no change	--
Chlorobenzene	semiannually	no change	--
Chromium (III)	quarterly	no change	--
Di-n-butyl-phthalate	semiannually	no change	--
Dichlorobenzenes	semiannually	no change	--
Diethyl phthalate	semiannually	no change	--
Dimethyl phthalate	semiannually	no change	--
4,6-dinitro-2-methylphenol	semiannually	no change	--
2,4-Dinitrophenol	semiannually	no change	--
Ethylbenzene	semiannually	no change	--
Fluoranthene	semiannually	no change	--
Hexachlorocyclopentadiene	semiannually	no change	--
Nitrobenzene	semiannually	no change	--
Thallium	semiannually	no change	--
Toluene	semiannually	quarterly	d
Tributyltin	semiannually	no change	--
1,1,1-Trichloroethane	semiannually	no change	--
Acrylonitrile	semiannually	no change	--
Aldrin	semiannually	monthly	e
Benzene	semiannually	no change	--
Benzidine	quarterly	no change	f
Beryllium	semiannually	no change	--
Bis(2-chloroethyl) ether	semiannually	no change	--
Bis(2-ethylhexyl) phthalate	semiannually	quarterly	d
Carbon tetrachloride	semiannually	no change	--
Chlordane	semiannually	quarterly	f
Chlorodibromomethane	quarterly	no change	--
Chloroform	semiannually	quarterly	d
DDT	quarterly	no change	--
1,4-Dichlorobenzene	semiannually	no change	--

Parameter	Monitoring Frequency (2017 Permit)	Monitoring Frequency (2023 Permit)	Notes
3,3’-Dichlorobenzidine	semiannually	quarterly	f
1,2-Dichloroethane	semiannually	no change	--
1,1-Dichloroethylene	semiannually	no change	--
Dichlorobromomethane	semiannually	quarterly	d
Dichloromethane	semiannually	quarterly	d
1,3-Dichloropropene	semiannually	no change	--
Dieldrin	semiannually	monthly	e
2,4-Dinitrotoluene	semiannually	no change	--
1,2-Diphenylhydrazine	semiannually	no change	--
Halomethanes	semiannually	no change	--
Heptachlor	semiannually	no change	--
Heptachlor epoxide	semiannually	no change	--
Hexachlorobenzene	semiannually	quarterly	f
Hexachlorobutadiene	semiannually	no change	--
Hexachloroethane	semiannually	no change	--
Isophorone	semiannually	no change	--
N-Nitrosodimethylamine	semiannually	quarterly	d
N-Nitrosodi-N-propylamine	semiannually	no change	--
N-Nitrosodiphenylamine	semiannually	no change	--
PAHs	semiannually	quarterly	d
PCBs as Aroclors	quarterly	no change	--
PCBs as Congeners	annually	no change	--
TCDD Equivalents	semiannually	quarterly	f
1,1,2,2-Tetrachloroethane	semiannually	no change	--
Tetrachloroethylene	semiannually	quarterly	d
Toxaphene	quarterly	no change	f
Trichloroethylene	semiannually	no change	--
1,1,2-Trichloroethane	semiannually	no change	--
2,4,6-Trichlorophenol	semiannually	no change	--
Vinyl chloride	semiannually	no change	--
Methyl-tert-butyl-ether	semiannually	no change	--
PFAS	--	annually	b

Footnotes for Tables F-16

a. A temperature recorder is used to continuously monitor temperature variations in effluent.

b. New monitoring requirement.

c. Based on Criterion 3 specified in section 9.2 above.

d. Based on Criterion 2 specified in section 9.2 above.

e. Based on Criterion 1 specified in section 9.2 above.

f. The reasonable potential analysis was inconclusive but since there is uncertainty as to whether the pollutant is present at concentrations above the water quality objective, an effluent limitation is carried over in the permit for the pollutant.

End of Footnotes for Tables F-16

9.3. Whole Effluent Toxicity Requirements

The rationale for WET has been discussed extensively in section 4.3.6 of this Fact Sheet.

9.4. Receiving Water Monitoring

9.4.1. Surface Water

Receiving water monitoring is required to determine compliance with receiving water limitations and to characterize the water quality of the receiving water. Requirements are based on the 2019 Ocean Plan and the Basin Plan. The conceptual framework for the receiving water program has three components that comprise a range of spatial and temporal scales: (a) core monitoring; (b) regional monitoring; and (c) special studies. Detailed information can be found in Section 1.8 of the attachment E.

The receiving water monitoring program contains the following core and regional components: Inshore and offshore water quality monitoring; benthic infauna and sediment chemistry monitoring; fish and macroinvertebrate (trawl and rig fishing) monitoring, including bioaccumulation/seafood safety; and kelp bed monitoring. Local and regional survey questions, sampling designs, monitoring locations, and other specific monitoring requirements are detailed in the MRP.

9.4.2. Groundwater – (Not Applicable)

9.5. Other Monitoring Requirements

9.5.1. Outfall and Diffuser Inspection

This survey investigates the condition of the outfall structures to determine if the structures are in serviceable condition to ensure their continued safe operation. The data collected will be used for a periodic assessment of the integrity of the outfall pipes and ballasting system.

9.5.2. Biosolids and Sludge Management

Attachment H establishes monitoring and reporting requirements for the storage, handling and disposal practices of biosolids/sludge generated from the operation of this POTW.

9.5.3. Discharge Monitoring Report-Quality Assurance (DMR-QA) Study Program

Under the authority of section 308 of the CWA (33 U.S.C. § 1318), USEPA requires major and selected minor dischargers under the NPDES Program to participate in the annual DMR-QA Study Program. The DMR-QA Study evaluates the analytical ability of laboratories that routinely perform or support self-monitoring analyses required by NPDES permits. There are two options to satisfy the requirements of the DMR-QA Study Program: (1) The Discharger can obtain and analyze a DMR-QA sample as part of the DMR-QA Study; or (2) Per the waiver issued by USEPA to the State Water Board, the Discharger can submit the results of the most recent Water Pollution Performance Evaluation Study from its own laboratories or its contract laboratories. A Water Pollution Performance Evaluation Study is similar to the DMR-QA Study. Thus, it also evaluates a laboratory's ability to analyze wastewater samples to produce quality data that ensure the integrity of the NPDES Program. The Discharger shall ensure that the results of the DMR-QA Study or the results of the most recent Water Pollution Performance Evaluation Study are submitted annually to the State Water Board. The State Water Board's Quality Assurance Program Officer will send the DMR-QA Study results or the results of the most recent Water Pollution Performance Evaluation Study to USEPA's DMR-QA Coordinator and Quality Assurance Manager.

10. CONSIDERATION OF NEED TO PREVENT NUISANCE AND WATER CODE SECTION 13241 FACTORS.

One of the provisions/requirements in this Order (section 4.3 of the Order) is included to implement state law. This provision/requirement is not required or authorized under the federal CWA; consequently, violations of this provision/requirement are not subject to the enforcement remedies that are available for NPDES violations. As required by Water Code section 13263, the Los Angeles Water Board has considered the need to prevent nuisance and the factors listed in Water Code section 13241 in establishing the state law provisions/requirements. The Los Angeles Water Board finds, on balance, that the state law requirements in this Order are reasonably necessary to prevent nuisance and to protect beneficial uses identified in the Basin Plan, and the section 13241 factors are not sufficient to justify failing to protect those beneficial uses.

10.1. Need to prevent pollution or nuisance: In establishing effluent limitations in this Order, the Los Angeles Water Board has considered state law requirements to prevent pollution or nuisance as defined in section 13050, subdivisions (*l*) and (m), of the Water Code. The only requirement in this Order that is based on State law is a study to investigate the feasibility of recycling, conservation, and/or alternative disposal methods for wastewater (such as groundwater injection), and/or capture and treatment of dry-weather urban runoff and stormwater on a permissive basis for beneficial reuse. This report will allow the Los Angeles Water Board to determine if and how to prevent pollution from any recycling or conservation program that might be implemented in the future.

10.2. Past, present, and probable future beneficial uses of water: Chapter 2 of the Basin Plan identifies designated beneficial uses for water bodies in the Los Angeles Region. Beneficial uses of water relevant to this Order are also identified above in Table F-6.

The Los Angeles Water Board has taken this factor into account in establishing effluent limitations in the Order, including the requirement set forth in section 4.3. The feasibility study will not affect the past or present beneficial uses of water, but it could affect the future beneficial uses of water. Should the Discharger be required to implement the feasibility study, any recycled water that may be produced will have to meet all legal requirements, including those set forth in Title 22 to protect beneficial uses. The requirements herein protect the past, present and probable future beneficial uses of the water.

10.3. Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto: The environmental characteristics are discussed in the Region's Watershed Management Initiative Chapter, as well as available in State of the Watershed reports and the State's CWA Section 303(d) List of impaired waters. The environmental characteristics of the hydrographic unit, including the quality of available water, will be improved by compliance with the requirements of this Order. Additional information on the Santa Monica Bay Watershed Management Area is available at: Los Angeles Regional Water Quality Control Board (ca.gov).

10.4. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area: The water quality standards necessary to protect beneficial uses of the Santa Monica Bay Watershed Management Area can reasonably be achieved through the coordinated control of all factors that affect water quality in the area, including the conservation of water and/or the production of recycled water contemplated in the feasibility study. For example, the water quality in the watershed could be improved through the addition of recycled water which meets Title 22 standards. The Los Angeles Water Board has taken this factor into account in establishing effluent limitations in the Order.

10.5. Economic considerations: The Permittee did not present any evidence regarding economic considerations related to this Order. However, the Los Angeles Water Board has considered the economic impact of requiring certain provisions pursuant to state law, which would be the cost of conducting the feasibility study for recycling, conservation, and/or alternative disposal methods for wastewater (such as groundwater injection), and/or capture and treatment of dry-weather urban runoff and stormwater on a permissive basis for beneficial reuse. Any additional costs associated with producing the study are reasonably necessary to prevent nuisance and protect beneficial uses identified in the Basin Plan, and to increase the water supply. The failure to consider conservation or recycled water could result in the loss of, or impacts to, beneficial uses would have a detrimental economic impact, particularly given the effects on beneficial uses and supplies of water from the drought and climate change. Economic considerations related to costs of compliance are therefore not sufficient, in the Los Angeles Water Board's determination, to justify failing to prevent nuisance and protect beneficial uses.

10.6. Need for developing housing within the region: The Los Angeles Water Board does not anticipate that the state law requirements in this Order will adversely impact the need for housing in the area. The region generally relies on imported water to meet many of its water resource needs. Imported water makes up a vast majority of the region's water supply, with local groundwater, local surface water, and reclaimed water making up the remaining amount. This Order helps address the need for housing by controlling pollutants in discharges, which will improve the quality of local surface and ground water, as well as water available for recycling and reuse. This in turn may reduce the demand for imported water thereby increasing the region's capacity to support continued housing development. A reliable water supply for future housing development is required by law, and with less imported water available to guarantee this reliability, an increase in local supply is necessary. Therefore, the potential for developing housing in the area will be facilitated by the conservation of water, or reuse or production of, recycled water that may result from the feasibility study.

10.7. Need to develop and use recycled water: The State Water Board's Recycled Water Policy requires the Los Angeles Water Board to encourage the use of recycled water. In addition, as discussed immediately above, a need to develop and use recycled water exists within the region, especially during times of drought. To encourage recycling, the Permittee is required by this Order to continue to explore the feasibility of recycling to maximize the beneficial reuse of tertiary treated effluent and to report on its recycled water production and use. The Discharger shall submit an update to this feasibility study as part of the submittal of the Report of Waste Discharge (ROWD) for the next permit renewal.

11. PUBLIC PARTICIPATION

The Los Angeles Water Board has considered the issuance of WDRs that will serve as an NPDES permit for JWPCP. As a step in the WDRs adoption process, the Los Angeles Water Board staff has developed tentative WDRs and has encouraged public participation in the WDRs adoption process.

11.1. Notification of Interested Parties

The Los Angeles Water Board notified the Permittee and interested agencies and persons of its intent to prescribe WDRs for the discharge and provided an opportunity to submit written comments and recommendations. The public notice and Tentative Order were posted on the Los Angeles Water Board's website at Tentative Orders / Permits | Los Angeles Regional Water Quality Control Board (ca.gov). Permittee notification was provided through the following: In addition, interested agencies and persons were notified through a transmittal email to the Discharger, being included in the email transaction, of the Los Angeles Water Board's intention to prescribe WDRs for the discharge.

The public had access to the agenda and any changes in dates and locations through the Los Angeles Water Board's website at: http://www.waterboards.ca.gov/losangeles/board_info/agenda/.

11.2. Written Comments

Interested persons were invited to submit written comments concerning the tentative WDRs as provided through the notification process. Comments were due either in person or by mail to the Los Angeles Water Board Executive Officer at the address on the cover page of this Order, or by email submitted to Don.Tsai@waterboards.ca.gov.

To be fully responded to by staff and considered by the Los Angeles Water Board, the written comments were due at the Los Angeles Water Board office by **5:00 p.m. on May 1, 2023**.

11.3. Public Hearing

The Los Angeles Water Board held a public hearing on the tentative WDRs during its regular Board meeting on the following date and time and at the following location:

Date: May 25, 2023
Time: 9:00 a.m.
Location: 320 W. 4th Street, Carmel Room
Los Angeles, California 90013

A virtual platform was also available for those who wanted to join online. The directions were provided in the agenda to register or to view the Board meeting.

Additional information about the location of the hearing and options for participating were available 10 days before the hearing. Any person desiring to receive future notices about any proposed Board action regarding this Discharger, please contact Don Tsai at Don.Tsai@waterboards.ca.gov, to be included on the email list.

Interested persons were invited to attend. At the public hearing, the Los Angeles Water Board heard testimony pertinent to the discharge, WDRs, and NPDES permit. For accuracy of the record, important testimony was requested in writing.

11.4. Review of Waste Discharge Requirements

Any person aggrieved by this action of the Los Angeles Water Board may petition the State Water Board to review the action in accordance with Water Code section 13320 and California Code of Regulations, Title 23, sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., within 30 calendar days of the date of adoption of this Order at the following address, except that if the thirtieth day following the date of this Order falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day:

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100
Or by email at waterqualitypetitions@waterboards.ca.gov

For instructions on how to file a petition for review, see http://www.waterboards.ca.gov/public_notices/petitions/water_quality/wqpetition_instr.shtml. Filing a petition does not automatically stay any of the requirements of this Order.

11.5. Information and Copying

The ROWD, other supporting documents, and comments received are on file and may be inspected at the address below by appointment between 8:30 a.m. and 4:45 p.m., Monday through Friday. Copying of documents may be arranged through the Los Angeles Water Board at the address below or by calling (213) 576-6600.

Los Angeles Regional Water Quality Control Board

320 W. 4th Street, Suite 200
Los Angeles, CA 90013-2343

11.6. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding the WDRs and NPDES permit should contact the Los Angeles Water Board, reference this facility, and provide a name, address, and phone number.

11.7. Additional Information

Requests for additional information or questions regarding this Order should be directed to Don Tsai via email at Don.Tsai@waterboards.ca.gov.

ATTACHMENT G. TOXICITY REDUCTION EVALUATION (TRE) WORK PLAN

1. Gather and Review Information and Data
    1.1. POTW Operations and Performance
    1.2. POTW Influent and Pretreatment Program
    1.3. Effluent Data, including Toxicity Results
    1.4. Sludge (Biosolids) Data
2. Evaluate Facility Performance
3. Conduct Toxicity Identification Evaluation (TIE)
4. Evaluate Sources and In-Plant Controls
5. Implement Toxicity Control Measures
6. Conduct Confirmatory Toxicity Testing

ATTACHMENT H. BIOSOLIDS AND SLUDGE MANAGEMENT

(Note: "Biosolids" refers to non-hazardous sewage sludge as defined in 40 CFR §503.9. Sewage sludge that is hazardous, as defined in 40 CFR part 261, must be disposed of in accordance with the Resource Conservation and Recovery Act (RCRA).)

1. GENERAL REQUIREMENTS

1.1. All biosolids generated by the Permittee shall be reused or disposed of in compliance with the applicable portions of:

1.1.1. 40 CFR part 503: for biosolids that are land applied, placed in surface disposal sites (dedicated land disposal sites or monofills), or incinerated; 40 CFR § 503 Subpart B (land application) applies to biosolids placed on the land for the purposes of providing nutrients or conditioning the soil for crops or vegetation. 40 CFR § 503 Subpart C (surface disposal) applies to biosolids placed on land for the purpose of disposal.

1.1.2. 40 CFR part 258: for biosolids disposed of in a municipal solid waste landfills.

1.1.3. 40 CFR part 257: for all biosolids use and disposal practices not covered under 40 CFR parts 258 or 503.

1.2. The Permittee is responsible for assuring that all biosolids from its facility are used or disposed of in accordance with 40 CFR part 503, whether the Permittee uses or disposes of the biosolids itself or transfers their biosolids to another party for further treatment, reuse, or disposal. The Permittee is responsible for informing subsequent preparers, appliers, and disposers of requirements they must meet under 40 CFR part 503.

1.3. Duty to mitigate: The Permittee shall take all reasonable steps to prevent or minimize any biosolids use or disposal which may adversely impact human health or the environment.

1.4. No biosolids shall be allowed to enter wetland or other waters of the United States.

1.5. Biosolids treatment, storage, and use or disposal shall not contaminate groundwater.

1.6. Biosolids treatment, storage, use or disposal shall not create a nuisance such as objectionable odors or flies.

1.7. The Permittee shall assure that haulers transporting biosolids off site for further treatment, storage, reuse, or disposal take all necessary measures to keep the biosolids contained.

1.8. If biosolids are stored for over two years from the time they are generated, the Permittee must ensure compliance with all the requirements for surface disposal under 40 CFR part 503 Subpart C, or must submit a written request to USEPA with the information in part 503.20(b), requesting permission for longer temporary storage.

1.9. Sewage sludge containing more than 50 mg/kg PCBs shall be disposed of in accordance with 40 CFR part 761.

1.10. Any off-site biosolids treatment, storage, use, or disposal site operated by the Permittee within Region 4 (Los Angeles Region of RWQCB) that is not subject to its own Waste Discharge Requirements shall have facilities adequate to divert surface runoff from the adjacent area, to protect the site boundaries from erosion, and to prevent any conditions that would cause drainage from the materials in the disposal site to escape from the site. Adequate protection is defined as protected from a storm or flood having a 1-percent chance of occurring in a 24-hour period in any given year and from the highest tidal stage that may occur.

1.11. There shall be adequate screening at the plant headworks and/or at the biosolids treatment units to ensure that all pieces of metal, plastic, glass, and other inert objects with a diameter greater than 3/8 inches are removed.

2. INSPECTION AND ENTRY

The Los Angeles Water Board, USEPA, or an authorized representative thereof, upon the presentation of credentials, shall be allowed by the Permittee, directly or through contractual arrangements with their biosolids management contractors, to:

2.1. Enter upon all premises where biosolids are produced by the Permittee and all premises where Permittee biosolids are further treated, stored, used, or disposed, either by the Permittee or by another party to whom the Permittee transfers the biosolids for further treatment, storage, use, or disposal;

2.3. Have access to and copy any records that must be kept under the conditions of this permit or of 40 CFR part 503, by the Permittee or by another party to whom the Permittee transfers the biosolids for further treatment, storage, use, or disposal; and

2.4. Inspect any facilities, equipment (including monitoring and control equipment), practices, or operations used in the production of biosolids and further treatment, storage, use, or disposal by the Permittee or by another party to whom the Permittee transfers the biosolids for further treatment, storage, use, or disposal.

3. MONITORING

3.1. Biosolids shall be monitored for the metals required in 40 CFR § 503.16 (for land application) or § 503.26 (for surface disposal), using the methods in "Test Methods for Evaluating Solids Waste, Physical/Chemical Methods" (SW-846), as required in 503.8(b)(4), at the following minimum frequencies:

Amount of Sewage Sludge (Metric Tons per 365 days)	Frequency
Greater than 0 but less than 290	Once per year
Equal to or greater than 290 but less than 1,500	Once per quarter
Equal to or greater than 1,500 but less than 15,000	Once per 60 days
Equal to or greater than 15,000	Once per month

For accumulated, previously untested biosolids, the Permittee shall develop a representative sampling plan, which addresses the number and location of sampling points, and collect representative samples.

Test results shall be expressed in milligrams pollutant per kilogram biosolids on a 100% dry weight basis.

Biosolids used for land application shall be tested for organic nitrogen, ammonia nitrogen, and nitrate nitrogen at the frequencies required above.

3.2. Biosolids shall be monitored for the following constituents at the frequency stipulated in 40 CFR § 503.16: arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, organic nitrogen, ammonia nitrogen, and total solids. If biosolids are removed for use or disposal on a routine basis, sampling should be scheduled for regular intervals throughout the year. If biosolids are stored for an extended period prior to use or disposal, sampling may occur at regular intervals, or samples of the accumulated stockpile may be collected prior to use or disposal, corresponding to the tons accumulated in the stockpile for that period.

3.3. Class 1 facilities (facilities with pretreatment programs or others designated as Class 1 by the Regional Administrator) and Federal facilities with >5 MGD influent flow shall sample biosolids for pollutants listed under section 307 (a) of the Clean Water Act (as required in the pretreatment section of the permit for POTWs with pretreatment programs). Class 1 facilities and Federal Facilities with >5 MGD influent flow shall test dioxins/dibenzofurans using a detection limit of <1 pg/g during their next sampling period if they have not done so within the past 5 years and once per 5 years thereafter.

3.4. The biosolids shall be tested annually or more frequently if necessary, to determine hazardousness in accordance with Title 22 of the California Code of Regulations, Article 1, Chapter 11, Division 4.5 (section 66261.3).

4. PATHOGEN AND VECTOR CONTROL

4.1. Prior to land application, the Permittee shall demonstrate that the biosolids meet Class A or Class B pathogen reduction levels by one of the methods listed in 40 CFR § 503.32. Prior to disposal in a surface disposal site, the Permittee shall demonstrate that the biosolids meet Class B levels or shall ensure that the site is covered at the end of each operating day.

4.2. If pathogen reduction is demonstrated using a “Process to Further Reduce Pathogens,” the Permittee shall maintain daily records of the operating parameters used to achieve this reduction. If pathogen reduction is demonstrated by testing for fecal coliform and/or pathogens, samples must be collected at the frequency specified in Table 1 of 40 CFR § 503.16. If Class B is demonstrated using fecal coliform, at least seven grab samples must be collected during each monitoring period and a geometric mean calculated from these samples. The following holding times between sample collection and analysis shall not be exceeded: fecal coliform – 6 hours when cooled to <4 degrees Celsius (extended to 24 hours when cooled to <4 degrees Celsius for Class A composted, Class B aerobically digested, and Class B anaerobically digested sample types); *Salmonella* spp. Bacteria – 24 hours when cooled to <4 degrees Celsius (unless using Method 1682 – 6 hours when cooled to 10 degrees Celsius); enteric viruses – 6 hours when cooled to <10 degrees Celsius (extended to one month when cooled to <4 degrees Celsius).

4.3. For biosolids that are land applied or placed in a surface disposal site, the Permittee shall track and keep records of the operational parameters used to achieve Vector Attraction Reduction requirements in 40 CFR § 503.33 (b).

5. LAND APPLICATION

The Permittee shall ensure that Class A thermophilically digested biosolids are applied at a rate not to exceed the agronomic rate for the crop that is grown.

6. SURFACE DISPOSAL

If biosolids are placed in a surface disposal site (dedicated land disposal site or monofill), a qualified groundwater scientist shall develop a groundwater monitoring program for the site or shall certify that the placement of biosolids on the site will not contaminate an aquifer.

7. NOTIFICATION

The Permittee, either directly or through contractual arrangements with their biosolids management contractors, shall comply with the following 40 CFR part 503 notification requirements.

7.1. Notification of Non-compliance

The Permittee shall require appliers of their biosolids to notify USEPA Region 9 and their state permitting agency of any noncompliance within 24 hours if the non-compliance may seriously endanger health or the environment. For other instances of non-compliance, the Permittee shall require appliers of their biosolids to notify USEPA Region 9 and their state permitting agency of the non-compliance in writing within 10 working days of becoming aware of the non-compliance.

7.2. Interstate Notification

If bulk biosolids are shipped to another State or to Indian Lands, the Permittee must send written notice within 60 days of the shipment and prior to the initial application of bulk biosolids to the permitting authorities in the receiving State or Indian Land (the USEPA Regional Office for the area and the State/Indian authorities).

7.3. Land Application Notification

A reuse/disposal plan shall be submitted to USEPA Region 9 Coordinator and, in the absence of other state or regional reporting requirements, to the state permitting agency, prior to the use or disposal of any biosolids from this facility to a new or previously unreported site. The plan shall be submitted by the land applier of the biosolids and shall include a description and a topographic map of the proposed site(s) for reuse or disposal, names and addresses of the applier(s) and site owner(s), and a list of any state or local permits which must be obtained. For land application sites, the plan shall include a description of the crops or vegetation to be grown, proposed nitrogen loadings to be used for the crops, a determination of agronomic rates, and a groundwater monitoring plan or a description of why groundwater monitoring is not required.

If the biosolids do not meet 40 CFR § 503.13 Table 3 metals concentration limits, the Permittee must require their land applier to contact the state permitting authority to determine whether bulk biosolids subject to the cumulative pollutant loading rates in 40 CFR § 503.12(b)(2) have been applied to the site since July 20, 1993, and, if so, the cumulative amount of pollutants applied to date, and background concentration, if known. The Permittee shall then notify USEPA Region 9 Coordinator of this information.

For biosolids that are land applied, the Permittee shall notify the applier in writing of the nitrogen content of the biosolids, and the applier's requirements under 40 CFR part 503, including the requirements that the applier certify that the requirement to obtain information in Subpart A, and that the management practices, site restrictions, and any applicable vector attraction reduction requirements Subpart D have been met. The Permittee shall require the applier to certify at the end of 38 months following application of Class B biosolids that those harvesting restrictions in effect for up to 38 months have been met.

7.4. Surface Disposal Notification

Prior to disposal at a new or previously unreported site, the Permittee shall notify USEPA and the State. The notice shall include a description and topographic map of the proposed site, depth to groundwater, whether the site is lined or unlined, site operator and site owner, and any state or local permits. It shall also describe procedures for ensuring grazing and public access restrictions for three years following site closure. The notice shall include a groundwater monitoring plan or description of why groundwater monitoring is not required.

8. REPORTING

The Permittee shall submit an annual biosolids report to USEPA Region 9 Biosolids Coordinator and the Los Angeles Regional Water Quality Control Board by February 19 of each calendar year. The report shall include:

8.1. The amount of biosolids generated that year, in dry metric tons, and the amount accumulated from previous years.

8.2. Results of all pollutant monitoring required in the Monitoring Section above. Results must be reported on a 100% dry weight basis.

8.3. Descriptions of pathogen reduction methods, and vector attraction reduction methods, as required in 40 CFR § 503.17 and 503.27, and certifications.

8.4. Results of any groundwater monitoring or certification by a groundwater scientist that the placement of biosolids in a surface disposal site will not contaminate an aquifer.

8.5. Names and addresses of land appliers and surface disposal site operators, and volumes applied (dry metric tons).

8.6. Names and addresses of persons who received biosolids for storage, further treatment, disposal in a municipal waste landfill, deep well injection, or other reuse/disposal methods not covered above, and volumes delivered to each.

8.7. The Permittee shall submit, or require all parties contracted to manage their biosolids to submit, an annual biosolids report to USEPA Region 9 Biosolids Coordinator by February 19 of each year for the period covering the previous calendar year. The report shall include:

Names and addresses of land appliers and surface disposal site operators, name, location (latitude/longitude), and size (hectares) of site(s), volumes applied/disposed (dry metric tons), results of any groundwater monitoring; for land application: biosolids loading rates (metric tons per hectare), nitrogen loading rates (kg/ha),calculated plant available nitrogen, dates of applications, crops grown, dates of seeding and harvesting and certifications that the requirement to obtain information in 40 CFR § 503.12(e)(2), management practices in §503.14, site restrictions in § 503.32(b)(5) have been met; for biosolids exceeding 40 CFR §503.13 Table 3 metals concentrations, the locations of sites where the biosolids were applied and cumulative metals loading at the sites to date; and for closed sites, the date of site closure and certifications of management practiced for three years following site closure.

8.8. The annual biosolids report shall be submitted to USEPA using USEPA's NPDES [Central Data Exchange (CDX)](https://cdx.epa.gov/) and can be accessed at https://cdx.epa.gov/.

ATTACHMENT I. PRETREATMENT REPORTING REQUIREMENTS

The Permittee is required to submit annual Pretreatment Program Compliance Reports (Report) to the Los Angeles Regional Water Quality Control Board (Los Angeles Water Board) and United States Environmental Protection Agency, Region 9 (USEPA). This Attachment outlines the minimum reporting requirements of the Report. If there is any conflict between requirements stated in this attachment and provisions stated in the Waste Discharge Requirements (WDRs), those contained in the WDRs will prevail.

1. PRETREATMENT REQUIREMENTS

1.1. The Permittee shall be responsible and liable for the performance of all Control Authority pretreatment requirements contained in Title 40 of the Code of Federal Regulations (40 CFR) part 403, including any subsequent regulatory revisions to 40 CFR part 403. Where 40 CFR part 403 or subsequent revision places mandatory actions upon the Permittee as Control Authority but does not specify a timetable for completion of the actions, the Permittee shall complete the required actions within six months from the issuance date of this permit or the effective date of the revisions to 40 CFR part 403, whichever is later. For violations of pretreatment requirements, the Permittee shall be subject to enforcement actions, penalties, fines and other remedies by the USEPA or other appropriate parties, as provided in the Clean Water Act (CWA). The Los Angeles Water Board or USEPA may initiate enforcement action against a nondomestic user for noncompliance with applicable standards and requirements as provided in the CWA and/or the California Water Code.

1.2. The Permittee shall implement and enforce in its entire service area, including contributing jurisdictions, its approved pretreatment program, and all subsequent revisions which are hereby made enforceable conditions of this Order. The Permittee shall enforce the requirements promulgated under sections 307(b), 307(c), 307(d) and 402(b) of the CWA with timely, appropriate and effective enforcement actions. The Permittee shall cause all nondomestic users subject to federal categorical standards to achieve compliance no later than the date specified in those requirements or, in the case of a new nondomestic user, upon commencement of the discharge.

1.3. The Permittee shall perform the pretreatment functions as required in 40 CFR part 403 including, but not limited to:

1.3.1. Implement the necessary legal authorities as provided in 40 CFR § 403.8(f)(1);

1.3.2. Enforce the pretreatment requirements under 40 CFR § 403.5 and 403.6;

1.3.3. Implement the programmatic functions as provided in 40 CFR § 403.8(f)(2); and

1.3.4. Provide the requisite funding and personnel to implement the pretreatment program as provided in 40 CFR § 403.8(f)(3).

1.4. The Permittee shall submit an annual report to the Los Angeles Water Board, State Water Resources Control Board (State Water Board), and USEPA Region 9, describing its pretreatment activities over the previous year. In the event the Permittee is not in compliance with any conditions or requirements of this Order, or any pretreatment compliance inspection/audit requirements, then the Permittee shall also include the reasons for noncompliance and state how and when the Permittee shall comply with such conditions and requirements. This annual report shall cover operations from January 1 through December 31 and is due on April 30 of each year. The report shall contain, but not be limited to, the following information:

1.4.1. A summary of analytical results from representative sampling of the publicly-owned treatment works (POTW) influent and effluent, as described in Attachment E – Monitoring and Reporting Program, for those pollutants USEPA has identified under section 307(a) of the CWA which are known or suspected to be discharged by nondomestic users. Representative grab sampling shall be conducted for pollutants that may degrade after collection, or where the use of automatic sampling equipment may otherwise result in unrepresentative sampling. Such pollutants include, but are not limited to, cyanide, oil and grease, volatile organic compounds, chlorine, phenol, sulfide, pH, and temperature. Sludge sampling and analysis are covered in the sludge section of this permit. The Permittee shall also provide any influent or effluent monitoring data for nonpriority pollutants which the Permittee believes may be causing or contributing to interference or pass through. Sampling and analysis shall be performed with the techniques described in 40 CFR part 136.

1.4.2. A discussion of upset, interference or pass-through incidents, if any, at the treatment plant which the Permittee knows or suspects were caused by nondomestic users of the POTW system. The discussion shall include the reasons why the incidents occurred, the corrective actions taken and, if known, the name and address of the nondomestic user(s) responsible. The discussion shall also include a review of the applicable pollutant limitations to determine whether any additional limitations, or changes to existing requirements, may be necessary to prevent pass through or interference.

1.4.3. An updated list of the Permittee’s Significant Industrial Users (SIUs) including their names and addresses, and a list of deletions, additions and SIU name changes keyed to the previously submitted list. The Permittee shall provide a brief explanation for each change. The list shall identify the SIUs subject to federal categorical standards by specifying which set(s) of standards are applicable to each SIU. The list shall also indicate which SIUs are subject to local limitations.

1.4.4. The Permittee shall characterize the compliance status of each SIU by providing a list or table which includes the following information:

a. Name of the SIU;

b. Category, if subject to federal categorical standards;

c. The type of wastewater treatment or control processes in place;

d. The number of samples collected, and inspections conducted by the Permittee during the year;

e. The number of samples taken by the SIU during the year;

f. For an SIU subject to discharge requirements for total toxic organics, whether all required certifications were provided;

g. A list of the standards violated during the year. Identify whether the violations were for categorical standards or local limits;

h. Whether the facility is in significant noncompliance (SNC) as defined at 40 CFR § 403.8(f)(2)(viii) at any time during the year; and

i. A summary of enforcement or other actions taken during the year to return the SIU to compliance. Describe the type of action, final compliance date, and the number of fines and penalties collected, if any. Describe any proposed actions for bringing the SIU into compliance.

1.4.5. A brief description of any programs the Permittee implements to reduce pollutants from nondomestic users that are not classified as SIUs.

1.4.6. A brief description of any changes in operating the pretreatment program which differ from the previous year including, but not limited to, changes concerning the program's administrative structure, local limits, monitoring program or monitoring frequencies, legal authority, enforcement policy, funding levels, or staffing levels.

1.4.7. A summary of the annual pretreatment budget, including the cost of pretreatment program functions and equipment purchases.

1.4.8. A summary of activities to involve and inform the public of the program including a copy of the newspaper notice, if any, required under 40 CFR § 403.8(f)(2)(viii).

1.4.9. A description of any changes in sludge disposal methods.

1.4.10. A discussion of any concerns not described elsewhere in the annual report.

1.5. Any substantial modifications to the approved Pretreatment Program, as defined in 40 CFR § 403.18(b), shall be submitted in writing to the Los Angeles Water Board and USEPA and shall not become effective until the Los Angeles Water Board and/or USEPA approval is attained.

1.6. Non-industrial Source Control and Public Education Programs. The Permittee shall continue to develop and implement its non-industrial source control program and public education program. The purpose of these programs is to reduce nonindustrial toxic pollutants and pesticides into the POTW. These programs shall be periodically reviewed and addressed in the annual report.

2. LOCAL LIMITS EVALUATION

In accordance with 40 CFR § 122.44(j)(2)(ii), the Permittee shall provide a written technical evaluation of the need to revise local limits under 40 CFR § 403.5(c)(1) within 180 days of issuance or reissuance of this Order. This written technical evaluation shall be consistent with local limits reviews described in section 7.1 of USEPA's Local Limits Development Guidance (EPA 833-R-04-002A, July 2004). Local limits shall be calculated to be protective of mass emission benchmarks in addition to water quality standards.

3. SIGNATORY REQUIREMENTS AND REPORT SUBMITTAL

3.1. Signatory Requirements

The annual report must be signed by a principal executive officer, ranking elected official or other duly authorized employee if such employee is responsible for the overall operation of the POTW. Any person signing these reports must make the following certification [40 CFR § 403.6(a)(2)(ii)]:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

3.2. Report Submittal

The Annual Pretreatment Report shall be submitted electronically using the State Water Board's California Integrated Water Quality System (CIWQS) Program website (http://www.waterboards.ca.gov/ciwqs/index.html). The CIWQS website will provide additional information for SMR submittal in the event there will be a planned service interruption for electronic submittal.

A copy of the Annual Report must be sent to USEPA electronically to the following address: R9Pretreatment@epa.gov. The maximum file size is 20 megabytes.

ATTACHMENT J. REASONABLE POTENTIAL ANALYSIS SUMMARY
FOR DISCHARGE POINTS 001 AND 002

Parameters	Unit	Max. Effluent Conc.	Ocean Plan 6-Month Median Objective	Ocean Plan Daily Max. Objective	Ocean Plan Instan-taneous Max.	Ocean Plan 30-Day Average Objective	Lowest C_o	C_s	With Monitoring Data	%Data Detected <20%	$UCB_{95/95}$	RPA Result-Need Limit?	Rationale	Note
Arsenic	µg/L	2.62	8	32	80	--	8	3	Yes	No	2.9989	No	$UCB_{95/95}$ < Lowest C_o	--
Cadmium	µg/L	0.062	1	4	10	--	1	0	Yes	No	0.0005	No	$UCB_{95/95}$ < Lowest C_o	--
Chromium (VI)	µg/L	0.12	2	8	20	--	2	0	Yes	No	0.0008	No	$UCB_{95/95}$ < Lowest C_o	--
Copper	µg/L	4.96	3	12	30	--	3	2	Yes	No	2.0201	No	$UCB_{95/95}$ < Lowest C_o	--
Lead	µg/L	--	2	8	20	--	2	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Mercury	µg/L	--	0.04	0.16	0.4	--	0.04	0.0005	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Nickel	µg/L	15.4	5	20	50	--	5	0	Yes	No	0.0775	No	$UCB_{95/95}$ < Lowest C_o	--
Selenium	µg/L	6.08	15	60	150	--	15	0	Yes	No	0.0396	No	$UCB_{95/95}$ < Lowest C_o	--
Silver	µg/L	0.21	0.7	2.8	7	--	0.7	0.16	Yes	No	--	No	Conclusive non-exceedances of the C_o	--
Zinc	µg/L	18.3	20	80	200	--	20	8	Yes	No	8.0640	No	$UCB_{95/95}$ < Lowest C_o	--
Cyanide, Total	µg/L	7.42	1	4	10	--	1	0	Yes	No	--	No	Conclusive non-exceedances of the C_o	--
Chlorine, Total Residual	µg/L	700	2	8	60	--	2	0	Yes	Yes	--	Yes	Conclusive non-exceedances of the C_o	--
Ammonia (As N)	µg/L	50000	600	2400	6000	--	600	0	Yes	No	293.7514	No	$UCB_{95/95}$ < Lowest C_o	--
Phenols, Non-Chlorinated	µg/L	2.17	30	120	300	--	30	0	Yes	No	0.0226	No	$UCB_{95/95}$ < Lowest C_o	a
Phenols, Chlorinated	µg/L	0.91	1	4	10	--	1	0	Yes	No	0.0167	No	$UCB_{95/95}$ < Lowest C_o	a
Endosulfans	µg/L	--	0.009	0.018	0.027	--	0.009	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	a
Endrin	µg/L	--	0.002	0.004	0.006	--	0.002	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	
HCH	µg/L	0.02	0.004	0.008	0.012	--	0.004	0	Yes	No	--	No	Conclusive non-exceedances of the C_o	a

Parameters	Unit	Max. Effluent Conc.	Ocean Plan 6-Month Median Objective	Ocean Plan Daily Max. Objective	Ocean Plan Instan-taneous Max.	Ocean Plan 30-Day Average Objective	Lowest C_o	C_s	With Monitoring Data	%Data Detected <20%	$UCB_{95/95}$	RPA Result-Need Limit?	Rationale	Note
Acrolein	µg/L	--	--	--	--	220	220	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Antimony	µg/L	2.65	--	--	--	1200	1200	0	Yes	No	0.0191	No	$UCB_{95/95}$ < Lowest C_o	--
Bis(2-Chloroethoxy) Methane	µg/L	--	--	--	--	4.4	4.4	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Bis(2-Chloroisopropyl) Ether	µg/L	--	--	--	--	1200	1200	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Chlorobenzene	µg/L	--	--	--	--	570	570	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Chromium (III)	µg/L	2.54	--	--	--	190000	190000	0	Yes	No	0.0143	No	$UCB_{95/95}$ < Lowest C_o	--
Di-N-Butyl Phthalate	µg/L	1.7	--	--	--	3500	3500	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Dichlorobenzenes	µg/L	--	--	--	--	5100	5100	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	a
Diethyl Phthalate	µg/L	0.65	--	--	--	33000	33000	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Dimethyl Phthalate	µg/L	--	--	--	--	820000	820000	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
4,6-Dinitro-2-Methyl-phenol	µg/L	--	--	--	--	220	220	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
2,4-Dinitrophenol	µg/L	--	--	--	--	4	4	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Ethylbenzene	µg/L	--	--	--	--	4100	4100	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Fluoranthene	µg/L	--	--	--	--	15	15	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Hexachlorocyclopen-tadiene	µg/L	--	--	--	--	58	58	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Nitrobenzene	µg/L	--	--	--	--	4.9	4.9	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--

Parameters	Unit	Max. Effluent Conc.	Ocean Plan 6-Month Median Objective	Ocean Plan Daily Max. Objective	Ocean Plan Instan-taneous Max.	Ocean Plan 30-Day Average Objective	Lowest C_o	C_s	With Monitoring Data	%Data Detected <20%	$UCB_{95/95}$	RPA Result-Need Limit?	Rationale	Note
Thallium	µg/L	--	--	--	--	2	2	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Toluene	µg/L	0.74	--	--	--	85000	85000	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Tributyltin	µg/L	--	--	--	--	0.0014	0.0014	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
1,1,1-Trichloroethane	µg/L	--	--	--	--	540000	540000	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Acrylonitrile	µg/L	--	--	--	--	0.1	0.1	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Aldrin	µg/L	0.008	--	--	--	0.000022	0.000022	0	Yes	No	--	Yes	Detections > Lowest C_o after complete mixing	--
Benzene	µg/L	--	--	--	--	5.9	5.9	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Benzidine	µg/L	--	--	--	--	0.000069	0.000069	0	Yes	Yes	--	Yes	No conclusive non-exceedances of the C_o	--
Beryllium	µg/L	--	--	--	--	0.033	0.033	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Bis(2-Chloroethyl) Ether	µg/L	--	--	--	--	0.045	0.045	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Bis(2-Ethylhexyl) Phthalate	µg/L	75	--	--	--	3.5	3.5	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Carbon Tetrachloride	µg/L	--	--	--	--	0.9	0.9	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Chlordane	µg/L	--	--	--	--	0.000023	0.000023	0	Yes	Yes	--	Yes	No conclusive non-exceedances of the C_o C	a
Chlorodibromo-methane	µg/L	0.56	--	--	--	8.6	8.6	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Chloroform	µg/L	20	--	--	--	130	130	0	Yes	No	0.1584	No	$UCB_{95/95}$ < Lowest C_o	--

Parameters	Unit	Max. Effluent Conc.	Ocean Plan 6-Month Median Objective	Ocean Plan Daily Max. Objective	Ocean Plan Instan-taneous Max.	Ocean Plan 30-Day Average Objective	Lowest C_o	C_s	With Monitoring Data	%Data Detected <20%	$UCB_{95/95}$	RPA Result-Need Limit?	Rationale	Note
DDT	µg/L	0.004	--	--	--	0.00017	0.00017	0.0000 57	Yes	Yes	--	Yes	With TMDL	a
1,4-Dichlorobenzene	µg/L	--	--	--	--	18	18	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
3,3-Dichlorobenzidine	µg/L	--	--	--	--	0.0081	0.0081	0	Yes	Yes	--	Yes	No conclusive non-exceedances of the C_o	--
1,2-Dichloroethane	µg/L	--	--	--	--	28	28	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
1,1-Dichloroethylene	µg/L	--	--	--	--	0.9	0.9	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Dichlorobromo-methane	µg/L	1.1	--	--	--	6.2	6.2	0	Yes	No	0.0088	No	$UCB_{95/95}$ < Lowest C_o	--
Dichloromethane	µg/L	2.8	--	--	--	450	450	0	Yes	No	0.0209	No	$UCB_{95/95}$ < Lowest C_o	--
1,3-Dichloropropene	µg/L	--	--	--	--	8.9	8.9	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Dieldrin	µg/L	0.01	--	--	--	0.00004	0.00004	0	Yes	Yes	--	Yes	Detection > Lowest C_o after complete mixing	--
2,4-Dinitrotoluene	µg/L	--	--	--	--	2.6	2.6	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
1,2-Diphenylhydrazine	µg/L	--	--	--	--	0.16	0.16	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Halomethanes	µg/L	--	--	--	--	130	130	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	a
Heptachlor	µg/L	--	--	--	--	0.00005	0.00005	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Heptachlor Epoxide	µg/L	--	--	--	--	0.00002	0.00002	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Hexachlorobenzene	µg/L	--	--	--	--	0.00021	0.00021	0	Yes	Yes	--	Yes	No conclusive non-exceedances of the C_o	--
Hexachlorobutadiene	µg/L	--	--	--	--	14	14	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--

Parameters	**Unit**	**Max. Effluent Conc.**	**Ocean Plan 6-Month Median Objective**	**Ocean Plan Daily Max. Objective**	**Ocean Plan Instan-taneous Max.**	**Ocean Plan 30-Day Average Objective**	**Lowest C_o**	**C_s**	**With Monitoring Data**	**%Data Detected <20%**	**$UCB_{95/95}$**	**RPA Result-Need Limit?**	**Rationale**	**Note**
Hexachloroethane	µg/L	--	--	--	--	2.5	2.5	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Isophorone	µg/L	--	--	--	--	730	730	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
N-Nitrosodimethylamine	µg/L	0.33	--	--	--	7.3	7.3	0	Yes	No	0.0024	No	$UCB_{95/95}$ < Lowest C_o	--
N-Nitrosodi-N-Propylamine	µg/L	--	--	--	--	0.38	0.38	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
N-Nitrosodiphenylamine	µg/L	--	--	--	--	2.5	2.5	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
PAHs	µg/L	0.021	--	--	--	0.0088	0.0088	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	a
PCBs Arochlors	µg/L	--	--	--	--	0.000019	0.000019	0.000016	Yes	Yes	--	Yes	With TMDL	a
TCDD Equivalents	µg/L	--	--	--	--	3.9E-09	3.9E-09	0	Yes	Yes	--	Yes	No conclusive non-exceedances of the C_o	a
1,1,2,2-Tetrachloroethane	µg/L	--	--	--	--	2.3	2.3	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Tetrachloroethylene	µg/L	0.55	--	--	--	2	2	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Toxaphene	µg/L	--	--	--	--	0.00021	0.00021	0	Yes	Yes	--	Yes	No conclusive non-exceedances of the C_o	--
Trichloroethylene	µg/L	--	--	--	--	27	27	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
1,1,2-Trichloroethane	µg/L	--	--	--	--	9.4	9.4	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
2,4,6-Trichlorophenol	µg/L	--	--	--	--	0.29	0.29	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--
Vinyl Chloride	µg/L	--	--	--	--	36	36	0	Yes	Yes	--	No	Conclusive non-exceedances of the C_o	--

Footnotes for Discharge Point 002 RPA

C_o – 2019 Ocean Plan objectives
C_s – 2019 Ocean Plan background concentrations
RPA – Reasonable Potential Analysis
$UCB_{95/95}$ - upper 95 percent confidence bound for the 95th percentile of the effluent performance data
a. See Attachment A of this Order for definition of terms.

Appendix E

Independent Review

Appendix E.1: 2020 IRP Water Demands

Appendix E.2: 2020 IRP Climate Change

Appendix E.3: Conceptual Feasibility

Appendix E.4: Innovation Facility/Treatment/Groundwater/Deliveries/Implementation

Appendix E.5: Additional Documentation

Appendix E.1

2020 IRP Water Demands

Integrated Resources Plan Retrospective Comments & Feedback

Integrated Resources Plan Special Committee
Item 6b
January 26, 2021

Summary of Retrospective Report

- Reviewed planning assumptions in 2015 IRP Update and compare to recent observations
  - Presented to IRP Committee in June 2020 and December 2020
- Examined planning assumptions in context of other recent studies
- Offered lessons learned
- Sought member agency and Board input

Summary of IRP Feedback

- Joint Letter from 12 Agencies* (Oct. 3, 2020)
  - Supportive of scenario framework
  - Support moving forward to policy discussion and resource mix
  - Prudent to continue momentum of collaborative process

*Calleguas MWD, Central Basin MWD, Eastern MWD, Foothill MWD, Inland Empire Utilities Agency, City of Long Beach, Municipal Water District of OC, City of Pasadena, Three Valleys MWD, City of Torrance, Upper San Gabriel Valley MWD, Western MWD

Summary of IRP Feedback (cont.)

- City of Los Angeles (Dec. 24, 2020)
  - Seeks additional evidence for scenarios and assumptions
  - Expressed concerns that local supply production and conservation lagged IRP targets since 2015
  - Expressed concern that imported supply stability has not improved
  - Emphasized that risks of underestimating demand outweigh risks of overestimation

Summary of IRP Feedback (cont.)

- San Diego County Water Authority
  Board Input (Dec. 30); Technical Input (Jan. 4)
  - Questioned continued use of scenario planning; recommended baseline forecast
  - Requested analysis at member agency level rather than aggregate
  - Suggested MWD demands will remain flat if not continue to decline in coming years
  - Raised interrelated rate refinement issues on fixed charges, insurance, and reliability

Other Feedback

- Provide data on assumptions and outcomes
- Questions about Scenario Planning compared to Robust Decision Making
- Questions on level of rebound in per-capita water use
- Questions on demographic assumptions for growth

Proposed Adaptive Management Monitoring

- Adaptive Management Plan Monitors Progress
  - Reflects current conditions
  - Projects 10 years into future
  - Useful for tracking compared to IRP scenarios
  - Updated with annual IRP Implementation Report
    - IRP implementation reports typically produced each fall
    - Useful for biennial budget preparation

Schedule for Remaining Work

Schedule for Remaining Work

2021

Key Steps	Jan	Feb	Mar	Apr
Refine Scenarios				
Engage with Member Agencies (Local Supplies and Demand assumptions)			Proposed Workshops	
Engage with Experts				
Imported Water Supply Refinements				
MWD Storage Assumptions				
Refined Gap Analysis				

Next Steps

- Continue with Scenario Planning
- Written response to comments
- File Retrospective Report with Board
- Modify scenarios based on member agency and expert panel input
- Develop adaptive management plan monitoring
- Coordination between major processes

Coordination Across Processes

- Multiple processes underway or soon to begin
  - Urban Water Management Plan
  - Integrated Resources Plan
  - Rate Refinement
  - Groundwater request
- Coordinate with member agency managers in February and on-going

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

METROPOLITAN'S UNCERTAIN FUTURE WATER DEMAND: WHAT THE EXPERTS SAID

As Metropolitan updates its long-term water strategy, its Integrated Resources Plan (IRP), the District is looking at a range of futures given all the uncertainties California faces when it comes to water. In this ongoing scenario planning process, Metropolitan is examining key uncertainties – being referred to as drivers – that will shape the future.

Southern California's future population growth, housing mix and economy are drivers that will have considerable influence on future demands on Metropolitan supplies. To better understand these drivers, Metropolitan enlisted the feedback of experts in water planning and demography to help the Board of Directors, our 26 Member Agencies and staff to advance the IRP process.

On March 23, 2021 Metropolitan held a three-hour workshop for these experts to engage with Board members and water managers to share insights on key influences of future water demands in Southern California. While climate change was mentioned, a separate workshop specifically dedicated to uncertainties related to climate change is scheduled for May 25, 2021.

The following are highlights of how these experts answered key questions on the drivers and their effects on future demand. Here is a video link to the full workshop.

Drivers: What are the most important underlying drivers that influence demands? How do they affect demands in each of the three major demand sectors: single family residential, multi-family residential and commercial/industrial?

Lisa Maddaus

- Co-owner and senior water resources engineer with Maddaus Water Management Inc.
- B.S. and M.S. in Civil and Environmental Engineering from UC Davis

Principal Drivers

> ***As we look to the future, we need to think about: What do new housing types look like? How are household uses changing? How are the existing households changing over in their water use? How are businesses using their water? ...There is a lot happening as these gears (drivers) turn. The question is how much are they accelerating? How much is the growth going to continue and at what pace?***

Key Points

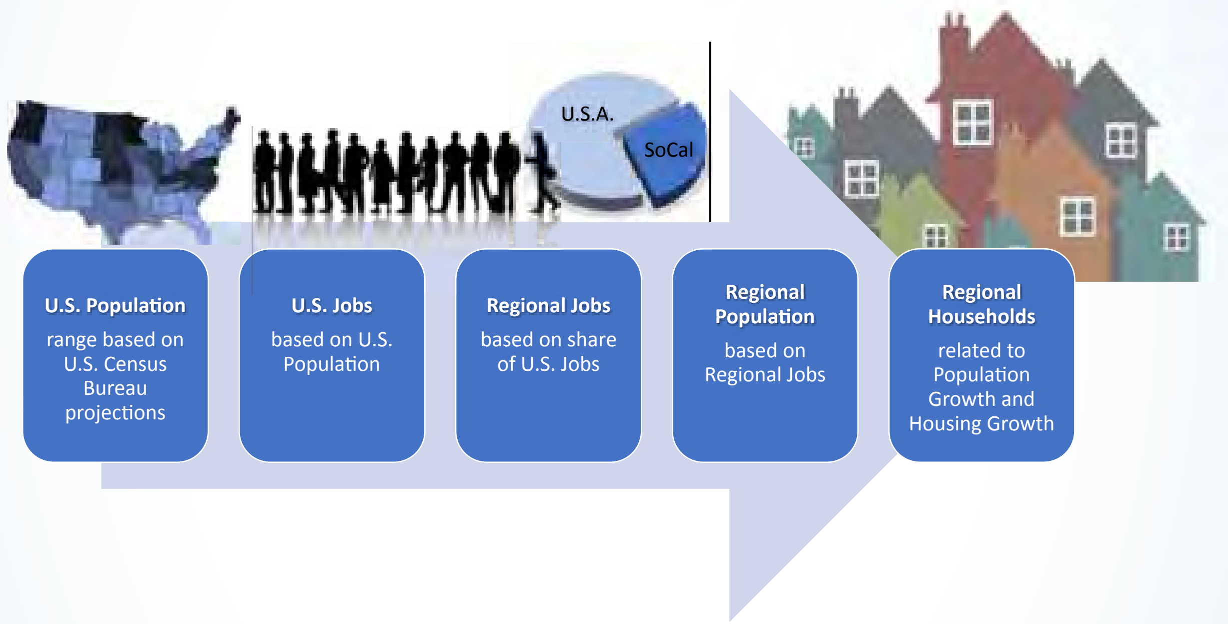
- Three quarters of current Municipal & Industrial demand is residential (single and multifamily). This will shift slightly in the future but not dramatically.
- Population, population growth, and demographics drive a lot of demand.
- There is a lot of complexity with other drivers happening in the background, including weather, climate, price of water, affluence and income, compliance with landscape ordinances, and temporary "shock" drivers. The effects may be interrelated, but relationships may not be linear.

Demographics: How do we account for uncertainties in future demographic factors and how can they be measured?

Stephen Levy

- Director and Senior Economist of the Center for Continuing Study of the California Economy in Palo Alto
- Degrees in economics from MIT and Stanford University

Framework for Demographic Projections



> ***"Even with the high forecast, we are looking at rates of growth that are low...We are going to move into a period of either very slow growth, if immigration is restricted, or relatively slow growth. We're looking at growth rates of under 1% a year."***

Key Points

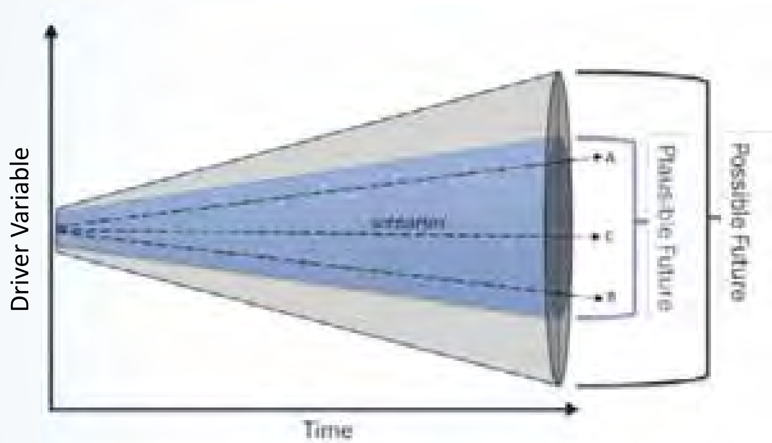
- Three main inputs from the national forecast are total population, total level of jobs, and importantly, the composition of jobs. The three main drivers for the region are immigration, competitiveness, and housing.
- The major uncertainty in U.S. growth is the future of immigration. With birth rates falling and death rates rising, immigration will be the key to how fast the country grows. Last year, the U.S. Census Bureau projected that the U.S. population would grow from its 2019 population by between 36 million and 79 million by 2045.
- The region's economy is resilient, fluctuating in a narrow range between 6 and 7% of US jobs over the past three decades.
- The composition of U.S. job growth is slightly favorable to the region with a focus on trade, tourism, technology, and creativity.
- Affordability, expanding housing supply, and investment in infrastructure are major drivers as to how the region will capture job growth.

Ranges: Given what is known about these drivers, provide guidance on estimating a plausible range of future outcomes for each driver and why.

Dan Rodrigo

- Senior Vice President and Global One Water Practice Leader for CDM Smith
- BS in Economics and MS in Environmental Planning from Southern Illinois University, Carbondale

Forecasting Drivers



- **Plausible** range includes things that are likely to occur but with considerable variability into the future.
- **Possible range** includes things that could happen, although we haven't seen evidence of it just yet. Black Swan Events* often fall in this range.

* A black swan is an unpredictable event that is beyond what is normally expected with potentially severe consequences. They are characterized by their extreme rarity, severe impact, and the widespread insistence they were obvious in hindsight.

> ***"New homes are based on plumbing codes and the model water efficient landscape ordinance. Indoor water use is roughly at or below 50 gallons per capita per day and outdoor is probably along the range of 20 to 50 GPCD. It's a good idea that Met may look at splitting the forecast between existing and new homes. That might be an improvement in the way to forecast residential demands."***

Key Points

- Demand forecasting is a mixture of art and science. Professional judgment with insights goes a long way.
- A good water demand forecast has robust statistical models, defensible projections of driver variables, back casting accuracy.
- For the IRP scenarios, we are focused on the plausible range, where things are likely to occur but with considerable variability in the future.
- While Southern California Association of Governments and Southern California Association of Governments forecast single and multifamily housing, they don't provide information on housing characteristics like density. Other sources can provide guidance such as General Plans, historical trends, building permits and professional judgment.
- Internal consistency is important when combining drivers in scenarios.

Methodologies: Given what is known about these drivers, provide guidance on approaches or methodologies to measure and quantify the effect of the drivers on demands, in each of the three major demand sectors.

Dr. Thomas Chesnutt

- CEO of A & N Technical Services, Inc.
- Ph.D. and M.Phil. in Policy Analysis from the RAND Graduate School, M.S. in Technology and Science Policy from the Georgia Institute of Technology and B.A. in Economics from Kenyon College

Hot Takes on Demand Driver Effects

CLIMATE CHANGE → WEATHER → WATER SUPPLY AND DEMAND, DIFFERENTLY

- Average Precipitation May Be The Same, Pattern Differs→ Bigger Effect on Supply
- Increase In Mean Temperature→ Large Effect on Future Demand via Outdoor Water Use
- Increase In Weather Variability→ Predictable Increase in Drought Likelihood and Duration

HIGH POPULATION GROWTH SCENARIOS

- Effect On Demand Dampened By ADU's, Densification, And Landscape Transformation

LOW GAP SCENARIOS

- Slower Adaptation

INTERVENTIONS CAN CHANGE THE EFFECT OF DRIVERS ON DEMAND

- Example: Customer Engagement/Information Can Change Response To Price

"Average precipitation under climate change could be the same but the pattern could be very different. If you have more precipitation arriving as rain instead of snow, that really has a huge effect on supply because the amount of snow stores water from the winter to when you need it in the summer. The big effect on demand may occur more through the driver of temperature. There would be a large effect on future demand via outdoor water use. There would actually be an increase in demand for what customers would be willing to pay for water under some of these scenarios. ...There is also a direct effect of climate change in increasing variability, which leads to a predictable increase in drought likelihood and duration, which in turn increases the value of the water service we are all interested in providing."

Key Points

- There are a range of methods for estimating the effects of demand drivers, including professional judgment (different kinds of end uses and prevalence), multiple variable (econometric), and a combination. The estimation method should depend on the measures available (wholesale and retail).
- There are long-term demand drivers (population and employment growth, regulations, climate change), mid-term drivers (densification, and shock drivers (weather variation, recession).
- There is risk for both high and low demand with each driver. Some uncertainties can be reduced by measurement.
- Interventions can change the effect of drivers on demand. Interrelationships between drivers and effects cannot be assumed away. There are standards for how to combine uncertainties.

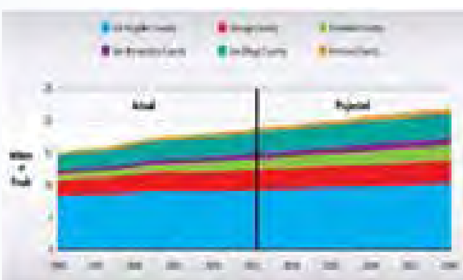
Interrelations: What are any major interrelations between ranges and direction of future outcomes for these drivers? Provide guidance on how to treat these drivers in an internally consistent fashion within the IRP scenarios.

Dr. Kurt Schwabe

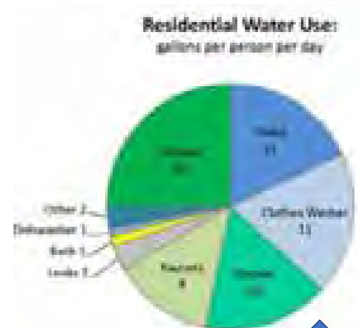
- Expert on economic issues and water use, agricultural production, urban water conservation, ecosystem services, and environmental regulation
- B.A. in Mathematics and Economics at Macalester College, M.S. in Economics at Duke, and Ph.D. in Economics from N. Carolina State

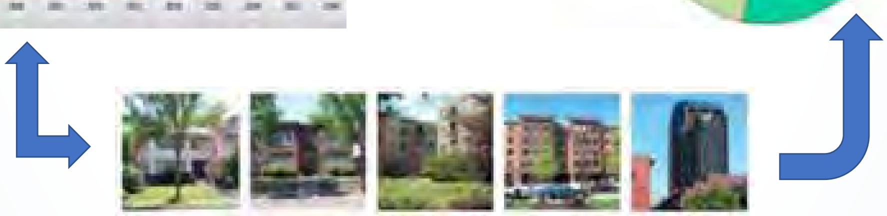
Demand Assumption Refinements- Interrelations

Issue 1: When developing models to predict future water demand, need to ensure that the assumptions that comprise individual drivers of demand are consistently applied



MWD (2015)





> *"In the '80s and the '90s we used to look at population growth and holding GPCD constant as a measure of water demand forecasting. That is long gone because of the complexities and the heterogeneity that you confront with regard to how people use water, how it is related to drivers and what the assumptions of those drivers depend upon."*

Key Points

- Assumptions for individual drivers of demand must be consistently applied. For example, assumptions for population growth should be consistent with assumptions for drivers of individual water demand.
- Understanding interrelations across drivers can help avoid over-estimating water savings.
- The accuracy of model predictions depends on how well the data and contexts used to generate the model parameters represent future conditions and contexts.

Summary of IRP Demand Expert Responses

The table below summarizes preliminary insights from individual feedback received to date from the IRP expert consultants on water demand. This summary was prepared for the purpose of facilitating interaction at the March 23, 2021 IRP Demand Experts Panel workshop. These insights are based on Metropolitan's compilation of the work in progress and ongoing discussions with individual experts. They do not represent the finalized or consensus group findings by the expert panel. A compiled report will be forthcoming from each expert.

	Question	Preliminary Insights
1	***What are the most important drivers that influence water demands?***	Demographics are generally recognized as major drivers influencing water demand. Demographic drivers include: • Households and housing (type, density, policy, location) • Population • Employment (including Business/Industry Mix) Other important drivers identified: weather, climate (not weather), price of water, affluence/income, compliance with policy, other "shock drivers" (see below) Drivers can be categorized in different ways. In terms of timing: • Long-term– population growth, changes in future climate (not weather variability), and adherence to plumbing codes and landscape ordinances • Mid-term – development trends such as shifts between multi-family and single-family homes, lot size and density, and emerging factors such as continuing work-at-home shifts, and California's Alternative Dwelling Unit (ADU) permitting • Shock– short-term inflections resulting from year-to-year weather variability, economic recession/recovery, consumer drought response (while important to measure, especially in terms of not double-counting or mistaking for longer-term shifts, shock drivers are not well-suited to capture in scenario planning) In terms of effect: • Scale Effect (e.g., population growth) • Composition Effect (e.g., housing type/land use) • Intensity Effect (e.g., per capita use for each housing type) • Although effects are interrelated, relationships may not be linear • Relationships can be explained but often not intuitive "Median is not the message" – Using averages without context can be problematic because means and medians do not account for skewness. For example, assessing water affordability by averaging water use data and household water expenditures with a single summary statistic (e.g., mean, median) is less helpful than to consider the entire distribution of use and income within a district to better understand affordability implications.

	Question	Preliminary Insights
2	***How can we estimate plausible ranges of future outcomes for each driver?***	Suggestions included examination of historical annual growth rates and ranges used by other regional planning organizations and government agencies. For example, the U.S. Census Bureau prepared a range of population projections using 2020 as a starting point to show a significant but plausible range of impact from uncertainties in future immigration on U.S. population (whereas other variables such as birth and death rates do not have comparable ranges of uncertainty) Ranges for long-term demographic projections (population, households, housing mix, persons per household, employment) should be based on varying assumptions about long-term health of Southern California economy via Stephen Levy. Ranges for long-term shifts in climate should be made using ranges of downscaled climate models that produce different predictions of temperature and precipitation for Southern California. Instead of assembling all climate models, a plot of changes in temperature and rainfall for each climate model/emissions assumptions would be used to create a quartile map (hot/dry, hot/wet, warm/dry, and warm/wet). Then ensembles of the climate models within each quartile can be used for demand changes. Ranges for plumbing code/landscape ordinances should be based on levels of future homes/businesses for current codes and ordinances on the higher end of the demand forecast and using 50 GPCD target for indoor per capita water use on the lower end of the demand forecast. Ranges for density of development is a professional judgment call, especially if California's Alternative Dwelling Unit (ADU) directive is implemented to expected levels. ADUs on existing single-family lots might occur on existing building footprints (e.g., second story or conversion of garage), or they might occur as a new structure in the backyard. If the ADU's occur as a new structure footprint, irrigation demand for that single-family home would be reduced.

	Question	Preliminary Insights
3	***What are approaches or methodologies to quantify the effects of the drivers?***	One approach to quantify driver effects on demands could be to develop a model to simulate demand over time under different assumptions regarding the plausible ranges discussed in Question #2. A stochastic dynamic model could represent uncertainty by particular distributions and be simulated over time. Particular shocks could be evaluated to illustrate how demand would change over time given uncertainty. Climate change, population growth, etc., could be included in this model. One of many possibilities could be to perform a Monte Carlo simulation and develop a distribution of outcomes under different scenarios over a certain number of years into the future (a time profile of use sufficient to account for uncertainty). MWD already has an econometric demand model by sector. This model is sufficient to estimate the impact on water use for most of the drivers I have listed. However, MWD would benefit from another type of statistical modeling of total monthly water use for the entire region (i.e., water production data vs. billing data by sector). This type of statistical model would be better suited for modeling impacts of year-to-year weather variations, long-term climate change, and shock variables such as economic recessions and droughts. For such a model, the dependent variable would be historical monthly per capita water use (controlling for growth). Independent variables that have been shown to normalize demands before shocks of economic recession and droughts for other water agencies have included max month temperature, monthly precipitation, previous month precipitation, mix of multi-family to total housing, % of post-2010 housing to total housing (to account for plumbing code efficiency). For measuring economic recessions, monthly unemployment rate can be used, and to account for drought impacts binary variables can be created to measure different stages of drought water restrictions. Development of this model would be relatively feasible for MWD to implement without additional member agency data collection or surveys. Recommended data sources include the ALN Apartment Database, Bureau of Labor statistics, the Census Bureau, SCAG, and SANDAG. Emerging trends in development are important to track as recent changes in types of land use yet to be developed has a significant impact on future indoor and outdoor water demands, especially in the single-family residential sector. Some drivers are becoming more difficult to measure. For example, measuring price impacts is becoming more difficult to tease out because of strict plumbing codes and landscape ordinances, availability of conservation rebates and incentives, and state-mandated per capita water use goals. If these other water conservation variables are handled correctly, inclusion of future price of water becomes less important and, in fact, can lead to double counting of future water conservation.

	Question	Preliminary Insights
4	***What are any major interrelations between ranges and direction of future outcomes for these drivers and how to treat these drivers with internal consistency within the IRP scenarios?***	Aggregate demand must be decomposed into its relevant parts and it is those parts that need to be internally consistent with one another as well as the many contexts under which the parameters were derived. Several interactions need to be accounted for in terms of the potential for double-counting impacts. Examples include the relationship between population growth and increased density for housing units, which has implications for irrigation demands; modeling for adherence to the CA Model Water Efficient Landscape Ordinance for future development should be done carefully in light of ADUs on single-family lots to avoid double-counting reduction in irrigation water use; and potential for double-counting impacts of price of water and passive and active water conservation. One would expect as regulatory requirements tighten, water use will decrease. However, the magnitude is really what is in question, and that depends on a number of factors, including current water use and its distribution. Whether households are in areas that are already somewhat coded for more efficient water use will matter, and/or the degree to which an agency's own practices (e.g., pricing and pricing structure, rebates, messaging) have moved customers in the direction such at newly imposed regulatory requirements may be non-binding. With regard to demographics, employment growth drives growth in population and household formation. However, success of housing policies and the physical and spatial characteristics of housing stock are major determinants of the region's economic competitiveness, as access to affordable housing affects the region's share of U.S. jobs and population. All other things being equal, population and water use are positively related. But other things may not be equal. Care has to be taken in how past per capita estimates are used in projecting future water demand due to population growth since agencies are pricing and messaging differently; regulations and coding have changed; and the type of water use or service (indoor vs outdoor) and residential unit (high density housing; rental; single family) will influence this relationship.

Appendix E.2

2020 IRP Climate Change

Summary of Preliminary Responses — Attachment 1

Climate Change Expert Feedback

The table below summarizes key feedback received so far. This document is intended to inspire discussion and additional questions for discussion with the Climate Change Expert Panel during the May 25, 2021, IRP Climate Change Experts Panel workshop.

	Question	Key Points
1	**What major components contribute to the range of future climate outcomes?**	• California is already warming and experiencing a range of impacts of a changing climate. • These impacts span everything from changing precipitation patterns, rising sea level, declining snowpack, increased drought, increased extreme precipitation events, and an expansion in the area burned by wildfires. All of these impacts have implications for understanding future supply and demand for water resources in California. • How much the climate changes and the extent to which we experience changes in the intensity or severity of many of these impacts are related to global emissions of greenhouse gases, which directly determine how much warmer the planet will get and how well we plan and manage for these changes. • How well we can project future climate changes is limited by global, regional, and local climate and hydrologic modeling techniques. However, models have performed well against observed warming (Figure 3 in Attachment 2) and are the best source of information to understand future climate. • Being a savvy consumer of future climate change information is required to ensure proper use and application of these data in water resources management and planning (see Questions 2-4 for more on modeling techniques and Question 8 for planning with this uncertainty).
2	**How do we apply global climate model output that examines climate change over a long timeframe to the shorter 25-year IRP planning horizon?**	• While changes are not as significant as those seen by the end of the 2100s, climate changes are still apparent in the GCMs in the next 25-40 years. These changes are still significant to water management, especially when considering the range of future projections (not just averages). Both the higher and lower ends of the mid-21st century range would provide useful comparison points. • The sources of uncertainty (i.e., the range of future projections) differ depending on what period you are most interested in exploring.

3	**What approaches or methodologies do you recommend for quantifying how climate change (e.g., changing temperatures and precipitation) affect Southern California and its imported supply watersheds?**	• To better understand potential impacts of global climate change at regional or local scales, there are many methods one can use. • Hydrologic projections (otherwise known as "climate change scenario studies" or "chain-of-models approaches") are commonly used in climate change assessments. • Regardless of the method used (see Question 4 on ways to select an appropriate method), recognize there should be a range of possible outcomes. Models, while helpful tools in exploring possible futures, cannot predict the future.
4	**What models and downscaling techniques are available and appropriate for the relevant regions?**	• Downscaling refers to techniques employed to make global-scale information more applicable to regional or local scales. There are a variety of different downscaling techniques that are used to produce regionally downscaled climate information. These techniques are continually under development and significant advancements have been made in recent years. This work is likely to continue to evolve. • Practitioners should consider what variables (e.g., seasonal temperature changes, annual precipitation) are of greatest interest to help identify models that would be most appropriate. • There is a range of data available to support modeling efforts.
5	**If the models and downscaling techniques differ for each region, how do we ensure internal consistency within the analysis?**	• This is not an uncommon challenge. It is better to use the model that captures the impact of interest for a particular question/region vs. trying to use a model that is universal. • The most important thing is to be sure choices are placed in context. To be consistent, one approach would be to use similar GCMs, downscaled in ways most appropriate to the questions of interest. Another approach would be to consistently look at an ensemble of models and results that are 90% and 10% of the range (see full answer for why Reclamation decided to use 90% and 10%, Metropolitan may choose different percentiles.) • No model is perfect and cannot provide all answers. They are one tool in the toolbox.
6	**What hydrologic changes are anticipated for the relevant regions?**	• This is a question that lengthy reports are written on. We will expand on this question throughout the course of our work with Metropolitan. To provide an illustration of some of the material we could provide, we share some highlights. New information shared here focuses on the Colorado River basin.

7	**What are the important underlying climate change drivers that influence demands, and how do they affect demands in each of the three major demand sectors (single-family residential, multi-family residential, commercial/industrial)?**	• Temperature, and to a lesser extent precipitation, are the major climate drivers influencing water demand. Here, we describe the impact of climate changes on major end uses and the extent to which each of these end uses is associated with the three major demand sectors: single-family residential, multi-family residential, and non-residential (or commercial, industrial, and institutional).
8	**What other recommendations do you have for our planning?**	• **Prudent Planning and "Reasonable Worst-Case Future":** By this we mean, planning for a future that is both politically possible to plan for, and climatologically possible without being on the extreme tail. This requires balancing the politically possible and the "climatologically problematic". That is to say, some futures are too hard to plan for politically and too uncertain to plan for based on climate models. For example, given the strong tie between flow reductions over the last 21 years and rising temperatures in the Colorado River Basin, prudence dictates that planning use flows less than the last 21 years. It remains an active area of inquiry about how much less. Planning for California would likely require some very wet, flood prone scenarios along with drought scenarios. Ultimately, the determination of a 'reasonable worst-case future' is a policy decision informed by qualitative weighting of certain and less certain science.

Preliminary Responses to Charge Questions Attachment 2

Climate Change Expert Feedback

Document Purpose

This is an overview of preliminary responses to a set of questions posed by the Metropolitan Water District of Southern California for the IRP process and the May 25, 2021 Board Workshop with the Climate Expert Panel. *This document is intended to inspire discussion and additional questions for discussion with the Climate Expert Panel during the Board workshop.* The following responses are structured to provide an overview of key points and suggested data and resources to guide a more in-depth review of the literature and science relevant to specific questions being asked related to climate change and water supply and demand for the primary geographies of interest (Southern California, Eastern Sierras, State Water Project, and the Colorado River Basin).

Useful definitions

- **Emissions:** The production or release of heat-trapping gases like carbon dioxide, methane, and nitrous oxide.
- **GCM:** General Circulation Models (GCM) are mathematical models that represent the general circulation of the atmosphere or ocean. These models are used to simulate future climate changes. Also known as Global Climate Models.
- **Downscaling:** Techniques employed to make global-scale information more applicable to regional or local scales.
- **Scenario:** Here we refer to two types of “scenarios”: 1) *Emission scenarios* (e.g., Representative Concentration Pathway (RCP) 4.5, 8.5), and 2) the scenarios being used by Metropolitan in the IRP process called the *Metropolitan's Future Scenarios* (A. low demand, stable imports, B. high demand stable imports, C. low demand, reduced imports, D. high demand, reduced imports). In general, a scenario is a plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline (IPCC, 2012).
- **Uncertainty:** Uncertainty is often categorized in two ways: 1) the kind that will always exist (e.g., inherent randomness natural to a process) and, 2) the kind that can be reduced with improved understanding or data (e.g., improving model structures or parameters, improving quality of observations) (from SECURE web portal).
- **Drivers:** Impacts that influence supply and demand outcomes that are outside Metropolitan's control.
- **Climate Drivers:** Key determinants of our overall climate. For example, temperature, precipitation, wind speed, dew point, soil moisture, and sea surface temperatures.
- **Drivers of climate drivers:** Various feedbacks of the Earth system that influence the climate drivers (e.g., emissions of greenhouse gases, how much carbon will be taken up by forests globally, will oceans continue to be a carbon sink, ice loss from Antarctica, feedbacks from warming polar regions like changes in albedo and methane releases from melting permafrost).
- **Signposts:** In other contexts for the IRP, ‘signposts’ are data and/or signals that help managers determine trajectories of variables of interest such as supply and demand. In the climate context, for this document, the only ‘signposts’ of interest are the ‘drivers of climate drivers’.

Q1. What major components contribute to the range of future climate outcomes?

Key Points:

- California is already warming and experiencing a range of impacts of a changing climate.
- These impacts span everything from changing precipitation patterns, rising sea level, declining snowpack, increased drought, increased extreme precipitation events and an expansion in the area burned by wildfires. All of these impacts have implications for understanding future supply and demand for water resources in California
- How much climate changes and the extent to which we experience changes in the intensity or severity of many of these impacts is related to global emissions of greenhouse gases which directly determine how much warmer the planet will get and how well we plan and manage for these changes.
- How well we can project future climate changes is limited by global, regional and local climate and hydrologic modeling techniques. However, models have performed well against observed warming (Figure 3) and are the best source of information we have to understand future climate.
- Being a savvy consumer of future climate change information is required to ensure proper use and application of these data in water resources management and planning (see Q2-4 for more on modeling techniques and Q8 for more on planning with this uncertainty) .

First, we know that climate change, and the impacts of a changing climate, are already here. We also expect many of these impacts to worsen in the future. Figure 1, from the 4th National Climate Assessment (2018), shows that widespread warming is already occurring across the Western United States.

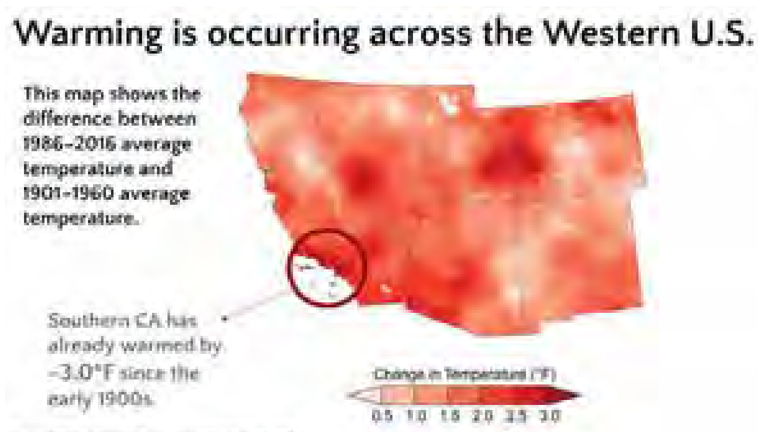


Figure 1: This map shows the difference between 1986-2016 average annual temperature relative to average annual temperature from 1901-1960. Southern California has warmed by nearly 3.0°F since the early 1900s. Source: Modified from the 4th National Climate Assessment Southwest Chapter, 2018.

California’s Fourth Climate Change Assessment summarized the impacts and direction of change expected to be experienced in California as the region continues to warm (Figure 2).

Figure 2: A summary of California climate impacts, the anticipated direction of change, and the scientific confidence associated with each impact. Source: California's Fourth Climate Change Assessment, 2018

When thinking about how to understand the range of outcomes for these impacts in the *future* we have to consider the following primary components:

1. **Human choices:**
   - ***Emissions Scenarios:*** The principal driver of long-term warming is total emissions of carbon dioxide (CO_2) and other greenhouse gases. This is a human choice. The Representative Concentration Pathways from the Intergovernmental Panel on Climate Change (IPCC) and Coupled Model Intercomparison Project (CMIP) climate model (Moss et al., 2010; [Collins et al., 2013]), have been designed to cover a wide range of possible magnitudes of climate change driven by different socioeconomic pathways, that include differing amounts of greenhouse gas emissions.
   - ***Systems management:*** Choices made today to be proactive rather than reactive to future climate impacts in how systems, like water infrastructure, are managed and designed.

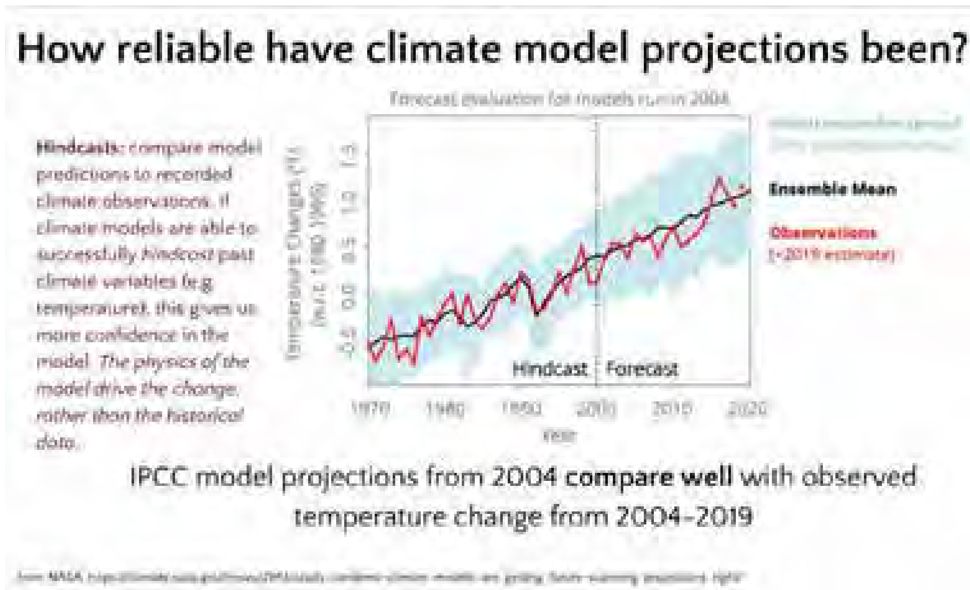


Figure 3: This graph from NASA shows how climate models run in 2004 to project change out to the year 2020 performed against actual observed change in temperature. The data show that model projections compare well with the observed temperature change that occurred between 2004 and 2019.

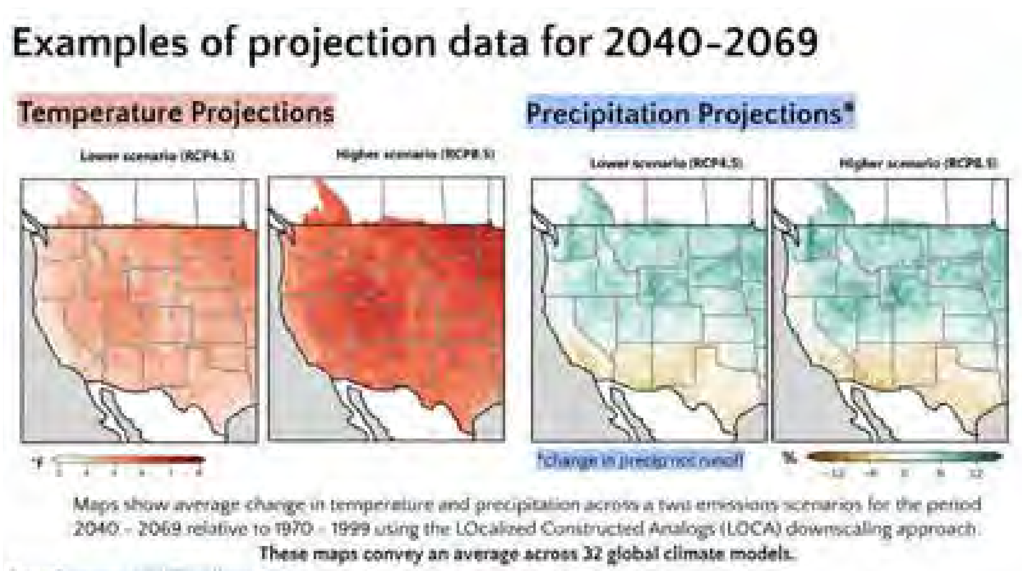


Figure 4: Examples of climate projection data from the LOcalized Constructed Analogs (LOCA) downscaling approach. The panels show temperature (left) and precipitation (right) projections for mid-century (2040-2069) under both low and high emissions scenarios. The change shown is relative to the time period 1970-1999. Note that precipitation projections are not runoff projections. Source: Modified from [Reclamation's SECURE Water Act report](2021).

2. Natural Variability:

Natural variability is influenced by processes internal to the climate system that arise, in part, from interactions between the atmosphere and ocean, such as El Niño/La Niña events. The sun, volcanic eruptions, and changes in the orbit of the Earth around the sun all influence the climate. Natural variability and human-caused climate change work together to shape the climate at any given point in time. In global climate models, internal variability is often used as a proxy for natural variability.

3. Model Uncertainty:

Representing complex Earth climate systems and sociopolitical pathways in global climate models, downscaled and regional climate models and hydrologic models all lead to some uncertainties in future climate conditions.

The primary sources of uncertainty in future climate projections include uncertainty related to the emissions pathway, model uncertainty, and internal variability (see Figure 6). The Bureau of Reclamation's West-wide Assessment (2021) provides more details, and summarizes these factors well in the following statement:

"Uncertainties in future projections stem from the inability to predict future global socio-political developments, incomplete understanding of complex system processes, imperfect representation of those processes in models, and irreducible natural variability. Numerous decisions must be made to generate usable projections, and each has associated uncertainties: choice in scenarios of greenhouse gases (uncertainties in human behavior); choice of models used for global climate simulation; choice of model initial conditions; choice of climate downscaling techniques; and, choice, configuration, and calibration of hydrologic models, as examples."

Q2. How do we apply global climate model outputs that examine climate change over a long timeframe to the shorter 25-year IRP planning horizon?

Key points:

- While changes are not as big as those seen by the end of the 2100s, climate changes are still apparent in the GCMs in the next 25-40 years. These changes are still significant to water management, especially when you consider the range of future projections (not just averages). Both the higher and lower ends of the mid-21st century range would provide useful comparison points.
- The sources of uncertainty (i.e., the range of future projections) differ depending on what time period you are most interested in exploring.

A. An illustration of the ranges from mid-21st and late-21st century projections:

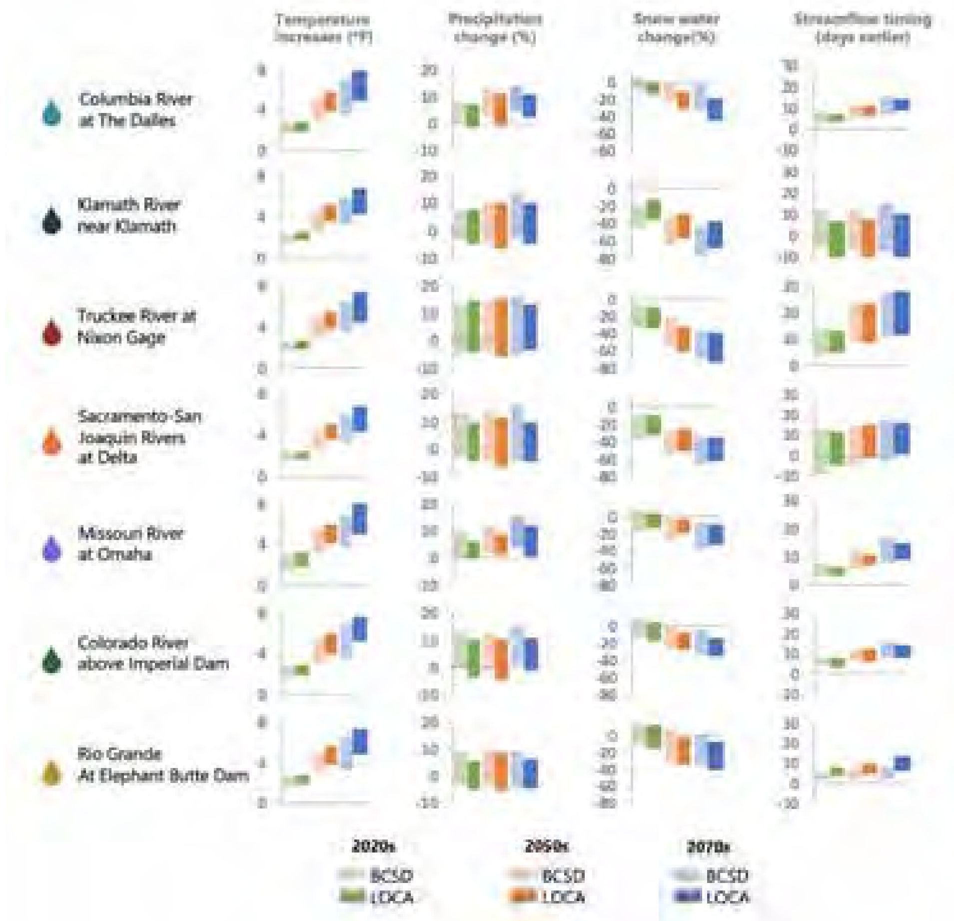


Figure 5: Climate change projection in seven basins across the Western US over the next century. Values represent the mid-range (the 25th to 75th percentiles) of future hydroclimate projections from future decades relative to 1990 - 1999. These include values from the 2016 SECURE Report using BCSD (one type of downscaling) with RCP2.5, RCP4.5, RCP6.5, and RCP8.5 (displayed as lighter shades on the left), and from another type of downscaling, LOCA

projections using RCP4.5 and RCP8.5, on the right. Source: Reclamation's SECURE Water Act report, see report for a map of the locations and additional details.

Take away from Figure 5 as it relates to the question: The ranges of the orange (2050s) have changes that are large, even if not as large as the full range of the blue (2070s), they are still important to consider.

B. How uncertainties differ depending on the time period of interest: In global climate models, the source of uncertainties--internal variability, model uncertainty, or global emission scenario uncertainty, as outlined in Q1 above--depends on how far into the future the projections are.

Figure 6 provides an illustration. For global temperature, the uncertainty (i.e., range in projections) in the mid-21st century is from both model uncertainty and global emission scenarios (blue and green lines). At the end of the century, global emission uncertainties have a greater influence on the range in future projections than model uncertainty (green line increases over time).

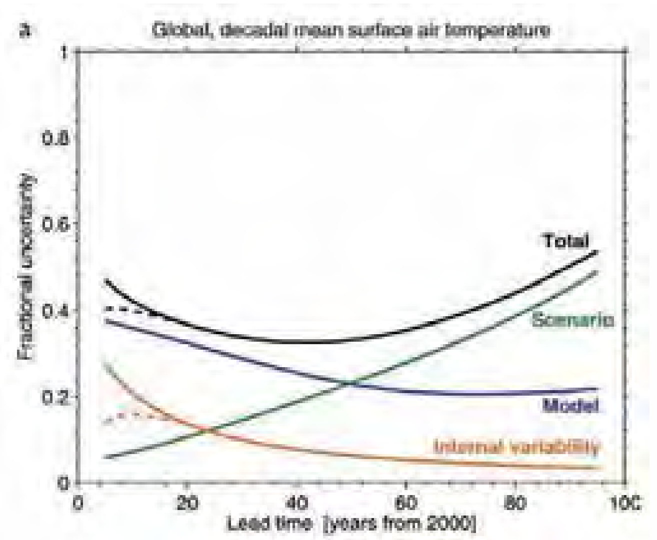


Figure 6: The relative importance of each source of uncertainty in decadal mean surface temperature projections is shown by the fractional uncertainty (the 90% confidence level divided by the mean prediction) for (a) the global mean, relative to the warming from the 1971–2000 mean. Source: Hawkins and Sutton 2009

Q3. What approaches or methodologies do you recommend for quantifying how climate change (e.g., changing temperatures and precipitation) affect Southern California and its imported supply watersheds

Key points:

- To better understand potential impacts of global climate change at regional or local scales, there are many methods one can use.
- Hydrologic projections (otherwise known as "climate change scenario studies" or "chain-of-models approaches") are commonly used in climate change assessments.
- Regardless of the method/s used (see Q4 on ways to select an appropriate method), it is important to recognize there should be a range of possible outcomes. Models, while helpful tools in exploring possible futures, cannot predict the future.

A. Details on different methods: Below is a brief overview of four approach categories from Vano et al (2018) "Dos and Don'ts." This is not an inclusive list, as more exist, and more will likely be developed.

1) Climate change scenario studies: These approaches are often characterized as a chain-of-models approach where global climate model projections are downscaled and the downscaled climate change information (e.g., 30 years of daily precipitation, temperature) is then used as input to hydrology models, which generate streamflow and snowpack information, which can be used as input to reservoir operations models. This type of study is often the focus of existing guidelines because it most explicitly uses global climate model information and often requires decisions on model selection to translate global information to a local scale.
2) Paleoclimate studies: Paleoclimate or paleoflood information is generated using information collected from the environment which can be proxies for past climate and flood events that date back further than the instrumental record (e.g., the width of tree rings can be correlated with streamflow) (Woodhouse et al. 2006). These analogs from the past can date back thousands of years, and provide improved perspectives on natural variability, such as the length of dry periods (Woodhouse and Lukas 2006), the characteristics of past floods (Raff 2013) or how sensitive river basins are to temperature increases (Lehner et al. 2017a). Studies have also used a combination of scenario-based and paleoclimate studies to evaluate future change (Reclamation 2011a; McCabe and Wolock 2007).
3) Stochastic hydrology studies: stochastic precipitation and hydrology timeseries can be used to stress test a system (Rodriguez-Iturbe et al. 1987; Salas 1993; Wilks and Wilby 1999; Yates et al. 2003; Erkyihun et al. 2016). The perturbations can be informed by historical information (e.g., paleoclimate information) or by global climate model trends. These techniques aim to avoid some of the uncertainties associated with using global climate models directly, yet address risk-based issues analytically (Olsen et al. 2015). In many cases, stationarity is assumed, although there are techniques that have

included non-stationary stochastic methods (Kilsby et al. 2007; Erkyihun et al. 2016). It is, however, important to recognize that these timeseries are based on statistical models that do not capture process-based understandings, which limits how these can be used to interpret future change.

4) <u>Climate-informed water system vulnerability analysis</u>: These approaches are commonly referred to as decision support modeling and include techniques such as decision scaling (Brown et al. 2012), scenario-neutral approaches (Prudhomme et al. 2010), and robust decision making (Lempert et al. 2003). Typically, the focus is first on defining the decision context and exploring sensitivities by perturbing the climate incrementally to identify system vulnerabilities to changes in temperature, precipitation, or other climate variables before considering whether and how to apply climate change information (Brown et al. 2012; Brown and Wilby 2012; Weaver et al. 2013). EPA and CWDR (2011) describe strengths and limitations of using different decision support tools.

B. More details on hydrologic projections (also referred to as climate change scenario studies): For hydrologic projections, a commonly used approach, each step in the climate impacts modeling chain (first column of the Figure 7 below) has uncertainties. While several studies have sampled the range of possible outcomes by varying elements at each step (second column), they are typically limited. Larger ensembles can reveal a more complete range, but can be computationally impractical in applications, and thus require the development of innovative methods to assess climate impacts.

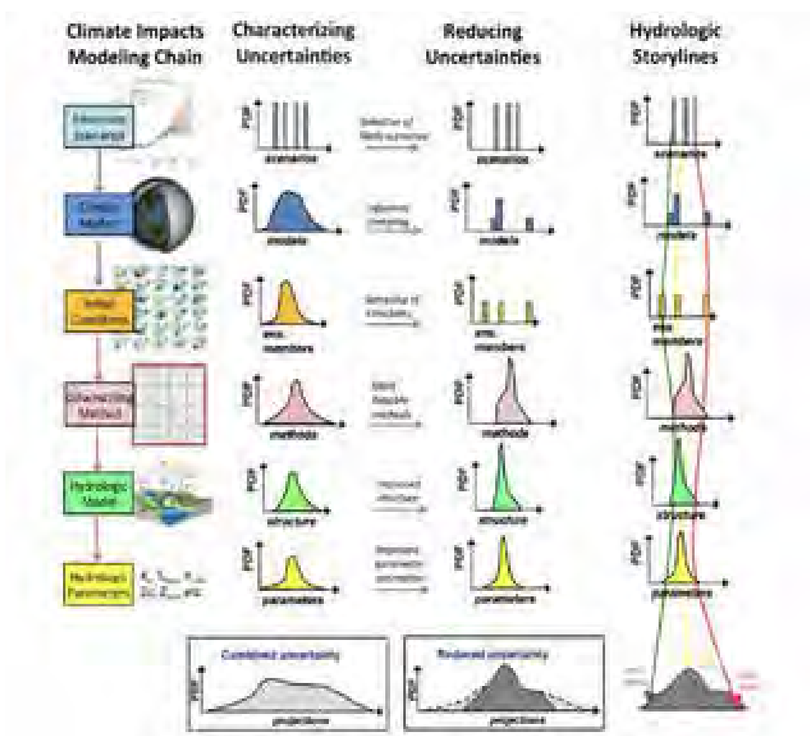


Figure 7: Schematic on approaches to explicitly characterize and reduce uncertainties in assessments of hydrologic impacts of climate change. Source: [Clark et al. 2016]

C. More details on how models can be useful tools: Vano et al. (2018) "Dos and Don'ts" provides useful advice about how models can be used appropriately:

"Models are useful tools, if used appropriately. Watershed-relevant climate change scenarios can provide information useful in assessing how the system is vulnerable to climate change and help identify adaptation options.

To generate climate change information at the global, planetary scale and make it relevant to local watersheds, many methodological choices must be made by both information producers (on how to generate the datasets) and users (on how to apply the climate data to their decision). In the U.S., for example, the U.S. Army Corps of Engineers has 21 regional reports (http://www.corpsclimate.us/rccciareport.cfm) and Appendix A in Bureau of Reclamation's (Reclamation) Literature Synthesis on Climate Change Implications for Water and Environmental Resources (Reclamation 2013) lists over 300 papers that could be leveraged as examples. In Europe, the Service for Water Indicators in Climate Change Adaptation (SWICCA) currently provides 15 case studies (http://swicca.climate.copernicus.eu).

Models, including global and regional climate models, as well as watershed models, are used to explicitly characterize possible futures as well as historical and current conditions. These simulated futures, often referred to as projections, when used together with simulated historical conditions, can then be used to assess potential changes. More specifically, evaluating relative differences (modeled historical vs. modeled future) in system performance over time can provide improved perspectives on potential improvements as well as risks . In this, it is important to recognize that **model outputs are not intended to be predictions, and should be treated instead as possible future 'scenarios' which can complement existing monitoring and performance evaluation systems.** They provide an opportunity to explore how natural and managed systems may respond to and influence future changes and to investigate uncertainties (Weaver et al. 2013; IPCC 2014b; Milly et al. 2015; Reclamation 2016). Scenarios can be viewed as narratives that can be used to stress-test water systems and infrastructure (Moss et al. 2010; Weaver et al. 2013). As such, a single stress test can be misleading when viewed in isolation; multiple stress tests, especially when they span a range of possible stresses, are preferred and can be added to as resources and time permit.

In performing these stress tests, current approaches often capitalize on "ensembles of opportunity" – that is, collections of available datasets – to evaluate the range of future impacts and their uncertainties. This may be the most appropriate path forward at present; although as the field of climate change impacts advances and computing capacity improves, it will be possible to better understand and quantify underlying uncertainties (Harding et al. 2012; Gutmann et al. 2014; Clark et al. 2016), evaluate and account for model dependencies (Knutti 2010b; Knutti et al. 2013; Bishop and Abramowitz 2013), and improve how models are selected for use including ensuring they capture features that make them appropriate for particular uses (Knutti 2010a; Tebaldi et al. 2011; Sanderson et al. 2015)."

The DOS AND DON'TS review important considerations when designing studies so models can be useful tools in exploring future change.

Another relevant resource is the Climate Change Handbook for Regional Water Planning. It was created in the California Department of Water Resources in partnership with the U.S. Environmental Protection Agency, Resources Legacy Fund, and The U.S. Army Corps of Engineers. It is on a list of resources for water managers, where they describe the report as: a framework for considering climate change in water management planning. Key decision considerations, resources, tools, and decision options are presented that will guide resource managers and planners as they develop means of adapting their programs to a changing climate.

Q4. What models and downscaling techniques are available and appropriate for the relevant regions?

Key Points:

- Downscaling refers to techniques employed to make global-scale information more applicable to regional or local scales. There are a variety of different downscaling techniques that are used to produce regionally downscaled climate information. These techniques are continually underdevelopment and significant advancements have been made in recent years, and this work is likely to continue to evolve.
- Practitioners should consider what variables (e.g., seasonal temperature changes, annual precipitation) are of greatest interest to help identify models that would be most appropriate.
- There is a range of data available to support modeling efforts.

A. Detail on different types of downscaling techniques.

Neil Berg at UCLA's Center for Climate Science shared details on different types of downscaling techniques during a technical training in 2018. See the presentation here.

Typically downscaling is thought of as either statistical or dynamical, although increasingly there are approaches that are hybrids. As such, it is helpful to view these approaches as lying along a continuum of increasing methodological complexity, and acknowledge that they have various tradeoffs: physical realism v. computational cost; single realizations v. ensembles; explicit physics/feedbacks v. simplicity. Which approach is best depends on the question being asked.

Statistical downscaling: Commonly used approaches include BCSD and LOCA which have been used in the National Climate Assessment, Reclamation's SECURE Water Act report and MACA which has been used in water demand analysis within Reclamation's SECURE report and fire simulations (Abatzoglou & Williams, 2016). (all these provide values that are across the West)

Dynamical downscaling: Because they require more computing time, they are often used more locally in individual studies. There are, however, some efforts to do intercomparisons across regional climate models in the US (e.g., NARCCAP, CORDEX).

Hybrid dynamical-statistical approaches: Two examples: Alex Hall at UCLA has led the development of a hybrid approach; it was used in a precipitation study done over Los Angeles. Ethan Gutmann at the National Center for Atmospheric Research has led the development of a hybrid approach (ICAR), which has datasets for the US.

B. How to determine appropriate models: Vano et al. (2018) "Dos and Don'ts" provides useful advice about how to determine appropriate models based on the impact/s being evaluated. This advice applies to models and downscaling techniques.

"Ideally, models should represent all relevant processes well. If certain processes are poorly captured, the model's ability to simulate the climate sensitivities of dominant processes could be in question. Yet models will always be limited by being simplifications of the real world (Clark et al. 2008; Carslaw et al. 2018). Therefore, for practical purposes, models are most often evaluated on how well they do at simulating key, measurable processes, especially those relevant to the impact of interest. For example, if the decisions relate to flooding, then hydrology model performance on short timescales matters. If, however, the decisions relate to water needs for drought, performance on shorter timescales may be less relevant. Evaluations should include how well model outputs are simulated historically (what is the current ability to simulate the variable of interest) and how sensitive they are to an altered climate. The latter can be done through evaluating whether modeled values respond accurately to a range of different climate conditions or through simple perturbations of the most relevant climate variables (e.g., Vano et al., 2012). This does not provide a comprehensive evaluation of how well future changes can be simulated, as this may not be knowable, but it can provide confidence that model sensitivities are physically reasonable and that further exploration using a model or approach is warranted. Additionally, techniques exist that can be used to evaluate how well a model performs under climatic conditions significantly different from those it was developed to simulate (Refsgraad et al. 2013)."

Here are a series of questions (shared during a technical training), that can be useful in identifying what models to use:

- Where is the area of interest?
- How large of an area?
- What is the impact of interest?
- When in the future?
- Does event sequencing matter?
- What type of climate uncertainty is important?
- What is available?

C. Examples of Available Data (shared during a technical training)

Statistical Approaches and Hydrology simulations are on the Green Data Oasis portal

- BCSD (12km), LOCA (6km)
- VIC streamflow

Dynamical Downscaling

- NARCCAP (50km),
- CORDEX (limited 25km)
- Others over regional domains or limited time periods

USGS GeoDataPortal

- Collection of different archives

Many others (NASA NEX, ARRM)

Q5. If the models and downscaling techniques differ for each region, how do we ensure internal consistency within the analysis?

Key points:

- This is not an uncommon challenge. It is better to use the model that captures the impact of interest for a particular question/region vs. trying to use a model that is universal.
- The most important thing is to be sure choices are placed in context. To be consistent, one approach would be to use similar GCMs, downscaled in ways most appropriate to the questions of interest. Another approach would be to consistently look at an ensemble of models and results that are 90% and 10% of the range (see example below for why Reclamation decided to use 90% and 10%, Metropolitan may choose different percentiles.)
- No model is perfect and cannot provide all the answers. They are one tool in the toolbox.

More details on defining the range:

For example, see the description in Reclamation's report in 2016 on "Considerations for Selecting Climate Projections for Water Resources, Planning, and Environmental Analyses"

"*Define the Range of Uncertainty to be Considered:* For each metric, study teams must define the range of uncertainty to be considered in their analysis. The range of uncertainty is typically represented as a range of percentiles that correspond to the higher end of the range of projected change, the middle or central tendency, and the lower end of the range of projected change. The central tendency is defined by the 50th percentile (median). In order to represent the range of projected climate change, the 10th and 90th percentiles, for example, encompass 80% of the values of a given metric while excluding the highest 10% and lowest 10% of values; similarly, the 20th and 80th percentiles encompass 60% of values while excluding the highest 20% and lowest 20%. Selecting a larger range of uncertainty results in considering a broader range of future climate conditions in the study, but bears the risk of including outlier values. By contrast, selecting a smaller range of uncertainty results in considering a narrower range of future climate conditions, but reduces the risk of including outlier values. In general, selecting projections based on the 10, 50 , and 90 percentiles is appropriate for most studies."

Q6. What hydrologic changes are anticipated for the relevant regions?

Key Points: This is a question that lengthy reports are written on. We will expand on this question throughout the course of our work with Metropolitan. To provide an illustration of some of the material we could provide, we share some highlights below. New information shared here focuses on the Colorado River basin.

Southern California and Eastern Sierra Precipitation: We provided Metropolitan a document addressing the question "*What are the plausible ranges in the quantity and pattern/timing of precipitation with a specific focus on Southern California and the Eastern Sierra (supply source for the LA Aqueduct)?*" The key summary points are copied below; see the document for more details.

In the future, in both Southern California and the Eastern Sierra:

1. Wet extreme events are projected to increase (e.g., storms bring more water)
2. Dry years are projected to increase (e.g., droughts increase)
3. Wet and dry swings are expected to be amplified
4. Annual average precipitation changes (e.g., averaged over 30 years) are small and unclear
5. Seasonal changes indicate statewide increases in precipitation in winter, decreases in spring
6. Snowpack will decline, increasing cold season and decreasing warm season streamflow (most relevant to Eastern Sierra)

Climate Changes in the Colorado River:

1. Warming temperatures are increasing evaporation which in turn is decreasing the amount of precipitation that turns into runoff
2. Colorado River runoff will likely decline by mid-century, potentially by large amounts
3. Reservoir evaporation will increase
4. Crop water demands will increase
5. Spring runoff will occur earlier
6. The Salton Sea is expected to continue to decline

Colorado River Basin Runoff Projections

Multiple studies since 2007 have attempted to assess how runoff in the Colorado River Basin will change in the 21st century. Current best guess runoff projections range from approximately +5% to -40% by mid-century with most projections indicating a decline (See Milly and Dunne, 2020, Lukas and Payton, 2020). Rising temperatures are a certainty and will increase ET, which in turn will reduce river flow. Because ET is about 80% of precipitation, every 1% increase in ET translates to a substantially larger 5% drop in river flow. Changes in precipitation can either reduce these temperature-induced declines or enhance them. Confidence in modeled precipitation is much lower than temperature and is the main reason why the range is so great. With no changes in long term precipitation[1], a reasonable assumption would be river flow declines -15% to -25% by mid-century. (Note that the current ~20% decline is approximately split between a temperature-induced decline and a precipitation decline. Thus, a future -15% to -25% decline due solely to temperature increases would become -25% to -35% with the current precipitation decline.

It is important to note the precipitation is not runoff, and that increases in precipitation may not lead to increases in runoff. It is quite possible that additional precipitation turns into evapotranspiration, as does approximately 80% of all precipitation in the Colorado River Basin now. Studies on future megadroughts indicate that megadroughts can occur even with substantial additional precipitation if it is warm enough.

Five important peer-reviewed papers in the last 5 years have provided useful insights into future flow. We know that runoff efficiency for a given amount of precipitation has declined (Woodhouse et al., 2016) that up to half of the approximately 20% flow decline since 2000 is due to human causes (Udall and Overpeck, 2017, Xiao et al, 2018, Hoerling et al, 2019, Milly and Dunne 2020) and that warming temperatures of over 1°C are reducing the flow by up to nearly 10% per degree Celsius temperature increase. Two papers have projected flow losses of up to 40% by mid-century (Udall and Overpeck, 2017, Milly and Dunne, 2020). An additional paper states that the American Southwest is now in a 19-year long 'megadrought' as measured by the 2nd lowest soil moisture in the last 1200 years (Williams et al, 2020). Without human-caused warming, this drought would be modest.

Most of these papers have focused on the impacts of the unequivocal, human caused, greater than 1°C temperature increase since the mid-20th century. The modest recent precipitation decline (~3%) could be natural variability, but one paper found human fingerprints on this deficit (Hoerling et al, 2019). If true, there are reasons to believe that the decline will not only continue but get worse, greatly amplifying the known temperature-induced flow losses. Such precipitation declines, along with temperature increases, are what push some runoff projections to -40% by mid-century.

In addition, recent runoff trends are worrisome. In the last two years, reasonable winter snowpacks have turned into very low runoff, with 100% of snowpack becoming 52% of runoff in 2020 and this year 80% turning into less than 30%. Record setting hot and dry periods in the summers of 2019 and 2020 dried soils significantly. Dry soil moisture from the previous year must be filled before runoff occurs in the next year. We should expect more, and worse, of these dry and very hot summer periods going forward, not fewer.

Changing Colorado River Runoff Patterns

Modeled future precipitation consistently shows a North to South gradient, with declining precipitation in the south and increasing in the north. The dividing line is often near the middle of the state of Colorado, but varies by model. Modeled precipitation in the Lower Basin is robustly projected to decline but the impacts of this have been little studied. Of particular concern to MWD would be declines of inflows in the Grand Canyon. These inflows are about 750 kaf/yr, about 5% of the total flow. Declines in these flows would translate directly into water availability in the Lower Basin and increases in Lower Basin shortages. Importantly, they are not part of the Colorado River Compact Section III (d) 75 maf over ten-year "delivery" clause and thus there is no valid claim that these flows are owed to the Lower Basin. In the overall scheme of Colorado River water deliveries to the Lower Basin, declines of up to half of these flows would be about 5% Lower Basin deliveries (375 kaf out of 8.25 maf), but such declines would increase the already substantial pressures to reduce water consumption in the Lower Basin and Arizona, especially.

Changes in Colorado River Runoff Timing

Runoff timing has advanced by 1 to 4 weeks (Clow, 2010, Lukas and Payton, 2020), and is expected to advance several weeks more by mid-century. (See figure below that shows a peak in early May compared to mid-June historically.)

Changes in Colorado River runoff timing do not have direct implications for MWD, as the water can generally be captured in storage. (This is not true for direct flow diverters in the Upper Basin who may have to change practices to utilize earlier runoff.) However, there are important indirect effects. Early runoff promotes greater ET as soils are exposed for longer periods of the year which in turn promotes more evaporation and transpiration by plants. This then can lead to runoff reductions in the following year (Das et al., 2012).

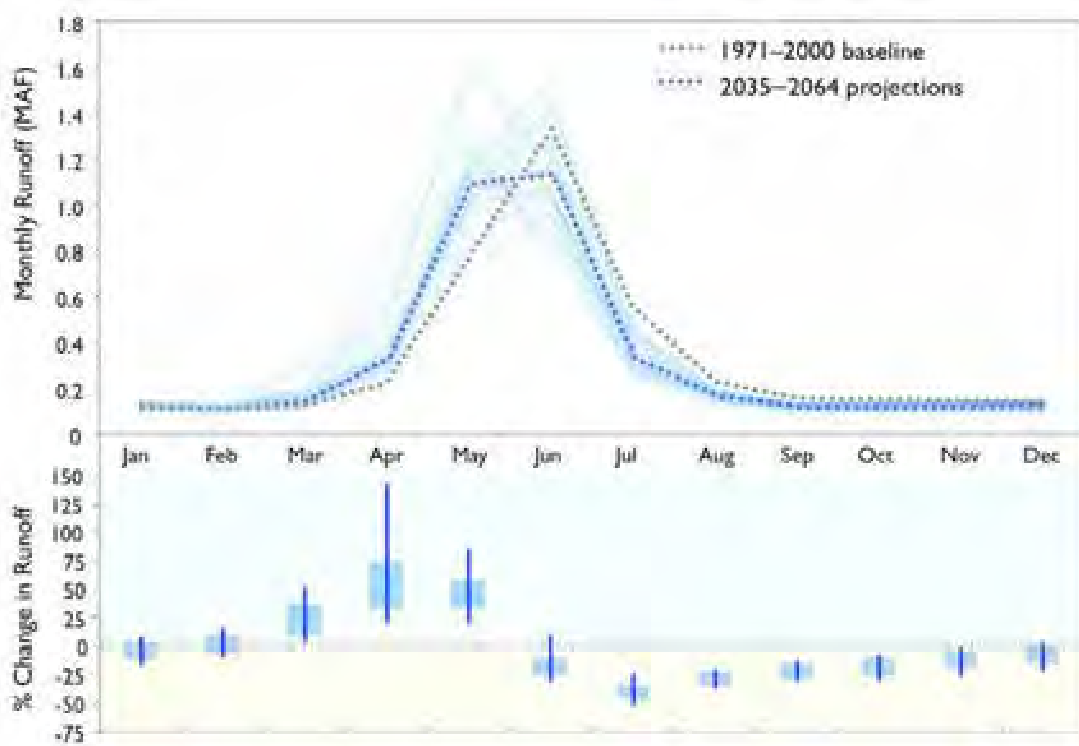


Figure 9: Projected monthly runoff change for the Colorado River headwaters from ~2050 (2035-2064) under moderate emissions (RCP4.5) from the CMIP4-BCSD. Projected average monthly flows for 31 projections (light blue lines) and the ensemble median (dark blue dotted line) compared to the 1971-2000 baseline (gray dashed line). The bottom panel shows the corresponding ranges of the monthly runoff changes from the model ensemble; the dark blue bars show the range from the 10th to 90th percentile and the light blue boxes show the 25th to 75th percentile. **As the hydrography shifts earlier, March-May runoff increases while June tends to decrease, and July-September runoff sharply decreases in all projections**. For original figure caption and data please see the State of the Science, 2020, https://wwa.colorado.edu/publications/reports/CRBreport/.

Dust on Snow Impacts on Colorado River Flow

Dust on snow has been found to advance runoff timing by up to 3 weeks and to reduce river flow by up to 5% (Painter et al., 2010). Drought in the Southwest has been associated with increases in the dust deposition that is responsible for runoff reductions and early melting. It has been hypothesized that severe future droughts could cause additional dust. Were dust to increase, the flow would decline modestly to 6% but runoff timing would advance by an additional 3 weeks (Deems et al., 2013) The advances in runoff timing due to dust are substantially larger than caused by warming. Dust physically darkens the snowpack which allows for much more solar energy to be absorbed thus hastening melting. There is some evidence that human interventions could reduce some of the impacts of dust (Duniway, 2019).

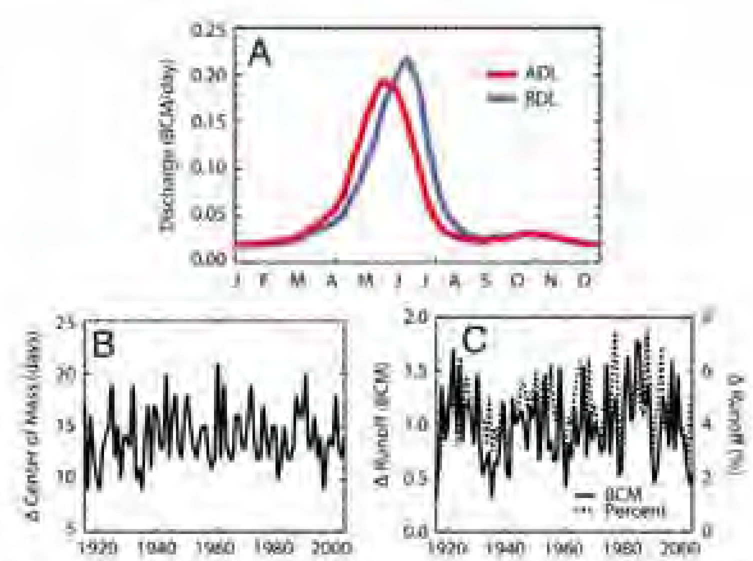


Fig. 2. Differences in runoff timing and volume between ADL and BDL dust scenarios. (*A*) Mean discharge at Lees Ferry, AZ on the Colorado River for ADL and BDL scenarios across the period 1916–2003. (*B*) Time series of BDL versus ADL Δ runoff in billion cubic meters across 1916–2003. (*C*) Time series of BDL versus ADL Δ runoff in percent of ADL runoff.

Figure 10: Differences in runoff timing and volume at Lees Ferry between After Dust Loading (ADL) and Before Dust Loading (BDL). Total runoff volumes are the areas under the curves. Note that the red ADL line shows earlier and lower total runoff -- i.e., the enclosed area from the red line to the blue line on the left is smaller than the enclosed area from the red line to the blue line on the right. Source: Painter et al., 2010.

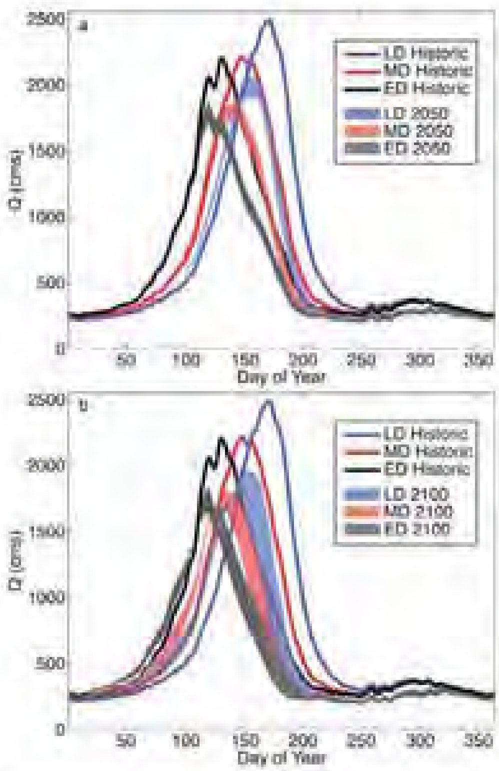


Fig. 8. (a) Mean annual hydrograph at Lees Ferry, showing moderate dust (MD), low dust (LD), and extreme dust (ED) historic traces and mean annual hydrograph for all three dust/albedo scenarios, for decade centered on 2050; colored areas show the range in hydrograph response between B1 and A2 emissions scenarios; and (b) as in (a), but for the decade ending 2100.

Figure 11: Lees Ferry runoff at 2050 (a) and 2100 (b) under Low (LD), Moderate (MD) and Extreme (ED) dust. The lines are for the historic period and the ribbons represent future warming under lower (B1) and higher (A2) greenhouse gas emissions. Under historic conditions (lines) MD and ED lines shift to earlier runoff but show about the same runoff volumes. Under climate change (ribbons) LD shows both a shift in runoff timing and lower runoff volume. MD and ED under climate change show similar volumes but ED runoff timing is advanced into spring. Source: Deems et al, 2013.

Increasing Colorado River Evapotranspiration (ET) Demand

Multiple studies as noted above have shown that increasing ET is the root cause of up to half of the decline in Colorado River flows. These data are often not directly published but would be available as hydrology model outputs. Data from Milly and Dunne (2020) show increases in basin wide ET of approximately 3% since the 1930s, with much of these increases occurring during the last 20 years. Milly and Dunne note the importance of the earlier loss of snowpack, which decreases the Earth's reflectivity ("albedo"), and that in turn allows for increases in all forms of evaporation, including transpiration. Winter sublimation, the direct conversion of snow to water vapor, will also increase as it warms although this amount has not been projected. Sublimation is very dependent on wind and future changes in wind are not well understood.

Increasing West Wide Crop Demands

Reclamation studied how climate change will affect crop demands in 2015. They found a 12% increase across the West, with greater increases occurring in the South (Rio Grande) and lesser increases in the north (Columbia). Perennial crops increased the most, while annual crops may be able to be planted and harvested earlier, minimizing the impacts of increasing temperature on ET. The study used a modern, physically-based method to calculate ET, unlike some older studies using inaccurate temperature-based methods.

BCSD Irrigation Demand and Reservoir Evaporation Projections

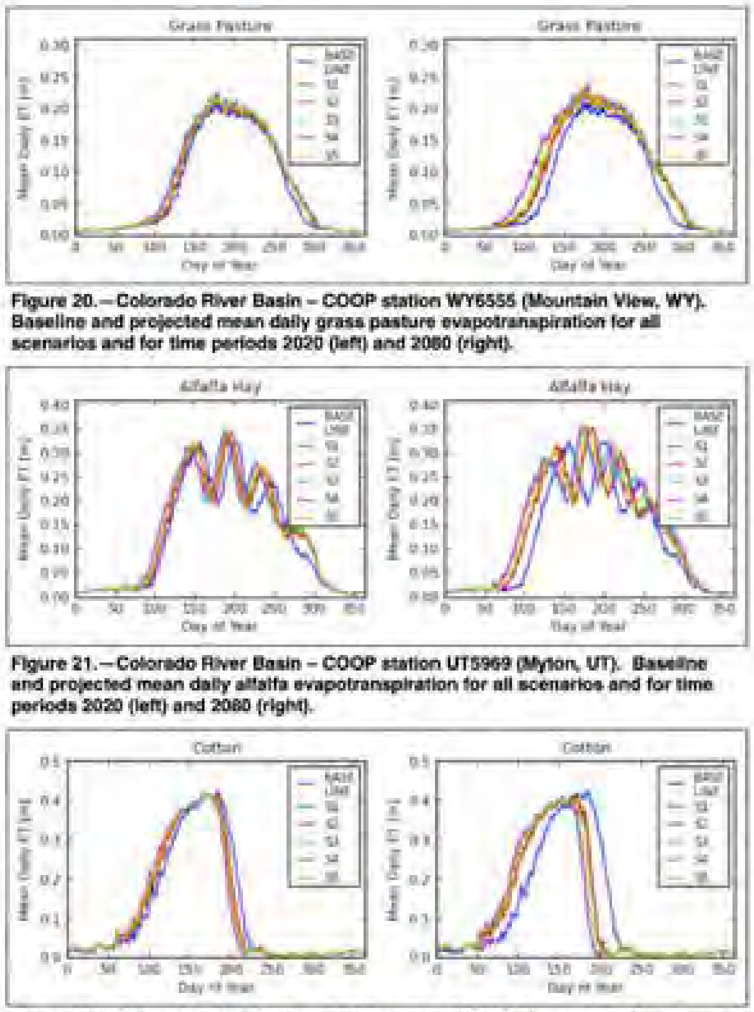


Figure 20.—Colorado River Basin – COOP station WY6555 (Mountain View, WY). Baseline and projected mean daily grass pasture evapotranspiration for all scenarios and for time periods 2020 (left) and 2080 (right).

Figure 21.—Colorado River Basin – COOP station UT5969 (Myton, UT). Baseline and projected mean daily alfalfa evapotranspiration for all scenarios and for time periods 2020 (left) and 2080 (right).

Figure 22.—Colorado River Basin – COOP station AZ9656 (Yuma, AZ). Baseline and projected mean daily cotton evapotranspiration for all scenarios and for time periods 2020 (left) and 2080 (right).

Figure 12: Evapotranspiration now versus different future scenarios (S1 thru S5) with higher temperatures. Note that for Grass Pasture and Alfalfa Hay the growing period starts earlier and ends later, enlarging consumptive use. For cotton, the growing period starts earlier but also ends earlier, offsetting some of the consumptive use increases. Source: Reclamation, 2015.

Increasing Colorado River Reservoir Evaporation

There has been only one comprehensive study on changes in lake evaporation due to climate change, a 2015 study by Reclamation (Reclamation, 2015). That study suggests a roughly linear thru time 10% increase in evaporation at Lakes Mead and Powell by 2100. If current Lake Mead evaporation is approximately 600 to 800 kaf / year, this means additional losses of 60 to 80 kaf

/ year by 2100 with similar but slightly smaller losses at Powell. These losses are dependent on reservoir contents, with lower reservoirs having less surface area and thus lower losses. Combined, the two reservoirs might thus lose an additional 120 kaf / year by 2100 and perhaps 60 kaf / year by 2050. These are reasonably small numbers in the context of the entire river, but are part of the larger trend of increasing ET losses everywhere.

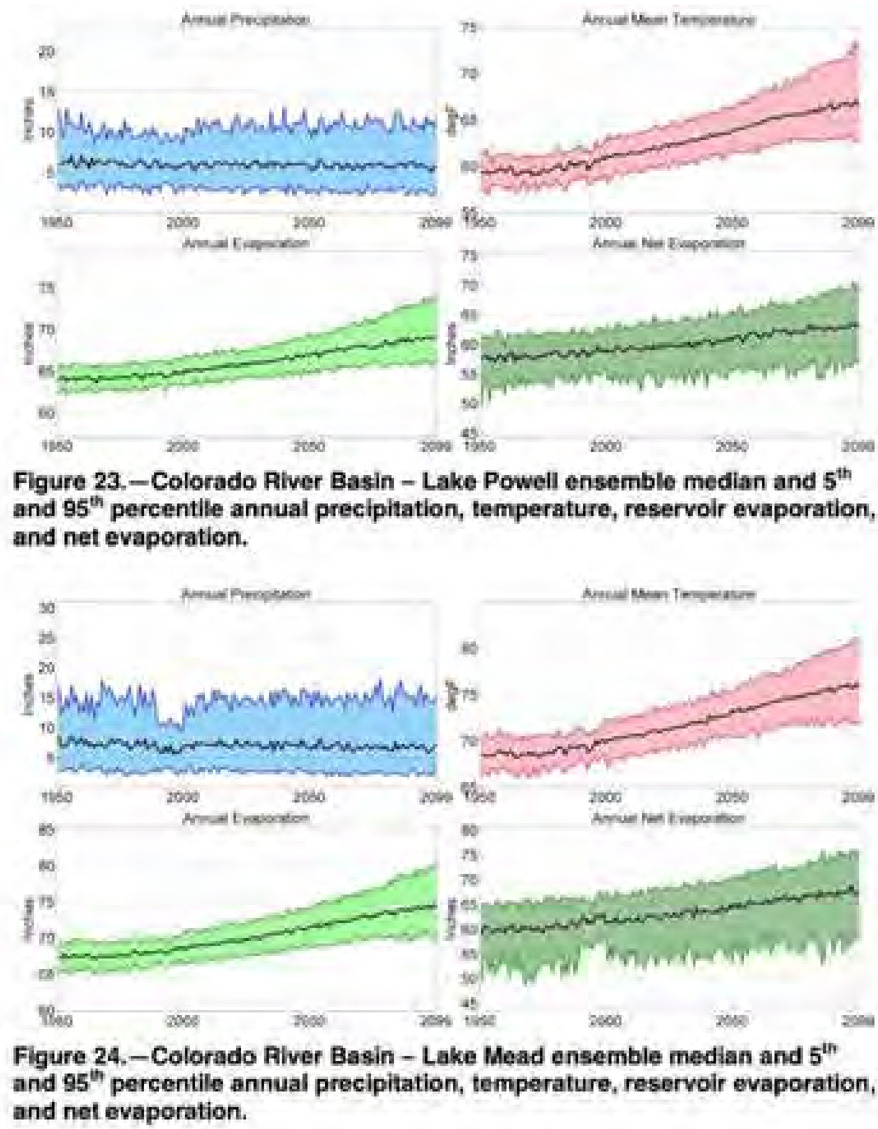


Figure 13: Changes in precipitation, annual mean temperature, annual evaporation and annual net evaporation (evaporation less precipitation) at Lake Mead from 1950 to 2099. Note the approximately 10% increase in evaporation from 2000 to 2099. Source: Reclamation, 2015.

Impacts to the Salton Sea

Salton Sea levels are directly and most importantly influenced by return flows from the Imperial Irrigation District. Those return flows are in turn influenced by total IID deliveries, and more importantly, on farm practices in IID. Evaporation is also a determinant of levels. Most projections for Salton Sea levels are for steadily declining levels over the next few decades due to an emphasis on improved irrigation efficiency, which means fewer return flows. It is unclear how future evaporation increases will affect the sea, but a reasonable guess would be increased evaporation in line with that projected at Lakes Powell and Mead. Salton Sea levels may be less of an issue of climate change and more related to water transfer agreements from IID. Were IID to face delivery shortages due to low reservoir levels in Lake Mead, this would likely lead to even lower levels in the Salton Sea than currently envisioned. Low Salton Sea levels lead to a variety of impacts from human health issues due to dust to significant environmental issues from the Sea turning hyper-saline. We are not aware of studies that directly tie climate change to impacts at the Salton Sea.

Q7. What are the important underlying climate change drivers that influence demands, and how do they affect demands in each of the three major demand sectors (single family residential, multi-family residential, commercial/industrial)?

Key Points: Temperature, and to a lesser extent precipitation, are the major climate drivers influencing water demand. Here, We describe the impact of climate drivers on major end uses and the extent to which each of these end uses is associated with the three major demand sectors: single-family residential, multi-family residential, and non-residential (or commercial, industrial, and institutional).

Effect of Climate Change on End Uses of Water:

A. **Landscape Irrigation:** Landscape water demand is sensitive to temperature and, to a lesser extent precipitation. Irrigation demand is higher in hot and/or dry periods and lower during cool and/or wet periods. As a result, irrigation is a major driver of intra- and inter-annual variability in water demand. Because precipitation in California typically occurs between October and May, the effect of precipitation on irrigation demand is likely to be greatest during the winter months and early Spring. In contrast, the effect of temperature on irrigation demand is likely to be year-round, peaking in summer and fall.

   A range of techniques are available for estimating how changes in climatic factors (temperature, wind speed, humidity, solar radiation, etc.) affect evaporation and plant transpiration. For example, the FAO Penman-Monteith equation is widely used for evaluating climate impacts on irrigation demand. Crop coefficients are useful for accounting for variations from the reference condition due to, for example, crop type, phenological development, harvests, and stress.

B. **Building Cooling:** Temperature also determines building cooling requirements, with warmer temperatures increasing cooling needs. Most buildings use either air or water for cooling, although some may use geothermal processes. For those that use water for cooling, a major determinant of the water requirements is whether the building uses single-pass (or once-through) cooling, evaporative cooling, or cooling towers. Where water is used for building cooling, changes in temperature will have a direct effect on building water requirements. A related important consideration is the penetration rate of cooling systems. In much of coastal California, residential homes are built without air conditioning, but as average temperatures rise, demand for air conditioning will increase, with concomitant impacts on energy demands and the water associated with energy production.

C. **Building Heating Systems:** Temperature also affects building heating requirements, with warmer temperatures reducing heating requirements. Where water is used for building heating, such as in boilers, changes in temperature can have a direct effect on building water requirements. For water-based heating systems, a major determinant of the water requirements is whether they are equipped with a closed-loop system that returns the water and steam condensate to the boiler for reuse or an open-loop system that expends the water or steam without return to the boiler.

D. **Electricity Generation:** Temperature also affects electricity generation. Warmer temperatures, particularly during the summer months, can increase building energy use for cooling while also reducing the thermal efficiency of power plants. This could, in turn, increase electricity generation and, depending on the energy technology employed, energy-related water use. Most renewables, like wind and solar photovoltaics, use minimal water during operation. However, thermoelectric power plants, like natural gas-fired plants or solar thermal plants, use water in boilers and, to a greater extent, in cooling systems. These cooling systems may be cooled by air or water, with once-through cooling systems more water intensive than recirculating cooling systems.

Effect of Climate Change on Major Demand Sectors: Generally, climate impacts on water demand will vary across each of the major demand sectors according to (1) the magnitude of climate change impacts on the end use, and (2) the proportion of total water use the end use represents.

A. **Single-Family Residential:** Landscape irrigation is common in single-family residences, accounting for up to 70% of household water use in some areas. As a result, climate impacts on landscape irrigation will affect household water demand. Most single-family homes do not use water-based heating and cooling systems, and consequently, temperatures would have no effect on water demand for those end uses. However, some single-family homes use evaporative coolers, such as swamp coolers, that require water during operation. For these households, warmer temperatures would increase water demand. While there are limited data on the use of evaporative coolers in California households and their water requirements, the Department of Water is studying these systems to support implementation of AB 1668/SB 606.

B. **Multi-Family Residential:** Like single-family residences, landscape irrigation is common in multi-family residences, and climate change would affect water requirements for this end use. Additionally, multi-family buildings may use water for cooling and heating systems. Typically, low-rise residences and small commercial buildings use air-based cooling systems, whereas larger buildings may use water-based cooling systems.

C. **Non-Residential (CII):** Landscape irrigation is common in the CII sector, and climate change would affect total CII water demand. Compared to the residential sector, however, landscape irrigation typically represents a lower percentage of total water use, and thus the effect on total demand is likely to be less. Buildings in the CII sector may use water for cooling and/or heating systems. While small commercial buildings typically use air-based systems, larger buildings are more likely to use water-based cooling systems.

Q8. What other recommendations do you have for our planning?

Prudent Planning and "Reasonable Worst Case Future: By this we mean, planning for a future that is both politically possible to plan for, and climatologically possible without being on the extreme tail. This requires balancing the politically possible and the "climatologically problematic". That is to say, some futures are too hard to plan for politically and too uncertain to plan for based on climate models. For example, given the strong tie between flow reductions over the last 21 years and rising temperatures in the Colorado River Basin, prudence dictates that planning use flows less than the last 21 years. It remains an active area of inquiry about how much less. Planning for California would likely require some very wet, flood prone scenarios along with drought scenarios. Ultimately, the determination of a 'reasonable worst case future' is a policy decision informed by qualitative weighting of certain and less certain science.

From Reclamation's West-Wide Climate and Hydrology Risk Assessment on what Deep Uncertainty is: "Because of the amount and nature of the uncertainty in future hydroclimate projections, however, it is also appropriate to consider concepts and techniques that provide decision makers with actionable information that does not rely on probabilities, using a subfield of decision science that deals with a deeply uncertain future. Deep uncertainty arises when, among other factors, the likelihoods of future conditions cannot be stated with confidence, and when experts do not agree on the most appropriate way to represent complex interactions between factors influencing a planning context (Lempert et al., 2003; Marchau et al., 2019).

The Society for Decision Making Under Deep Uncertainty is a great resource for additional information: https://www.deepuncertainty.org/

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HOW OUR FUTURE CLIMATE AFFECTS SOUTHERN CALIFORNIA WATER:
WHAT THE EXPERTS SAID

Southern California's water future will be profoundly impacted by our changing climate. Science can't provide a precise answer, given how future decisions will impact future levels of greenhouse gas emissions. But experts studying climate change can provide a range of potential futures to assist Metropolitan in updating the district's long-term water strategy, our Integrated Water Resources Plan (IRP).

Future changes in temperature and precipitation will significantly impact both water supplies and demand. By carefully examining four different scenarios of various possible levels of supplies and demands due in part to different climate circumstances, Metropolitan intends to develop an updated IRP that can help Southern California adapt to the future as it unfolds.

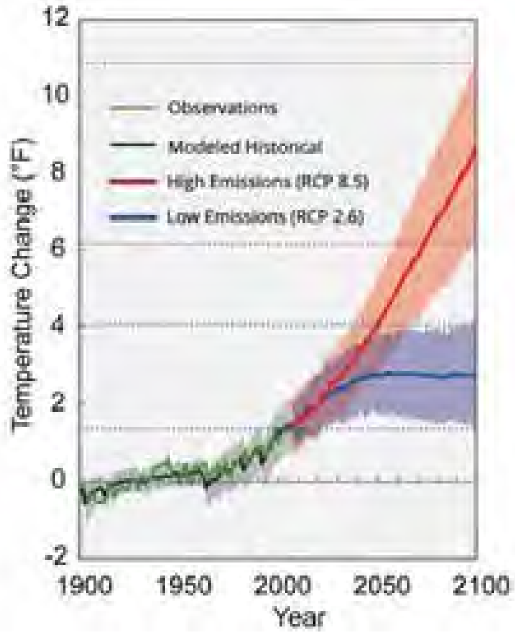
On May 25, the Metropolitan Board of Directors held a three-hour workshop to listen to four climate change experts provide insights into their research and their thoughts on prudent planning. Along with a separate panel of experts with various specialties relating to demand management, Metropolitan intends to incorporate this feedback, along with that of our Member Agencies, Board and the Public, to develop the District's first IRP that utilizes scenario planning. The following are summaries of the experts' initial remarks. Listen here to the full workshop.

Global Climate Change

Dr. Heidi Roop

- Assistant Professor, University of Minnesota Department of Soil, Water and Climate
- Ph.D in Geology from Victoria University of Wellington, M.S. in Geology from Northern Arizona University, B.A. in Geology from Mount Holyoke College

Human Choices: the principal driver of long-term warming is total emissions of CO_2



Projected warming under continued **HIGH emissions**

Projected warming under **LOW emissions**

RCP = Representative Concentration Pathway.

Modified from 3rd National Climate Assessment, 2014

> ***"We don't have crystal balls as climate scientists. But we have tools in our toolbox that help us navigate these scenarios."***

Key Points

- Global averages do not provide information that is locally useful and actionable
- The greatest source of uncertainty is connected to human behavior
- Climate models are projections, not predictions, and can provide a range of potential outcomes
- Models are rapidly progressing to provide local information and decision-relevant information

Going from Global to Local

Dr. Julie Vano

- Research Director at Aspen Global Change Institute
- Ph.D. in Civil and Environmental Engineering from University of Washington, M.S. in Land Resources from University of Wisconsin and B.A. in Biology, minors in Mathematics and Chemistry from Luther College

No Model is Perfect

> *"The accuracy of streamflow simulations in natural catchments will always be limited by simplified model representations of the real world as well as the availability and quality of hydrologic measurements." (Clark et al., WRR, 2008)*

Do not expect perfect results,

Not prediction, but a tool to test how system responds (what if scenarios)

BUT we can make better choices…

Seek simple yet defensible (do not need a Cadillac)

Be aware of models' shortcomings

Use a range, not a single model outcome

"In using these models, they can be really helpful tools. But it is important to be a savvy consumer. No model is perfect."

Key Points

- A model with a fine spatial scale may provide a false sense of precision
- Use a range of potential outcomes from a climate change model rather than a single output
- Different models should be used to best inform different decisions

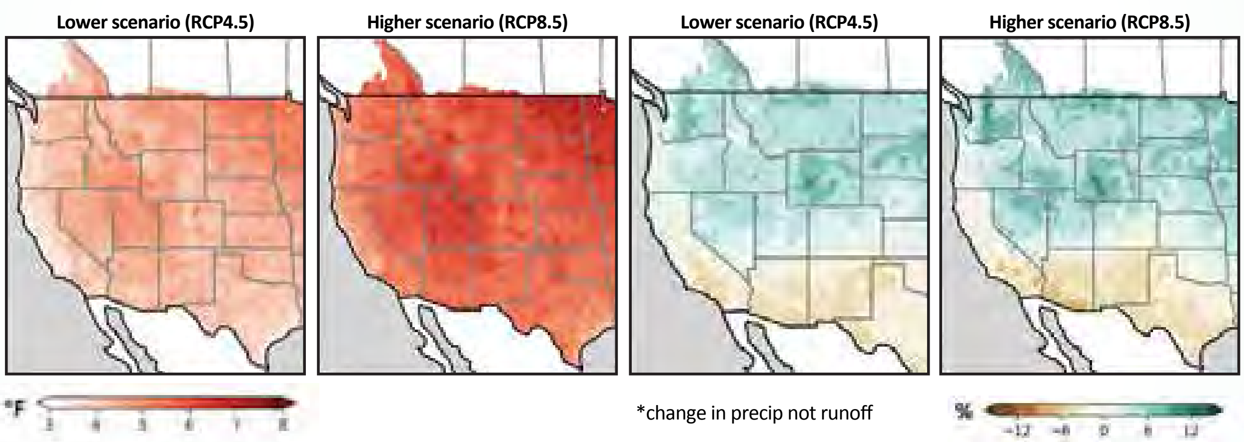
Regional Hydrologic Changes

Brad Udall

- Senior Water and Climate Research Scientist at Colorado Water Institute, Colorado State University
- M.B.A. from Colorado State University and B.S. in Environmental Engineering from Stanford University

Regional Hydrologic Changes

Temperature Projections | **Precipitation Projections***



*change in precip not runoff

Maps show average change in temperature and precipitation across a two emissions scenarios for the period 2040 - 2069 relative to 1970 - 1999 using the LOcalized Constructed Analogs (LOCA) downscaling approach.

These maps convey an average across 32 global climate models.

Source: Reclamation's 2021 SECURE Water Act

> *"If you add heat to the planet like we're doing and not add it uniformly....you are going to end up with profound changes in the water cycle."*

Key Points

- In the Sierra, the drought year of 2015 was the first time in 132 years that the average winter temperature was above freezing
- Future peak flows in the Sacramento-San Joaquin Delta will shift from March and April to December through March
- The Central Valley and Colorado River basins will have in common earlier runoff, more rain and less snow, lower late season flow and declining water quality

Climate Change & Water Demand

Heather Cooley

- Director of Research at the Pacific Institute
- M.S. in Energy and Resources and B.S. in Molecular Environmental Biology from the University of California, Berkeley

Landscape Irrigation

Estimated water use = (ET0 x Plant Factor x Landscape Area x 0.62) / Irrigation Efficiency

Plant Factors

0 to 0.1 = very low water use plants

0.1 to 0.3 = low water use plants

0.4 to 0.6 = moderate water use plants

0.7 to 1.0 = high water use plants

Image from the Inland Empire Landscape Guide

> *"The impact of climate change on landscape irrigation can be moderated by changing these plant factors and the plant palettes that we have, looking at differences in landscape area...as we move toward densification."*

Key Points

- Temperature and precipitation are major drivers on future water demand, temperature being more significant
- For single-family residential homes, climate change's greatest impacts are on landscape irrigation
- Some grasses require 55 inches of water per year, with native plants using up to 90 percent less

Appendix E.3

Conceptual Feasibility

RECLAMATION
Managing Water in the West

Water Infrastructure Improvements for the Nation Act of 2016 (Pub. L. 114-322), Title I Water Resources Development Section 4009(c):

Feasibility Study Review Findings

April 2021

Prepared for

United States Congress

Prepared by

U.S. Department of the Interior
Bureau of Reclamation

Mission Statements

The Department of the Interior conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Table of Contents

Eligible Projects

This periodic report is provided in accordance with the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 (Pub. L. 114-322), Title I Water Resources Development Section 4009(c). The purpose of this report is to provide a summary of each of the review findings for Title XVI feasibility studies reviewed, completed, and not previously transmitted to Congress that meet the established requirements as defined in the Bureau of Reclamation (Reclamation) Manual Directives and Standards WTR-11-01 and under section 1604 of Pub. L. 102-575, as amended. The following list of completed feasibility studies is provided:

- City of Ada (Oklahoma), Reclamation and Reuse Feasibility Study
- City of Morro Bay (California), Water Reclamation Facility Program
- City of Nampa (Idaho), Nampa Recycled Water Program
- City of Oxnard (California), Recycled Water Feasibility Study
- Metropolitan Water District of Southern California (California), Regional Recycled Water Program
- Padre Dam Municipal Water District (California), East County Advanced Water Purification Program – Phase II
- Weber Basin Water Conservancy District (Utah), Title XVI Reuse Feasibility Study

This list of projects eligible to compete for funding will be added to the list transmitted previously and will be amended as subsequent reports are provided to Congress as additional feasibility studies are completed and reviewed.

Summary of Results

This report includes a brief one-page summary of the results of each feasibility study review under WTR 11-01, including the following determinations:

- The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended.
- The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of Title XVI projects.
- The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Project specific reports are provided to summarize the results of each feasibility study review, provide a brief project description, and identify conditions.

City of Ada

Project Sponsor: City of Ada
Location: Ada, Oklahoma
Project: Reclamation and Reuse Feasibility Study
Total Estimated Project Cost: $13,081,300
Review Completed: February 19, 2020

Project Description: The City of Ada considered the feasibility of treating its wastewater effluent to the level required for non-potable reuse for municipal, industrial, and agricultural purposes. Additional treatment infrastructure for the City's Wastewater Treatment Plant (WWTP) will include coagulation, flocculation, filtration, and chlorine disinfection to meet the water quality standards required for unrestricted non-potable reuse. The recommended project also includes a new non-potable distribution system to serve large industrial and irrigation users within proximity to the WWTP. The additional treatment and distribution infrastructure will produce an estimated 897 acre-feet per year of recycled water, which will provide long-term benefits to the Arbuckle-Simpson Aquifer by offsetting the use of potable water for irrigation and industrial purposes.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include City of Ada's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.
- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.
- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.
- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).
- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

City of Morro Bay

Project Sponsor: City of Morro Bay
Location: Morro Bay, California
Project: Water Reclamation Facility Program
Total Estimated Project Cost: $125,882,000
Review Completed: July 22, 2020

Project Description: The City of Morro Bay evaluated options for implementing a water reuse strategy. The recommended project includes building a Water Reclamation Facility (WRF), injection wells to allow for indirect potable reuse, and a raw wastewater conveyance system and pump stations. The WRF will incorporate advanced treatment technology to produce purified water that meets indirect potable reuse standards for groundwater replenishment and reuse. The project is expected to produce an annual 825 acre-feet of recycled water for injection into the underlying Morro Valley Groundwater Basin, which will ultimately supply the City's potable water distribution system. The project will help limit the City's reliance on imported water and improve water quality of the Morro Groundwater Basin.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include City of Morro Bay's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.

- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.

- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.

- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).

- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

City of Nampa

Project Sponsor: City of Nampa
Location: Nampa, Idaho
Project: Nampa Recycled Water Program
Total Estimated Project Cost: $61,465,000
Review Completed: June 9, 2020

Project Description: The City of Nampa considered the feasibility of upgrading its wastewater treatment plant to produce highly treated effluent, which would be used to augment irrigation water supply. The recycled water produced will be sent via pipeline to Pioneer Irrigation District's primary irrigation conveyance canal. Components of the proposed project include tertiary filtration and upgraded disinfection at the wastewater treatment plant, as well as a recycled water distribution force main and pump station. The project will allow the City to expand recycled water use and maintain water quality by reducing wastewater discharge to Indian Creek.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include the City of Nampa's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.
- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.
- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.
- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).
- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

City of Oxnard

Project Sponsor: City of Oxnard
Location: Oxnard, California
Project: Recycled Water Feasibility Study
Total Estimated Project Cost: $275,151,000
Review Completed: May 19, 2020

Project Description: The City of Oxnard considered approaches to cover its projected water supply gap with advanced purified water. The recommended project will expand recycled water capacity at the City's Advanced Water Purification Facility by 12.5 million gallons per day and expand its desalter capacity by 7.5 million gallons per day to treat groundwater for total dissolved solids and nitrates. The treated water will help the City meet its groundwater quality objectives and will be used for potable reuse via groundwater augmentation and aquifer storage and recovery. Project outcomes will include alleviating groundwater overdraft, providing a drought-proof water supply, maximizing self-sufficiency, utilizing all partially constructed assets, and improving the groundwater quality for irrigation and drinking water.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include City of Oxnard's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.

- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.

- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.

- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).

- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

Metropolitan Water District of Southern California

Project Sponsor: Metropolitan Water District of Southern California
Location: Los Angeles, California
Project: Regional Recycled Water Program
Total Estimated Project Cost: $2,700,000,000
Review Completed: April 3, 2020

Project Description: The Metropolitan Water District of Southern California evaluated the feasibility of a potential Regional Recycled Water Program in partnership with the Sanitation Districts of Los Angeles County to produce up to 150 million gallons per day, or 168,000 acre-feet per year, of purified water. The proposed project consists of a new advanced water treatment facility at the Sanitation District's Joint Water Pollution Control Plant. The project's conveyance system includes approximately 60 miles of pipeline and three pumping plants. The purified water will be delivered to recharge regional groundwater basins, which later will be reused as a potable water supply.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include Metropolitan Water District of Southern California's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.
- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.
- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.
- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).
- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

Padre Dam Municipal Water District

Project Sponsor: Padre Dam Municipal Water District
Location: Santee, California
Project: East County Advanced Water Purification Program – Phase II
Total Estimated Project Cost: $251,610,000
Review Completed: January 16, 2020

Project Description: The purpose of this feasibility study was to evaluate and identify components for Phase II of the District's East County Advanced Water Purification Program. Phase II will expand Padre Dam's Ray Stoyer Water Recycling Facility by an additional 9 million gallons per day of treatment capacity, expand the solids handling facility to manage added solids load, and expand the Advanced Water Purification facility to produce an additional 8 million gallons per day of recycled water. With the Phase II Project, the expanded program will generate an additional 8,960 acre-feet per year of local potable water supply through surface water augmentation at Lake Jennings.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include Padre Dam Municipal Water District's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.
- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.
- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.
- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).
- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

Weber Basin Water Conservancy District

Project Sponsor: Weber Basin Water Conservancy District
Location: Layton, Utah
Project: Title XVI Reuse Feasibility Study
Total Estimated Project Cost: $46,430,000
Review Completed: February 6, 2020

Project Description: Weber Basin Water Conservancy District considered approaches for implementing a water reuse project to provide a more resilient and reliable water supply throughout its service area. The District plans to partner with Central Weber Sewer Improvement District (CWSID) to operate a recycled water plant at the CWSID Water Reclamation Facility. Treatment technology will include biological aerated filters, denitrification filters, and cloth disc filters, which were recommended based on nutrient removal capability and long-term reliability. Once treated by CWSID, recycled water will be delivered to the Willard Canal for non-potable reuse or stored in Willard Bay to meet in-stream flow requirements.

Feasibility Study Review Finding: The feasibility study report meets the requirements of a feasibility study as defined under section 1604 of Pub. L. 102-575, as amended. The feasibility study, and the process under which the study was developed, each comply with Federal laws and regulations applicable to feasibility studies of water recycling projects. The project is technically and financially feasible and provides a Federal benefit in accordance with the reclamation laws.

Funding Conditions:

- Reclamation will include the Weber Basin Water Conservancy District's project on a publicly available list of projects that have a completed feasibility study that has been determined to meet program requirements. The list will be available on the Reclamation website.
- The project sponsor is eligible to apply for funding through an annual competitive funding opportunity announcement, but the total Federal funding received towards the planning, design, and construction of this project may not exceed 25 percent of the total cost of the project or $20 million, whichever is less.
- Planning, design, and construction activities completed prior to the transmission of this list of eligible projects or outside of the scope of the project described in the completed feasibility study are not eligible for funding.
- Prior to receiving Federal funding, the project must comply with all applicable environmental laws, including the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).
- Prior to receiving Federal funding for construction activities, the project sponsor must demonstrate that it is financially capable of funding the non-Federal portion of project construction costs and all necessary project operation, maintenance, and replacement costs, pursuant to Reclamation Manual Directives and Standards WTR-11-02.

Appendix E.4

Innovation Facility/Treatment/ Groundwater/Deliveries/Implementation

NATIONAL WATER RESEARCH INSTITUTE

Preliminary Final Panel Report #1

Review of Metropolitan Water District's
Regional Recycled Water Program
Advanced Purification Center Demonstration Project

Based on the NWRI Independent Advisory Panel Meeting held
August 8-9, 2018 at Los Angeles, California

Prepared by:
NWRI Independent Scientific Advisory Panel for the
Regional Recycled Water Program
Advanced Purification Center Demonstration Project

Prepared for:
Metropolitan Water District of Southern California
Los Angeles, CA USA

Submitted by:
National Water Research Institute
Fountain Valley, CA USA

September 28, 2018

NWRI

DISCLAIMER

This report was prepared by an NWRI Independent Advisory Panel, which is administered by the National Water Research Institute (NWRI). Opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

ABOUT NWRI

A joint powers authority and nonprofit organization, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies, and to protect public health and improve the environment. NWRI's JPA member agencies are: Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

For more information, please contact:

National Water Research Institute
18700 Ward Street
Fountain Valley, California, USA 92708
Phone: (714) 378-3278
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Contents

INTRODUCTION

The National Water Research Institute (NWRI) is pleased to present this report on the findings and recommendations from Meeting #1 of the NWRI Independent Scientific Advisory Panel (Panel) for the Regional Recycled Water Program (RRWP), Advanced Purification Center Demonstration Project (Project). The Panel met on August 8-9, 2018 in Los Angeles, California.

REGIONAL RECYCLED WATER PROGRAM

The RRWP is a partnership of Metropolitan Water District of Southern California (Metropolitan) and the Sanitation Districts of Los Angeles County (LACSD). The partners are exploring the potential of a program to create a new water resource with regional benefit for Southern California. The RRWP would consist of an advanced water treatment (AWT) facility at the LACSD Joint Water Pollution Control Plant (JWPCP) in Carson, California, and a new regional conveyance system to beneficially reuse water currently discharged to the Pacific Ocean. Metropolitan and LACSD envision this AWT facility would treat secondary effluent from the JWPCP and with AWT processes to purify the water for recharge in Los Angeles and Orange counties. In the future, the potential exists for the Project to provide a source of water for other indirect and direct potable uses. The RRWP would diversify the region's water resources and significantly contribute to long-term water supply targets outlined in Metropolitan's Integrated Resources Plan.

California remains a leader in recycling wastewater for beneficial reuse. The RRWP would be designed to meet or exceed the water quality parameters of other successful indirect potable reuse (IPR) projects in California, including the Groundwater Replenishment System developed collaboratively by Orange County Water District and Orange County Sanitation District, and the Montebello Forebay Groundwater Recharge project owned and operated by LACSD. The RRWP design would direct purified water through a new regional distribution system for delivery to Metropolitan's member agencies to meet regional groundwater replenishment needs. Groundwater basins currently being considered as users of the RRWP product include West Coast Basin, Central Basin, Main San Gabriel Basin, and Orange County Basin. In addition to providing Metropolitan with a significant new drought-resistant water supply, the RRWP would contribute to the LACSD's goal to maximize reuse of treated wastewater. If Metropolitan and LACSD move forward with the RRWP, the full-scale facilities would likely be implemented over multiple phases to a maximum build-out of up to 150 million gallons per day (MGD).

ADVANCED PURIFICATION CENTER DEMONSTRATION PROJECT

The Project will provide critical input for the design of full-scale RRWP facilities, clarify capital and operational and maintenance costs for advanced treatment, and ultimately acquire the necessary regulatory permits for a full-scale facility should the RRWP proceed. The Project will build upon a successful pilot study conducted by Metropolitan and the Sanitation Districts between 2010 and 2012 evaluating two AWT process trains. Construction on the 500,000 gallon per day AWT demonstration plant, now known as the RRWP APC Demonstration Project, began in late 2017, and should be completed in late 2018.

The Project will enable the partners to test AWT processes to support regulatory acceptance of an advanced treatment train that includes a membrane bioreactor (MBR), filtration, and advanced oxidation (AO). It is noteworthy that this is the first potable reuse project in California that proposes a MBR as the core treatment process. The partners expect the

Project to operate for approximately one year and will provide opportunities for public outreach aimed at obtaining public acceptance for the RRWP. The partners engaged NWRI in early 2018 to administer and facilitate the Independent Scientific Advisory Panel for this Project as required by Title 22. The Panel's charge is to review the scientific, technical, and regulatory aspects of the Project.

NWRI PANEL PROCESS OVERVIEW

To ensure the success of Meeting #1, NWRI engaged the Project Planning Team, the Panel Chair, and Panel during June 2018, and organized multiple coordination meetings among these groups. The purpose of these meetings was to: (a) plan an effective process that met all expectations of Metropolitan-LACSD; (b) ensure good communication among Metropolitan-LACSD, the NWRI team, and the Panel; (c) focus the Panel's scope of review; and, (d) draft, review, and finalize the Key Questions to guide the Panel's Meeting #1 Findings and Recommendations.

Panel Meeting #1 was held August 8-9, 2018, at the Metropolitan Headquarters Building located at Union Station, 700 North Alameda Street, Los Angeles, California. The meeting was facilitated by Ed Means of Means Consulting LLC, under contract to NWRI. The following Panel members attended Meeting #1:

- Chair: Charles Haas, Ph.D., Expert in Microbiology, Drexel University
- Richard "Dick" Bull, Ph.D., Expert in Toxicology, MoBull Consulting
- Joseph Cotruvo, Ph.D., Expert in Chemistry, Joseph Cotruvo and Associates, LLC
- Adam Olivieri, PE, Dr.PH., Expert in Potable Reuse Permitting and Public Health, EOA, Inc.
- Thomas Harder; P.G., P.H.G., Expert in Hydrogeology, Thomas Harder & Co.
- Vernon Snoeyink, Ph.D., Expert in Corrosion; University of Illinois
- Paul Westerhoff, Ph.D., Expert in Water Treatment Technology & Process, Arizona State University

Michael Stenstrom, Ph.D., an expert in Wastewater Treatment Technology & Process at University of California, Los Angeles, was unable to attend. However, Dr. Stenstrom states that he reviewed the test plans and has no concerns with the Panel's consensus findings and recommendations.

Short biographies for each Panel member are provided in **Attachment A**. The Agenda for Meeting #1 is included as **Attachment B,** and a list of Meeting #1 Attendees is presented in **Attachment C**.

PANEL FINDINGS AND RECOMMENDATIONS

These Findings and Recommendations address the Metropolitan-LACSD Key Questions and respond to the presentations provided by Metropolitan, LACSD, and their consultants during the morning of August 8, 2018. The Panel's feedback is organized as answers to the Key Questions along with additional observations related to the scope of review.

Prior to the meeting, the Panel received the following documents for review: (1) Metropolitan Water District RRWP APC Demo Plant Testing and Monitoring Plan –Year 1 (June 8, 2018); and (2) LACSD APC Demo Facility Monitoring Plan (June 2018); and (3) LACSD Boron Source Investigation Report (January 12, 2018). The Panel relied on these documents, the utility presentations listed in this report, the meeting agenda, the Key Questions, and their individual expertise to prepare for Meeting #1. The presentations will be available to view and download from Metropolitan's web site at http://www.mwdh2o.com/DocSvcsPubs/rrwp/index.html#home.

- Presentation 1: Regional Recycled Water Program Overview
- Presentation 2: Monitoring Plan for JWPCP Compliance
- Presentation 3: Advanced Water Treatment Plant: Testing and Monitoring Plan

The Panel organized its closed working sessions on the afternoon of August 8th and the morning of August 9th to discuss the eight Key Questions. The Panel's responses to these questions are presented below.

QUESTION 1: Is the proposed approach for testing the membrane bioreactor (MBR) at the Demonstration Plant appropriate to validate pathogen log removal and achieve regulatory credit?

PANEL RESPONSE: Overall, the approach presented in the pre-meeting review materials and at Panel Meeting #1 is rational and reasonable, provided the following issues are addressed:

- The Panel understands the initial testing phase is designed to verify log removal credits for *Cryptosporidium* and *Giardia* by the MBR, which will be fed with secondary treated water (for the operational envelope described in the test plan).
- Metropolitan has assumed that log reduction values (LRVs) would increase when primary treated water is fed into the MBR; this assumption needs to be verified in practice.
- The Panel recommends a preliminary enumeration of *Cryptosporidium* and *Giardia* in the secondary effluent to ensure that the planned assessment can reliably demonstrate LRV greater than 2.5.
- The Panel recommends documenting how the 95th percentile removals for LRVs for *Cryptosporidium* and *Giardia* will be calculated from the data collected.
- Develop a project-specific Quality Assurance Project Plan (QAPP).

QUESTION 2: Is the approach for testing the reverse osmosis and ultraviolet light/advanced oxidation process appropriate for meeting the water quality and operational goals indicated in the testing and monitoring plan?

PANEL RESPONSE: Overall, the approach presented for testing the reverse osmosis (RO) and the ultraviolet/advanced oxidation process (UV/AOP) is appropriate for meeting the water quality and operational goals indicated in the testing and monitoring plan, provided the following issues are addressed:

- The Panel recommends the inclusion of a specific statement of purpose in the RO and UV/AOP Testing Plan (for example, to verify operational goals or and/or to achieve regulatory compliance).
    - Some nitrogenous chemicals are precursors for formation of nitrosamines.

  - Develop criteria for RO-influent loading of (a) nitrate to meet effluent nitrogen goals, and (2) TOC to prevent membrane fouling.
  - Verify nitrate removal during RO treatment to meet AWT effluent goals.
  - Develop a response plan for use if a post-RO TOC spike should be detected. For example, the plan might require grab samples for separate characterization of spikes attributed to low molecular weight, neutral, and/or volatile compounds, which are not effectively treated by RO.
- The Panel recommends the Project Team coordinate monitoring of RO and UV/AOP effluent with changing MBR operations.
  - Document a strategy to address RO fouling (e.g., increase anti-scalants, cleaning regimes, backwashing with RO permeate, etc.) should it occur. The goal of reduced fouling is to maintain optimal operation of the MBR to achieve the required pathogen removal.
  - Consider size exclusion chromatography (LC-OCD, SEC-TOC) or fluorescence excitation-emission matrix organic characterization to determine fouling potential on the MBR as operational parameters change.
  - Define a plan to evaluate the use of RO permeate water for backwashing the RO membranes. IDE Technologies case studies indicate that RO permeate water may improve backwash efficiency in preventing long-term inorganic fouling of the RO membrane active surfaces.
- Conduct treated water holding studies to determine whether NDMA will be regenerated dependent upon final AOP (H_2O_2 versus chlorine) and distribution disinfection strategy (chlorine or chloramine).

QUESTION 3: Is the approach to test and monitor Demonstration Plant waste streams and brine discharges appropriate for full-scale evaluation on the JWPCP processes, secondary effluent quality, and brine management regulatory challenges?

PANEL RESPONSE: Overall, the approach presented for testing and monitoring the Demonstration Project waste streams and brine discharges is appropriate for full-scale evaluation. However, the flow and concentration/strength of wastewater discharged via the LACSD Outfall (Outfall) varies both on a regular diurnal basis, in response to changes in operational conditions, and as a result of changes to the volume of characteristics of flows influent to the JWPCP and its various side stream flows. At full scale, the Project would add a brine side stream flow to the Outfall. The additional brine side stream will vary in terms of volume and character as well. The intent of the following observations are to encourage the Project Team to evaluate impacts of the RO brine side stream on Outfall operations and to investigate how flow equalization could stabilize JWPCP operations, stabilize water quality discharged through the outfall, and simplify AWPC operations.

- The Panel recommends the Project Team re-examine the analytical plan for ensuring regulatory compliance for discharge.
  - Ensure that toxicity testing addresses a discharge stream of 100 percent brine as an extreme, although unlikely, boundary.
  - Evaluate "normal" condition in which brine is blended with secondary treated water.

  - Measure orthophosphate in the waste activated sludge to address concerns with struvite formation as water flows back to JWPCP.

- The Panel recommends the Project Team assess the benefits of implementing flow equalization ahead of the JWPCP or AWTF to diminish the impacts of diurnal wastewater flow variations on AWTF operations, and, in developing strategies to manage brine produced by the AWTF.
- As return flows from the AWT increase with expansion, recommended analysis for future work includes:
  - Evaluate effects of waste stream recycling on primary and secondary process stability at the JWPCP.
  - Evaluate potential for scaling in the conveyance piping and Outfall structures.

QUESTION 4: What additional operational criteria should be considered in advanced water treatment process equipment evaluations?

PANEL RESPONSE

- The Panel recommends the Project Team clarify whether particle counts on the MBR effluent would provide any benefit for determining how to optimize the AWTF performance.
- It is unclear if organic matter or biofilm growth will control RO fouling, and no surrogate (beyond TOC) to predict RO fouling is identified in the testing plan. The Panel recommends the Project Team consider size exclusion chromatography, fluorescence, or other techniques if fouling of the RO membrane results from operation of the MBR.
- The Panel recommends the Project Team Develop criteria for RO influent loading of nitrate and TOC (validate nitrate removal from RO influent to meet AWT effluent goal).
- The Panel recommends the Project Team consider aerobic bacterial spores as a surrogate for *Cryptosporidium.*
  - Ambient spores may be more useful than spiking because they are ubiquitous, present in large quantities, of appropriate size, and easy to measure.
  - *Giardia* is more difficult to measure; spores may be used as a surrogate to determine LRVs for *Giardia.*
- The Panel recommends the Project Team consider effects of water conservation on source loading (future).

QUESTION 5: Which existing demonstration projects implemented by other agencies serve as good examples for the proposed project?

PANEL RESPONSE: The Panel identified the following facilities for comparative purposes.

- These MBR systems are relevant but not completely analogous:
  - Ironhouse Sanitary District (Oakley, CA)
  - City of Abilene Hamby Water Reclamation Facility and Indirect Reuse Project (Abilene, TX)
  - North Valley Regional Recycled Water Program (Modesto, CA)

  - Healdsburg Wastewater Treatment Plant (Healdsburg, CA)
  - King County Regional Wastewater Treatment System (King County, Washington)
- Comparable physical facilities in California.
  - Reverse osmosis: Orange County Water District (OCWD), Santa Clara Valley Water District (SCVWD), and City of San Diego
  - UV and Advanced Oxidation: OCWD, SCVWD, City of San Diego, Los Angeles Sanitation's Terminal Island Water Reclamation Plant (which uses chlorine)
- Instructive institutional settings,
  - Orange County Water District (Fountain Valley, CA)
  - Hampton Roads Sanitation District (Virginia Beach, VA)
  - Singapore Public Utilities Board
- The Panel recommends the Project Team begin developing a training program. Keep in mind that other agencies have used AWTP demonstration projects for operator training.
- The Panel recommends the Project Team develop an interactive educational program for public visitation/tours of the Demonstration Facility.

QUESTION 6: How should the make-up and variability of influent (i.e., JWPCP secondary effluent) to the Demonstration Project be monitored and evaluated?

PANEL RESPONSE:

- The Panel recommends the Project Team establish operational goals and response strategies for IPR (e.g., membrane fouling rate). An important critical control point is the JWPCP secondary effluent.
- The Panel recommends the Project Team identify water quality conditions, including chemical spikes, that could cause treatment train failure (MBR, RO, UV/AOP), or effluent quality to exceed target levels (e.g., tritium, acetone, certain neutral-charged industrial chemicals in the influent).
- The Panel recommends the Project Team determine whether perfluorinated compounds (e.g., Total Oxidizable Perfluorinated Assay) are a potential contaminant, and if so, which PFCs are present.
- The Panel recommends the Project Team conduct a source control assessment for tritium, nitrosamines and precursors, 1,4-dioxane, and boron in the major source, unless the public health goal (PHG) value can be modified or exempted based upon low toxicity. Use the findings to design the AWTF and determine (a) pretreatment requirements for chemicals and (b) control of release frequency and amounts for tritium.
- The Panel recommends the Project Team consider using sensors and programming for improved dosing (O_2 and carbon) into the MBR to manage variable diurnal nitrogen and carbon concentrations from the JWPCP.

- Note that future direct potable reuse (DPR) regulations could require more stringent water quality specifications, monitoring, and a more comprehensive source control and response plan than required for IPR projects. For example, compounds that have low molecular weight, are neutral or volatile may penetrate RO membranes.

QUESTION 7: Is the analytical methodology described in the testing and monitoring plan adequate for achieving the Demonstration Project objectives?

PANEL RESPONSE:

- The Panel recommends the Project Team develop appropriate monitoring frequency for organic molecules (including NDMA and 1,4-dioxane, and other chemicals found in substantial spills) that can be used as indicators of variability in the influent waste water.
    - Control of these variables will may require more frequent monitoring or a robust source control program to identify sources and limits on the amounts and frequency of release in the sewershed.
    - Consider total oxidizable precursor (TOP) assay for unidentified perfluorinated compounds, if they are determined to a contaminant of concern. Perfluorinated compounds should be removed by RO.
- The Panel recommends the Project Team document all intended QA/QC protocols for the sampling and analysis plan.
- The Panel recommends the Project Team articulate the basis for selecting monitoring parameters including surrogates, certain key pathogens, and selected chemicals of concern.
- The Panel recommends the Project Team link monitoring frequency to observed variability in concentrations of surrogates, certain key pathogens, and selected chemicals of concern.

QUESTION 8: What additional considerations or approaches should be included in the Demonstration Project testing and monitoring plan for validating the advanced water treatment processes being tested, for ultimate permitting of a groundwater replenishment project?

PANEL RESPONSE:

- The Panel recommends the Project Team develop a boron management strategy.
    - Enforce an appropriate source control program to reduce the amount of boron entering the waste water.
    - Create a pilot testing plan for selective boron removal from AWTF effluent, if necessary.
    - Seek congruence in the boron limits among Basin Plans.
    - Seek a variance in the Basin Plan, if appropriate.
- The Panel recommends the Project Team develop a plan to assess the need for post-RO stabilization, disinfection, and basin impacts.

ADDITIONAL RECOMMENDATIONS AND OBSERVATIONS

The Panel also offers the following comments on topics apart from the eight questions addressed above.

- **BORON.** The Panel would be interested in reviewing a future evaluation of the frequency of monitoring for boron and statistical distribution of boron detections.
- **EMERGING TECHNQUES FOR DNA/GENETIC ANALYSIS.** The Panel noted that developments are proceeding with *omics technologies; other utilities are evaluating these methods.
- **FUTURE TESTING.** The Panel understands that Metropolitan is planning to conduct additional testing after Year One of the project. This future testing should address some of the Panel's recommendations.
- **COORDINATION OF EFFORT BETWEEN METROPOLITAN AND THE SANITATION DISTRICTS:**
    - The Panel recommends that Metropolitan and the Sanitation Districts develop joint research plans for Year Two (and future years) of the RRWP.
    - The Panel recommends that Metropolitan and the Sanitation Districts develop a comprehensive MOU for joint operation of the Demonstration Project.

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ATTACHMENT A: PANEL MEMBER BIOGRAPHIES

Independent Science Advisory Panel for
Metropolitan Water District of Southern California
Regional Recycled Water Program Advanced Purification Center Demonstration Project

Panel Chair: Charles N. Haas, Ph.D., Professor of Environmental Engineering and Head, Department of Civil, Architectural and Environmental Engineering, Drexel University
Dr. Charles Haas has more than 45 years of experience conducting research in water treatment, risk assessment, environmental modeling and statistics, microbiology, and environmental health. He has led the Department of Civil, Architectural, and Environmental Engineering at Drexel University since 1991, and previously served on the faculties of Rensselaer Polytechnic Institute and Illinois Institute of Technology. Haas holds a B.S. in Biology and an M.S. in Environmental Engineering from Illinois Institute of Technology, and a Ph.D. in Environmental and Civil Engineering from University of Illinois.

Richard J. Bull, Ph.D., MoBull Consulting (Professor Emeritus, Pharmacology/Toxicology, Washington State University)
Dr. Richard Bull has been involved in toxicological research for 45 years and has focused on human health effects of drinking water contaminants, including mechanisms of carcinogenesis of halogenated solvents and disinfectant by-products including trihalomethanes, haloacetic acids and bromate. He has been recognized with two EPA Scientific Achievement Awards and the Distinguished Service Medal from the U.S. Public Health Service. He is a Member of Consultations on the World Health Organization (WHO) Guidelines for Drinking Water Quality, serves on International Agency for Research on Cancer (IARC) Working Groups on the Evaluation of Carcinogenic Risks to Humans, and chaired the US EPA's Drinking Water Committee. Bull is author or co-author of more than 135 peer-reviewed publications, and has written reviews, books, and chapters relating to toxicology of drinking water contaminants. He is currently reviewing disinfection by-products for the Archives of Toxicology. Bull holds a B.S. in Pharmacy from University of Washington and a Ph.D. in Pharmacology from the School of Medicine at University of California, San Francisco.

Joseph A. Cotruvo, Ph.D., BCES, President, Joseph Cotruvo and Associates, LLC
Dr. Joseph Cotruvo has more than 45 years of experience with research and policy related to drinking water quality. He is a long-time member of the WHO's Guidelines for Drinking Water Quality Committee and serves on advisory panels for drinking water quality and desalination projects, including Singapore's National Environment Agency Water Standards Advisory Committee, the Nanyang Technical University Environment and Water Research Institute Advisory Board, and wastewater and potable water reuse projects in California including for Orange County, San Diego, and Los Angeles. At US EPA, Cotruvo directed the Drinking Water Standards Division, which developed national regulations and risk assessments for microbial contaminants, organic and inorganic chemicals and radionuclides, disinfection by-products, surface water filtration, and proposed corrosion control lead and copper rules. He also directed the Risk Assessment Division in Pollution Prevention and Toxics and initiated EPA's Drinking Water Health Advisory Program. Cotruvo holds a B.S. in Chemistry from University of Toledo and a Ph.D. in Physical Organic Chemistry from Ohio State University.

Thomas E. Harder, PG, CHG, Principal Hydrogeologist, Thomas Harder & Co.
Mr. Thomas Harder has more than 2229 years of professional groundwater consulting experience. He has provided technical direction and management for large water resource projects in southern California, including the Chino Desalter Well Field Design and Construction, the West Coast Basin Barrier Project, and the Mojave Water Agency's Regional Recharge and Recovery Project. His expertise includes regional groundwater basin analysis, perennial (i.e., safe) yield, artificial recharge, groundwater management and models, contaminant hydrogeology, and wells. Harder holds a

B.S. in Geology from California Polytechnic University, Pomona, and an M.S. in Geology with emphasis in Hydrogeology from California State University, Los Angeles. He is a registered geologist and hydrogeologist in California.

Adam Olivieri, DrPH, P.E., EOA, Inc.
Dr. Adam Olivier has more than 35 years of experience in the technical and regulatory aspects of water recycling, groundwater contamination by hazardous materials, water quality and public health risk assessments, water quality planning, wastewater facility planning, urban runoff management, and on-site waste treatment systems. He has gained this experience through a number of positions, including: staff engineer with the California Regional Water Quality Control Board (San Francisco Bay Region); staff specialist and Post-doctoral fellow with the School of Public Health at University of California, Berkeley; project manager/researcher for the Public Health Institute; and as a consulting engineer. Dr. Olivieri is currently Vice President of EOA, Inc., in Oakland, California, where he manages a variety of projects, including serving as Santa Clara County Urban Runoff Program's Manager since 1998. He received a B.S. in Civil Engineering from University of Connecticut, an M.S. in Civil and Sanitary Engineering from University of Connecticut, and both an MPH and Dr.PH in Environmental Health Sciences from University of California, Berkeley.

Vernon Snoeyink, Ph.D., Professor Emeritus, Civil and Environmental Engineering, University of Illinois
Dr. Vernon Snoeyink's research has focused on drinking water quality control, including removal of organic and inorganic contaminants from water using adsorption systems, especially granular and powdered activated carbon systems coupled with membrane systems. His expertise includes mechanisms of formation and means to control water quality in distribution systems in response to reactions of iron, aluminum, and other inorganics. Snoeyink is a member of National Academy of Engineering, American Society of Civil Engineers (ASCE), American Water Works Association (AWWA), Association of Environmental Engineering and Science Professors (AEESP), and International Water Association. He served as President of AEESP and on the Editorial Advisory Board of AQUA. His awards include the AEESP Distinguished Lectureship, the Research Award from AWWA, the Warren A. Hall Medal from the University Council on Water Resources, the Samuel Arnold Greeley Award and the Simon Freese Award from ASCE, the Thomas Feng Distinguished Lectureship from University of Massachusetts, and the Tau Beta Pi Daniel C. Drucker Eminent Faculty Award from University of Illinois. He has also been recognized for excellence in teaching and advising. He holds a B.S. in Civil Engineering, an M.S. in Sanitary Engineering, and Ph.D. in Water Resources Engineering from University of Michigan.

Michael K. Stenstrom, Ph.D., P.E., BCEE, Professor, Civil and Environmental Engineering, UCLA
Dr. Michael Stenstrom teaches courses in water and wastewater treatment, mathematical modeling of environmental systems, and laboratory analysis. His research focuses on improving oxygen transfer at wastewater treatment plants. Stenstrom has received the Harrison Prescott Eddy Research Award, the Science Coalition's Great Advances in Scientific Discovery Award, and the 2005 Water Quality Improvement Award from the California Water Resources Control Board. He completed his undergraduate and graduate studies in engineering at Clemson University, and he is a Registered Professional Civil Engineer in California and a Board Certified Environmental Engineer with the American Academy of Environmental Engineers.

Paul K. Westerhoff, Ph.D., P.E., BCEE, Professor, Sustainable Engineering/Built Environment, Arizona State University
Dr. Paul Westerhoff's research focuses on emerging contaminants, water treatment processes, and water quality, including: occurrence, characterization, and oxidation of natural organic matter; removal of oxo-anions from drinking water; algal metabolites and algal biotechnology; wastewater reuse; and nanotechnology and sensors. He was awarded the Editors' Choice Award for 2016 in Environmental Science: Water Research & Technology for the paper entitled N-Nitrosamine Formation Kinetics in Wastewater Effluents and Surface Waters. Westerhoff holds a B.S. in Civil Engineering from Lehigh University, an M.S. in Civil and Environmental Engineering from University of Massachusetts, Amherst, and a Ph.D. in Civil, Architectural, and Environmental Engineering from University of Colorado at Boulder. He is a Registered Professional Engineer in Arizona.

ATTACHMENT B: PANEL MEETING #1 AGENDA

Independent Science Advisory Panel Workshop No. 1
MWD Union Station Room 2-450
August 8-9, 2018

Timing	Topic	Presenter
August 8, 2018		
8:00 a.m.	Welcome and Introduction	NWRI/MWDSC/LACSD
8:15 a.m.	Regional Recycled Water Program	MWD/LACSD
9:15 a.m.	Defining ISAP Charge	NWRI
9:30 a.m.	Demonstration Plant Testing and Monitoring Plan	Stantec/Trussell/Carollo
10:30 a.m.	Break	All
10:45 a.m.	Monitoring Plan for JWPCP's Compliance	LACSD
11:30 a.m.	Luncheon	All
12:30 p.m.	Questions and Answers	All
2:45 p.m.	Break	All
3:00 p.m.	Closed Session	Panel Members
5:00 p.m.	Adjourn	
August 9, 2018		
8:00 a.m.	Panel Members Discussion (Room 2-414)	Panel Members
9:00 a.m.	Regulatory Meeting (Room 2-450)	All (Panel continues work)
11:00 a.m.	Luncheon	All
12:00 p.m.	Report by SAP/Next Steps (Room 2-414)	All
2:00 p.m.	Adjourn	

ATTACHMENT C: PANEL MEETING #1 ATTENDEES

Panel Members

- Panel Chair: Charles Haas, Ph.D., Drexel University
- Richard J. Bull, Ph.D., MoBull Consulting
- Joseph A. Cotruvo, Ph.D., BCES, Joseph Cotruvo and Associates
- Thomas E. Harder, PG, CHG, Thomas Harder and Co.
- Adam Olivieri, DrPH., P.E., EOA, Inc.
- Vernon Snoeyink, Ph.D., University of Illinois
- Michael K. Stenstrom, Ph.D., P.E., BCEE, University of California, Los Angeles
- Paul K. Westerhoff, Ph.D., PE, BCEE, Arizona State University

Panel Facilitator

- Ed Means, Means Consulting

National Water Research Institute

- Kevin M. Hardy, Executive Director
- Dawna Hernandez, Event Manager
- Suzanne Sharkey, Water Resources Scientist and Project Manager

Metropolitan Water District

- John Bednarski
- Richard Begian
- Mickey Chaudhuri
- Heather Collins
- George DiGiovanni
- Jim Green
- Robert Harding
- Gordon Johnson
- Gloria Lai-Blüml
- Sun Liang
- Kimberly McGeeney
- Paul Rochelle
- Carolyn Schaffer
- Mic Stewart

Sanitation Districts of Los Angeles County

- Erika Bensch
- Lysa Gaboudian
- Joe Gully
- Ann Heil
- Michael Liu
- Nikos Melitas
- Mike Sullivan

Sanitation Districts of Los Angeles County

- Shawn Thompson
- Chris Wissman

State Water Resources Control Board

- Faraz Asad
- Brian Bernados
- Saeed Hafeznezami
- Sean MCarthy
- Jeff O'Keefe

Los Angeles Regional Water Quality Control Board

- Cris Morris
- Milasol Goslan
- Jeong-Hee Lim

Industry/Technical/Research Groups

- Zakir Hirani, Stantec
- Jeff Mosher, Carollo Engineers
- Paul Brown, PRB Inc.
- Adam Zacheis, Carollo
- Shawn Thompson, LACSD
- Shane Trussell, Trussell Technologies

APPENDIX A:

Reports from Advisory Panel Workshops

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THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

SANITATION DISTRICTS OF LOS ANGELES COUNTY

Advisory Panel

for the

Potential Regional Recycled Water Supply Program

Report No. 1: Demonstration Plant Design

June 30, 2016

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Table of Contents

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I. Executive Summary

The Metropolitan Water District of Southern California (Metropolitan) and the Sanitation Districts of Los Angeles County (Sanitation Districts) are considering development of a large-scale regional indirect potable reuse program for groundwater recharge in several groundwater basins. The potential Regional Recycled Water Supply Program (Program) would begin with a proposed 1 million gallon per day (mgd) advanced water treatment demonstration plant to be located at the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) in Carson. In early 2016, Metropolitan and the Sanitation Districts convened a panel of eight key subject matter experts to provide independent review and critical input on the scope and direction of the Program during its demonstration project phase. In this initial effort, the Panel will provide input into the development of the Program's feasibility and financial assessments, as well as the design of the demonstration plant. The Advisory Panel plans to meet periodically in a workshop format to provide input on overall program feasibility and work plans; design of the demonstration plant; groundwater basins and water delivery assessments; and ideas and approaches to program implementation.

At the first workshop on March 31 and April 1, 2016, the Advisory Panel reviewed the overall program and engaged the Project Technical Team in an in-depth discussion of the demonstration plant design. The Project Technical Team consists of Metropolitan staff, Sanitation Districts staff, and consultant staff. After the team presentation, the Panel met independently to consider the proposed treatment processes and related issues regarding nitrogen and boron management as well as the procurement process and selection of demonstration unit processes.

On the second day of the workshop, the Advisory Panel presented their recommendations and comments to the Project Technical Team. The Panel also raised other issues and ideas that need to be explored for full scale treatment plant design, maximizing recycled water use, public outreach, operator training, financing and institutional framework, which will be presented in future panel reports when those topics are covered. This report summarizes the first workshop and the Advisory Panel's guidance to the team on design of the demonstration plant. Future workshops are planned for the Advisory Panel to consider other elements of the Program.

II. Advisory Panel Members

The eight-member panel includes the following experts in advanced water treatment and recycled water programs:

- Richard Atwater, Co-Chair: Former Executive Director of Southern California Water Committee; expert on recycled water programs.
- Margie Nellor, Co-Chair: Nellor Environmental Associates, Inc.; expert on recycled water reuse programs, pretreatment and related regulatory issues.
- Shivaji Deshmukh: Assistant General Manager of West Basin Municipal Water District; expert on recycled water engineering and operation of advanced water treatment facilities.
- Thomas Harder: Thomas Harder and Associates (Hydrogeology); expert on Southern California's groundwater basins.

- David Jenkins: Professor Emeritus, University of California, Berkeley; expert on biological wastewater treatment processes, and water and wastewater chemistry.
- Edward Means: President, Means Consulting LLC; expert on water quality and water resources management.
- Joseph Reichenberger: Professor, Loyola Marymount University; expert on water, wastewater and recycled water systems and treatment.
- Paul Westerhoff: Professor, Arizona State University; expert on advanced water treatment processes.

III. Methodology

The Panel will meet periodically in a workshop format to review and discuss selected topics for the Program including:

- Overall program feasibility and work plans,
- Design of the demonstration plant,
- Groundwater basins and water delivery assessments, and
- Ideas and approaches to program implementation.

Prior to each workshop, the Panel will be provided resource material and a series of questions from the Project Technical Team to allow the panelists to prepare for the issues to be raised. After a morning briefing and facilitated discussion with the team, the Panel will work independently of the team to discuss the issues and develop recommendations. Upon completion of their discussions, the Panel will provide an "out-briefing" to the team and respond to clarifying questions regarding the Panel's comments and recommendations. The Panel will then prepare a report to Metropolitan and the Sanitation Districts documenting the issues discussed, recommendations, alternatives and other issues to be considered. The Panelists may not always reach consensus on the recommendations but will agree on the contents of each report. The Project Technical Team will consider the input received and provide written responses to the recommendations as appropriate.

IV. Workshop on Demonstration Plant Design

The Advisory Panel met on March 31 and April 1, 2016 to review the Potential Regional Recycled Water Supply Program proposed jointly by Metropolitan and the Sanitation Districts. The focus of this first workshop, held at Metropolitan's Headquarters, was the design of the demonstration plant. In addition to the Panel, the following members of the districts' management and Project Technical Team participated:

Paul Brown	Program Manager, Metropolitan
Michael Thomas	Facilitator, Metropolitan

Metropolitan: Debra Man, Gordon Johnson, John Bednarski, Gloria Lai-Blüml, Kimberly Wilson, Evelyn Ramos, Sun Liang (by phone), Carolyn Schaffer

Sanitation Districts: Grace Hyde, Robert Ferrante, Dave Snyder, Nikos Melitas, Rob Morton, Michael Liu, Martha Tremblay, Shannon Bishop, Phil Friess

Consulting Design Team: James Borchardt, Eric Mills, Zakir Hirani, Bill Vogel, Shane Trussell, Adam Zacheis, Debbie Burris, Michael Adelman

a. Project Understanding

The Advisory Panel understands that the proposed Program would involve the development of a large-scale (up to 150 mgd) regional indirect potable reuse program. The product water would be used for groundwater recharge in several groundwater basins that are managed through different institutional agreements and are subject to different regulatory requirements. The Program will need to:

- Identify locations to deliver an uninterrupted flow of product water at the flow rate supplied by the full scale treatment plant,
- Satisfy the public that the treated water is safe to use,
- Produce and deliver water that complies with all applicable regulations,
- Produce water that provides the reliability needs of customers and is at a cost that is marketable and competitive with other sources.

The Program would begin with a proposed 1 mgd advanced water treatment demonstration plant to be located at the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) in Carson. The demonstration plant would be used to test the effectiveness of various advanced water treatment processes.

b. Preparation for the Workshop

To prepare for the workshop the Advisory Panel reviewed the following documents:

- Potential Regional Recycled Water Supply Program, Historical Review and 2015 Update, Working Draft, Version 1.7,Metropolitan Water District.
- Proposal Design and Operation of Demonstration Plant for Potential Regional Recycled Water Supply Program, RFP-1116, December 2015, MWH.
- Metropolitan Board Authorization for $15 million, Potential Regional Recycled Water Supply Program, Agenda Item 8-3, 11/15/2015.
- PowerPoint Presentation to Metropolitan Board of Directors Potential Regional Recycled Water Supply Program, Supporting Agenda Item 8-3, 11/9/2015.
- Pilot Study of Advanced Treatment Processes to Recycle JWPCP Secondary Effluent – Final Report, Metropolitan and Sanitation Districts, September 28, 2012, including Appendices A – JWPCP Process Descriptions and Water Quality Data; Appendix B –Pilot Study Design Criteria, Operational Information, and Water Quality Data; Appendix C –Title 22+ Sampling Data; Appendix D -- JWPCP Background and NdN.
- Request for proposal, RFP-PL-1116, Design and Operation of Demonstration Facility for Potential Regional Recycled Water Supply Program, Metropolitan, including Attachments A through F.

The Panel was also provided a series of questions in advance of the meeting regarding design of the demonstration plant including:

1. Given the multiple uses expected for the demonstration plant (including process validation and optimization, vendor equipment testing, operator training, and public outreach), what are the most

important design considerations that should be addressed? Specific considerations should consider the following:

- What is the most effective approach for integrating the technical and regulatory-related elements of the design?
- What accommodations are needed to provide flexibility for various equipment vendor products?
- What is the Panels' experience regarding prequalification of equipment for testing?
- What features are needed to maximize the operator training objectives of the facility?
- What features are needed to maximize public outreach and educational aspects of the facility?

2. What specific design considerations should be included to increase the demonstration plant's value for process validation and optimization?
    - Are two complete parallel trains required? Can the trains be limited to test alternatives for biological treatment and microfiltration/ultrafiltration (MF/UF)?
    - Will the current approach evaluating various biological nitrification/denitrification (NdN) alternatives and ion exchange (IX) be sufficient to select the best overall strategy for nitrogen management?
    - Are the appropriate treatment processes being considered in the current design of the demonstration plant given the processes that are currently being utilized at the JWPCP?
    - Are there other concerns with the secondary effluent that should be addressed through the demonstration plant or process changes at the JWPCP?
    - Is the demonstration plant being configured appropriately to investigate the issue of log removal credit by various treatment processes in order to achieve regulatory approval?
    - Can the demonstration plant waste streams and brine discharges be used to evaluate full-scale impacts on JWPCP processes, secondary effluent quality, and brine management regulatory challenges?
    - How many equipment vendors or treatment processes should the demonstration plant be designed to evaluate?
    - What unit processes should be prequalified during operation of the demonstration plant?
    - Should the demonstration plant unit processes be selected based on their scalability to 150 mgd, especially the biological process?
    - Will the current approach comparing IX and reverse osmosis (RO), pH management be sufficient to select the best overall strategy for boron management?
    - What operational criteria should be considered in equipment evaluations?
    - Which existing demonstration projects implemented by other agencies serve as good examples for the proposed project?
    - How should make-up and variability of influent (JWPCP secondary effluent) to the demonstration plant be monitored and evaluated?
3. What considerations or design features should be incorporated in the demonstration plant in order to evaluate the benefits and cost-effectiveness of possible modifications at the JWPCP?
    - How can the demonstration plant be used to evaluate potential changes at JWPCP?

- Can alterations be made to the JWPCP to provide better quality feed water for the demonstration plant?
- Would additional source control be cost-effective in improving feed water quality?
- What are the best practices for integration of wastewater treatment and advanced water treatment facilities under the operation of the two agencies?
- How should training at the demonstration plant be developed to encourage cooperation, collaboration, and teamwork?

c. Background Presentation by Project Technical Team

To begin the workshop the Project Technical Team presented the proposed process train selection for the demonstration plant and the background behind that selection. Items of discussion included:

1. Groundwater Quality Objectives: Staff presented the groundwater quality objectives for the various groundwater basins where the recycled water potentially could be used for groundwater replenishment. Notwithstanding the Title 22 Criteria for groundwater replenishment, the boron objective of 0.5 milligrams/Liter (mg/L) in the Main San Gabriel Basin and the nitrate objective of 3.4 mg/L in the Orange County Basin may set the water quality requirements for the product water of a full-scale project. These would impact the selection of the treatment train.

2. Secondary Effluent Water Quality: Secondary effluent water quality at the JWPCP was compared to the secondary effluent water quality at the City of Los Angeles Hyperion Water Reclamation Plant (Hyperion) and Orange County Sanitation District (OCSD) Plant 1. Both Hyperion and OCSD facilities provide secondary effluent used as feed water for advanced treatment facilities that produce product water used for indirect potable reuse projects (groundwater replenishment via surface and subsurface application). Secondary effluent from Hyperion is feed water to the West Basin Municipal Water District's Edward C. Little Water Recycling Facility (ECLWRF) and is used for the West Coast Basin Seawater Intrusion Barrier. Secondary effluent from OCSD's Plant 1 is used as feed water to the Orange County Water District's (OCWD) Groundwater Replenishment System (GWRS).

3. Nitrogen Removal: The Sanitation Districts research team has considered three approaches to nitrogen removal based on literature review, process modeling, and some pilot testing:
   - Retrofit of the JWPCP activated sludge process – biological nitrogen reduction using either membrane bioreactor (MBR) or integrated fixed film activated sludge (IFAS).
   - Adding a tertiary process for nitrification and possibly denitrification – tertiary MBR (tMBR) or tertiary biological active filter (tBAF).
   - Side stream nitrification or deammonification treatment of ammonia-rich biosolids centrate.

   The Sanitation Districts nitrogen removal findings are as follows:
   - An activated sludge retrofit of the JWPCP would require significant operational changes.
   - Pilot testing of tBAF at JWPCP has been successful. The effect of tBAF on downstream membrane performance requires further study.
   - Pilot testing of side stream treatment of centrate demonstrated ammonia removal and robust operation. Side stream treatment may also provide bioaugmentation benefits to inducing nitrification in the main stream.

The mass balance calculations prepared by the design team suggest that nitrification alone on main stream or with 25% NdN on side stream treatment will not be enough to meet the lowest basin water quality objective for nitrogen in advanced treated product water, given typical nitrogen loadings and RO rejection.

4. Source Control Overview: The Sanitation Districts source control program has been approved by the U.S Environmental Protection Agency (USEPA) and is administered under a Wastewater Ordinance that includes permitting, monitoring, inspection, enforcement, and outreach. The program regulates 2,100 industries.

   The historical approach to management of the Sanitation Districts Joint Outfall System (consisting of six upstream water reclamation plants (WRPs) and the JWPCP) is to route higher salt and organic strength flows around the upstream WRPs for treatment at the JWPCP. This industrial contribution makes up about 19% of the JWPCP's influent dry weather flow.

5. Constituents of Concern: Constituents of concern identified in the pilot study that need further consideration for the demonstration plant include:
   - Boron – thought to be contributed from oil well fields
   - Nitrosamines – thought to be contributed as disinfection by-products (DBPs) or by industrial dischargers such as metal finishers
   - 1,4-dioxane – thought to be contributed via disposal of consumer products and by discharge from membrane manufacturers

   The Source Control Program will continue investigating sources of these constituents.

6. Pathogen Log Reduction: The requirements for log removals of virus, *Giardia*, and *Cryptosporidium* are 12/10/10 respectively based on the Title 22 Criteria pathogen log reduction requirements for groundwater replenishment. These requirements must be met by surface and subsurface application projects using at least three treatment processes. Full advanced treatment (FAT) facilities, as defined in the Title 22 Criteria must include (1) RO that meets sodium chloride rejection and TOC performance requirements and (2) advanced oxidation process (AOP) that meets either indicator compound or 1,4-dioxane performance requirements. The two AWT facilities, OCWD's GWRS and West Basin's ECLWRF, have been approved by the Division of Drinking Water (DDW) under the 2014 Title 22 Criteria and achieve greater log reduction.

7. Proposed Treatment Process: The proposed design being considered for the demonstration plant includes two parallel process trains, each with a capacity of 0.5 mgd:
   - Train #1: MBR tertiary treatment for nitrification and denitrification, followed by MF/UF, RO, AOP, and product water chemical stabilization. Side stream IX was proposed to remove additional nitrogen and boron.
   - Train #2: Similar to Train #1 except an alternative biological nitrification and denitrification system was proposed (e.g. tBAF) in place of MBR.

   The Project Technical Team is exploring options for virus removal that have not yet been approved by DDW. These options raise the following questions:

- When using MBR treatment is MF/UF required before RO? Log removals were estimated by the Design Team to be 14/10/10 with only MBR treatment prior to RO treatment.
- Can ultraviolet irradiation (UV) be substituted for MF/UF following MBR treatment? Log removals were estimated by the Design Team to be 14/12/12 with MBR and UV preceding RO.

Free chlorine and hydrogen peroxide will each be tested for the AOP.

There was significant discussion on the need for IX treatment for boron and nitrogen removal. In lieu of these treatment systems, could source control of significant industrial nitrogen and especially boron discharges be a more economical alternative?

The presentation by the Design Team included a discussion of data management and monitoring of critical control points.

The Design Team presented a "walk through" video of a hypothetical full scale, 150 mgd advanced treatment facility using the processes currently proposed for the demonstration plant. The facility occupies most of the land currently assigned to the water reclamation plant at the JWPCP.

It was clear from the presentation that schedule is a major driver for the Program. Design of the demonstration plant is proposed to be complete by the end of 2016; completion of demonstration plant construction and initial start-up is proposed by end of 2017.

d. Key Topics for Panel Discussion

With the information provided above as background, the Project Technical Team posed five questions to the Advisory Panel on the demonstration plant design:

1) Should UV-AOP and IX be tested on combined effluent from two trains?
2) Is the approach to nitrogen management appropriate?
3) Is the approach to boron management appropriate?
4) Is the equipment procurement strategy appropriate?
5) Should the demonstration plant unit processes be selected based on their scalability to 150 mgd?

e. Panel Discussions and Recommendations

Before addressing the specific questions on the demonstration plant design, the Advisory Panel stated the purpose of the demonstration plant is to ***demonstrate*** the treatment train on the JWPCP effluent rather than ***piloting*** new technologies. This is not a "pilot plant," it is a "demonstration plant." The Metropolitan Board direction in their approval letter of 11/10/2015 was that the "*demonstration project would serve as a proof of concept and would provide critical information needed for implementation of the potential regional recycled water supply program*." The goal of the demonstration plant is to confirm source water quality; confirm treatment processes for regulatory approval and suitability for groundwater replenishment; and confirm quality of brine and waste streams. Where possible, the demonstration plant should focus on optimization of proven processes. Defining the critical control points is an important goal at demonstration scale. The Panel emphasized that although schedule is an important driver for the project, it should not be allowed to compromise the ability to garner critical data to secure public and regulatory acceptance.

The Project Technical Team must establish quantitative water quality targets entering and leaving the demonstration plant, recognizing that current requirements and treatment technologies will evolve over time. Direct potable reuse may be in the not-too-distant future and this should be considered in the layout and design of the demonstration plant. Above all, the entire Program is “customer driven.” There must be a market for the product water and having a showcase demonstration project will assist in gaining and maintaining public acceptance.

The approach to some of the key questions, such as nitrogen management and boron removal, would best be implemented using a pilot study approach, (e.g., bench scale or small scale) rather than a “demonstration” approach. The Advisory Panel suggested that there could be, for example, one “demonstration” treatment train and one “exploratory” train for pilot-scale studies.

In the design of the demonstration plant, consideration should be made to provide connections for future, small-scale side stream treatment of alternative technologies. The Advisory Panel noted that piloting of alternative technologies could be done once the full scale facility was in operation.

The Advisory Panel strongly emphasized the value of a public outreach program as part of the overall Program, including the development of the demonstration plant and its operation. The Demonstration Plant is to be a showcase to build support from local agencies, regulators, political leaders and the general public. In that light, it must be odor free and noise free. All of its potentially odorous and noisy components should have sound attenuating enclosures and should not be located where the public has access to them. The Panel recommended that the demonstration plant continue to be available after the full scale plant is on-line for tours and testing alternative technologies in the future.

1. Testing UV-AOP and IX on combined effluent from two trains

The Advisory Panel does not recommend this. Combining the effluent produces an “artificial” water quality resulting in demonstrating something that will never exist. The AOP needs to be tested separately with water pretreated by the MBR-MF-RO or the BAF-MF-RO (if selected), because the water qualities from these pretreatment processes will be different.

The Advisory Panel recommendation is to use two 0.5 mgd UV-AOP systems, one for each train. If the budget cannot accommodate the parallel UV-AOP trains, then a single 0.5-mgd system would be satisfactory. In the latter case, it should be plumbed so that it could take effluent from one train or the other separately, and the balance of flow would bypass the AOP.

The Advisory Panel recommends small, side stream IX columns be plumbed to either treatment train.

In addition, bench-scale testing or small flow rates could be used to test the chemistry of post-stabilization and post-chlorination.

2. Approach to nitrogen management

Advanced treatment of the existing non-nitrified JWPCP secondary effluent, which would involve ammonia removal by RO, may not be desirable. West Basin’s ECLWRF has had operational challenges with this approach; low flux rates and/or more frequent cleaning of the MF and RO systems were required. Direct treatment of non-nitrified secondary effluent also has other disadvantages. The Sanitation Districts' pilot plant showed that higher concentrations of TOC constituents, including chemicals of emerging concern, passed through the treatment plant because the current JWPCP biological treatment operates at a low solids retention time. The Advisory Panel recommends that RO not be relied on for ammonia removal.

The Advisory Panel discussed whether it would be possible for the JWPCP to be operated in an NdN mode. Sanitation Districts' staff evaluated this.

For a demonstration plant feed consisting of non-nitrified JWPCP effluent, the Project Technical Team's proposed approach is to size either the BAF or the MBR to achieve full NdN. Both systems could be operated in "nitrify only" mode or with carbon feed for partial or full denitrification. The advantage of testing BAF versus MBR is that the BAF footprint may be smaller than that of an MBR and the BAF operating cost may be lower than for an MBR. The BAF comes with some risk since, if the carbon dosing is not optimized and carefully paced for NdN, observations at El Paso have indicated that high levels of effluent colloidal solids can be produced that can lead to accelerated MF fouling. It is imperative to avoid process trains that might not work at demonstration scale.

The BAF could be made into a "conventional filter" by turning off the carbon feed so that it is not working in "biological" mode. There are both encouraging (San Diego) and discouraging (West Basin) examples of membrane treatment following tertiary filtration.

The Advisory Panel thought it might be appropriate to do pilot-scale BAF at the JWPCP during the design phase of the demonstration project and monitor fouling and AOC/BDOC (assimilable organic carbon/ biodegradable dissolved organic carbon) downstream of the BAF pilot system. To do this the Project Technical Team should coordinate with the Sanitation Districts to first verify that BAF is viable before taking it to demonstration scale. The demonstration plant design can always be changed or a process deleted or changed in the bid documents.

If, after collecting data from operating the existing BAF, it appears that the BAF is not an acceptable alternative, there could be two MBR trains. The MBR trains could use, respectively, technologies from the two major MBR manufacturers, with the possibility of one nitrifying only and the other operating in NdN mode.

Ideally, demonstration scale should focus on optimization rather than high-level process selection. Optimizing MBR for this application can be done readily using the proposed approach.

The total nitrogen load in the JWPCP secondary effluent and ultimately to the demonstration plant would be reduced if side stream centrate nitrogen removal was added at the JWPCP. This might result in lower costs for nitrification and nitrogen removal in the demonstration plant.

3. **Approach to boron management**

The boron water quality objective for the groundwater basins potentially being recharged through the Program ranges from 0.5 mg/L (Main San Gabriel Basin) to 1.5 mg/L (West Coast Basin). The DDW has set a Notification Level of 1.0 mg/L for boron. A preliminary assumption was made that the boron water quality objective for the Main San Gabriel Basin would be a driver for product water quality. The water quality objective for boron was set in the early 1970s based on maintaining existing groundwater water quality (non-degradation). Boron, in the concentrations noted above, has no known human health implication. The World Health Organization has relaxed their boron guideline and the USEPA has made a determination not to regulate boron with a national primary drinking water regulation (i.e., MCL) because it is not likely to occur at levels of concern in surface and ground water systems and, as such, does not present a meaningful opportunity for health risk reduction.

It is possible for Regional Water Quality Control Boards (RWQCBs) to establish site specific water quality objectives that could be less stringent than those adopted into Basin Plans. For example, the Santa Ana RWQCB adopted an amendment to its Basin Plan that allowed for higher objectives for total dissolved solids (TDS) and nitrate to promote water recycling. To be eligible for the higher objectives (maximum benefit objectives), wastewater dischargers were required to commit to implement specific projects and programs to reduce salts and nitrogen, (such as construction of brine lines and groundwater desalters, recharge of storm water and recycled water, etc.), otherwise the original, more stringent objectives applied. The use of recycled water is a benefit to the people of the State by reducing the need for imported water.

Legally a basin objective is not necessarily a hard limit on the concentration of the product water. RWQCBs have the authority to set discharge limits at the water quality objective if they believe it is necessary to protect groundwater quality and prevent degradation. However, the State Anti-degradation Policy (SWRCB Resolution 68-16) allows a lowering of water quality if the change is consistent with maximum benefit to the people of the State and will not unreasonably affect present and anticipated uses of water (including drinking) and will not result in water quality less than prescribed in policies. In addition, permit limits for groundwater replenishment projects are set to ensure that groundwater does not contain concentrations of chemicals in amounts that adversely affect beneficial uses or degrade water quality. The RWQCBs overseeing the affected groundwater basins would have to make regulatory accommodations for boron (whether via a change in the Basin Plan objective, the permit limit established taking into consideration available assimilative capacity in the groundwater, blending with recharge sources for surface application, or blending with native groundwater).

After further consideration of source control options for boron, it may be worth having a discussion with the State Board and affected RWQCBs to discuss this matter. Boron removal is very costly. Furthermore, IX for boron removal may cause additional operational and permit challenges at the JWPCP with product and brine management and ocean discharge (salt, pH, etc.).

The Project Technical Team should confirm that the 0.5 mg/L boron concentration is a real hurdle. The team should talk to the State Board, RWQCBs, DDW (drinking water and recycling staffs), and the groundwater basin managers to set water quality targets before eliminating boron removal from the demonstration plant scope. The basin managers will need to understand the cost and financing implications of any boron decision. If there is concurrence, the Advisory Panel recommends making boron a smaller point of emphasis in the demonstration plant work and, possibly, consider eliminating it from the scope. If boron is an issue, pretreatment, point-of-discharge treatment, and/or source control should be investigated first.

There are likely much less expensive ways of doing recharge in the Main San Gabriel Basin compared to large-scale IX for boron removal at the JWPCP. This should include discussions with the RWQCBs and DDW of the use of diluent water (as defined in the regulations) to reduce the boron concentration reaching the groundwater table. If required, point of discharge IX on a smaller flow might be more cost-effective for specific basins.

Any testing of boron IX should be done at a small scale, e.g. on a side stream. This is more "pilot scale" work than "demonstration" work and it could potentially be separate from the demonstration plant scope.

4. **Equipment procurement strategy**

Ideally the time allowed for prequalification testing for wastewater treatment should be one year to account for effects of seasonal water quality variation. However this is not possible considering the project schedule.

The Project Technical Team intends to "decouple" the demonstration study phase from the full-scale vendor prequalification phase. The demonstration study phase would demonstrate a given technology for each process; when it comes to procurement for full scale, an experience clause would be used for selection of the full-scale equipment supplier. It is important to not give the impression that equipment suppliers selected for the demonstration plant will be the only suppliers considered for full-scale.

If MF/UF is upstream of RO, suppliers should be comfortable doing qualification-based procurement for RO systems. The suppliers may not be comfortable going straight from MBR to RO. The Advisory Panel recommends that an area be set aside for vendor skids, installed and operated by the suppliers for short periods of time to validate their equipment. Appropriate turnouts should be designed into the demonstration plant to facilitate this. It could be specified that every supplier who wants to bid on the full-scale facility should be required to provide a skid and to validate their equipment.

The overall strategy should be to get as many vendors as possible to bid on the demonstration project and the full-scale plant. Transparency will be very important. Any process for selecting vendors should be clear and defensible. The process of procurement should be well documented and follow Metropolitan and Sanitation Districts procedures.

OCWD experience has shown that continuity of personnel is important for procurement. Having Metropolitan and Sanitation Districts staff involved throughout the process, from demonstration plant to full-scale construction, should be a priority. The procurement strategy selected must allow all qualified suppliers to bid and Metropolitan and the Sanitation Districts must carefully vet all of suppliers that ultimately end up furnishing equipment. The Advisory Panel recommends that an integrated procurement process for both the demonstration plant and full-scale plant be developed.

5. **Selecting demonstration plant unit processes based on scalability to 150 mgd**

The Advisory Panel reviewed the proposed demonstration plant processes and determined they would generally be scalable to a 150 mgd treatment plant as shown below:

Process	Scalability
Stabilization	Readily scalable even from bench-scale
UV-AOP (ultraviolet-advanced oxidation process)	Advisory Panel is not concerned about the risk of scaling from 1-mgd units to 10-mgd or larger units. There could be hydraulic changes that may affect the relationship between equipment sizing and dose, but this responsibility should be borne by the AOP suppliers. (As an aside, the Advisory Panel believes the extra equalization tank shown in the proposed process train at the demonstration plant will not be required.)
IX (ion exchange)	Readily scalable even from very small columns
RO (reverse osmosis)	Readily scalable from demonstration scale, as long as the appropriate elements are selected
MF/UF (microfiltration/ultrafiltration)	Readily scalable from demonstration scale
MBR (membrane bioreactor)	Readily scalable from demonstration scale
BAF (biologically active filter)	Scalability from demonstration to full-scale is unclear
Anammox (anaerobic ammonium oxidation)	There is no evidence on the scalability since this process has not been used at anything approaching 60 to 150 mgd. This would be a pilot project that is not ready for inclusion in the demonstration plant. Anammox may have applicability for side stream nitrogen removal from the centrate at the JWPCP. Reducing the overall nitrogen load to the AWT facility would be beneficial.

ACRONYMS

ANAMMOX	anaerobic ammonium oxidation
AOC	assimilable organic carbon
AOP	advanced oxidation process
AWT	Advanced Water Treatment
BAF	biologically active filter
BDOC	biodegradable dissolved organic carbon
BOD	biological oxygen demand
DBP	disinfection byproduct
DDW	Division of Drinking Water
ECLWRD	Edward C. Little Water Recycling Facility
FAT	Full Advanced Treatment
GWRS	Groundwater Replenishment System
IFAS	Integrated Fixed-Film Activated Sludge
IX	ion exchange
JWPCP	Joint Water Pollution Control Plant
MBR	membrane bioreactor
MCL	maximum contaminant level
MF	microfiltration
mg/L	milligrams per liter
MGD	million gallons per day
NdN	nitrification and denitrification
NF	nanofiltration
NPDES	National Pollutant Discharge Elimination System
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
O&M	operation and maintenance
PV	photovoltaic
RO	reverse osmosis
RRT	response retention time
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board
tBAF	tertiary biologically aerated filter

tMBR	tertiary membrane bioreactor
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
UF	ultrafiltration
USEPA	United States Environmental Protection Agency
UV	ultraviolet (disinfection)
WRP	water reclamation plant

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

SANITATION DISTRICTS OF LOS ANGELES COUNTY

Advisory Panel

for the

Potential Regional Recycled Water Program

Report No. 2:

Feasibility Methodology

Program and Infrastructure Review

Groundwater Basin Assumptions

September 18, 2016

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Table of Contents

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I. Executive Summary

The Metropolitan Water District of Southern California (Metropolitan) and the Sanitation Districts of Los Angeles County (Sanitation Districts) are considering development of a large-scale regional indirect potable reuse program for groundwater recharge in several groundwater basins. The potential Regional Recycled Water Program (Program) would begin with a proposed 0.5 million gallon per day (mgd) advanced water treatment (AWT) demonstration plant to be located at the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) in Carson. In early 2016, Metropolitan and the Sanitation Districts convened a panel of eight subject matter experts to provide independent review and critical input on the scope and direction of the Program for the demonstration project and development of the feasibility study for a full-scale AWT facility and conveyance system.

At the first workshop on March 31 and April 1, 2016, the Advisory Panel reviewed the overall program and engaged the Project Technical Team in an in-depth discussion of the demonstration plant design. The Project Technical Team consists of Metropolitan staff, Sanitation Districts staff, and consultant staff. The Advisory Panel's report is available on Metropolitan's website.

The second workshop was held July 27-28, 2016. The focus was on the approach to determining overall program feasibility, including methodology, infrastructure, and groundwater basin assumptions. The panel considered the approach and methodology for determining feasibility. This included a defined base case and assumptions for a 150 mgd AWT facility and conveyance system to deliver water for groundwater recharge to four groundwater basins within Metropolitan's service area. The Advisory Panel was asked to focus on two key questions raised in the feasibility analysis:

1) Is it technically and institutionally possible to implement a 150 mgd indirect potable reuse program using effluent from the JWPCP?
2) Are the costs and benefits of the program consistent with Metropolitan's 2015 Integrated Water Resources Plan (IRP) and other approaches for achieving a comparable amount of recycled water?

The Advisory Panel concurred with the overall approach to evaluating feasibility and stated that the proposed report outline and draft working documents were sound pending the incorporation of workshop input. The Advisory Panel encouraged the inclusion of all key assumptions and a description of associated risks and mitigation measures.

The Advisory Panel also considered the program infrastructure and whether the base case program adequately addressed all the critical requirements needed to evaluate program feasibility. The panel discussed the demonstration facility, full-scale AWT facility, and conveyance system. The panel generally concurred with the assumptions and approach, and provided recommendations for each of the program elements.

The Advisory Panel also considered the groundwater basin analysis and assumptions. The panel concurred that the use of calibrated groundwater flow models to assess potential changes in groundwater levels and flow that could result from the project is a reasonable initial investigation and should be followed up with additional studies. The three models currently being used to evaluate the project have been calibrated and documented and have previously been used to support basin management decisions. The model results of potential project operations in the Main San Gabriel Basin and the Central/West Coast Basins were not available at the time of the workshop and are, thus, still subject to review. However, the general approach Metropolitan has taken in using these modeling tools to evaluate potential project impacts is appropriate.

II. Workshop Objectives and Participants

The Advisory Panel met on July 27-28, 2016 to review the potential Regional Recycled Water Program proposed jointly by Metropolitan and the Sanitation Districts. The purpose of the workshop was to consider the approach to determining overall program feasibility, including methodology, infrastructure, and groundwater basin assumptions.

The following members of the Advisory Panel participated:

Richard Atwater (Co-chair)	Expert on recycled water programs
Shivaji Deshmukh	Assistant General Manager, West Basin Municipal Water District
Thomas Harder	Thomas Harder and Company (Hydrogeology)
David Jenkins	Professor Emeritus, University of California, Berkeley
Edward Means	President, Means Consulting LLC
Joseph Reichenberger	Professor, Loyola Marymount University
Paul Westerhoff	Professor, Arizona State University
Excused: Margaret Nellor (Co-chair)	Nellor Environmental Associates, Inc.

In addition to the panelists, the following members of the districts' management and Project Technical Team participated:

Paul Brown	Program Manager, Metropolitan
Renee Hoekstra	Facilitator, Metropolitan

Metropolitan: Debra Man, Gordon Johnson, Jim Green, John Bednarski, Brad Coffey, Gloria Lai-Blüml, Kimberly Wilson, Jay Arabshahi, Matt Hacker, Mickey Chaudhuri, Sun Liang, Carolyn Schaffer, June Skillman, Taylor Machado, Evelyn Ramos, Tom Hibner, Barbara Rogers

Sanitation Districts: Grace Hyde, Robert Ferrante, Rob Morton, Martha Tremblay, Shannon Bishop, Ann Heil, Phil Friess

Consulting Design Team: James Borchardt, Eric Mills, Zakir Hirani, Shane Trussell, Adam Zacheis, Gary Meyerhoffer, Hannah Ford, Michael Adelman

III. Preparation for the Workshop

Prior to the meeting, the Advisory Panel was provided with a series of working documents related to the following:

- Feasibility Approach and Methodology
- Full-Scale Advanced Water Treatment Facility
- Recycled Water Conveyance System
- Groundwater Basins Evaluation

The working documents were developed around a "base case" that is being used for the analysis and evaluation, defined as follows:

> *The base case is an implementable system of program elements, including facilities, infrastructure, institutional arrangements, and financing assumptions (each of which have quantifiable and acceptable levels of risk) that are necessary and sufficient for accomplishing the program objectives of indirect potable reuse. It is a hypothetical system model that has not yet been designed to achieve "optimized performance" but is deemed capable of accomplishing the program's functional goals.*
>
> *The base case is not designed to handle peak flows to the JWPCP. The base case facilities are expected to periodically reduce deliveries to groundwater basins when conditions warrant.*
>
> *Finally, the base case system should not be considered as either the "best" or the "worst" case scenario with respect to implementation costs or timelines. It represents a realistic approach to achieving the program's functional goals and is intended to demonstrate "feasibility" only.*

The base case is intended to provide delivery flexibility with a design flow of 150 mgd, average daily deliveries of 144 – 150 mgd and a minimum delivery of approximately 110 mgd.

IV. Panel Charge for the Workshop

The Advisory Panel was charged with the following series of questions for this workshop:

1) **Methodology for Establishing Feasibility**
   - Are the essential elements that must be considered for evaluating program "feasibility" being addressed?
   - Are there recommended improvements to the approach for assessing feasibility?
   - Is there additional information that should be provided?

2) **Comprehensive Program and Infrastructure Review**
   - Has the base case program adequately addressed all the critical requirements needed to evaluate program feasibility?
   - What aspects of the program present the greatest risk, uncertainty, and vulnerability?
   - What can be done to improve overall program feasibility?
3) **Groundwater Basin Assumptions**
   - Are there specific groundwater basin issues or concerns that should be acknowledged and/or addressed in the feasibility study?
   - What are the advantages/disadvantages of providing a guaranteed annual replenishment supply for the regional groundwater basins?

Metropolitan updated the Advisory Panel on the status of the feasibility study and provided presentations on the key topics for the workshop. The panel presentations are included in the Appendix available on Metropolitan’s website.

V. Methodology for Establishing Feasibility

The Advisory Panel was asked to provide comments on 1) whether the essential elements to determine feasibility, as described below, are appropriately considered; 2) recommended improvements to the approach; and 3) additional information that should be provided in the feasibility study.

The Advisory Panel focused on two key questions raised in the feasibility analysis:

1) Is it technically and institutionally possible to implement a 150 mgd indirect potable reuse program using effluent from the JWPCP?
2) Are the costs and benefits of the program consistent with Metropolitan's 2015 Integrated Water Resources Plan (IRP) and other approaches for achieving a comparable amount of recycled water?

To simplify the feasibility analysis, and to avoid analyzing and evaluating a myriad of possible program alternatives, a base case was developed that would meet the program goals. The base case includes a 150 mgd “demand-driven” AWT facility. This facility would be able to periodically ramp down production for delivery flexibility. It would not be designed to manage peak flows at the JWPCP. Based on the analysis, 110 mgd or more can be consistently delivered to the various spreading basins and injection wells, with 150 mgd delivered 85 percent of the time. No new spreading facilities are assumed to be needed.

The current wastewater flow at the JWPCP has dropped significantly due to water conservation. Although the JWPCP has a design capacity of 400 mgd, current (2015) average daily flow is 265 mgd. The daily minimum is 150 mgd; the daily peak is 350 mgd. With an estimated recovery of 85 percent, the AWT plant will need a minimum inflow of 180 mgd to produce 150 mgd of product water. Since the current minimum flow to the JWPCP is 150 mgd, flow equalization will be needed.

Advisory Panel Comments

The Advisory Panel concurred with the approach to evaluating feasibility and stated that the overall approach in the report outline and draft working documents is sound. The panel provided the following comments for consideration.

Direct Potable Reuse. The Advisory Panel discussed whether direct potable reuse (DPR) should be included in the base case, in addition to indirect potable reuse (IPR) through groundwater recharge. There is now a clearer regulatory path to future DPR, (e.g. the state has issued a draft feasibility study), and Metropolitan should be prepared for this eventuality. The panel acknowledged that DPR may not address the regional water supply reliability problem as effectively as storage in the groundwater basins. These basins provide a large share of the region's storage, and their availability is built into regional reliability assumptions. The demonstration plant data could help to evaluate the feasibility of future DPR even though regulations may still be ten years or more away. The report should describe how IPR projects would contribute to meeting future DPR standards and indicate how Metropolitan would be contributing to the development of this body of knowledge.

Program Implementation. The Advisory Panel stated that phasing the project to minimize the risk of stranded investments should be evaluated. In addition, planning should be coordinated with other projects to prevent overlapping planning for water demands and potential duplication of facilities. Development of other projects could impact demand for the program water.

Public outreach and environmental justice issues need to be considered and addressed. Panel members pointed out that the Orange County Water District (OCWD) has successfully addressed these issues through comprehensive outreach and education for the Groundwater Replenishment System (GWRS).

Stormwater capture is currently a major initiative throughout Southern California and has led to major ongoing and planned capital expenditures. Dovetailing with this initiative would provide additional regional-scale benefits.

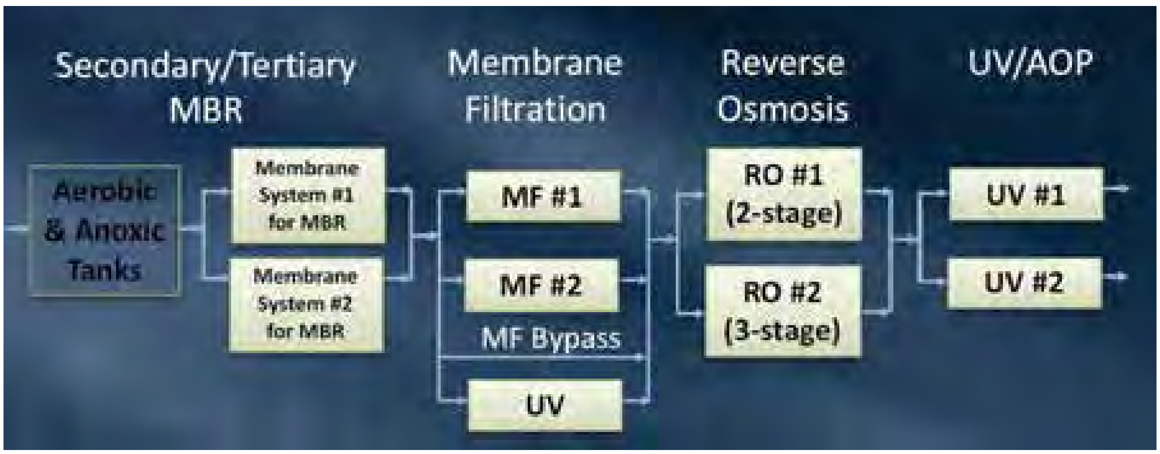
VI. Comprehensive Program and Infrastructure Review

The Advisory Panel was asked to provide comments on 1) whether the base case adequately addresses all the critical requirements needed to evaluate program feasibility; 2) aspects of the program that present the greatest risk, uncertainty, and vulnerability; and 3) recommendations to improve overall program feasibility.

Demonstration Facility

When the Advisory Panel met, work on the demonstration plant was at the 50 percent design stage. Preliminary cost estimates indicated that the original 1 mgd demonstration plant concept would not likely be constructed within the original program budget authorization of $15 million. To keep the program within budget and not compromise objectives, the demonstration plant was re-sized for 0.5 mgd. This change retained the full functionality for testing at a more reasonable cost.

An updated demonstration plant process train was presented to the Panel.



<u>Advisory Panel Comments.</u> The demonstration plant will use a two-pass RO system and a three-pass RO system in parallel for comparison. The panel agrees that the product water quality from either the two-pass RO system or the three-pass RO system will be similar.

The Advisory Panel questioned having two equipment vendors for each process when the trains are not separate. The Advisory Panel recommends that the Design Team confirm that the regulators are comfortable with there being more than one equipment vendor for each process.

The Advisory Panel suggests consideration of a short aerated zone upstream of the membranes to avoid anoxic water going directly to the membranes and creating risks of fouling.

The Advisory Panel agrees with the Design Team that the demonstration plant will be able to use several carbon sources (methanol and MicroC2000^{TM}). The treatment process should also include a phosphoric acid feed to prevent the biological process from being phosphorus limited.

The Advisory Panel recommends that the feasibility study include a discussion of how the demonstration facility fits into the program. It will confirm key assumptions and demonstrate the technology for the regulating agencies and the public. It will provide the design information for the first large-scale facility treating non-nitrified secondary effluent.

Advanced Water Treatment Facility

The base case includes a 150 mgd AWT facility located at the JWPCP. A conceptual site layout of the full-scale AWT facility was presented. There is space available for the facility within the existing JWPCP property with space for future expansion. Three dimensional renderings of major facilities in the AWT facility were presented.

The base case assumes that sidestream centrate treatment and flow equalization will be provided to improve the quality of the influent to the AWT plant and ensure a constant flow. The proposed treatment train for the AWT facility includes a membrane bioreactor, reverse osmosis, and advanced oxidation (MBR-RO-AOP) followed by stabilization with lime and carbon dioxide (CO_2), then finally chlorination, before the treated water is pumped into the conveyance system. This treatment train is expected to achieve more than the required 12 log virus/10 log *Giardia*/10 log *Cryptosporidium* removal/inactivation (12/10/10) without MF. This treatment approach assumes that the treatment processes used in the demonstration facility receive regulatory approval for use in the full-scale facility.

In the base case, the water quality goals for nitrogen will be met through sidestream centrate treatment at the JWPCP along with partial NdN, tertiary membrane bioreactor (tMBR) treatment following the existing secondary treatment at the AWT, and rejection of nitrate by RO. MicroC2000™ could be used as the carbon source for NdN. Satellite ion exchange (IX) or retrofit of JWPCP with NdN are alternative nitrogen management options. The Design Team is evaluating nitrogen management alternatives in coordination with the Sanitation Districts.

In the base case, boron loading will be reduced through source control with no additional treatment process at the AWT plant. If this is not achievable, satellite IX facilities or diluent water credit could be pursued with the groundwater basin managers and the regulatory agencies.

The AWT facility would be designed with spare/redundant equipment to achieve greater than 98 percent online time.

Advisory Panel Comments. The Advisory Panel recommends that operational water quality targets be established for the AWT source water. This includes influent and secondary effluent water quality, source control measures, boron, nitrogen, and water chemistry/blending. In this context, the panel asked if there had been any progress on boron source control. The Sanitation Districts responded that sampling is underway by their industrial waste staff. Sixty-five different possible dischargers had been identified. The panel asked if space should be allocated for ion exchange facilities (IX). The Design Team responded that it is anticipated that treating the full flow by IX would be cost-prohibitive, so satellite facilities treating only a small part of the flow would be used if needed. The Design Team stated that space would be set aside at the demonstration facility so that pilot-scale IX testing could be conducted on an as-needed basis.

The Advisory Panel thought it might be too optimistic to exclude MF/UF after the MBR in the base case and encouraged the Design Team's current plan to have the demonstration plant provide the data both with and without MF in the treatment train. The panel supports the decision to allocate space for future MF in the full-scale layout if needed. This could also provide for the addition of MF to meet future potential DPR requirements.

The Advisory Panel commented that it may be appropriate to divert denitrified water, prior to RO-treatment, for non-IPR use near the JWPCP.

The Advisory Panel asked about where the secondary effluent flow equalization basin would be located. The Sanitation Districts indicated that flow equalization is still being evaluated. Existing clarifiers that are not needed for current reduced flow could potentially be used. The Advisory Panel inquired whether tankage used for equalization could also be used to start the process of nitrification by adding fixed-film media, air, and return secondary solids. The Design Team responded that this would be considered in future studies.

The need for flow equalization in the future was discussed. Based on the flow rates experienced at JWPCP currently and as anticipated with ongoing conservation efforts, flow equalization may be needed to operate the plant at a constant flow rate of 150 mgd initially. However, as flows increase due to population growth, it is possible that flow equalization may not be needed at some point in the future. The Advisory Panel recommends that the trend of decreasing wastewater flows due to conservation be considered in planning the ultimate capacity of the AWT.

The Advisory Panel inquired about the acceptability of brine stream discharge from the full-scale AWT facility into the Sanitation Districts' permitted ocean discharge. The Sanitation Districts responded that they will assess this during the demonstration project and coordinate with the Regional Water Quality Control Board. Toxicity is critical because there may be constituents that could become an issue when concentrated in the brine discharge.

The Advisory Panel recommends that the planning process assess energy consumption and sources. AWT is an energy-intensive process and the issue of carbon emissions will arise.

Conveyance System

A schematic map of the conveyance system to deliver the water to the groundwater basins was presented. It included points of discharge to recharge basins in the Main San Gabriel Basin to the northeast and the Orange County Basin to the east. A range of flows to be conveyed to spreading grounds at Santa Fe, Rio Hondo, and Orange County, along with injection wells at West Coast Basin, Long Beach, and Central Basin were shown. The goal of the conveyance system analysis was to identify potential alignments using public rights-of-way to the extent possible and to minimize impacts on utility relocation, traffic, etc. Alignments were evaluated using a matrix based on environmental, constructability and real property criteria. The base case includes three pump stations and about 54 miles of new pipeline ranging from 60 to 84 inches in diameter.

<u>Advisory Panel Comments.</u> The Advisory Panel noted that two Metropolitan surface water treatment plants are relatively close to the conveyance lines as shown in the base case. The panel suggests that at some future time and, with DPR regulations permitting, connection to existing Metropolitan raw water pipelines and ultimately the treatment plants may be possible. This would enhance the operational flexibility when full spreading capacity may not be available.

The Advisory Panel commented that the base case conveyance system is proposing cement mortar-lined pipes, which have been a problem for OCWD. Even if the AWT facility is designed to produce stable water quality with post-conditioning, this is not always achieved in practice and a robust conveyance material is important. The panel suggested use of high density polyethylene pipe, but this material has size and pressure limitations. Fiberglass pipe, per AWWA C-950, may be suitable; it is available in large diameters and various pressure classes. The panel also noted that activated sludge effluent is aggressive and must be accounted for in the materials and budgeting. The panel recommends that a robust, non-corrosive pipeline material or lining *in lieu* of cement mortar lined steel be considered during design.

The Advisory Panel agrees with the assumption in the base case that new injection wells should be stainless steel to avoid issues with corrosion and plugging.

The Advisory Panel recommends that planning for the conveyance system should be flexible and account for future possible sources of water such as other reuse projects, desalination, DPR, etc. The conveyance system must be coordinated with existing water supply and recycled water facilities, other planned projects, and other possible sources, including the conveyance for the Water Replenishment District's Groundwater Reliability Improvement Project. Since these projects are likely to occupy the same space along the San Gabriel River levee, there may be a potential for joint ownership. Coordination with the Los Angeles County Flood Control District, Army Corps of Engineers, other utilities and cities will be needed during conveyance system planning.

VII. Groundwater Basin Assumptions

The Advisory Panel was asked to provide comments on 1) specific groundwater basin issues or concerns that should be acknowledged and/or addressed in the feasibility study, and 2) the advantages and disadvantages of providing a guaranteed annual replenishment supply for the regional groundwater basins.

The general approach to evaluating groundwater recharge feasibility in the base case includes:

- Demand Analysis – Is there sufficient demand for recharge water?
- Operational Assessment – Are there operational issues that may limit how much can be recharged?
- Groundwater Modeling – What are the impacts of recharge and extraction of project water?
- Facility Needs – Are additional facilities required?

Metropolitan has met with member agencies and basin managers to discuss the program. The agencies and basin managers provided data and information to assist with the evaluation. Metropolitan, in coordination with the basin managers and spreading basin operators, evaluated a range of groundwater recharge needs, demand, available spreading basin capacity and diluent water availability. Urban runoff and stormwater are percolated in the same spreading grounds during the rainy season. For the West Coast Basin, the water would be used for recharge through new injection wells as well as to meet refinery demands.

For the operational assessment, the base case assumes that spreading capacity at the recharge basins would be available at least 95 percent of the time. Metropolitan also assumed that diluent water (i.e. a blending water source) would be required in the initial three years of recycled water recharge.

Potential impacts from recharge and extraction of project water are being studied using groundwater flow models. Three pre-existing models are being utilized, each under the oversight of the respective basin managers: Central Basin under contract with Water Replenishment District (WRD); Main San Gabriel Basin under contract with Main San Gabriel Basin Watermaster; and Orange County Basin operated by the Orange County Water District. At the time of the workshop the Orange County Basin analysis had been completed with the analyses of the Central Basin and Main San Gabriel Basin underway and not available to the panel.

The normal operations assumed for the base case of 150 mgd are as follows: up to 62 mgd to Main San Gabriel Basin; up to 11 mgd to Central Basin at Montebello Forebay/Rio Hondo Spreading Grounds; up to 4 mgd to injection wells at Long Beach; up to 15 mgd to West Coast Basin through new injection wells; and 58 mgd to Orange County Basin. The deliveries during wet periods, with a minimum of 110 mgd, are as follows: up to 77 mgd to Main San Gabriel Basin; up to 18 mgd to Orange County Basin; and up to 15 mgd to West Coast Basin.

Advisory Panel Comments

<u>Groundwater Modeling.</u> The use of calibrated groundwater flow models to assess potential changes in groundwater levels and flow that could result from the project is reasonable and prudent. The three models currently being used to evaluate the project have been calibrated and documented and have previously been used to support basin management decisions. The model results of potential project operations in the Main San Gabriel Basin and the Central/West Coast Basins were not available at the time of the workshop and are, thus, still subject to review. However, the general approach Metropolitan has taken in using these modeling tools to evaluate potential project impacts is necessary and appropriate.

The Advisory Panel asked about the basis for the probabilities of recharging these flows and if wet/dry rotations of the basins were considered. Metropolitan stated that a detailed analysis was conducted using historic data from each basin. Wet and dry periods were included in the analysis.

The Advisory Panel asked whether diluent water from other sources was considered in the analysis of the proposed recharge sites. Metropolitan responded that this was taken into consideration in the analysis. The capacities at each basin are ultimate build-out capacities, and the modeling accounts for ramp-up using diluent water.

The Advisory Panel asked about the criteria for determining that 15 mgd could be delivered to the West Coast Basin. Metropolitan responded that the 15 mgd is based on unused capacity within the basin adjudication. The Advisory Panel commented that, in the West Coast Basin service area, taking imported water is easier and less costly than building wells. The base case assumes that pumpers in the West Coast Basin will increase production of their groundwater wells; however, assuming increased production is a potential risk. The location of the increased pumping could be affected by the location of the intruded sea water in the West Coast Basin and extraction and brackish water desalination may be required. The WRD is studying expanding brackish water desalination, and the injection of program water will need to be coordinated with WRD to optimize pumping in the West Coast Basin. Over time, pumping groundwater will likely cost less than direct deliveries of treated imported water. In the feasibility report, the planned flows should be described as ranges (e.g., 0-15 mgd) pending formalization of the flows with the basin managers.

<u>Groundwater Contamination.</u> The Advisory Panel commented that there are potential issues with recharging water in one place and producing from wells in other locations. The issues may arise from movement of a pollutant plume or mounding of groundwater around the injection site with depression around production wells, ("pumping hole"), depending on the ability to move water underground. A risk strategy needs to be considered for potential movement of Superfund and other contaminant plumes in the various basins.

The Advisory Panel noted the particle tracking work presented with the groundwater basin analysis. This was done to understand where the water goes when it is injected or spread into each basin, and to evaluate local issues (plume movement, potable water well impacts, etc.), that may result from replenishment. A six-month travel time from recharge to nearest production well is currently required by regulations. This travel time needs to be confirmed for injection into a confined aquifer. Additional analysis may be needed.

The Advisory Panel raised the issue of water losses in the basins. It was stated that basins have roughly a 3-6 percent loss on average. The panel agrees with Metropolitan's response that this issue is best addressed in the next/upcoming phases of the program via detailed groundwater modeling and documented along with other groundwater impacts.

The Advisory Panel noted that experience in Florida and elsewhere has shown that as a plume of low-TDS water enters the basin from IPR injection, it can mobilize naturally occurring geochemical constituents in the soil (e.g. arsenic). The Design Team indicated that some alkalinity addition as part of the post-stabilization step may be required to avoid mobilizing geochemical constituents in the soil during recharge. In addition, Metropolitan has been talking to groundwater basin managers about their experience with this in their basins.

Recharge Operations and Maintenance. Metropolitan is proposing to operate the AWT facility by ramping down to 110 mgd under wet weather conditions. This will allow the groundwater basins to recharge stormwater. The report should address wet weather operation of each groundwater basin since it is likely to vary from basin to basin.

Recharge in the Main San Gabriel Basin could eventually be limited by a maximum key well groundwater level above which replenishment with recycled water is not allowed (particularly in wet years like 1998 and 2004). This is an existing limit driven by agreements with the sand and gravel producers. The groundwater modeling for the Main San Gabriel Basin should account for this.

The Advisory Panel noted that there may be environmentally sensitive habitat issues associated with taking the basins offline for maintenance at some locations during certain times of the year. All basins need to be assessed for such habitat issues.

At existing locations where blended stormwater and AWT water will be recharged into the same basin, chemical effects that are difficult to predict may occur due to the blending of these water sources. Water quality modeling should look at stability and possible dissolution or precipitation. As water levels in the basins increase, nitrate leaching could be a greater issue than arsenic leaching.

Although reduction of infiltration has taken place in other locations due to swelling of clay minerals driven by ion exchange reactions, the existing recharge basins proposed for use in the program have not shown or documented this tendency.

Potential Regional Benefits. The Advisory Panel discussed the benefits of providing this water for groundwater recharge in the region. The program provides water that can be stored underground (i.e. in the aquifer) for supply during emergencies. In the event of an outage, earthquake, etc., this project is comparable in water supply significance to Diamond Valley Lake and provides a benefit in the form of avoided cost for building reservoir storage. Water quality improvement and salinity management for groundwater basins is an important benefit in counteracting salt accumulation. A firm supply of low-TDS water is a valuable regional asset.

Acronyms

AOP	advanced oxidation process
AWT	advanced water treatment
DPR	direct potable reuse
GWRS	Groundwater Replenishment System
IPR	indirect potable reuse
IRP	Integrated Water Resources Plan
IX	ion exchange
JWPCP	Joint Water Pollution Control Plant
MBR	membrane bioreactor
MF	microfiltration
mgd	million gallons per day
NdN	nitrification and denitrification
OCWD	Orange County Water District
RO	reverse osmosis
tMBR	tertiary membrane bioreactor
TDS	total dissolved solids
UF	ultrafiltration
UV	ultraviolet (disinfection)
WRD	Water Replenishment District

Appendix - Presentations*

- Demonstration Facility
- AWT Facility
- Conveyance System
- Groundwater Analysis Methodology

* The appendices are available on Metropolitan's website at the following link: http://mwdh2o.com/AboutYourWater/regional-recycled-water[mwdh2o.com]

Appendix E.5

Additional Documentation

AECOM
300 Lakeside Drive, Suite 400
Oakland, CA 94612
aecom.com

Project name: Pure Water Southern California LSWRP Feasibility Study

Project ref: 60719411

Title: Feasibility Study for Pure Water Southern California
Scope of Review: Economic Benefits
Originator: Nik Carlson

Submission for Independent Review: Monday, December 18, 2023

Initial Independent Review Completed: Thursday, December 21, 2023.

Post Review Consultation: Wednesday, December 27, 2023

Revised Submission for Back-Check: Tuesday, January 9, 2024

Final Review Back-Check Completed: Monday, January 15, 2024.

Signature: Jason Weiss

Reviewer: Jason Weiss

Brown AND Caldwell

201 North Civic Drive, Suite 300
Walnut Creek, CA 94596

T: 925.937.9010

Title: Feasibility Study for Pure Water Southern California (PWSC) for the WaterSMART Large-Scale Water Recycling Projects

Scope of Review:

Confirmation of Feasibility Study development in accordance with Reclamation's WTR 11-01 and TR-MR 28

Executive Summary

Chapter 1: Introduction and Study Area

Chapter 2: Problems and Needs

Chapter 5: Economic Analysis of Alternatives

Chapter 7: Environmental Considerations and Potential Effects

Chapter 8: Legal and Institutional Requirements

Chapter 9: Financial Capabilities

Chapter 10 Research Needs

Chapter 11: Independent Review Process

Chapters Originator: Varied Authors

Submission for Independent Review: Monday, December 18, 2023

Independent Review Completed: January 4, 2024, through January 9, 2024

Post Review Consultation: As needed

Signature: Seema B Chavan

Reviewer: Seema Chavan

Addendum

climate change. Protections against drought and climate change introduce a water security benefit not available with other Metropolitan sources. benefit not available with other Metropolitan sources. ~~Alternative 2 would provide a similar benefit.~~

Alternatives 1 and 2 provide a purified water supply that is independent of the hydrologic cycle and thereby improve the resilience of the region to climate change. Both alternatives also decrease greenhouse gas emissions by reducing pumping of imported water supplies (State Water Project and Colorado River Aqueduct). Alternative 1 provides 118,590 acre feet per year (AFY) of increased local water supply versus the 107,000 AFY provided by Alternative 2. The additional 11,590 AFY benefit of Alternative 1 will result in a greater aquifer recharge rate and increase the availability of long-term groundwater supplies. Supporting higher groundwater levels under Alternative 1 will also reduce the energy needed for groundwater pumping. Furthermore, Alternative 1 would provide the highest energy resilience due to reduced travel for daily operation and maintenance with centralized facilities; reduced staff requirements (less travel); and a reduced number of pumps for water distribution pipelines and RO concentrate disposal (separate conveyance would be required for two treatment facilities under Alternative 2). Therefore while both Alternatives provide for a drought resilient approach to addressing climate change due to the nature of the source water and delinking from the hydrologic cycle; other factors including reduced energy demand and associated carbon footprint resulted in a higher grading of Alternative 1 than Alternative 2.

Adding the benefit of DPR with raw water augmentation: The No-Action Alternative would not add DPR. Alternative 1 would also deliver water to Metropolitan's Weymouth and Diemer WTPs via raw water augmentation for DPR. This DPR approach would directly serve many member agencies, because treated water from the Weymouth and Diemer WTPs is delivered to most of Los Angeles and Orange Counties. Production of purified water within Metropolitan's service area would reduce the use of, and increase capacity in, the integrated conveyance system that delivers water into Metropolitan's service area. This additional supply could be used for exchanges with the SNWA, Arizona parties, or other partners. Alternative 2 would also provide DPR with raw water augmentation.

If—for any reason—the full amount of purified water cannot be delivered to the groundwater basins for IPR, it may also be possible to deliver this extra purified water for raw water augmentation instead, which would allow the AWPF to operate most efficiently in continuous production.

The benefits for Metropolitan and its member agencies resulting from raw water augmentation include the following:

- The number of raw water sources available to Metropolitan would increase.
- Drought resilience would increase, because purified water is largely independent of rainfall.

- Increase the locally available water supply to protect against seismic events and service disruptions.

A summary of the comparative evaluation of the effectiveness, efficiency, completeness, and acceptability of the two action alternatives considered for a water recycling project is provided in Table 6-1.

Table 6-1. Comparative Evaluation of Alternatives 1 and 2[1]

CRITERION	CONCLUSIONS OF EVALUATION					
	Reduce risk of regional shortages	Reduce risk of earthquake outages	Reduce loss of groundwater production	Reduce imported water reliance	Climate change resilience	Benefit of DPR
Effectiveness	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest
Efficiency	**Alternative 1** would be more efficient than Alternative 2. Alternative 2 would have a higher construction cost and annual cost for OM&R than Alternative 1. No Action would be least efficient.					
Completeness	**Alternatives 1 and 2** are essentially equal in terms of completeness. Both alternatives require additional actions to meet the target of 650,000 AFY identified in the IRP.					
Acceptability	**Alternative 1** has a smaller footprint for disturbed areas than Alternative 2. The smaller footprint would reduce the project impacts, streamline regulatory compliance, and reduce impacts to the public during construction. Therefore, Alternative 1 would have higher acceptability. No Action would be the least acceptable.					

Notes:
[1] Alternative 1 provides additional water for groundwater recharge and provides greater energy resiliency.
DPR = direct potable reuse
MGD = million gallons per day
OM&R = operation, maintenance, and replacement

Alternative 1 produces more high purity water to effectively meet the project objectives. Alternative 1 also has lower capital and operation and maintenance costs and is, thereby, more efficient. The smaller footprint for Alternative 1 reduces environmental impacts and results in higher acceptability.

6.2. Determinations

PWSC (Alternative 1) would reduce the scope of future development of local water supplies and improve water supply sustainability. Phase 2 of the PWSC program would add another 35 MGD of purified water for future DPR.

In addition, PWSC would

- reduce the reliance of Metropolitan on diversions from the Bay-Delta and the Colorado River