The Metropolitan Water District of Southern California

The mission of the Metropolitan Water District of Southern California is to provide its service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way.

Agenda

PWSCRC Committee
- M. Camacho, Chair
- J. Morris, Vice Chair
- D. Alvarez
- A. Chacon
- A. Fellow
- L. Fong-Sakai
- R. Lefevre
- M. Luna
- J. McMillan
- G. Peterson
- K. Seckel
- T. Smith

Subcommittee on Pure Water Southern California and Regional Conveyance - Final

Meeting with Board of Directors *

January 23, 2024

9:30 a.m.

Tuesday, January 23, 2024 Meeting Schedule
09:30 a.m. PWSCRC
11:30 a.m. Audits
01:00 p.m. Break
01:30 p.m. Exec

Agendas, live streaming, meeting schedules, and other board materials are available here: https://mwdh2o.legistar.com/Calendar.aspx. If you have technical difficulties with the live streaming page, a listen-only phone line is available at 1-877-853-5257; enter meeting ID: 891 1613 4145. Members of the public may present their comments to the Board on matters within their jurisdiction as listed on the agenda via in-person or teleconference. To participate via teleconference 1-833-548-0276 and enter meeting ID: 815 2066 4276 or click https://us06web.zoom.us/j/81520664276pwd=a1RTQWh6V3h3ckFhNmdsUWpKR1c2Zz09

MWD Headquarters Building • 700 N. Alameda Street • Los Angeles, CA 90012
Teleconference Locations:
3008 W. 82nd Place • Inglewood, CA 90305
525 Via La Selva • Redondo Beach, CA 90277

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* The Metropolitan Water District's meeting of this Committee is noticed as a joint committee meeting with the Board of Directors for the purpose of compliance with the Brown Act. Members of the Board who are not assigned to this Committee may participate as members of the Board, whether or not a quorum of the Board is present. In order to preserve the function of the committee as advisory to the Board, members of the Board who are not assigned to this Committee will not vote on matters before this Committee.

1. Opportunity for members of the public to address the committee on matters within the committee's jurisdiction (As required by Gov. Code Section 54954.3(a))

<u> CONSENT CALENDAR ITEMS -- ACTION **</u>**

2. CONSENT CALENDAR OTHER ITEMS - ACTION

A. Approval of the Minutes of the Subcommittee on Pure Water Southern California and Regional Conveyance Meeting for November 28, 2023 (Copies have been submitted to each Director, Any additions, corrections, or omissions) **21-2946**

Attachments: 01232024 PWSCRC 2A (11282023) Minutes

**** END OF CONSENT CALENDAR ITEMS****

3. SUBCOMMITTEE ITEMS

a. Pure Water Southern California - Quarterly Update and 2023 Cost Estimate Details **21-2948**

Attachments: 01232024 PWSCRC 3a Report
01232024 PWSCRC 3a Presentation

b. Assessment of Reuse Alternatives for Pure Water Southern California **21-2947**

Attachments: 01232024 PWSCRC 3b Presentation

c. Drought Mitigation Portfolio Progress Update: An Operational Perspective **21-2949**

Attachments: 01232024 PWSCRC 3c Presentation

d. State Water Project Dependent Areas Drought Mitigation Update **21-2950**

Attachments: 01232024 PWSCRC 3d Presentation

4. FOLLOW-UP ITEMS

NONE

5. FUTURE AGENDA ITEMS

6. ADJOURNMENT

NOTE: This committee reviews items and makes a recommendation for final action to the full Board of Directors. Final action will be taken by the Board of Directors. Committee agendas may be obtained on Metropolitan's Web site https://mwdh2o.legistar.com/Calendar.aspx. This committee will not take any final action that is binding on the Board, even when a quorum of the Board is present.

Writings relating to open session agenda items distributed to Directors less than 72 hours prior to a regular meeting are available for public inspection at Metropolitan's Headquarters Building and on Metropolitan's Web site https://mwdh2o.legistar.com/Calendar.aspx.

Requests for a disability-related modification or accommodation, including auxiliary aids or services, in order to attend or participate in a meeting should be made to the Board Executive Secretary in advance of the meeting to ensure availability of the requested service or accommodation.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

MINUTES

SUBCOMMITTEE ON PURE WATER SOUTHERN CALIFORNIA AND REGIONAL CONVEYANCE

November 28, 2023

Chair Camacho called the meeting to order at 9:33 a.m.

Members present: Directors Alvarez, Camacho, Chacon, Fellow (teleconference location posted), Fong-Sakai, McMillan (teleconference location posted), Morris, Peterson (teleconference location posted), Seckel, and Smith.

Members absent: Directors Lefevre and Luna.

Other Board members present: Chair Ortega, Directors Abdo, Armstrong, Bryant (teleconference location posted), Cordero, De Jesus (teleconference location posted), Dennstedt (teleconference location posted), Dick, Erdman, Goldberg, Kurtz, Miller (teleconference location posted), and Quinn.

Committee staff present: Bednarski, Chapman, Chaudhuri, Hagekhalil, Martinez, Quilizapa, and Upadhyay

1. OPPORTUNITY FOR MEMBERS OF THE PUBLIC TO ADDRESS THE COMMITTEE ON MATTERS WITHIN THE COMMITTEE'S JURISDICTION

NONE

<u>CONSENT CALENDAR ITEMS – ACTION</u>

2. CONSENT CALENDAR OTHER ITEMS - ACTION

A. Approval of the Minutes of the Subcommittee on Pure Water Southern California and Regional Conveyance for September 26, 2023 (Copies have been submitted to each Director, any additions, corrections, or omissions)

Director Seckel made a motion, seconded by Director Morris, to approve the consent calendar consisting of item 2A.

The vote was:

Ayes:	Directors Alvarez, Camacho, Chacon, Fellow, Fong-Sakai, McMillan, Morris, Peterson, Seckel, Smith.
Noes:	None
Abstentions:	None
Absent:	Directors Lefevre and Luna

The motion for Item 2a passed by a vote of 10 ayes, 0 noes, 0 abstentions, and 2 absent.

END OF CONSENT CALENDAR ITEMS

3. SUBCOMMITTEE ITEMS

a. Subject: Presentation of Advanced Water Treatment Champions Award to Metropolitan by California-Nevada American Water Works Association and California Water Environment Association

Presented by: Adel Hagekhalil, General Manager
Chuck Greely, President of ACWA
Denise Morales, Executive Administrator, California Nevada - ACWA

Mr. Hagekhalil, Mr. Greely, and Ms. Morales reported on the following:

- Honoring Metropolitan's leadership and unwavering support of advanced water treatment.
- Recognized the demonstration plant in Carson as a cutting-edge facility for advanced water treatment.
- Commended Metropolitan for visionary leadership for One Water and developing a diverse workforce.
- Presented the award to employees who are certified Advanced Water Treatment Operators.

b. Subject: Pure Water Southern California Cost Estimate

Presented by: Bruce Chalmers, Program Manager- Pure Water Southern California, Engineering Services Group

Mr. Chalmers reported on the following:

- Review of 2018 cost estimate for the program, and new/updated 2023 cost estimates.
- Key changes to the project/scope configuration since 2018, including; capacity, conveyance pipeline diameter, acquisition of property for new dedicated recharge basin, and community benefits.
- Initial estimates of potential partner contributions and grants.
- Assumptions on cost calculations including soft costs and program contingency.
- Facility costs for Phase 1 breakdown: treatment, conveyance, recharge, DPR to Weymouth facilities, property permitting, and design.
- Phase 1 proposed delivery schedule from 2023 to 2032.
- Proposed next steps, both financial and technical, as well as Board authorization of a phased approach to the Program.

The following Directors provided comments or asked questions.

1. Quinn
2. Smith
3. Fong-Sakai
4. Seckel
5. Armstrong
6. Dick
7. Alvarez
8. DeJesus
9. Fellow
10. Peterson
11. Bryant
12. Dennstedt
13. Erdman

Staff responded to Directors questions and comments.

c. Subject: Assessment of Reuse Alternatives for Pure Water Southern California

Item deferred.

d. Subject: State Water Project Dependent Areas Drought Mitigation Update

Presented by: John Shamma, Section Manager, Engineering Services Group

Mr. Shamma reported on the following:

- Proposed regional conveyance solutions for further development.
- Surface storage study updates.
- Summary of improvements under implementation: Wadsworth Bypass, Inland Feeder Intertie, Sepulveda Feeder Pump Stations, etc.
- Proposed hybrid approach to conveyance that would include a combination of raw and treated water alternatives.
- Lower-bound solution provides flow capacity to meet equitable access/reliability commitment.
- Upper-bound solutions provide flow capacity to enhance regional reliability.
- Options to improve flow capacity to State Water Project Dependent Areas.
- Proposed draft for definition for equitable access.

The following Directors provided comments or asked questions.

1. Fong-Sakai
2. Seckel
3. Alvarez

Staff responded to Directors questions and comments.

4. FOLLOW-UP ITEMS

NONE

5. FUTURE AGENDA ITEMS

NONE

6. ADJOURNMENT

The next meeting will be on January 23, 2023.

Meeting adjourned at 11:44 a.m.

Michael Camacho
Chair

Engineering Services Group

- **Pure Water Southern California - Quarterly Update and 2023 Cost Estimate Details**

Summary

The attached memorandum provides background to the Pure Water Southern California (PWSC) Cost Update presentation delivered to the Pure Water Southern California/Regional Conveyance Subcommittee on November 28, 2023. Provided in this memorandum are the following:

- General cost estimate methodology and approach
- The cost parameters and assumptions used to develop the 2023 cost estimates
- Summary 2023 cost estimate table
- Appendices with supporting unit cost information and calculations

Purpose

Informational on Cost Estimate Details for PWSC as requested by the Directors at the November PWSC/Regional Conveyance Subcommittee Meeting

Attachments

Attachment 1: Memorandum on Pure Water Southern California – Cost Estimate Methodology

Date of Report:1/23/2024

Pure Water Southern California
2023 Cost Estimate Methodology
January 23, 2024

Introduction

The purpose of this memorandum is to document the basis for and provide background to the Pure Water Southern California (PWSC) Cost Update presentation delivered to the Pure Water Southern California and Regional Conveyance (PWSCRC) Subcommittee on November 28, 2023. At this meeting, a request was made to provide more detailed backup for the estimated costs. This memorandum supplies the requested information, highlighting the following:

- General cost estimate methodology and approach
- Cost parameters and assumptions used to develop the 2023 cost estimates
- Basis for the 2023 construction and operation and maintenance (O&M) costs
- Appendices with supporting unit cost information and calculations

A detailed summary of the PWSC costs and backup information are provided in the Appendices for the advanced water purification facility (AWPF), the conveyance facilities, and for the upsizing for potential Operation Next flows.

Background

The Metropolitan Water District of Southern California (Metropolitan), in partnership with the Los Angeles County Sanitation Districts (Sanitation Districts), is considering making a major investment in a new drought-resilient water supply with the development of the Pure Water Southern California program (PWSC or Program). The PWSC is an innovative, large-scale, regional recycled water project that has a goal of creating 155,000 acre-feet per year (AFY) of safe, reliable, and drought-resilient water supplies for the region. Long-term drought, climate change, and competing demands have impacted Metropolitan's water supply portfolio. Sustainable local water supplies are crucial to maintain the reliability of the water supply for the region's 19 million residents, reduce the stress on local groundwater supplies, increase Metropolitan's water storage, and provide operational flexibility.

Subcommittee Meeting Cost Update

On November 28, 2023, staff presented the updated PWSC costs to the PWSCRC Subcommittee. The presentation showed that the estimate cost in 2018 dollars for Phase 1 was $2.6 billion (B) while the cost for Phase 2 was a total of $3.4 billion. These are present worth costs (2018 cost not including escalation to the midpoint of construction) and have been cited in all of Metropolitan's documentation since 2018. From 2018 to today, considerable effort has taken place to better define the PWSC and to identify the required facilities. Figure 1 shows the PWSC facilities as currently envisioned. These are representative of the facilities used in this cost update.

Multiple factors have impacted the 2023 Program costs. Since the 2018 cost estimate was developed, costs have increased due to inflation and supply chain issues which have been reported on extensively in the news over the last couple of years. According to the Consumer Price Index (CPI), inflation alone has increased the cost of the Program approximately 24 percent since the last estimate was prepared while other indices suggest an even higher amount of inflation than the CPI. Similar cost increases have been seen resulting from supply chain issues. Additionally, the Program is much better defined now when compared to 2018 conceptual program, including the additional cost estimates for items like major treatment processes, ancillary facilities, capacity, direct potable reuse (DPR) regulations, property acquisition, community benefits, build America/buy America requirements, and other requirements.

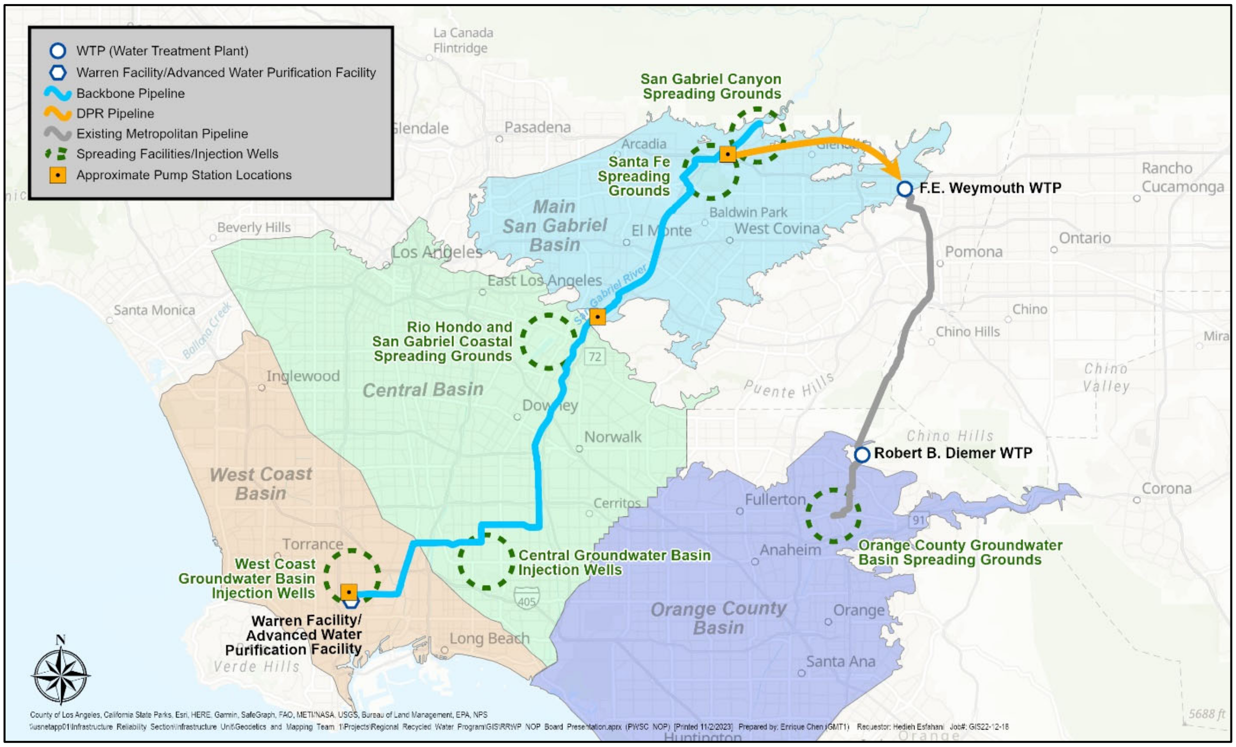

Figure 1. PWSC Conceptual Facilities (2023)

Methodology/Approach

The cost estimating methodology and approach is described below for the AWPF, conveyance facilities, upsized conveyance facilities for Operation NEXT, and mitigation measures/community benefits. It should be noted that this cost estimate is based on the planning-level information available from approximately June 2022 to July 2023 as part of the environmental planning process for the program. The estimate is intended to provide a cost range to assist with subsequent planning and decision-making efforts. Significant facility refinements that may have occurred after this timeframe will be captured in a future cost estimate update prepared towards the end of the environmental planning phase. Final Program costs 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.

Advanced Water Purification Facility (AWPF)

Figure 2 below shows the site plan representative of the AWPF site plan used to prepare the cost estimate. The figure shows the AWPF site for only Phase 1, with the undeveloped areas reserved for Phase 2 facilities and potential AWT DPR facilities. Processes shown in the figure include the existing Warren Facility high purity oxygen activated sludge (HPOAS) secondary treatment basins, centrate treatment, membrane bioreactor (MBR), reverse osmosis process (RO), ultra-violet-advanced oxidation (UV-AOP), chemical systems, and various other processes, water storage and pump station facilities, backbone conveyance pipeline within the plant, and existing demonstration plant. It also shows ancillary facilities including a warehouse, workshops, parking, administration/operations building, amphitheater/visitor center, electrical substation and distribution switchyard, and electrical facilities.

Figure 2. Phase 1 AWPF Facilities

Conveyance Facilities

Figure 3 below is representative of the conceptual conveyance facilities used to prepare the cost estimate and represent the scope of the program for the environmental planning process. The figure shows the current backbone pipeline alignment concept, the approximate locations of the backbone pump stations and the proposed locations of the service connections to the injection wells, existing recycled water systems, or groundwater recharge basins.

Upsized Conveyance Facilities for Operation NEXT

Figure 4 below is representative of the conceptual conveyance facilities that would be required to upsize approximately 14-mile of the backbone conveyance pipeline to accommodate potential future flows from Los Angeles Department of Water and Power's (LADWP)Operation NEXT program. The upsized pipeline is used in the cost estimate. To convey Operation NEXT water, the pipeline diameter would need to be increased from 7 feet to 9 feet, which would double the quantity of steel. The length of trenchless construction required in this 14-mile segment would also be doubled because of the narrow right of way.

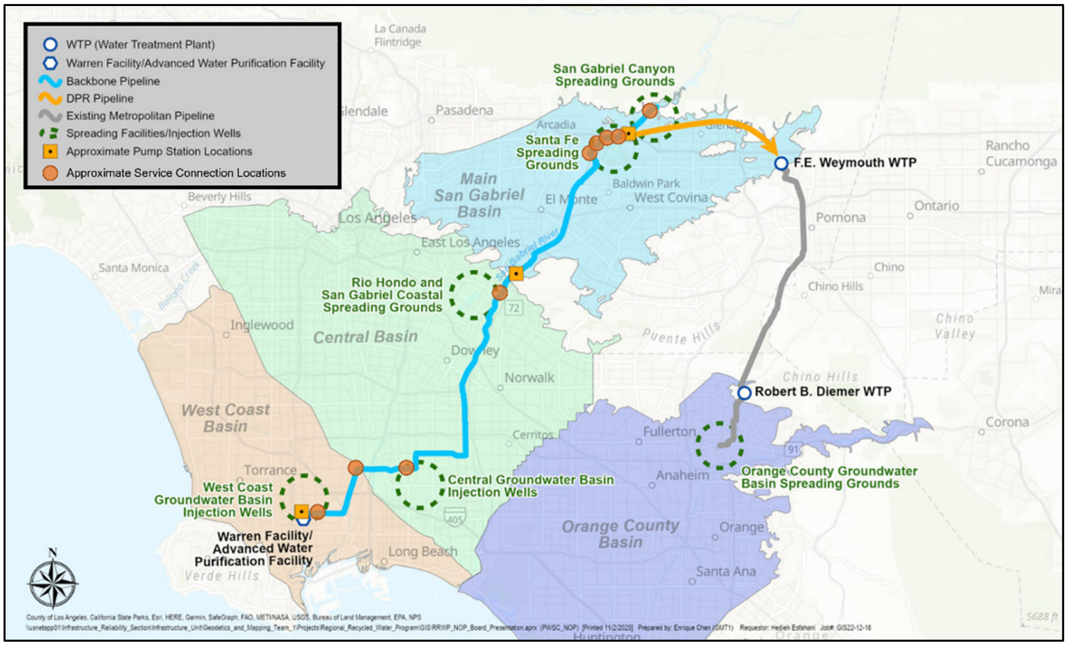

Figure 3. Phase 1 PWSC Conveyance Facilities

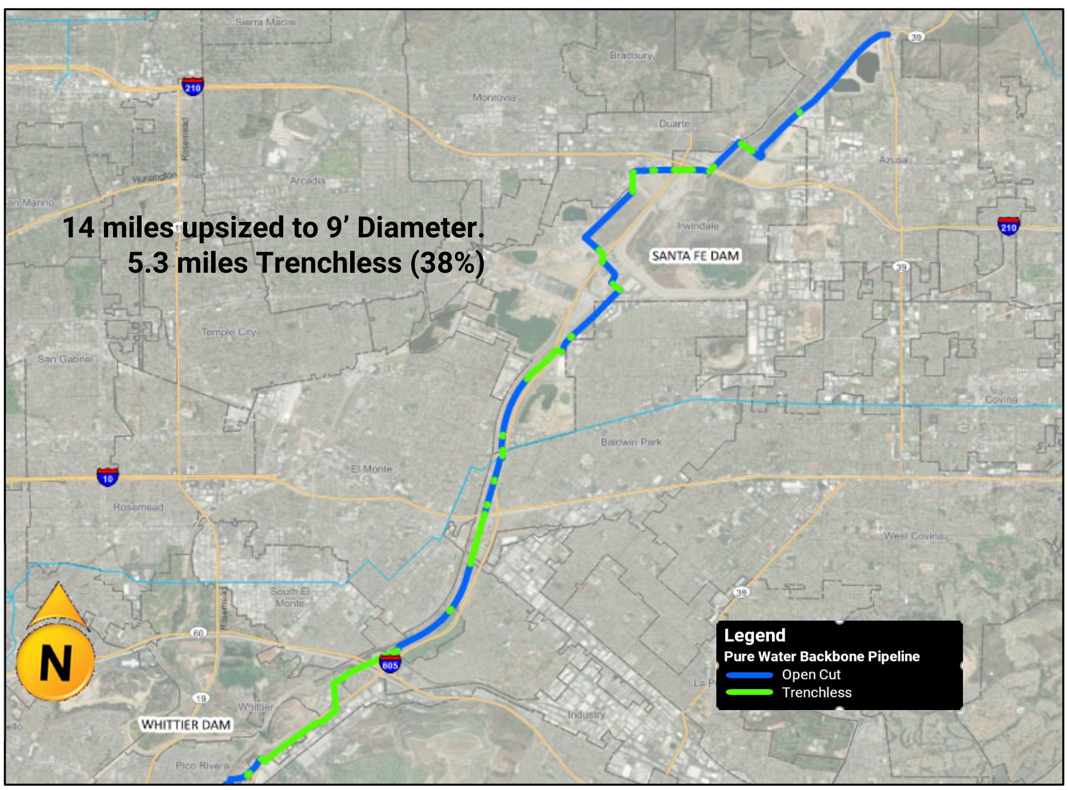

Figure 4. Upsized Conveyance Pipeline for Operation NEXT

Mitigation Measures and Community Benefits

While detailed costs are provided whenever possible, some cost amounts in the 2023 cost estimate are developed as lump sum placeholders where there is currently inadequate information to develop accurate costs. For example, lump sum estimates are used to account for Program mitigation measures and a potential community benefits program. While specific mitigation measures may be identified during the environmental review process and/or required as a condition of securing permits and approvals from the various regulatory agencies, community benefit commitments often are driven by other factors and may be different from such mitigation measures and regulatory requirements.

Regarding community benefits, staff is in the process of developing a recommendation for a potential community benefits program for the PWSC. Community benefits may be separate from the environmental mitigation measures mandated by the California Environmental Quality Act. The approach of establishing and implementing a community benefits program has precedence on other large public works programs in California including portions of the California High-Speed Rail program and the Los Angeles Metro West Santa Ana Branch Transit Corridor project. Staff intends to provide a presentation to the Board on the details of a potential community benefits program at a future PWSCRC Subcommittee meeting.

A community benefits program would be focused on outreach efforts and subsequent beneficial actions to address the goals and needs of the communities impacted by the PWSC that may be outside the scope of regulatory requirements. Currently, there are no statutory definitions for a community benefits program and the terminology and definitions for such plans vary. Community benefit plans can address a variety of objectives such as local job creation, workforce development, climate resilience, equity, and public health enhancements.

The budgets presented in the 2023 cost estimate include placeholder estimates for both environmental mitigation and the community benefits program. As staff works to evaluate the costs of mitigation measures and define community benefits, this budget will be revised for future cost estimates.

Cost Parameters and Assumptions

The assumptions made on how to calculate the costs impact the overall cost estimate. Some of the basic assumptions include the percentage allowances used for program management (5%) and design/construction management (CM)(25%). A Program contingency of 35% is included to cover unknowns. The classification of the cost estimate update varies depending on the level of design definition. Components that have a greater level of project definition are considered a Class 4 estimate, while components that have lower levels of project definition are considered a Class 5 estimate. Class 4 estimates have a level of accuracy of -30% to +50% while Class 5 estimates have a level of accuracy of -50% to +100%. Classification levels are as defined by the Association for the Advancement of Cost Engineering, International (AACE). As the Program becomes more defined, contingencies are anticipated to be reduced and the range of level of accuracy would narrow. An updated Class 4 cost estimate will be completed at the end of the environmental planning phase.

Cost Estimates

Amounts are estimated for both construction and operation & maintenance (O&M) costs.

Construction Costs (2023)

The Phase 1 PWSC costs are summarized in Table 1 for the treatment, conveyance, recharge and DPR facilities. These Program costs have been prepared and refined over approximately the last year. While the update of the 2018 cost estimate began in 2022, for this estimate, the costs are considered to be in 2023 dollars. A contingency is included with the facility costs in Table 1.

Table 1. Construction Cost Summary

Description	Cost ($M)[1]
Treatment Facilities	$2,120
Conveyance Facilities	$2,120
Recharge Facilities	$180
DPR Facilities to Weymouth	$140
Subtotal	**$4,560**
Design/Construction Management (CM)	$1,370
Property/Permitting[2]	$390
Mitigation Measures/Community Benefits[2]	$70
Total	**$6,390**

Notes:
1. Costs are in 2023 dollars and include a 35% contingency with no escalation
2. Property/permitting and Mitigation measures/community benefits do not include a contingency

The subtotal for the Phase 1 facility costs is approximately $4.6 billion, while the other miscellaneous costs (design, CM, property acquisition, etc.) make up the remaining $1.8 billion; for a total of $6.39 billion. Many of the costs have detailed backup for quantities, equipment, and materials, while other costs are estimates based on assumptions or experience. For example, design and CM costs are estimated based on a percentage of the construction costs while the mitigation measures and community benefits are a lump sum based on experience and discussions with other agencies. The similar costs for the treatment and conveyance facilities is coincidental. A detailed breakdown of the construction costs **without contingency** is included in the cost spreadsheet provided in Appendix A.

Advanced Water Purification Facilities

The proposed AWPF will include Warren Facility modifications and the advanced water treatment (AWT) process. The Warren Facility modifications include site modifications and other miscellaneous work that must be completed outside of the advanced AWPF project. It should be noted that the high-purity oxygen Ludzack-Ettinger (HPOLE) and MBR facilities are included in the AWPF pretreatment facilities costs. The AWT process will generally consist of the RO, UV, chemical systems, civil sitework, yard piping, and site electrical. Ancillary facilities were included in the 2018 cost estimate; however, additional required ancillary facilities have been added since the RRWP Conceptual Study Report in 2019. See Appendix B for the cost buildup of specific AWPF facilities and appurtenances.

Conveyance and Recharge Facilities

The Conveyance Facilities include the backbone pipeline, backbone pump stations, valves, service connections, and other allowances. See Appendix C for the cost of specific conveyance facilities. The costs for the recharge facilities were escalated from the 2018 estimate with few changes to the original assumptions.

Potential Integration of Operation NEXT

There is a potential synergy between the City of Los Angeles recycled water programs and the PWSC. One of the alternatives being considered is to upsize a portion of the PWSC backbone pipeline to provide the flexibility to carry Operation NEXT water to a potential East/West pipeline supplying water to State Water Project (SWP) dependent areas at some point in the future. For the purposes of this cost estimate, it was assumed that Operation NEXT would provide an additional 150 MGD of purified water flow into the backbone pipeline. The estimate also assumes that approximately 14 miles of the backbone pipeline between Whittier Narrows and the

Canyon Spreading grounds would be upsized from 7- to 9-feet in diameter to safely and reliably convey the combined flows from the PWSC and Operation NEXT. Metropolitan has included backup for the incremental cost of this upsized backbone pipeline in the estimate and has provided backup for the cost in Appendix D.

O&M Costs

O&M costs are also an important part in determining the unit cost of the purified water. O&M costs are calculated for both the treatment and conveyance facilities. Costs are identified for power, major equipment replacement, labor, and other miscellaneous items. A 15% contingency is added to the raw costs. Table 2 below highlights the estimated O&M costs and include the contingency. Details for the O&M costs are provided in Appendix A.

Table 2. PWSC O&M Costs

Facilities	Treatment ($M)[1, 2]	Conveyance ($M)[1. 2]
Power, Chemicals, Maintenance and Consumables	115	29
Major Equipment Replacement	12	1
Labor	50	2
Other	6	13
Subtotal	**183**	**45**
Total	**228**	

Notes:

1. Costs are in 2023 dollars and contingency is added
2. Rounded to nearest million dollars

Advanced Water Purification Facility O&M Costs

AWPF O&M costs are calculated for power, chemical, maintenance and consumables; equipment replacement; labor, and other costs. The O&M costs were prepared in collaboration with the Sanitation Districts and summarized in a document entitled "*updated Opinion of Probably Cost for the NdN Tertiary MBR base Advanced Water Treatment Facility" (Stantec 2022).* This document is provided in Appendix B.

Conveyance and Recharge Facilities O&M Costs

The conveyance and recharge facilities O&M costs include pump station O&M costs for both the backbone pipeline pump stations and the DPR pipeline pump stations. Costs are calculated for labor and spare parts, materials, and replacements. Material costs are estimated for the mechanical components of the pump stations only and do not include the backbone pipeline (shutdowns, lining repair, valve replacement, etc.).

APPENDIX A - DETAILED CONSTRUCTION COST ESTIMATE

Detailed Construction Cost Estimate

Item		Phase 1: 115 mgd (90 IPR + 25 DPR) with 25 mgd to Weymouth via Azusa pipeline for DPR treatment using UV/ClO2 at <	Phase 2: Additional 35 mgd (90 IPR + 60 DPR) with 60 mgd to Weymouth via Azusa pipeline & new smaller pipeline for DPR treatment using	Total: Phase 1 + Phase 2
AWT Production Capacity (MGD)		115	150	150
AWT Production Capacity (TAFY)		129	168	168
Average Annual Yield (TAF) at 92%	92%	118	155	155
Construction Cost w/o Soft Costs ($Million)		**$3,380**	**$956**	**$4,335**
PWSC WATER PURIFICATION PLANT FACILITIES		**$1,613**	**$777**	**$2,389**
Warren Facility Modifications		**$93.7**	**$228.9**	**$322.6**
Warren Facility Site Modifications		$34.8	$0.0	$34.8
Backup Generator Retrofit		$1.3	$0.0	$1.3
Drought Tolerant Landscaping		$1.7	$0.0	$1.7
Street Beautification		$11.8	$0.0	$11.8
Campus Water Recycling System		$10.8	$0.0	$10.8
WAC/B&G Club Oil Well Abandonment		$3.0	$0.0	$3.0
Warren Facility Warehouse		$4.9	$0.0	$4.9
EV Chargers at CNG Station (Semi Trucks)		$1.3	$0.0	$1.3
Warren Facility Process Modifications		$58.9	$228.9	$287.8
Connection to Secondary Effluent Channel		$2.0	$0.0	$2.0
HPOLE RAS Pump Station Upgrades		$5.6	$0.0	$5.6
Grit Cleanings Station		$3.0	$0.0	$3.0
Sidestream Centrate Treatment		$48.3	$18.9	$67.2
Off-site Equalization/sMBR Flow Routing		$0.0	$210.0	$210.0
AWT		**$1,474.5**	**$367.2**	**$1,841.7**
Site Preparation		$38.0	$52.2	$90.2
Utility/Storm Drain Relocation		$3.1	$41.0	$44.1
Site Grading		$21.9	$11.2	$33.1
Soil/Concrete Pile Removal		$4.0	$0.0	$4.0
Oil Well Abandonment		$8.0	$0.0	$8.0
Abandoned Structure Removal		$1.0	$0.0	$1.0
AWT Pretreatment Process Facilities		$534.8	$138.8	$673.6
Drum Screens		$15.2	$4.6	$19.8
Influent Pump Station		$28.3	$1.3	$29.6
MBR		$491.3	$132.9	$624.2
AWT Process Facilities		$570.9	$160.4	$731.3
RO Equalization Tank/PS		$60.0	$5.0	$65.0
RO		$210.7	$75.0	$285.7
UV-AOP		$43.9	$12.9	$56.8
Chemicals and Lime System		$32.5	$9.4	$41.9
Electrical and I&C		$106.1	$31.5	$137.6
Yard Piping		$20.0	$5.0	$25.0
Finished Water Clearwell/PS/Surge tanks		$92.0	$20.0	$112.0
BABA	1%	$5.7	$1.6	$7.2
Required Ancillary Facilities		$141.1	$14.9	$156.0
Operations/Administration/Electrical Buildings		$47.6	$11.8	$59.4
Public Outreach Facilities		$10.0	$0.0	$10.0
Laboratory		$62.3	$0.0	$62.3
MWD Warehouse		$13.2	$3.1	$16.3
EV facilities		$8.0	$0.0	$8.0
Additional Ancillary Facilities		$189.7	$0.9	$190.6
Demonstration Garden		$0.4	$0.0	$0.4
Amphitheater/Innovation Center		$4.0	$0.0	$4.0
Tour Galleries		$0.3	$0.0	$0.3
Battery Storage		$12.3	$0.0	$12.3
Solar Panels		$4.6	$0.0	$4.6
Parking		$3.6	$0.9	$4.5
On-site Substation/Switchgear Facilities		$25.0	$0.0	$25.0
SCE Off-site Substation/Transmission Facilities		$130.0	$0.0	$130.0
Workforce Facilities (off-site)		$9.6	$0.0	$9.6
DPR Facilities		**$44.5**	**$180.5**	**$225.0**
DPR (Ph 1 at Weymouth, Ph 2 at Warren Facility)		$44.5	$180.5	$225.0
TBD		$0.0	$0.0	$0.0

Detailed Construction Cost Estimate
(Continued)

CONVEYANCE AND RECHARGE FACILITIES		$1,767.0	$179.0	$1,946.0
Conveyance Facilities		**$1,570.0**	**$29.0**	**$1,599.0**
Backbone Conveyance Facilities		$1,167.0	$25.0	$1,192.0
Backbone Pump Stations		$118.0	$10.0	$128.0
Backbone Pipeline		$855.0	$0.0	$855.0
Backbone Valves and Service Connections		$62.0	$0.0	$62.0
Utility Relocation Allowance		$20.0	$3.0	$23.0
Separation Requirements Allowance		$46.0	$6.0	$52.0
Hazardous Soils and Groundwater Allowance		$66.0	$6.0	$72.0
Additional Conveyance Facilities		$403.0	$4.0	$407.0
Upsized Backbone Pipeline		$388.0	$0.0	$388.0
Conveyance System Business Impacts		$6.0	$2.0	$8.0
Fiber Optic		$9.0	$2.0	$11.0
TBD		$0.0	$0.0	$0.0
Recharge Facilities		**$135.0**	**$0.0**	**$135.0**
Injection Wells		$42.0	$0.0	$42.0
Spreading Facilities Improvements		$41.0	$0.0	$41.0
Relocation of Wells at Canyon Spreading Grounds		$18.0	$0.0	$18.0
Backbone Laterals by others		$34.0	$0.0	$34.0
TBD		$0.0	$0.0	$0.0
DPR Facilities		**$62.0**	**$150.0**	**$212.0**
DPR Pipelines, Pump Stations, Storage		$62.0	$150.0	$212.0
TBD		$0.0	$0.0	$0.0
Subtotal		**$3,379.7**	**$955.6**	**$4,335.3**
Soft Costs		**$1,013.9**	**$286.7**	**$1,300.6**
Program Management Consultant/ Soft Costs	5%	$169.0	$47.8	$216.8
Engineering/Soft Costs - AWT	25%	$403.2	$194.1	$597.3
Engineering/Soft Costs - Conv & Recharge	25%	$441.8	$44.8	$486.5
Subtotal		**$4,393.6**	**$1,242.2**	**$5,635.8**
Contingency	35%	$1,537.8	$434.8	$1,972.5
Subtotal		**$5,931.3**	**$1,677.0**	**$7,608.4**
Property and Community Benefits		**$457.0**	**$48.0**	**$505.0**
Property and Permits		$387.0	$18.0	$405.0
FORCO property		$158.0	$0.0	$158.0
Workforce Facilities Property (off-site)		$6.0	$0.0	$6.0
Permits, Appraisals, Easement, Land Acquisition		$173.0	$18.0	$191.0
Purchase Rock Pit #3		$50.0	$0.0	$50.0
Mitigation Measures & Community Benefits		$70.0	$30.0	$100.0
Environmental Mitigation Measures		$30.0	$10.0	$40.0
Community Benefits		$40.0	$20.0	$60.0
TOTAL ($ Million)		**$6,388.3**	**$1,725.0**	**$8,113.4**

APPENDIX B – AWPF BACK-UP COST INFORMATION

Stantec

Updated Opinion of Probable Cost for the NdN Tertiary MBR based Advanced Water Treatment Facility

Draft Final Technical Memorandum

Date: 8th July, 2022

Prepared for:

Metropolitan Water District of Southern California

Prepared by:

Stantec

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Abbreviations

Abbreviation	Definition
ADD	Average Day Demand
AFY	Acre Feet per Year
APC	Advanced Purification Center
AWT	Advanced Water Treatment
AWTF	Advanced Water Treatment Facility
AWTP	Advanced Water Treatment Plant
BAC	Biological Activated Carbon
BIM	Building Information Modeling
DAFT	Dissolved Air Floatation Treatment
DDW	Division of Drinking Water
DPR	Direct Potable Reuse
EBCT	Empty Bed Contact Time
FAT	Full Advanced Treatment
FORCO	Fletcher Oil and Refinery Company
FTE	Full-time Equivalents
GWRS	Groundwater Replenishment System
HGL	Hydraulic Grade Line
HPOAS	High-purity Oxygen Activated Sludge
HRT	Hydraulic Retention Time
I&C	Instrumentation and Controls
IPR	Indirect Potable Reuse
JTAP	JWPCP Technical Analysis Project
JWPCP	Joint Water Pollution Control Plant
LACSD	Los Angeles County Sanitation Districts
LOX	Liquid Oxygen
MDD	Maximum Day Demand
MF	Membrane Filtration (Micro or Ultrafiltration)
MGD	Million Gallons per Day
MBR	Membrane Bioreactor
Metropolitan	Metropolitan Water District of Southern California
MWD	Metropolitan Water District of Southern California
NdN (also NDN)	Nitrification-Denitrification
NRCY	Nitrified Mixed Liquor Recycle
O&M	Operations and Maintenance

OPC	Opinion of Probable Cost
OPCC	Opinion of Probable Construction Cost
PHD	Peak Hour Demand
PWSC	Pure Water Southern California (formerly the Regional Recycled Water Program)
QTO	Quantity Take-off
RAS	Return Activated Sludge
RO	Reverse Osmosis
SCE	Southern California Edison
sMBR	Secondary MBR
TDH	Total Dynamic Head
TM	Technical Memorandum
T&M	Testing and Monitoring
tMBR	Tertiary MBR
TOC	Total Organic Carbon
UV/AOP	Ultraviolet Advanced Oxidation Process
VFD	Variable Frequency Drive
WAS	Waste Activated Sludge
WBMWD	West Basin Municipal Water District

1.0 INTRODUCTION

In accordance with the scope of work in Task Order No. 1, Task 6 – "Cost of Service Analysis", this technical memorandum (TM) has been prepared to summarize this task's approach and findings. This includes updated cost estimates for the full-scale advanced water treatment (AWT) facility.

1.1 PROGRAM BACKGROUND AND DRIVERS

Imported sources make up a large portion of Metropolitan Water District of Southern California's (Metropolitan) customers water supplies. The reliability of imported supplies is in question due to both water availability with the imposition of restrictions due to ongoing drought conditions as well as the potential impacts to conveyance infrastructure functionality after a major seismic event. The potential for procuring new supplies to import are very limited. Within this context, the reuse of water from the municipal wastewater facilities, including the Los Angeles County Sanitation Districts' (LACSD) Joint Water Pollution Control Plant (JWPCP), is a critical supply component necessary to provide long-term sustainable water supply sources to Metropolitan's customers.

Metropolitan and LACSD are developing Pure Water Southern California (PWSC), a large-scale regional recycled water program, to beneficially reuse water currently discharged to the Pacific Ocean. The overall program involves construction of an Advanced Water Treatment (AWT) facility to treat effluent from the LACSD's Joint Water Pollution Control Plant (JWPCP) located in the City of Carson, California, as well as a new regional conveyance system and associated infrastructure to utilize the purified water to augment regional water supplies.

PWSC is planned to purify primary or secondary wastewater effluent from LACSD's JWPCP through AWT processes for potable reuse in Southern California. Water from the program will be used to recharge groundwater basins. This system will also have the flexibility to accommodate industrial users whose needs are consistent with the quality of water produced by the advanced water treatment facility (AWTF). Finally, future use of this system for direct potable reuse (DPR) applications appears feasible once applicable regulations are established. As currently envisioned PWSC will be constructed in a phased approach with the ultimate capacity of the program considering both the availability of source water at the JWPCP and the anticipated water demands of member agencies for groundwater replenishment and raw water augmentation.

1.2 PROJECT BACKGROUND AND OBJECTIVES

Various studies have been performed by Metropolitan and LACSD on viability and cost of implementing an advanced water treatment facility (AWTF). In 2016, Metropolitan completed a feasibility study (Metropolitan Report No. 1530, 2016) that included a Class 4 opinion of probable cost (OPC) prepared by Stantec (Stantec, 2016) and used as part of an assessment of PWSC's economic viability. Stantec performed a nitrogen management evaluation (Stantec, 2018), prepared site layouts and developed cost estimates for various AWTF phasing alternatives; findings from these studies were summarized in a conceptual planning studies report (Metropolitan Report No. 1618, 2019). Stantec updated the OPC in 2018 (Stantec, 2018) to reflect then current market conditions. Later in 2020, LACSD retained Jacobs and Hazen separately, each to conduct specific tasks for the JWPCP Technical Analysis Project (JTAP), which included preparation of Class 4 cost estimates for multiple process trains (LACSD, 2021). This TM incorporates information from the JTAP reports and provides an updated cost estimate after analyzing the differences between previous OPCs and the equivalent process train OPC in the JTAP reports (Train 1C, by Jacobs). The resulting OPC is a Class 4 estimate. The class of estimates referred to herein are based on criteria established by the Association for the Advancement of Cost Engineering International (AACEI). Class 4 cost estimates have typical expected accuracy ranges of -15% to -30% on the low side, and +20% to +50% on the high side. The timeline in **Figure 1-1** depicts the flow of work leading up to this report.

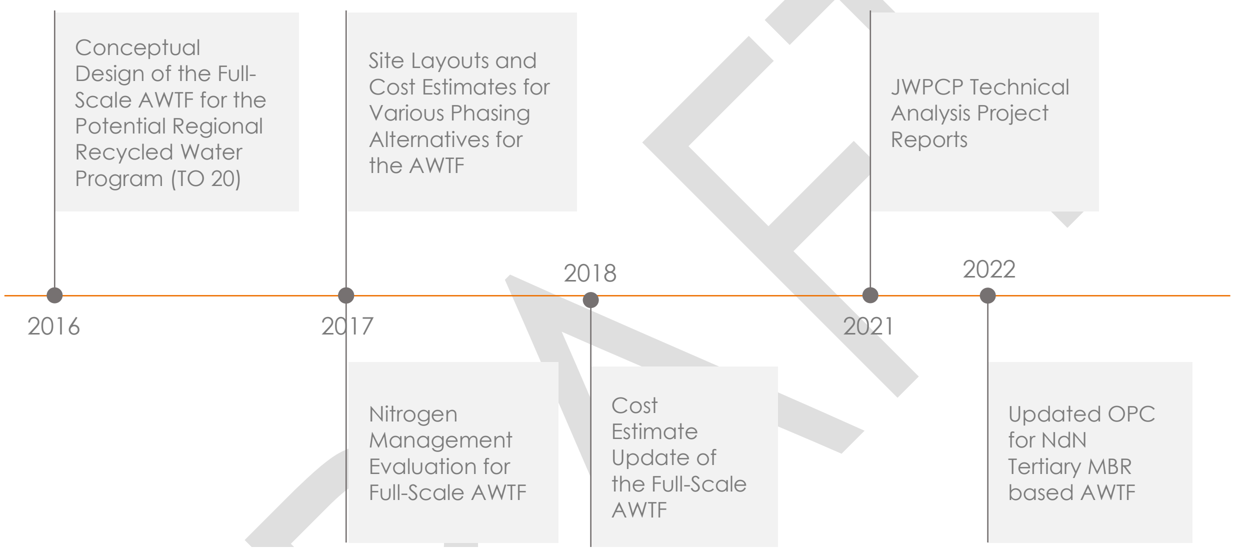


Figure 1-1: Timeline of Cost Estimates for the AWTF to Date

The objectives of this TM are to:

1. Review the differences between the 150-MGD IPR-only AWTF estimates prepared by Stantec (for Metropolitan) and Jacobs (for LACSD) and develop an updated 2021 estimate.
2. Update the 2021 150-MGD IPR-only AWTF estimate to 2022 dollars and include additional ancillary facilities identified by the Metropolitan staff.
3. Develop estimates for DPR facilities for each phase based on Metropolitan's program phasing plan.
4. Develop cost estimates for each phase including ancillary and DPR facilities.

The construction and annual O&M costs presented in this TM are costs at year zero with an assumption that Metropolitan will make appropriate adjustments based on program's construction schedule.

1.3 STUDY APPROACH

The general approach for updating the OPC is shown in **Figure 1-2** and summarized as follows:

- Stantec's previous estimates from 2016 and 2018 for a 150-MGD IPR-only AWTF were escalated to 2021 dollars so that they can be compared to Jacobs' 2021 estimates from JTAP studies.
- Each line item from these two 2021 estimates was reviewed to understand the differences and an updated estimate was developed for the overall AWTF cost.
- The 2021 updated estimate was then escalated to 2022 dollars at Metropolitan's request.
- Several new ancillary facilities were identified by Metropolitan staff to be included in the site plan and cost estimates were developed for those facilities in 2022 dollars.
- The estimates for the ancillary facilities were added to the 2022 AWTF estimate to produce the overall facility cost for a 150-MGD IPR-only facility at the Joint Site.
- Phasing plan developed by Metropolitan was used to estimate costs for each phase:
  - Phase 1: 100 MGD IPR at Joint Site + 10 MGD DPR at Weymouth WTP
  - Phase 2: Additional 50 MGD IPR at Joint Site + 150 MGD DPR at Joint Site
- Using the cost estimates for DPR facilities and applying phasing factor for additional mobilization/demobilization costs, cost estimates were developed for Phases 1 and 2.

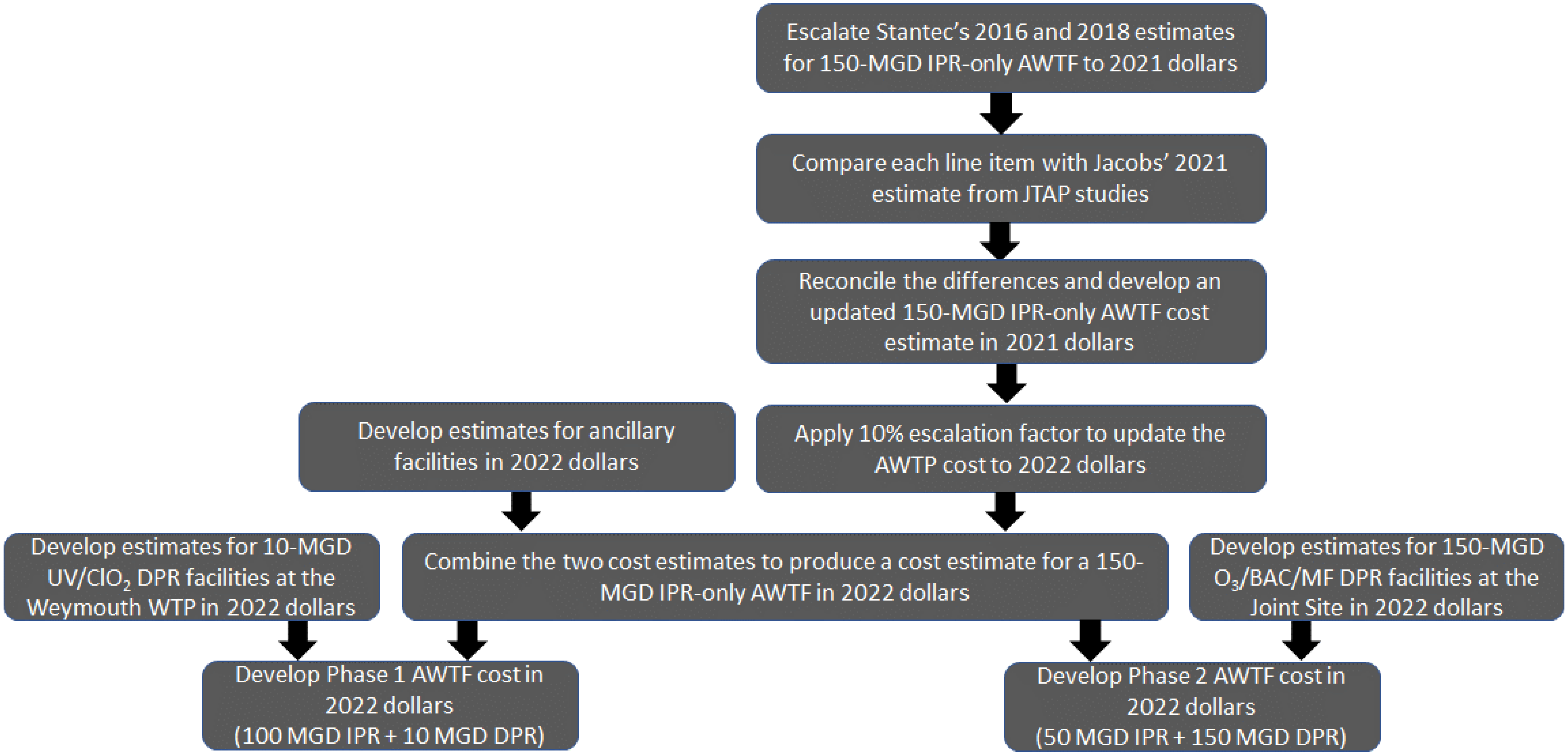


Figure 1-2: Approach to Develop the Cost Estimates for IPR and DPR Facilities

1.4 TM STRUCTURE AND CONTENT

This TM consists of five sections:

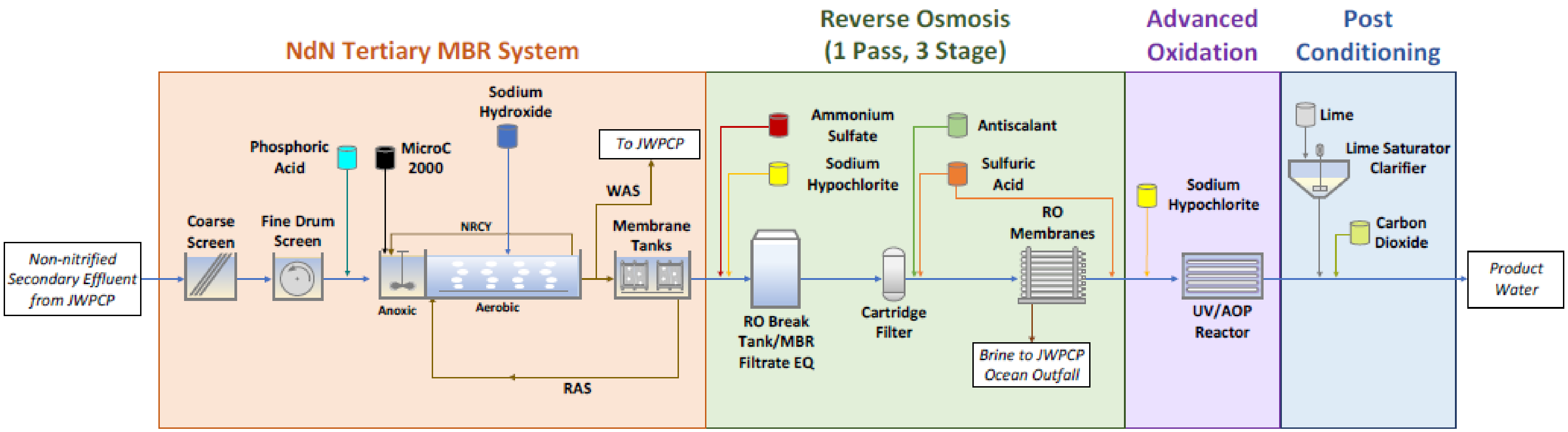
- **Section 1 – Introduction**: Provides background, drivers, and approach to developing the OPC.
- **Section 2 – Update of Cost Estimates**: Provides assumptions and key parameter values used to develop the capital and O&M cost estimates along with the estimates in 2021 dollars. Line by line comparison between Stantec and Jacobs' estimates is provided in Appendices B and C; those estimates are shown in 2021 dollars since Jacobs estimates were developed in 2021.
- **Section 3 – Ancillary Facilities**: Provides a brief description of facilities and a summary of the cost estimate for ancillary facilities.
- **Section 4 – DPR Facilities**: Provides a brief description of facilities and a summary of the cost estimate for DPR facilities.
- **Section 5** – **Cost Estimates for Individual Phases based on Current Program Phasing Plan**: Describes the methodology to derive cost estimates for the two program phases and resulting estimates.
- **Section 5 – Summary**: Summarizes the updated cost estimates in 2022 dollars.

2.0 UPDATE OF COST ESTIMATES

The cost estimates for each unit process/component of the full-scale AWT facility from Stantec and Jacobs were compared and the differences analyzed to develop the updated estimates for the full-scale AWTF. This section describes the key project markups and assumptions used in developing the capital and O&M costs along with the summary of these estimates. Details on differences between the estimates and the justifications for new estimates are included in **Appendices B and C** for the construction and O&M costs, respectively. The costs for the clearwell, effluent conveyance pumps and surge tanks are not included in these estimates since those will be covered by PWSC's conveyance team.

2.1 DESCRIPTION OF PROCESS TRAIN

The treatment process presented in Stantec's reports is equivalent to the Train 1C process in the JTAP reports. The process configuration (**Figure 2-1**) consists of a NdN tMBR, single pass RO, UV/AOP and stabilization. The sidestream centrate treatment has also been included in the overall treatment cost. The design criteria for the process train are included in **Appendix A**.



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 →

Figure 2-1: Process Flow Diagram for the NdN tMBR based Advanced Water Treatment Facility

2.2 COST ESCALATION

Stantec estimates developed in 2016 (and updated in 2018) were first escalated to 2021 dollars to allow comparison with Jacobs' estimates developed in 2021. Stantec's cost estimation team utilizes the TBD Consultants Bid Index, based on actual construction costs in San Francisco, CA, to provide OPCs with reasonable accuracy. Though based in San Francisco, we have found this bid index to be reliable. According to TBD Consultants bid index, an escalation of 33% on construction costs was required to update the May 2016 estimates to May 2021 dollars. A comparison of the TBD index to ENR's California Construction Cost Index is shown in **Table 2-1**. To compare the operations and maintenance (O&M) costs, Stantec used escalated equipment costs as a basis to develop the equipment replacement and maintenance costs.

Table 2-1: Construction Index Factor Comparison

	ENR CCCI[1]	TBD Consultants Bid Index[2]
May 2016	10315.44	193.1
May 2018	11012.77	219.06
May 2021	11989.91	257.12
Escalation Factor	16.2%	32.8%

1. ENR California Construction Cost Index (CCCI) is provided in the JTAP reports.
2. TBD Consultants uses a construction bid index based off of actual bids in San Francisco, CA. http://www.tbdconsultants.com/mobi/TBDBidIndex.htm

2.3 CONSTRUCTION AND PROJECT MARKUPS

The markups that differ between Stantec's estimates prepared for Metropolitan and Jacobs' estimates prepared for LACSD include:

- Construction markups (e.g. contractor overhead and profit)
- Project markups (e.g. engineering and administrative services, contingency)

Construction markups are summarized in **Table 2-2**. Based on current market conditions, the markups from Jacobs' estimates are more consistent with recent experience from Stantec's cost estimators and are recommended to be used for the updated costs.

Table 2-2: Construction Markups

	Stantec's Estimate from 2016 TO20	Jacobs' Estimate	Recommendation
Sales Tax	9.5% applied to 40% of subtotal, separate from Contractor markups	9.5% applied to 40% of subtotal, prior to Contractor markups	9.5% applied to 40% of subtotal, prior to Contractor markups
Contractor Overhead	Combined with Contractor Profit	7.5%	7.5%
General Conditions	5% at 4 years	7.5%	7.5%
Subcontractor General Conditions	6%	not stated	included in general conditions percentage
Contractor Profit	10% on self-perform, 4% on subs	10%	10%
Mobilization/Bonds/Insurance	2.50%	5%	5%
Total	19%[1]	30%	30%

1. This is a blended percentage based on taking the contractor markups total divided by the cost subtotal

Project markups are summarized in **Table 2-3**. The recommended markups were obtained from Metropolitan and were applied on top of construction costs for an estimated project cost.

Table 2-3: Project Markups

	Metropolitan Conceptual Design Report	Jacobs' Estimate	Recommendation
Engineering	25%	12%	17%
Services During Construction/Startup		6%	6%
Construction Management (CM)		12%	12%
Permitting/Legal Fees		Lump sum of $10M	Lump sum of $10M
Administrative Fees		Lump sum of $5M	5%
Engineering and Admin Total	25%	30% + $15M	40% + $10M
Contingency	35%	35% applied prior to Engineering and Administrative Costs	35% applied prior to Engineering and Administrative Costs

2.4 LIMITATIONS OF THE APPROACH

The updated OPCs presented in this TM combine two cost estimates with different underlying assumptions and basis of design at different points in time. While the basis of design for each OPC was evaluated, the unit costs the OPCs are built from were not evaluated or updated. The updated OPC considered these assumptions and generally used the more conservative estimate.

Stantec strongly recommends updating this OPC using the quantity take-offs from a BIM model prepared on the basis of a well-developed conceptual design for the selected final process train with up-to-date unit costs. With this recommendation in mind, decisions regarding economic feasibility and costs of service should recognize the limitations and potential inaccuracies of this approach.

2.5 O&M COST PARAMETERS

The approach to developing the O&M costs between Stantec's and Jacobs' estimates was similar. The parameters used in the development of the O&M costs are shown in **Table 2-4** and then discussed by category in following paragraphs.

Table 2-4: O&M Cost Parameters

	Updated/Escalated Stantec's Estimate	Jacobs' Estimate	Recommendation
Maintenance	3% of equipment cost	3% of equipment cost	3% of equipment cost
Major equipment overhaul	Not included	5% of mechanical equipment cost, at year 10	5% of mechanical equipment cost each year
Local sales tax on replacement components	9.5%	9%	9.5%
Contingency	15%	15%	15%
Labor Costs, $/hr	$150/hr for 2,080 hrs	$150/hr for 1,800 hrs	$150/hr for 2,080 hrs
Biosolids Disposal, $/DT	Not used	190	190
Pure Oxygen feed, $/lb-$O_2$	Not used	0.015	Not used
Replacement frequency, years			
MBR modules	10	10	10
MF modules	10	10	10
Cartridge filters	0.5	0.5	0.5
RO elements	5	5	5
UV lamps	1.6	1.6	1.6
UV ballasts	10	5	5
UV-AOP sleeves, sensors	Not included	per vendor quotes	per vendor quotes
Blowers	>20	>20	>20
Major pumping systems	>20	>20	>20
Net Present Value			
Net Present Value period, years	Not used	20	Not used
Net Present Value interest rate, %	Not used	5	Not used
Electricity			
JWPCP produced, $/kWh	Not used	0.06 [1]	Not used
Purchased electricity, $/kWh	0.15	0.15	0.15
Chemicals			

	Updated/Escalated Stantec's Estimate	Jacobs' Estimate	Recommendation
Ammonium sulfate (40%), $/gal	2.25	3.54	2.25
Antiscalant (100%), $/gal	13.00	8.63	13.00
Carbon dioxide, $/lb	0.085	0.08	0.09
MicroC 2000 (100%), $/gal	3.05	3.35	3.05
Caustic soda (25%), $/gal	1.42	1.39	1.42
Citric acid (50%), $/gal	13.50	5.05	13.50
Hydrated lime, $/lb	0.19	0.25	0.19
Hydrochloric acid (33%), $/gal	Not used	1.80	Not used
Sodium bisulfite (25%), $/gal	1.49	1.10	1.49
Sodium hypochlorite (12.5%), $/gal	0.84	0.82	0.84
Sulfuric acid (93%), $/gal	2.08	1.84	2.08
Sodium dodecylbenzylsulfonate, $/lb	Not used	1.5	Not used

[1] The energy savings from energy produced at JWPCP was not factored into Jacobs' estimates. All alternatives projected using more energy than production capacity at JWPCP.

The categories of O&M parameters and how they compare between the estimates are described as follows:

- **Maintenance**: Both estimates used the same basis of 3% of equipment costs for maintenance.
- **Major equipment replacement**: Both estimates assumed major equipment such as pumps and blowers would have a useful life of greater than 20 years and therefore full replacement costs were not included. Jacobs' estimate included a 5% allowance for the cost of major equipment overhaul at year 10.
- **Contingency**: A contingency of 15% was applied in addition to all O&M costs, except for labor.
- **Labor**: Both estimates used the same hourly rate, though Stantec's estimate assumed this rate was applied at 40 hrs per week for 52 weeks (equal to 2,080 hours per year) compared to an average yearly total hours of 1,800 assumed for Jacobs' estimate.
- **Biosolids disposal and pure oxygen feed**: Specific unit cost parameters based on JWPCP operational costs were used by Jacobs in their estimate of costs associated with processes at the JWPCP. Stantec's estimate in 2018 was based on approximate percentages of total treatment cost for secondary treatment at JWPCP. Jacobs' estimate is based on greater specificity and more recent cost data.
- **Assets requiring scheduled replacement**: Both estimates included replacement costs for assets requiring schedule replacement with less than a 20-year life, such as membranes and UV lamps and ballasts. Stantec's estimate was based on the 2021 unit cost quotes per replacement part obtained by Jacobs. Sales tax was applied to the replacement costs.
- **Electricity**: Both estimates were based on $0.15/kWh.
- **Chemicals**: Unit costs used in Jacobs' estimate were the same as from Stantec's 2018 estimate except for updated costs for MicroC 2000 (carbon) and sodium hypochlorite. Stantec

received updated costs for all chemicals in early 2022 as part of this effort except for sodium bisulfite and sodium hypochlorite, which were escalated based on the overall average increase in chemical unit costs from the quotes received.

2.6 UPDATED CAPITAL COST ESTIMATE FOR A 150-MGD IPR FACILITY AT THE JOINT SITE

The cost estimates developed in 2021 dollars to compare with Jacobs' estimates were escalated to 2022 dollars per Metropolitan's request. Escalation from Q2 2021 dollars (included in Section 2) to Q2 2022 dollars was based on a 10% escalation factor since the TBD price index has not yet been updated for 2022 at the time of this report.

The total capital cost in 2022 dollars (**Table 2-5**) is estimated to be **$2.5 billion** based on an assumption that the entire facility will be built in a single phase. This estimate also includes additional ancillary facilities per Metropolitan's request that were not part of the previous estimates developed by Stantec; details on those facilities can be found in **Section 3**. An additional Title 22 Facility for 1.0 mgd of non-potable reuse consisting of UV disinfection and storage is included based on recent planning efforts with Metropolitan. This estimate does not include any DPR facilities and is meant to provide comparison to previous (2016 and 2018) estimates for a 150-MGD IPR-only AWTF.

Table 2-5: Updated Capital Cost Estimate for a 150-MGD IPR Facility at the Joint Site

Area	Capital Cost
Site Improvements	$16,330,000
Drum Screen and Influent Pump Station	$20,630,000
Biological Treatment	$289,600,000
RO	$209,800,000
UV-AOP	$33,960,000
Chemicals	$8,174,000
Lime System	$16,930,000
Electrical and I&C	$82,270,000
Yard Piping	$10,460,000
Sidestream Centrate Treatment	$75,680,000
Title 22 Facility[1]	$7,000,000
O&M Buildings and Ancillary Facilities[2]	$126,600,000
Estimating Allowance	$73,470,000
Subtotal	**$971,000,000**
Construction Markups [3]	$339,200,000
Subtotal Construction Cost	**$1,310,200,000**
Construction Cost Contingency [4]	$458,600,000
Engineering, Startup, Admin, Const. Mgmt.[5]	$707,400,000
Permitting	$10,000,000
Capital Cost ($)	**$2,487,000,000**

[1] Title 22 Facility consists of 1.0 mgd UV disinfection and a 400,000 gallon storage tank

[2] The buildings and the ancillary facilities costs from Section 3 are combined in one line item here. This excludes electrical buildings which are included within process line items

[3] Construction markups include sales tax of 9.5% on 40% of equipment cost, contractor overhead of 15%, contractor profit of 10%, and mobilization/bonds/insurance of 5%.

[4] Contingency is 35% of subtotal construction cost

[5] Project markups include engineering at 17%, startup at 6%, CM at 12%, admin at 5%, applied on top of the sum of the subtotal construction cost and contingency.

2.7 UPDATED O&M COST ESTIMATE FOR THE 150-MGD IPR FACILITY AT THE JOINT SITE

A summary of the updated O&M costs is presented in **Table 2-6.** The annual O&M cost is estimated to be **$156M** excluding biogas credit**.**

Table 2-6: Updated O&M Cost Estimate for a 150-MGD IPR Facility at the Joint Site

Area	Annual O&M Cost
Influent and MBR	$49,836,000
RO	$43,809,000
UV AOP	$6,258,000
Stabilization	$6,198,000
Effluent Chlorination	$3,120,000
Balance of Chemicals, Buildings, Electrical	$3,150,000
Major Equipment Replacement Cost	$4,859,000
Labor	$37,128,000
JWPCP Secondary Treatment and Biosolids[1]	$996,000
Title 22 Facility[2]	$10,000
Ancillary Facilities	$500,000
O&M Cost ($)	**$155,864,000**
Annual Biogas Credit[1]	$1,243,000
Annual O&M with Biogas Credit	**$154,621,000**

[1] JWPCP Secondary Treatment and Biosolids, and Biogas Credit O&M cost reflect only the differences between the tMBR train and current JWPCP operations

[2] Title 22 facility O&M is based on power, maintenance, and replacement parts for UV disinfection facility

3.0 ANCILLARY FACILITIES

3.1 DESCRIPTION OF FACILITIES

The ancillary facilities include facilities that assist with operating the plant as well as others that provide a space for education and demonstration to the public. A list of the facilities and their basic descriptions can be found below in **Table 3-1**.

Table 3-1: Description of Potential Ancillary Facilities

Facility	Basic Facility Description
Operations Building	Offices, central control room, locker rooms, and full kitchen/lunchroom. Includes training room.
Laboratory	Laboratory with additional space for pilot facilities with available connections to process waters. Adjacent to Operations Building.
MWD Warehouse	Large warehouse with size split and shared with LACSD
MWD Maintenance	Includes equipment and space for any necessary maintenance for mechanical, electrical, I&C, or painting at the facility.
Electrical Buildings	Buildings housing the electrical controls for the facility.
Electrical Substation	Electrical Substation
Fueling Facilities	Gasoline and Diesel refueling station, as well as EV charging stations for fleet vehicles.
Demonstration Garden	Garden to showcase native and low water needs plants that would do best to reduce water usage.
Amphitheater	Large outdoor amphitheater to give talks or hold activities out with seating.
Innovation Center	A center to demonstrate technologies used within the facility.
Tour Galleries	Area to lead tours on to showcase the facility and both the history and future of the facility.
Stormwater capture (LID), and multiple PS	Bioswales for stormwater capture throughout the facility and a pond or potentially another water feature to showcase captured stormwater.
Battery Storage	Battery storage facilities.
Solar Power	Solar panels for energy generation
Generators	Generators for emergency power to run essential equipment in case of power outage.
Parking	Parking for both staff and public.

3.2 CONSTRUCTION COSTS

Class 5 cost estimates, as defined by AACEI, for the construction of ancillary facilities were developed by Stantec. The estimates are parametric, based on unit costs per square foot and developed with reference to Metropolitan's Lake Matthews Reservoir Rehabilitation Storage Facility project bid. **Table 3-2** summarizes the ancillary facilities, anticipated footprints, and Class 5 costs for each. Sections of the facility that have already been priced in other sections are noted accordingly in the cost estimate columns and their values are not repeated. Class 5 cost estimates have typical expected accuracy ranges of -20% to -50% on the low side, and +30% to +100% on the high side.

Table 3-2: Ancillary Facility Capital Cost Summary

Facility	Gross Footprint (sf)[1]	Building Area (sf)	Cost Estimate	Cost Estimate Assumptions
Operations Building	15,000	N/A	Included elsewhere	Assuming 75 operators, and 50 on any given day. May need expansion for training rooms. Two story building.
Laboratory	47,000	50,000	$60,500,000	Lab staff of 40 employees. Need an additional 2000 sf for pilot facilities. Separate but adjacent to the Ops building.
Warehouse	50,000	23,000	$12,850,000	LACSD needs 13,000 sf for their part of the warehouse.
Maintenance Building	75,000	N/A	Included elsewhere	Includes parking. Indoor space is 20,000 -30,000 sf
Electrical Buildings	13,260	N/A	Included elsewhere	N/A
Electrical Substation	N/A	N/A	Included elsewhere	N/A
Fueling Facilities	10,000	N/A	$2,000,000	Installation of underground petroleum storage tanks
Demonstration Garden	10,000	N/A	$350,000	Meandering sidewalks, some CA native planting potential smaller bioswales. Maybe 1/2 acre landscaped.
Amphitheater	5,000	5,000	$625,000	Outdoor, open, seating (benches), maybe electronics for presentation, no real cover
Innovation Center	1,200	N/A	Included elsewhere	Likely retain existing APC learning center. Triple-wide trailer
Tour Galleries	N/A	N/A	$250,000	Outdoor sidewalks (4' width) and placards
Stormwater capture (LID), and multiple PS	N/A	N/A	Included elsewhere	Bioswales around parking lot. Sewer that runs under the disposal pit. Set up grading that water can go through bioswales to a sump and pump into sewer.
Battery Storage	3,830	N/A	$12,000,000	Assumed to be 2 MW, based off of previous MWD battery storage average of $6 million per MW

Solar Power	10 acres	N/A	$4,500,000	1.5 MW estimated at $3/watt, based on recent costs with conservatism for unknowns of mounting and electrical infrastructure
Generators	13,150	N/A	Included elsewhere	N/A
Parking	139,368	N/A	$3,484,000	Next to innovation center. Canopies over with Solar, EV, etc.
Subtotal Ancillary Facility Construction Cost			$96,600,000	Includes Contractor Markups
Construction Cost Contingency (35%)			$33,800,000	
Engineering, Startup, Admin, Const. Mgmt. (40%)			$52,200,000	
Total			**$182,600,000**	

[1] Gross footprint includes parking, landscaping, and facility

3.3 OPERATION & MAINTENANCE COSTS

The O&M cost estimate is based on the total ancillary facilities estimated costs. It uses an estimate of 0.5% of the total cost of the facility of $96,600,000, leaving O&M estimated costs at about $500,000 dollars per year.

4.0 DIRECT POTABLE REUSE FACILITIES

4.1 BASIS OF COST ESTIMATE

The location of DPR processes within the process train for PWSC is still under evaluation. Metropolitan's planned potential approaches to implement DPR and research needs associated with each approach are discussed in the two TMs generated by the Stantec Team (Stantec, 2022a and b).

Amongst the proposed DPR implementation approaches, those that place ozone/BAC processes upstream of RO have been stipulated in the draft DPR regulations. The process design criteria for ozone/BAC processes for such implementation are well defined and therefore, process sizing and cost estimation can be completed. For the DPR implementation approaches that place ozone/BAC processes downstream of RO, several treatment questions have yet to be addressed and Metropolitan plans to do so over the next few years.

For the Phase 1 of the program, Metropolitan plans to install UV and chlorine dioxide processes at the Weymouth WTP to further treat 10 MGD of advanced treated water (ATW). Adding these processes to the treatment train and limiting the ATW's contribution as a percentage of the total feed water supply to Weymouth WTP to less than 10% during Phase 1 allows Metropolitan to meet the draft DPR regulatory requirements. The preliminary estimate for such treatment concept is provided in **Table 4-1**.

For the Phase 2, Metropolitan plans to produce up to 60 MGD of DPR quality water. Since that flow would result in ATW making up more than 10% of the total feed water supply to the Weymouth WTP, ozone, BAC and UV (or MF) processes will have to be included in the process train and will likely be located at a satellite facility somewhere between the Joint site and the Weymouth WTP. The Stantec Team has been tasked to develop the design basis, site layout and cost estimates for such treatment concept, which will be included in a separate TM.

Another DPR treatment approach under consideration places ozone, BAC and MF processes at the Joint site upstream of the RO. Under this treatment concept, the entire plant flow (150 MGD product water) will be treated to DPR standards. Although this approach is less likely to be implemented, it provides the most conservative cost estimate for DPR implementation and is included in this TM (**Table 4-2**).

4.2 CONSTRUCTION COSTS

The cost estimate for the DPR treatment is a Class 5 Opinion of Probable Construction Cost based on criteria established by AACEI. The costs are based on the following assumptions:

- Design criteria as shown in **Appendix A**
- **For the 10 MGD of DPR treatment at the Weymouth WTP**:
  - Costs are based on vendor quotes, with parametric estimates for balance of plant construction

- Costs for chlorine facilities are not included; this estimate assumes existing on-site chlorine systems at Weymouth WTP will be utilized
- No other ancillary facilities are included in the estimate based on an assumption that the existing Weymouth facilities will be used for maintenance and storage

- **For the 150 MGD of DPR treatment at the Joint site**:
  - Liquid oxygen (LOX) storage and supply for the ozone process will be required and is included in this estimate
  - Ozone & BAC costs are based on a scaled bid price for the 34-MGD Pure Water San Diego, North City Pure Water Facility (NCPWF), which has the same design criteria as PWSC
  - NCPWF bid was in Oct 2020 and was escalated to Q2 2021 dollars using TBD index, with an additional 10% escalation between Q2 2021 and Q2 2022 (TBD index is not yet updated for 2022). The estimate to account for capacity scaling to 150-mgd was done using power factor scaling equation with coefficient of 0.75 (Dysert, 2003):

    $\$B = \$A * (\text{Capacity B} / \text{Capacity A})^{e}$, where:

    $B = cost of construction for Project B, unknown
    $A = cost of construction for Project A, known
    Capacity B = capacity of Project B (in our case, flow rate of facility in mgd)
    Capacity A = capacity of Project A (in our case, flow rate of facility in mgd)
    e = power factor exponent (in our case, 0.75 based on comparison to other facility costs)
  - MF cost is based on JTAP Train 4 estimate, escalated from Q2 2021 to Q2 2022 dollars by using 10% escalation factor
  - The DPR line items for ozone, BAC and MF include proportional adders for contractor mobilization, electrical and I&C, site work, yard piping, testing, building enclosure for equipment, sales tax on equipment, and associated support facilities (LOX storage and feed system, BAC backwash tank/MF feed tank, CIP system)
  - No additional ancillary facilities were included assuming use of IPR facilities for operations, maintenance, and storage

Table 4-1: Capital Cost Summary for the 10-MGD DPR Facility at the Weymouth WTP

Area/Item	Cost
UV [1]	$1,103,000
ClO_2 [1]	$500,000
Chemical Storage [1]	$76,000
Tank for Contact Time [1]	$7,573,000
Building and Pad [1]	$3,360,000

Subtotal	**$12,612,000**
Contractor Markups	$3,800,000
Construction Subtotal	**$16,412,000**
Construction Cost Contingency (35%)	$7,100,000
Engineering, Startup, Admin, Const. Mgmt. (40%)	$9,400,000
Capital Cost ($)	**$33,000,000**

[1]Each item includes electrical, I&C, civil site work, and installation costs

Table 4-2: Capital Cost Summary for the 150-MGD DPR Facilities at the Joint Site

Area/Item	Cost
Ozone [1]	$166,540,000
BAC[1]	$123,420,000
MF [1]	$236,800,000
Subtotal	**$526,760,000**
Contractor Markups	$158,000,000
Construction Subtotal	**$684,760,000**
Construction Cost Contingency (35%)	$239,666,000
Engineering, Startup, Admin, Const. Mgmt. (40%)	$369,800,000
Capital Cost ($)	**$1,294,000,000**
Capital Cost ($M)	**$1,294**

[1]Each item includes electrical, I&C, civil site work, building, tanks, LOX system, and installation costs

4.3 OPERATION & MAINTENANCE COSTS

O&M costs were developed using the same unit costs as in Section 2.5, where applicable (e.g. electricity unit cost of $0.15/kWh) and are based on the following assumptions:

- **For the 10-MGD of DPR treatment at the Weymouth WTP (Table 4-3)**:
  - O&M costs for UV and ClO_2 processes include power, maintenance, replacement, and chemicals (ClO_2).
  - Additional maintenance and replacement costs are included for the chlorine contact tank and building, labeled in **Table** as "Other".

- Unit cost for chlorine gas is \$0.93/lb and sodium chlorite is \$1.00/lb.
- Labor – 0.5 FTEs, assuming \$150/hr, 2090 hr/FTE, no contingency.

- **For the 150 MGD of DPR treatment at the Joint site (Table 4-4)**:
  - Ozone & BAC costs are based on quantities scaled from the 34-MGD Pure Water San Diego, North City Pure Water Facility which has the same design criteria as PWSC. Unit costs for energy and chemical are then applied to these quantities. No activated carbon replacement is assumed to be needed for the analysis period.
  - Liquid oxygen (LOX) storage and supply for the ozone process is included in this estimate
  - MF cost is based on JTAP Train 4 estimate, escalated from Q2 2021 to Q2 2022 dollars by using 10% escalation factor.
  - Labor – additional 10 FTEs in addition to IPR staff, assuming \$150/hr, 2080 hr/FTE, no contingency.

Table 4-3: O&M Costs for 10 MGD DPR Facilities at the Weymouth WTP

Area	Annual O&M Cost
UV	\$100,000
ClO_2	\$147,000
Other	\$299,000
Labor	\$156,000
O&M Cost (\$)	\$700,000

Table 4-4: O&M Costs for 150 MGD DPR Facilities at the Joint Site

Area	Annual O&M Cost
Ozone	\$14,850,000
BAC	\$1,890,000
MF	\$11,000,000
Labor	\$3,120,000
O&M Cost (\$)	\$30,900,000

5.0 COST ESTIMATES FOR INDIVIDUAL PROGRAM PHASES BASED ON CURRENT PHASING PLAN

The program implementation plan developed by the Metropolitan includes two phases:

- Phase 1 – 100 mgd of IPR treatment (MBR, RO, UV-AOP, Stabilization) at the Joint Site, 10 mgd of UV and chlorine dioxide treatment at the Weymouth WTP
- Phase 2 – Add 150 MGD of DPR treatment (Ozone, BAC, MF) and expand IPR capacity to 150 mgd total

The proposed DPR treatment concept for Phase 2 is conservative and Metropolitan may choose to implement DPR at a satellite facility, which will require treating only 60 MGD of water to DPR standards. Such concept may result in lower capital and O&M costs for Phase 2.

During Phase 1, a majority of the infrastructure for the ultimate capacity of 150 mgd would be constructed including all buildings and the ancillary facilities and most of the treatment process piping and structural infrastructure (buildings/canopies, basins, etc.). During Phase 2, the IPR treatment process equipment and remaining necessary infrastructure for an additional 50 mgd capacity would be added, along with all facilities associated with the DPR treatment processes as described in Section 4. The phased costs were developed based on following assumptions:

- Phase 1 costs were estimated per-line item based on an assumed percentage of the 150 mgd construction cost for the infrastructure that would be built during Phase 1. The total cost of Phase 1 is approximately 84% of the 150 mgd IPR construction cost.
- A phasing factor of 10 % was applied to Phase 2 costs to account for additional contractor mobilization/demobilization activities and inefficiencies of constructing the facility in two phases.
- The DPR line items for ozone, BAC and MF include proportional adders for contractor mobilization, electrical and I&C, site work, yard piping, testing, building enclosure for equipment, sales tax on equipment, and associated support facilities (LOX storage and feed system, BAC backwash tank/MF feed tank, CIP system).
- All costs are in 2022 dollars and do not account for the time-value of money based on when the construction of Phase 1 and Phase 2 occur.

The capital and O&M costs for each phase are summarized in **Table 5-1** and **Table 5-2**, respectively.

Table 5-1: Capital Costs for Individual Phases in 2022 Dollars

	Phase 1	Phase 2	Phase 1 + 2
	100 mgd IPR at Joint Site and 10 mgd DPR at Weymouth WTP	Additional 50 mgd IPR and 150 mgd DPR at Joint Site	
Area	**Capital Cost**	**Capital Cost**	**Capital Cost**
Site Improvements	$16,330,000	$0	$16,330,000
Drum Screen and Influent Pump Station	$15,472,500	$5,157,000	$20,630,000
Biological Treatment (including Carbon Addition)	$231,680,000	$57,920,000	$289,600,000
Ozone	$0	$166,540,000	$166,540,000
BAC	$0	$123,420,000	$123,420,000
MF	$0	$236,800,000	$236,800,000
RO	$157,350,000	$52,450,000	$209,800,000
UV-AOP	$25,470,000	$8,490,000	$33,960,000
Chemicals	$6,130,500	$2,043,500	$8,174,000
Lime System	$12,697,500	$4,232,500	$16,930,000
Title 22 Facility	$7,000,000	$0	$7,000,000
Electrical and I&C	$74,043,000	$8,227,000	$82,270,000
Yard Piping	$10,460,000	$0	$10,460,000
Sidestream Centrate Treatment	$75,680,000	$0	$75,680,000
O&M Buildings and Ancillary Facilities	$126,600,000	$0	$126,600,000
Estimating Allowance	$55,102,500	$18,367,500	$73,470,000
10-MGD UV and ClO_2 at Weymouth WTP	$12,612,000	$0	$12,612,000
Phasing Factor (additional mob/de-mob)	$0	$15,690,000	$15,690,000
Subtotal	**$826,700,000**	**$699,400,000**	**$1,526,000,000**
Sales Tax[1]	$31,420,000	$6,570,000	$37,980,000
Contractor Markups[1]	$257,450,000	$211,800,000	$469,194,000
Subtotal Construction Cost	**$1,115,600,000**	**$917,800,000**	**$2,033,200,000**
Construction Cost Contingency[2]	$390,460,000	$321,230,000	$711,620,000
Engineering, Startup, Admin, Const. Mgmt.[3]	$602,424,000	$495,612,000	$1,097,928,000
Permitting	$5,000,000	$5,000,000	$10,000,000
Capital Cost ($)	**$2,114,000,000**	**$1,740,000,000**	**$3,854,000,000**
Capital Cost ($M)	**$2,114**	**$1,740**	**$3,854**
Capital Cost per gpd ($/gpd)	**$21.1**	**n/a**	**$25.7**

[1] Construction markups include sales tax of 9.5% on 40% of equipment cost; contractor markups consist of contractor overhead of 15%, contractor profit of 10%, and mobilization/bonds/insurance of 5%.

[2] Contingency is 35% of subtotal construction cost

[3] Project markups include engineering at 17%, startup at 6%, CM at 12%, admin at 5%, applied on top of the sum of the subtotal construction cost and contingency.

Table 5-2: O&M Costs for Individual Phases in 2022 Dollars

	Phase 1	Phase 2	Phase 1 +2
Annual O&M Costs	**100 mgd IPR at Joint Site + 10 MGD DPR at Weymouth WTP**	**Additional 50 mgd IPR and 150 mgd DPR at Joint Site**	
Area	**O&M Cost**	**O&M Cost**	**O&M Cost**
Influent and MBR [1]	$33,224,000	$16,612,000	$49,836,000
Ozone	$0	$14,850,000	$14,850,000
BAC	$0	$1,890,000	$1,890,000
MF	$0	$11,000,000	$11,000,000
RO	$29,206,000	$14,603,000	$43,809,000
UV AOP	$4,172,000	$2,086,000	$6,258,000
Stabilization	$4,132,000	$2,066,000	$6,198,000
Effluent Chlorination	$2,080,000	$1,040,000	$3,120,000
10-MGD UV and ClO_2 at Weymouth WTP	$700,000	$0	$700,000
Balance of Chemicals, Buildings, Electrical	$2,100,000	$1,050,000	$3,150,000
Major Equipment Replacement Cost	$3,239,333	$1,619,667	$4,859,000
Labor	$35,568,000	$4,680,000	$40,248,000
JWPCP Secondary Treatment and Biosolids	$664,000	$332,000	$996,000
Ancillary Facilities	$500,000	$0	$500,000
Total	**$115,700,000**	**$71,900,000**	**$187,600,000**
Annual Biogas Credit	$828,667	$414,333	$1,243,000
Annual O&M with Biogas Credit	$114,900,000	$71,500,000	$186,400,000

[1] Influent and MBR O&M cost includes sidestream treatment, odor control, equalization, biological process chemicals, influent pumps/screens and MBR costs.

6.0 SUMMARY

Stantec was tasked by Metropolitan to update the full-scale AWTF cost estimates to 2022 dollars and include additional ancillary and DPR facilities in these estimates. Using Metropolitan's program phasing plan, Stantec also developed estimates for each phase of the Program. **Table 6-1** summarizes the 2022 estimates. The Phase 2 estimates were developed based on an assumption that all 150 MGD of product water will meet DPR water quality requirements. However, Metropolitan is considering use of a satellite DPR facility that will allow Metropolitan to treat only 60 MGD of water to DPR standards – the flow that is expected to be used for DPR application. Therefore, the Phase 2 estimates presented in this TM are expected to be conservative. Stantec Team is in the process of developing the estimates for a satellite DPR facility, which will be included in a separated TM.

Table 6-1: Summary of Cost Estimates

Program Treatment Components	Capital Costs ($M)	Annual O&M Costs ($M/yr)
150-MGD IPR-only AWTF[1]	$2,487	$156
Additional Ancillary Facilities	$183	$0.5
10-MGD DPR Facilities at Weymouth WTP	$33	$0.7
150-MGD DPR Facilities at Joint Site	$1,294	$30.9
Program Phases	**Capital Costs ($M)**	**Annual O&M Costs ($M/yr)**
Phase 1 (100 MGD IPR + 10 MGD DPR)	$2,114	$116
Phase 2 (50 MGD IPR + 150 MGD DPR)	$1,740	$72
Phase 1 + 2	$3,854	$188

[1] Assumes the whole facility is built in a single phase and includes essential ancillary facilities as indicated in Table 3-2

7.0 REFERENCES

Los Angeles County Sanitation Districts (2021). Technical Analysis of Biological and Advanced Water Treatment Processes at the Joint Water Pollution Control Plant - Analysis of Train 1C-1F: Nitrification and Denitrification Tertiary Membrane Bioreactor + Reverse Osmosis.

Metropolitan Water District of Southern California (2019). Regional Recycled Water Program Conceptual Planning Studies Report – Report No. 1618.

Stantec, Carollo Engineers and Trussell Technologies Inc. (2016). Conceptual Design of the Full-scale AWT Facility for the Potential Regional Water Supply Program.

Stantec, Carollo Engineers and Trussell Technologies Inc. (2018). Cost Estimate Update of the Full-Scale Advanced Water Treatment Facility.

Stantec (2018). Nitrogen Management Evaluation for Full-scale Advanced Water Treatment Facility.

Stantec (2022a). Approach to Generate Data for Environmental Impact Studies for Direct Potable Reuse Facilities for the Regional Recycled Water Program.

Stantec, Carollo Engineers and Trussell Technologies Inc. (2022b). Roadmap to Address the Direct Potable Reuse Research Needs for the Regional Recycled Water Program.

TBD Consultants Price Index, http://www.tbdconsultants.com/mobi/TBDBidIndex.htm

8.0 APPENDICES

Appendix A DESIGN CRITERIA

Table 8-1 Influent Pump Station Design Criteria

Parameter	Unit	Value
General		
JWPCP Secondary Effluent Required	MGD	180
Influent Pump Station		
Number of Pumps (Duty + Standby)	-	3+1
Design Capacity, Each	**MGD**	**86**
Motor Power, Each	HP	770
Influent Fine Screens		
Type	-	Center-Fed Drum Screen
Size of Perforations	mm	2
Number of Screens (Duty + Standby)	-	5+1
Capacity, Each	MGD	50
Power, Each	HP	3.0
Washer/compactor (Duty + Standby)	--	1+1

Table 8-2 Biological Process Design Criteria for MBR

Parameter	Unit	Value
General		
MBR Average Flow	mgd	180
MBR Peak Flow	mgd	234
MCRT	days	>10
Waste Activated Sludge (WAS)		
MBR WAS Flow	% of Influent	1.83%
WAS Flow Rate	MGD	3.30
WAS Solids Content	%	3.4 to 3.8
WAS Pumps (Duty + Standby)	--	1 + 1
WAS Pump Capacity, Each	gpm	2,300
WAS Pump Power, Each	HP	40
Return Activated Sludge (RAS)		
RAS Flow Setpoint	% of Q	150%
RAS Flow Rate, Total	MGD	351
RAS Flow Pumps, (Duty + Standby)	-	5 + 1
RAS Flow Pump Capacity, Each	MGD	80
RAS Flow Pump Power, Each	HP	300
Nitrified Mixed Liquor Recycle (NRCY)		
NRCY Flow Setpoint	% of Q	150%
NRCY Flow Rate, Total	MGD	351
NRCY Flow Pumps, (Duty + Standby)	-	12 + 0

NRCY Flow Pump Capacity, Each	MGD	33.3
NRCY Flow Pump Power, Each	HP	40
Bioreactor		
Number of Trains	-	6
Anoxic Basins		
Number of Basins per Train	-	2
Number of Basins Total	-	8
Wet Volume, Each Basin	gal	1,670,000
Total Volume	gal	13,360,000
HRT (Excluding Recycle Flow)	hours	1.8
Mixer Type	--	Top mounted
Mixer Motor	HP	30
Number of Mixers	--	16
Mixing Power, Total	HP	480
Aeration Basins		
Number of Basins per Train	-	3
Number of Basins Total	-	12
Wet Volume, Each Basin	gal	1,380,000
Total Volume	gal	16,560,000
HRT (Excluding Recycle Flow)	hours	2.2
Process Air Capacity	cfm	72,000
Process Air Blowers, (Duty + Standby)	-	3 + 1
Process Air Blower Capacity, Each	cfm	24,000
Process Air Blower Power, Each	HP	1,430

Table 8-3 Membrane System Design Criteria for MBR

Parameter	Unit	Value
General		
Membrane System Influent	MGD	180
Number of Membrane Basins Total	-	18
Maximum MLSS Concentration	mg/L	3,820
Design Permeate Flux	gfd	17
Number of Cassettes Per Basin (Duty + Standby)	-	26 + 4
Membrane Area per Cassette	ft^2	22,360
Membrane Air Scour		
Membrane Air Scour Rate per Cassette	cfm	208
Membrane Air Scour Rate, Total	cfm	97,200
Membrane Air Blowers, (Duty + Standby)	-	7+1
Membrane Air Blowers Capacity, Each	cfm	17,500
Membrane Air Blower Power, Each	HP	800
Filtrate Pumping		
Filtrate Pumps, Total	-	17+1
Filtrate Pump Flow, Each	MGD	14

Filtrate Pump Power, Each	HP	285
MBR Air Compressor System		
Type	-	Rotary screw
Number of Compressors (Duty + Standby)		1 + 1
Motor Power for Compressor, Each	HP	75
Air Flow, Each	cfm	360
Design Pressure, Each	psi	125

Table 8-4 Ozonation System Design Criteria

Parameter	Unit	Value
General		
Process Influent Flow	mgd	180
Number of Trains	--	5
Ozone Contactors		
Maximum Applied Dose[b]	mg/L	14
CxT Value	mg-min/L	3.9
Contact Time (T_{10})	min	6
Contactor Baffling Factor	--	0.6
Total Contactor Residence Time	min	10
Number of Ozone Contactors	--	5
Volume per Contactor	gal	259,000
Injection System		
Injection Type	--	Side Stream
Number of Injectors (Duty)	--	10
Number of Injectors (Standby)	--	5
Ozone Transfer Efficiency, Minimum	%	95%
Ozone Generators		
Minimum Generator Capacity at 10% (each)	lb/day	2,287
Total Ozone Production	lb/day	22,870
Number of Ozone Generators (Duty)	--	10
Number of Ozone Generators (Standby)	--	2
Power Supply Unit per Generator	--	1
Power per Generator	kWh/day	10,292
Ozone Destruct System		
Number of Destruct Units (Duty)	--	10
Number of Destruct Units (Standby)	--	5
LOX System		
LOX Usage (pounds per day)	lb/day	228,697
LOX Usage (standard cubic ft per hour)	scfh	115,111
LOX Usage (gallons per day)	gpd	24,013
Oxygen Supply		LOX System
LOX Tank Orientation	--	Horizontal
LOX Tank Volume (each)	gal	80,000

Parameter	Unit	Value
Number of LOX Tanks	--	2
LOX Storage at Peak Flow and Dose	days	5
Minimum Vaporizer Capacity	scfh	115,200
Number of Vaporizers	--	5

Table 8-5 Biologically Activated Carbon Design Criteria

Parameter	Unit	Value
General		
Process Influent Flow	mgd	180
Number of Trains	--	5
BAC Filters		
Type of Filter	--	Gravity
Surface Area, Each Filter	ft^2	700
Filter Length, Each	ft	35
Filter Width, Each	ft	20
Media Bed Depth	ft	10
Number of Filters (Duty)	--	35
Number of Filters (Standby)	--	5
Flow per Filter (Duty)	mgd	5.31
Flow per Filter (Duty + Standby)	mgd	4.65
Filter Loading Rate (Duty)	gpm/ft^2	5.3
Filter Loading Rate (Duty + Standby)	gpm/ft^2	4.6
EBCT (Duty)	min	14.2
EBCT (Duty + Standby)	min	16.2
L/d Ratio	--	2,345
Feed Pumps (Duty + Standby)	--	4 + 1
Feed Pump Flow, each	mgd	46.5
Feed Pump Power, each	HP	200
Activated Carbon Media		
Mesh Size	--	8x16 or 8x20
Effective Size	mm	1.3
Uniformity Coefficient	--	1.4 to 1.5
Iodine Number	mg/g	900
Trace Capacity Number, Min	mg/cm^3	9
Abrasion Number, Min	--	75
Density, Apparent	g/cm^3	0.56
Specific Gravity, Wetted	--	1.4
Backwash System		
Backwashes per Week, Each Filter	--	1
Total Backwash Loss	%	0.5%
Backwash Supply Source	--	MBR Filtrate

Parameter	Unit	Value
Design Backwash Velocity	gpm/ft^2	23
Design Backwash Flow Rate	gpm	16,100
Backwash Time	min	10
Backwash Volume	gal	161,000
Backwash Pumps (Duty + Standby)	--	1 + 1
Backwash Pump Flow, each	mgd	23.2
Backwash Pump Power, each	HP	150
Design Air Scour Velocity	cfm/ft^2	4
Design Air Scour Flow Rate	scfm	2,800
Air Scour Blower (Duty + Standby)	--	1+1
Air Scour Blower Capacity, each	cfm	2,800
Air Scour Blower Power, each	HP	150

Table 8-6 Microfiltration Membranes Design Criteria

Parameter	Unit	Value
General		
Influent Flow	MGD	186
Filtrate Flow	MGD	177
Membrane System Sizing		
Recovery	%	95%
Number of Sub-Systems	--	4
Cells per Sub-system	--	5
Cells in Operation	--	18
Cells in Standby/Available	--	2
Cells, Total	--	20
Membrane Type	--	PVDF Hollow Fiber
Modules per Cell		1,000
Available Module Space per Cell		1,100
Total Number of Modules		20,000
Membrane Surface Area per Module	ft^2	375
Membrane Surface Area per Cell		375,000
Instantaneous Flux (18 cells operating)	gfd	33
Average Flux (18 cells operating)	gfd	26
Net Filtrate Flow, per train	MGD	9.8
Backwash Requirements		
Backwash Frequency	mins	22
Backwashes per Cell per Day	--	60
Backwash Filtrate Volume per Cell	gal	15,210
Backwash Waste per Day	MG	13.5
Maintenance Wash Requirements		
Chlorine Maintenance Wash Frequency	hrs	24
Acid Maintenance Wash Interval	hrs	72

Volume of Chemical Waste per Wash	gal	56,000
Full CIP Interval	days	30.0
Volume of Chemical Waste per CIP	gal	120,000
Total Volume of CIP Waste per Day	gal	80,000

Table 8-7 Reverse Osmosis System Design Criteria

Parameter	Unit	Value
RO Break Tank		
Total Volume	MG	10
Number	--	1
Length	feet	683
Width	feet	108
Sidewater Depth	feet	19
Freeboard	feet	2
Hydraulic Residence Time	min	81.49
RO Feed Transfer Pump Station		
Flow, Total	MGD	177
RO Feed Pumps, (Duty + Standby)	-	7 (6+1)
RO Feed Pump Flow, Each	MGD	29.5
Power, Each	HP	2,500
Total dynamic head	feet	381
Type	--	vertical turbine
Efficiency	%	82%
Drive	--	variable frequency
Wetted end material	--	316 SS
Cartridge Filters		
Total flow	mgd	177
Maximum Design Loading Rate (per cartridge)	gpm	20 (5 per 10-inch length)
Average Design Loading Rate (per cartridge)	gpm	16 (5 per 10-inch length)
Maximum Design Capacity (per housing)	gpm / mgd	5,660 / 8.2
Average Design Capacity (per housing)	gpm / mgd	4,528 / 6.5
Number of Housing	--	29 (28+1)
Cartridge filters per housing	--	283
Pressure rating	psi	150
Flange size	inches	20
Element filter pore size	microns	5
Element length	inches	40
Element diameter	inches	2.5
Element type	--	string-wound
RO Feed Booster Pump Station		
Flow, Total	MGD	177
RO Feed Pumps, (Duty + Standby)	-	7 (6+1)

Parameter	Unit	Value
RO Feed Pump Flow, Each	MGD	29.5
Power, Each	HP	1,250
Total dynamic head	feet	196
Type	--	vertical turbine
Efficiency	%	82%
Drive	--	constant speed
Wetted end material	--	316 SS
General		
Total Feed Flow	MGD	177
Total Permeate Flow	MGD	150
Total Concentrate Flow	MGD	27
System Recovery	%	85%
RO Skids		
Number of Skids (Duty + Standby)	--	30 + 3
Skid feed capacity	MGD	5.9
Skid permeate capacity	MGD	5.0
Vessels per skid	--	147
Total Elements per Vessel	--	7
Membrane Area per Module / Element Area	ft^2	400
Element area per skid	ft^2	411,600
Vessel configuration	--	11 high, 14 wide
Spacer	mil	34
Average design flux	gfd	12.1
Pressure Vessel Array, Each Skid (Stage 1 : Stage 2 : Stage 3)	-	84:42:21
Second Stage Booster Pumps		
Flow, Total	MGD	88.5
Pumps, (Duty + Standby)	-	30 + 3
Pump Flow, Each	MGD	3.0
Power, Each	HP	50
Third Stage Booster Pumps		
Flow, Total	MGD	44.3
Pumps, (Duty + Standby)	-	30 + 3
Pump Flow, Each	MGD	1.5
Power, Each	HP	20

Table 8-8 UV/AOP System Design Criteria

Parameter	Unit	Value
General		
Total Flow	MGD	150
Type of UV System	--	Low Pressure High Output
Minimum UV Transmittance	%	95%
UV Reactor		

Parameter	Unit	Value
Reactor Make	--	Trojan/Xylem-Wedeco
Reactor Model	--	UVFlex 200 / K143 12-40 600W
UV Dose	mJ/cm2	>1600 / 1,680
Flow Per Reactor Train	MGD	25 / 15
Number of Reactor Trains	--	7 (6+1) / 11 (10+1)
Ballasts per Reactor	--	192 / 240
Lamps per Reactor	--	384 / 480
Lamp Power	kWh/kgal	1 / 0.6
Reactor Power, Each	kWh/kgal	310
Total Connected Load	kWh/kgal	3,024/3,413
Advanced Oxidation		
Oxidant	--	NaOCl
Maximum Oxidant Dose	mg/L	5
Minimum Removal of 1,4-dioxane	log	0.5
Minimum Removal of NDMA	log	1.2
Minimum Removal of Cryptosporidium/Giardia/Virus	log	6

Table 8-9 Post-treatment Stabilization Design Criteria

Parameter	Unit	Value
General		
Target Finished Water pH Range	pH units	7.5 to 8.5
Target Finished Water LSI	-	0 to +0.5
Alkalinity	mg/L as CaCO3	>50
Stabilization Process	-	Lime Addition
Lime Stabilization		
Lime Dose	mg/L as $Ca(OH)_2$	30 to 50
Lime Clarifiers	-	3
Lime Clarifier Drive Power, each	HP	10
Lime System Solution Water Pumps	-	5 (4+1)
Lime Silos	--	8
Storage Time	days	14
Total Storage Volume	ton	350
Carbon Dioxide Stabilization		
CO2 dose	mg/L	4 to 5
Carbon Dioxide Storage, Total	ton	90
Number of Tanks	--	1.0
Storage Time	days	30.0
Carbon Dioxide Storage Tank, Each	ton	90

Table 8-10 Chemical System Design Criteria

Parameter	Unit	Value
Phosphoric Acid		
Injection Location/Purpose	--	Secondary Effluent (Biomass Uptake)
Strength	%	85%
Target Residual	mg-P/L	0.2
Target Dose	mg/L	
Total Storage Volume	gal	12,000.0
Storage Volume, Each Tank	gal	6,000
Number of Tanks	--	2
Carbon Source (Micro C 2000)		
Injection Location/Purpose	--	MBR Anoxic Tank (Denitrification)
Strength	%	100%
Target Dose - Anoxic Basin	mg/L COD	130.1
Total Storage Volume	gal	360,000.0
Storage Volume, Each Tank	gal	20,000
Number of Tanks	--	18
Sodium Hypochlorite		
Injection Locations/Purpose	--	RO feed (for biofouling control), UV-AOP feed (oxidant), Final Effluent (Disinfection)
Strength	%	12.5%
Target Dose	mg/L	1 to 5
Storage Time	days	30
Storage Unit	--	Tanks
Number of Units (ALL NaOCl)	--	16
Unit Volume	gal	15,400
Unit Volume	cu ft	2,059
Total Storage Volume	cu ft	33,000
Unit Diameter	ft	14
Unit Height	ft	16
Liquid Ammonium Sulfate		
Injection Location/Purpose	--	RO feed (for chloramine formation / biofouling control)
Strength	%	40%
Target Dose	mg/L	1 to 6
Storage Time	days	30
Storage Unit	--	Tanks
Number of Units	--	4
Unit Volume	gal	13,500
Unit Volume	cu ft	1,805
Unit Diameter	ft	14
Unit Height	ft	14

Parameter	Unit	Value
Sulfuric Acid		
Injection Location/Purpose	--	RO feed (for scaling control)
Strength	%	93%
Target Dose	mg/L	7 to 70
Storage Time	days	10
Storage Unit	--	Tanks
Number of Units	--	3
Unit Volume	gal	10,600
Unit Volume	cu ft	1,417
Unit Diameter	ft	14
Unit Height	ft	11
Antiscalant		
Injection Location/Purpose	--	RO feed (for scaling control)
Strength	%	100%
Target Dose	mg/L	2 to 4
Storage Time	--	30
Storage Unit	--	Tanks
Number of Units	--	1
Unit Volume	gal	13,500
Unit Volume	cu ft	1,805
Unit Diameter	ft	14
Unit Height	ft	14
Sodium Hypochlorite		
Strength	%	12.5%
Dose, Maintenance Clean	gal/tank/clean	50
MBR CIP		
Injection Location/Purpose	--	MBR Backwash (Membrane Cleaning)
Frequency, Maintenance Clean	frequency/tank	2 times per week
Dose, Recovery Clean	gal/tank/clean	972
Frequency, Recovery Clean	frequency/tank	2 times per year
Storage Time	days	47/10
MF CIP		
Injection Location/Purpose	--	MF Backwash (Membrane Cleaning)
Dose, Recovery Clean	gal/tank/clean	972
Frequency, Recovery Clean	frequency/tank	1 time per month
Storage Time	days	30
Total Storage		
Storage Unit	--	Tanks
Number of Units	--	5, FRP
Unit Volume	gal	6,000
Total Storage Volume	gal	30,000
Citric Acid		

Parameter	Unit	Value
Strength	%	50%
MBR CIP		
Injection Location/Purpose	--	MBR Backwash (Membrane Cleaning)
Dose, Maintenance Clean	gal/tank/clean	97
Frequency, Maintenance Clean	frequency/tank	1 time per week
Dose, Recovery Clean	gal/tank/clean	377
Frequency, Recovery Clean	frequency/tank	2 times per year
Storage Time	days	48/20
MF CIP		
Injection Location/Purpose	--	MF Backwash (Membrane Cleaning)
Dose, Recovery Clean	gal/tank/clean	377
Frequency, Recovery Clean	frequency/tank	1 time per month
Storage Time	days	30
Total Storage		
Storage Unit	--	Tanks
Number of Units	--	4
Unit Volume	gal	4,700
Total Storage Volume	gal	18,800
Citric Acid		
Injection Location/Purpose	--	RO feed (for CIP)
Strength	%	50%
Target Dose	%	0.1%
Storage Criteria	--	1 CIP event
Storage Unit	--	Silo
Number of Units	--	6
Unit Volume	gal	8,600
Sodium Hydroxide		
Injection Location/Purpose	--	RO feed (for CIP and neutralization)
Strength	%	25%
Target Dose	%	0.2%
Storage Criteria	--	1 CIP event
Storage Unit	--	Tanks
Number of Units	--	1
Unit Volume	gal	7,700
Unit Volume	cu ft	1,029
Unit Diameter	ft	14.0
Unit Height	ft	8.0
Sodium Tripolyphosphate		
Injection Locations	--	RO feed (for CIP)
Strength	%	85%
Target Dose	%	1.0%

Parameter	Unit	Value
Storage Criteria	--	1 CIP event
Storage Unit	--	Silo
Number of Units	--	4
Unit Volume	gal	6,100
Unit Volume	cu ft	816
Unit Diameter	ft	12.0
Unit Height	ft	8.6
Sodium Dodecilsulphonate		
Injection Locations	--	RO feed (for CIP)
Strength	%	80%
Target Dose	%	0.5%
Storage Criteria	--	1 CIP event
Storage Unit	--	Silo
Number of Units	--	4
Unit Volume	gal	3,600
Unit Volume	cu ft	481
Unit Diameter	ft	10.0
Unit Height	ft	5.0

Table 8-11 Odor Control System Design Criteria

Parameter	Unit	Value
General		
Service	--	Primary Effluent Pump Station, Fine Screen Facility, Bioreactors
Carbon Adsorbers		
Type	--	Dual-Bed Carbon
Capacity, each	cfm	40,000
Quantity	--	3 (2+1)
Fans		
Type	--	FRP Centrifugal
Capacity, each	--	40,000
Quantity	--	3 (2+1)

Table 8-12 Sidestream Centrate Treatment System Design Criteria

Parameter	Unit	Value
Number of Basins	--	4
Basin Sidewater Depth	ft	21
Basin Dimensions	ft x ft	86 x 73
Total Volume per Basin	MG	0.98
Total Volume	MG	3.9
Design SARR	NH_3-N/m^2/d	2.1
Design Fill	%	50%

Appendix B CONSTRUCTION COST SUMMARY

The escalated OPC from Task Order 20 (herein referred to as Stantec's estimate) is approximately $51.1M less than the Train 1C OPC in the JTAP report (herein referred to as Jacobs' estimate). Jacobs' estimate included additional items such as odor control, larger filtrate flow equalization basin, and MBR building instead of a canopy, a higher assumption for building unit costs, a different approach to yard piping costs, and other key differences that are explained in the following sections. Another reason for the cost difference is in the differing underlying assumptions for a certain process area. Stantec compared the line items in each OPC to identify the reason for cost differences. The major areas identified with significant capital cost differences were the biological treatment equipment and facilities, reverse osmosis equipment and facilities, and the buildings on site. The cost estimates were examined to understand the differences and to provide Metropolitan an updated OPC for budgeting purposes. The following principles were employed in the adjustment of costs when comparing the two OPCs:

- For line items with a difference of less than 10% or less than $1 million, the higher cost was selected to be conservative. For the others, a revised cost was developed with justification provided.
- If a greater level of detail or precision could be determined based on the information used for one of the estimates compared to the other, that estimate was used

Revised cost estimates and associated justifications are discussed in the following sections.

B.1 SITE IMPROVEMENTS

For the general site development costs, Jacobs used 3% of the construction cost for sitework and 1% of the construction cost for demolition. Stantec's estimate used QTOs from the full-scale AWT facility BIM model. Since the general site development cost from Stantec's estimate was developed with greater detail in the BIM model, it is expected to be more precise than a blanket percentage (4%) cost applied to the total construction cost and therefore, Stantec's estimate was used in the updated cost. Stantec included costs for the Joint Site improvements, but this was not included in Jacobs' scope. The Stantec cost consisted of relocation of 10" gas line, 72" sewer line, 10'x12' storm drain culvert, and other utilities. It is not included in this analysis and assumed to be outside of the program scope. A summary of the costs, differences, and updated cost is shown in **Table 8-13**.

Table 8-13: Site Improvements Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
General Site Development	$14,840,000	$18,010,000	$3,170,000	21%	$14,840,000
Improvements at the Joint Site	$10,510,000	n/a-	n/a	n/a	n/a

Subtotal for Site Improvements	$25,340,000	$24,010,000	($1,340,000)	-5%	$14,840,000

B.2 DRUM SCREEN & INFLUENT PUMP STATION

The overall OPCs for screening and the influent pump station were similar between the two estimates. Jacobs' estimate used a horizontal, rotating center-fed drum screen with 2-mm opening while Stantec's estimate used a perforated in-channel rotary drum screen. The influent pump station in Jacobs' estimate applied a 1.3 peak flow factor resulting in larger pumps and a higher cost. The updated cost (**Table 8-14**) uses Jacobs' estimate because it accounted for the drum screen and larger influent pump station.

Table 8-14: Drum Screen & Influent Pump Station Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Drum Screen and Influent Pump Station	$15,940,000	$18,750,000	$2,810,000	18%	$18,750,000
Subtotal for Drum Screen and Influent Pump Station	$15,940,000	$18,750,000	$2,810,000	18%	$18,750,000

B.3 BIOLOGICAL TREATMENT

Stantec's estimate for the MBR included the MBR membrane tanks, blower structure, and carbon addition facilities. Jacobs' estimate included enclosing the MBR equipment within a building, while Stantec assumed the equipment is housed under a canopy. An odor control system (concrete covers and carbon vessels) was included in Jacobs' estimate. Due to the updated quotes Jacobs received from vendors as well as the inclusion of a building and odor control, the updated cost (**Table 8-15**) uses the costs from Jacobs' estimate. The cost estimates from Stantec and Jacobs for the carbon addition facility were very close in terms of cost and associated assumptions. Stantec's estimate used 14 tanks with 18,000-gallon volume each, while Jacobs' estimate used 12 tanks with 20,000-gallon volume. Since the difference in cost was less than $1 million, the greater cost was used in the updated cost.

Table 8-15: Biological Treatment Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Aeration, Anoxic, and Membrane Tanks for MBR & Blowers Structure	$164,820,000	$218,970,000	$54,160,000	33%	$218,970,000
MBR Equipment Building	n/a	$35,950,000	n/a	n/a	$35,950,000
Odor Control for Bioreactors	n/a	$4,690,000	n/a	n/a	$4,690,000

MicroC 2000 Storage & Dosing [1]	$2,700,000	$3,640,000	$940,000	35%	$3,640,000
Subtotal for Biological Treatment	$167,510,000	$263,260,000	$95,750,000	57%	$263,260,000

B.4 REVERSE OSMOSIS

The RO process area includes the RO feed tank, RO cartridge filters, RO facility, and RO flush tank. This process train utilizes single-pass RO. Stantec's estimate included a building for RO, while Jacobs' used a canopy. Jacobs' estimate also includes a filtrate equalization tank (10 MG), RO pretreatment and cleaning chemicals, and applies a safety factor on the high-pressure pump size. Jacobs' estimate also used fewer number of larger pieces of equipment, reflecting updated vendor configurations. Due to the updated RO equipment sizes and more conservative equalization tank volume used in Jacobs' estimates, the updated cost (**Table 8-16**) used Jacobs' estimates.

Table 8-16: Reverse Osmosis Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
RO Feed Tank	$4,780,000	$13,030,000	$8,250,000	173%	$13,030,000
RO Cartridge Filters	$17,370,000	$12,050,000	($5,330,000)	-31%	$12,050,000
RO Facility	$136,470,000	$165,580,000	$29,110,000	21%	$165,580,000
RO Flush Tank	$4,090,000	n/a	n/a	n/a	n/a
Subtotal for RO	$162,720,000	$190,660,000	$27,940,000	17%	$190,660,000

B.5 ULTRAVIOLET ADVANCED OXIDATION PROCESS

Stantec and Jacobs estimates were within 10% of each other. The vendor equipment utilized was similar and includes a pre-engineered building. The higher estimate was used in the updated cost (**Table 8-17**) to be conservative.

Table 8-17: UV Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
UV AOP Facility	$29,120,000	$30,870,000	$1,750,000	6%	$30,870,000
Subtotal for UV AOP Facility	$29,120,000	$30,870,000	$1,750,000	6%	$30,870,000

B.6 CHEMICALS

Jacobs' estimate uses a canopy in the chemical storage line instead of a full chemical facility. In terms of chemical storage, Jacobs used lower chemical dosages but longer storage durations;

the end result was a lower estimate than Stantec's. Jacobs' chemical storage & dosing cost was used because it was based on updated modeling. Since Jacobs' chemical storage & dosing cost was used, the chemical facility was not included (**Table 8-18**).

Table 8-18: Carbon Addition and Chemicals Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Chemical Facility	$3,890,000	n/a	n/a	n/a	n/a
Chemical Storage & Dosing	$10,510,000	$7,430,000	($3,080,000)	-29%	$7,430,000
Subtotal for Chemicals	$17,100,000	$7,4300,000	($6,969,000)	-48%	$7,430,000

B.7 LIME SYSTEM

The lime system includes lime storage, pumping, and clarifiers. One key difference in assumptions between Stantec's and Jacobs' estimates was the storage volume provided for chemicals and lime. Volumes were based on dosages and the duration between chemical deliveries. For the lime system, Stantec's estimate used a 7-day storage while Jacobs' estimate used a 14-day storage; both estimates use the same lime dose. Stantec used three transfer pumps while Jacobs used five transfer pumps. The updated cost (**Table 8-19**) was based on 14-day storage and five transfer pumps, coupled with the higher lime system clarifier cost.

Table 8-19: Lime System Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Lime System	$4,760,000	$12,020,000	$7,260,000	153%	$12,020,000
Lime System Clarifiers	$3,370,000	$1,680,000	($1,700,000)	-50%	$3,370,000
Subtotal for Lime System	$8,130,000	$13,690,000	$5,560,000	68%	$15,390,000

B.8 SIDESTREAM CENTRATE TREATMENT

Sidestream centrate treatment cost estimates appeared to be based on the same vendor for Annamox treatment with other applicable equipment and facilities included. Stantec's estimate applied an escalation factor. Hazen's estimate is based on more recent vendor information and is therefore used in the updated cost (**Table 8-20**).

Table 8-20: Sidestream Centrate Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate[1]	Difference ($)	Difference (%)	Updated Cost
Sidestream Annamox	$90,320,000	$68,800,000	($21,520,000)	-24%	$68,800,000
Subtotal for Sidestream Annamox	$90,320,000	$68,800,000	($21,520,000)	-24%	$68,800,000

[1]This cost was developed by Hazen

B.9 BUILDINGS

The buildings anticipated at the future facility are subject to significant additional refinement. Both estimates utilized similar building footprints, but the probable unit costs assumed significant differences in building types. Stantec's estimate applied a unit cost for a basic warehouse type building, whereas Jacobs' estimate applied a unit cost for a building with substantial architectural features. Jacobs' estimate did not include an electrical building. The design assumptions for the buildings are shown in **Table 8-21**.

Table 8-21: Footprint and Cost Assumptions for the Buildings

	Stantec's Estimate		Jacobs' Estimate		Updated Estimate	
	Footprint (sq ft)	Unit Cost	Footprint (sq ft)	Unit Cost	Footprint (sq ft)	Unit Cost
Maintenance Building	225 x 85	$93/sf	230 x 88	$1,005/sf	230 x 88	$400/sf
Electrical Building	233 x 72	$115/sf	n/a	n/a	n/a	n/a
Administrative Building	225 x 85	$373/sf	200 x 75	$1,017/sf	225 x 85	$1,000/sf

A summary of the OPCs for each building is provided in **Table 8-22**. To reconcile the building costs, the larger footprint for each is used along with unit costs of $400/sf for the maintenance building (higher than a basic warehouse) and $1,000/sf for the administrative building to account for a laboratory and other features. The electrical building cost is not included since Jacobs' costs for process areas are used and those included electrical buildings per information provided by Jacobs.

Table 8-22: Buildings Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Maintenance Building	$1,970,000	$20,340,000	$18,380,000	935%	$8,100,000
Electrical Building	$1,940,000	n/a	n/a	n/a	n/a
Administrative Building	$7,730,000	$15,260,000	$7,530,000	97%	$19,130,000
Subtotal for Buildings	$11,640,000	$39,800,000	$28,160,000	242%	$33,930,000

B.10 ELECTRICAL AND I&C

The electrical and I&C items included the onsite electrical substation, the electrical substation for SCE, emergency generators, slabs for a generator building, and overall electrical and I&C costs. The difference in the site electrical substation and the electrical substation for SCE was the escalation factor. Jacobs' estimate for substations was the same as Stantec's 2018 estimate whereas Stantec's estimate included escalation to 2021 dollars. Stantec's estimate for emergency generators was based on five generators, each costing $250,000. Jacobs' estimate was not specific to generator sizing, it used a factor applied to a demand with a conservative factor of safety. Stantec's estimate was used in the updated cost due to greater degree of precision. The significant difference between Stantec's and Jacobs estimated "Electrical & I&C" line item resulted from a difference in approach to cost allocation. Stantec's Electrical and I&C line item included all anticipated electrical & I&C costs at the AWPF. Jacobs' estimate incorporated these electrical & I&C costs for each process into the process area line items not the Electrical and I&C line item. Since Jacobs' estimates were used in the process area updated costs (**Table 8-23**), they were also used for the Electrical & I&C line item to avoid double counting of those costs. The slabs for the generator building were included in the updated cost.

Table 8-23: Electrical and I&C Costs Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Electrical Substation	$2,960,000	$2,460,000	($500,000)	-17%	$2,960,000
Electrical Substation for SCE	$26,570,000	$22,360,000	($4,210,000)	-16%	$26,570,000
Emergency Generator	$1,760,000	$10,940,000	$9,180,000	521%	$10,940,000
Generator Building (slabs only)	$200,000	n/a	n/a	n/a	$200,000
Electrical & I&C	$104,940,000	$34,110,000	($70,820,000)	-67%	$34,110,000
Subtotal for Electrical & I&C	$136,420,000	$69,870,000	($66,550,000)	-49%	$74,780,000

B.11 YARD PIPING

Stantec's and Jacobs' approach to estimating the yard piping costs were substantially different. Stantec's BIM model included the yard piping and QTOs were used to develop the OPC. Jacobs applied a blanket percentage at 10% of the construction cost to calculate the yard piping costs. This cost includes drainage and is a parametric estimate based on a recent facility designed by Jacobs. The updated cost (**Table 8-24**) uses Stantec's estimate with an update on the mechanical installation crew (increase from 31 to 400 days). At $4,500/day with the escalation factor applied, the increase is approximately $2.2 million.

Table 8-24: Yard Piping Capital Cost Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Yard Piping	$7,300,000	$60,020,000	$52,720,000	722%	$9,500,000
Subtotal for Yard Piping	$7,300,000	$60,020,000	$52,720,000	722%	$9,500,000

B.12 ESTIMATING ALLOWANCES

Stantec's estimate included an allowance for startup, commissioning, and owner training as well as for estimating accuracy and unlisted items. This line item is not a contingency; it covers known items that may not be estimated accurately and small items that may be left out and therefore, this allowance is included in the updated cost (**Table 8-25**). Examples of unlisted items include details, finishes, and amenities.

Table 8-25: Estimating Allowances Comparison

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Startup/Commissioning/Owner Training	$460,000	n/a	n/a	n/a	$460,000
Estimating Accuracy, Unlisted Items Allowance	$66,790,000	n/a	n/a	n/a	$66,790,000
Subtotal for Estimating Allowances	$67,250,000	n/a	n/a	n/a	$67,250,000

Appendix C O&M COST SUMMARY

The escalated and updated annual operation and maintenance (O&M) OPC from the 2018 studies by Stantec is approximately $22M per year more than the Train 1C O&M OPC in the JTAP report. This amounts to an approximate difference of ~16% as compared to the total annual estimated O&M cost of $136M per year, excluding costs for existing JWPCP processes. Stantec compared the line items in each OPC to identify and assess significant cost differences. The major areas identified with substantive O&M cost differences are the influent and biological treatment equipment, biological process chemicals, chloramine addition, treated water chlorination, buildings on site, and labor. Additionally, labor was reevaluated and updated based on planning discussions with Metropolitan. The following principles were used when deciding which cost between the two OPCs should be recommended:

- For line items with a difference less than 10% or less than $1 million annual O&M cost, the higher cost was selected to be conservative.
- For line items with a difference greater than 10% or more than $1 million annual O&M cost, a revised recommended cost was developed with an explanation.
- If a greater level of detail or precision could be determined based on the information used for one of the estimates compared to the other, that estimate was used

Cost differences and reconciliation are discussed in the sections that follow.

C.1 INFLUENT AND MBR

Stantec's estimate for influent and MBR equipment consisted of costs for power, maintenance, and replacement of consumables (membranes). The power cost was based on equipment capacity instead of an operational average for the blowers and pumps and therefore is more conservative. The Jacobs' estimate for influent and MBR equipment did not detail quantities between power, maintenance, and replacement of consumables but likely was lower for power costs, given similar basis for maintenance and consumables. Jacobs' estimate was used for the updated cost for the influent and MBR equipment since Stantec's estimate overestimated power consumption.

Biological process chemical costs included carbon addition for Stantec's whereas carbon and phosphoric acid addition for Jacobs'. Stantec's estimate was used for carbon as it was based on a higher dose (more conservative). The cost of phosphorus acid was based upon the demand experienced at the APC testing program.

The O&M costs for sidestream centrate treatment differed by 36% but the difference was less than $1M/year. The costs in Jacobs' estimate were prepared by Hazen and were recommended since they were more recent and was prepared after research done by LACSD on sidestream centrate treatment.

The following additional costs were included in Jacobs' estimate:

- Odor control: odor control is required at the future facility and is included in the updated cost.
- Equalization: This is a minor cost based on the maintenance of valves and gates associated with the equalization tank in Jacobs' process design for this train; this cost was included in the updated cost.

A summary of costs, differences, and updated cost is shown in **Table 8-26**.

Table 8-26: Influent and MBR O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Influent and MBR Facilities	$20,150,000	$14,380,000	($5,770,000)	-29%	$14,380,000
Biological Process Chemicals	$31,780,000	$28,650,000	($3,130,000)	-10%	$32,580,000
Sidestream Centrate	$1,870,000	$2,540,000	$670,000	36%	$2,540,000
Odor Control	n/a	$330,000	$330,000	n/a	$330,000
Equalization	n/a	$8,000	$8,000	n/a	$8,000
Subtotal for Influent & MBR	$53,790,000	$45,910,000	($7,880,000)	-15%	$49,840,000

C.2 REVERSE OSMOSIS

Stantec's estimate for chloramine addition was based on a conservative chloramine dose of approximately 4 mg/L as chlorine. Jacobs' estimate was slightly lower and was recommended since testing at the APC has typically required a lower dose than in Stantec's estimate. The RO equipment costs including power, chemicals (antiscalant and sulfuric acid), maintenance, and replacement parts were similar and within $1 million total cost difference. Therefore, Stantec's cost was used in the updated cost (**Table 8-27**).

Table 8-27: RO O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Chloramine Addition	$6,240,000	$4,460,000	($1,780,000)	-29%	$4,460,000
RO System	$39,350,000	$38,390,000	($960,000)	-2%	$39,350,000
Subtotal for RO	$45,590,000	$42,850,000	($2,740,000)	-6%	$43,810,000

C.3 ULTRAVIOLET ADVANCED OXIDATION PROCESS

Stantec's and Jacobs' estimates were based on similar assumptions for equipment, chemical dose and unit cost, and replacement of consumables. Jacobs' used the latest reactor types and considered multiple products (Wedeco K, Trojan Flex) that have fewer lamps and other components, while Stantec used the Wedeco K reactor since the Trojan Flex was yet not available at the time. The costs were within 10% and $1 million total difference. Stantec's cost was used as the updated cost (**Table 8-28**) as it was slightly more conservative.

Table 8-28: UV AOP O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
UV AOP System	$6,260,000	$5,770,000	($490,000)	-8%	$6,260,000
Subtotal for UVAOP	$6,260,000	$5,770,000	($490,000)	-8%	$6,260,000

C.4 STABILIZATION

Stantec's and Jacobs' estimates were based on similar assumptions for equipment, chemical dose and unit cost for lime and carbon dioxide addition for water quality stabilization. The costs were within $1 million of each other. Stantec's cost was used as the updated cost to be conservative. An additional cost was included by Jacobs' and added to the updated cost (**Table 8-29**), for hauling of residual sludge from lime clarifiers, a cost not included in the Stantec estimate.

Table 8-29: Stabilization (Lime and Carbon Dioxide) O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Stabilization	$6,160,000	$5,450,000	($710,000)	-12%	$6,160,000
AWT residuals handling	n/a	$34,000	$34,000	n/a	$34,000
Subtotal for Stabilization	$6,160,000	$5,480,000	($680,000)	-11%	$6,200,000

C.5 EFFLUENT CHLORINATION

Stantec's estimate in 2016 included chemical costs for additional chlorination downstream of UV AOP. Stantec's estimate in 2018 and Jacobs' estimates did not include effluent chlorination. There will be some free chlorine and chloramine residual downstream of UV AOP since it uses chlorine as an oxidant. However, it is conservative to assume some additional chlorine dosing or formation of chloramines prior to product water conveyance. To be conservative, it is recommended effluent chlorination be included in the updated cost (**Table 8-30**) and that any residual chlorine from the UV AOP process is assumed to be zero.

Table 8-30: Effluent Chlorination O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Effluent Chlorination	$3,260,000	n/a	($3,260,000)	n/a	$3,120,000
Subtotal for Effluent Chlorination	$3,260,000	n/a	($3,260,000)	n/a	$3,120,000

C.6 BALANCE OF CHEMICALS, BUILDINGS, ELECTRICAL

The balance of AWT plant O&M costs includes the following components and corresponding recommendations:

- **Chemical systems power & maintenance**: Stantec's estimate included a separate chemical pump power cost and an equipment maintenance cost. Jacobs' estimate included this within each process line item. Stantec's cost is included in the updated cost since many of Stantec's process line-item costs are used.
- **Administration and maintenance buildings**: Stantec's estimate was based on HVAC power costs on similar AWT process building design estimates. Jacobs' estimate used a percentage applied to the building costs. Stantec's estimate was included in the updated cost since it is based on similar facilities.
- **Electrical maintenance**: Stantec's estimate includes only general electrical maintenance. Jacobs' estimate was based on an emergency generator. Jacobs' estimate was included for the updated cost to account for emergency generator cost and because it is more conservative.

A summary of costs, differences, and updated cost is shown in **Table 8-31**.

Table 8-31: Balance of Chemicals, Buildings, Electrical O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Chemical Systems Power & Maintenance	$240,000	n/a	($240,000)	n/a	$240,000

Administration and Maintenance Buildings	$2,470,000	$93,000	($2,380,000)	-96%	$2,470,000
Electrical Maintenance	$50,000	$440,000	$400,000	869%	$440,000
Subtotal for Balance of Chemicals, Buildings, Electrical	$2,750,000	$540,000	($2,210,000)	-80%	$3,150,000

C.7 MAJOR EQUIPMENT REPLACEMENT COST

Major equipment replacement cost was not included in either estimates for equipment such as influent screens, blowers, and pumps. To account for the eventual replacement of this equipment over time, an average annual cost of 5% of equipment was included in the updated cost (**Table 8-32**) estimate; this assumes that equipment will be replaced every 20 years on an average. This cost excludes major process equipment replacements, such MBR and RO equipment.

Table 8-32: Major Equipment Replacement O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Major Equipment Replacement	Not included	Not included	n/a	n/a	$4,860,000
Subtotal Major Equipment Replacement	n/a	n/a	n/a	n/a	$4,860,000

C.8 LABOR

Stantec's estimate for labor was based on costs for the AWT only (i.e. excluded costs for JWPCP labor) and 52 full-time equivalents (FTEs), $150 per hour, and 2,080 hours per FTE per year, with 15% contingency. Jacobs' estimate was based on staffing estimate of 52 FTEs, $150 per hour and 1,800 hours per FTE per year without a contingency. An updated estimate for the updated cost was developed using the information from Orange County Water District's (OCWD's) Groundwater Replenishment System (GWRS) with additional factors considered to be more accurate. OCWD's GWRS staff (64 FTEs) was scaled to 79 FTEs to account for additional plant size and complexity for PWSC (100 mgd for GWRS vs 150 mgd for PWSC), plus an additional 40 FTEs for laboratory staffing, assuming $150 per hour, 2,080 hours per FTE per year without contingency. This results in a total of 119 FTEs for 150 mgd IPR facility. A summary of costs, differences, and updated cost is shown in **Table 8-33**.

Table 8-33: Labor O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Labor	$18,660,000	$14,040,000	($4,620,000)	-25%	$37,128,000
Subtotal Labor	$18,660,000	$14,040,000	($4,620,000)	-25%	$37,128,000

C.9 JWPCP SECONDARY TREATMENT AND BIOSOLIDS PROCESSING

The cost of O&M associated with JWPCP secondary treatment and biosolids was included in both Stantec's and Jacobs' estimates to account for differences between AWT process trains that impact the treatment at JWPCP. For the updated estimate, the JWPCP costs were revised to reflect only the differences between the tMBR train and current JWPCP operations. The components and recommendations are as follows:

- **High purity oxygen activated sludge (HPOAS) treatment**: Stantec's estimate in 2018 was based on approximate percentages of total treatment cost for secondary treatment at JWPCP. Jacobs' estimate was based on greater detail and more recent cost data. For the updated estimate, neither is included since current HPAOS treatment is not impacted by the tMBR AWT train. If sMBR was to be implemented instead, a portion of the HPOAS flow will be treated with sMBR and therefore, a portion of the current HPOAS O&M cost should be credited.

- **Biosolids disposal**: Stantec's estimate in 2018 was based on approximate percentages of total treatment cost for secondary treatment at JWPCP and was escalated to 2021 dollars. Jacobs' estimate was based on more recent cost data although both estimates are similar. Both estimates are shown in **Table 8-34** as tMBR biosolids only (excludes biosolids from HPOAS). Jacobs' estimate for the increase in biosolids disposal from the tMBR process is included in the updated cost.

- **Dissolved air flotation treatment (DAFT) and dewatering energy costs**: Stantec's estimate in 2018 was based on approximate percentages of total treatment cost for secondary treatment at JWPCP. Jacobs' estimate was based on greater detail and more recent cost data. For the updated estimate, neither is included since current treatment is not substantially impacted by the tMBR.

- **Biogas credit**: Jacobs' estimate included a biogas energy credit based on biosolids production and cogeneration of methane produced from anaerobic digesters. The basis for this credit includes biosolids production from existing HPOAS processes to compare with other trains such as sMBR. For the updated estimate, Jacobs' estimate was used for the biogas credit for solids from tMBR process only.

A summary of costs, differences, and updated cost is shown in **Table 8-34**.

Table 8-34: JWPCP Secondary Treatment and Biosolids Processing O&M Cost Summary

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
HPOAS Treatment	$17,110,000	$11,680,000	($5,430,000)	-32%	$0
Biosolids Disposal (tMBR solids only)	$790,000	$1,000,000	$200,000	25%	$1,000,000
DAFT Energy Cost	n/a	$240,000	$240,000	n/a	$0

	Stantec's Estimate	Jacobs' Estimate	Difference ($)	Difference (%)	Updated Cost
Dewatering Energy Cost	n/a	$350,000	$350,000	n/a	$0
Subtotal for JWPCP	$17,900,000	$13,270,000	($4,840,000)	-27%	$1,000,000
Biogas credit	n/a	$8,440,000	n/a	n/a	$1,240,000
Subtotal for JWPCP with biogas credit	n/a	$4,820,000	n/a	n/a	($250,000)

Stantec

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%		

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

BLACK & VEATCH

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

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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

APPENDIX C – CONVEYANCE SYSTEM BACK-UP COST INFORMATION

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**

APPENDIX C – CONVEYANCE SYSTEM BACK-UP COST INFORMATION

Cost Details for 7' Diameter Pipe Segments and Facilities

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B&V Project 410259

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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

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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Metropolitan Water District of Southern California
Pure Water Conveyance Feasibility Study
Opinion of Probable Construction Cost
June 2022

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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Opinion of Probable Construction Cost
June 2022

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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Metropolitan Water District of Southern California
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Pure Water Feasibility Study

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

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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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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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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ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

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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ENGINEER'S OPINION OF
PROBABLE CONSTRUCTION COST

June, 2022

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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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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Metropolitan Water District of Southern California
Pure Water Conveyance Feasibility Study
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 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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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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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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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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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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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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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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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

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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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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

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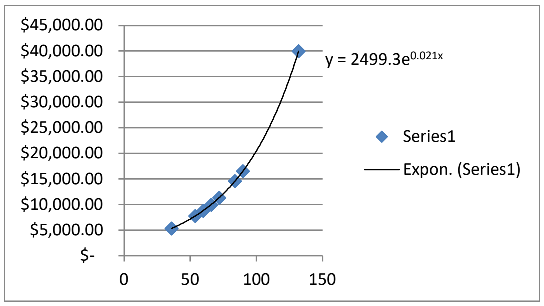
Los Angeles, California
Metropolitan Water District of Southern California
Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Pure Water Supply System
Opinion of Probable Construction Cost

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.

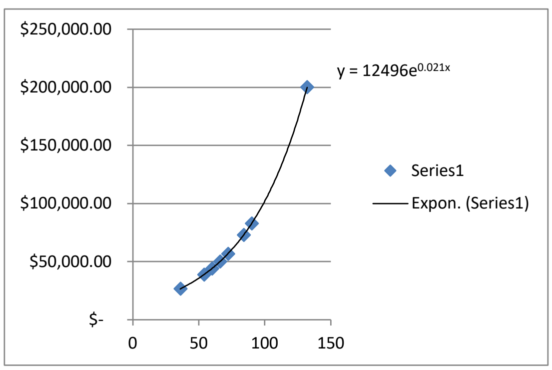
Determine anode bed costs for all pipe diameters outside of SCE Easement

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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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 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

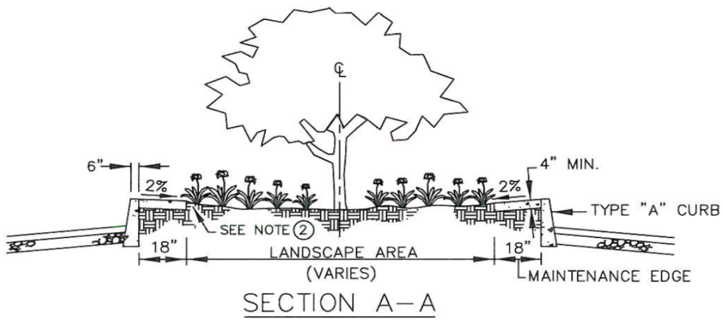
Assumptions

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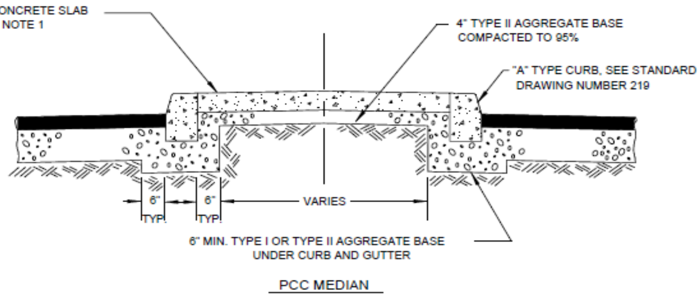
Los Angeles, California
Metropolitan Water District of Southern California
Feasibility Level Engineering Analysis of Conveyance/Distribution System for Potential Regional Recycled Water Supply System
Opinion of Probable Construction Cost

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

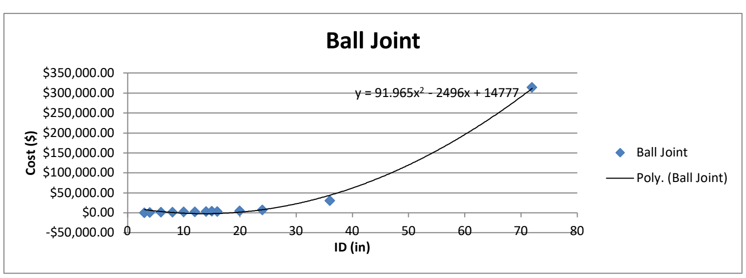
Item Description	Quantity	Unit	Unit Cost	Unit Cost	Total Cost
Seismic Hazards/Fault Zones					
0.75" Pipe	300	LF	$67	$76	$22,726
Ball Joint	2	EA	$159,018	$178,741	$357,482
Subtotal					$380,208

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:

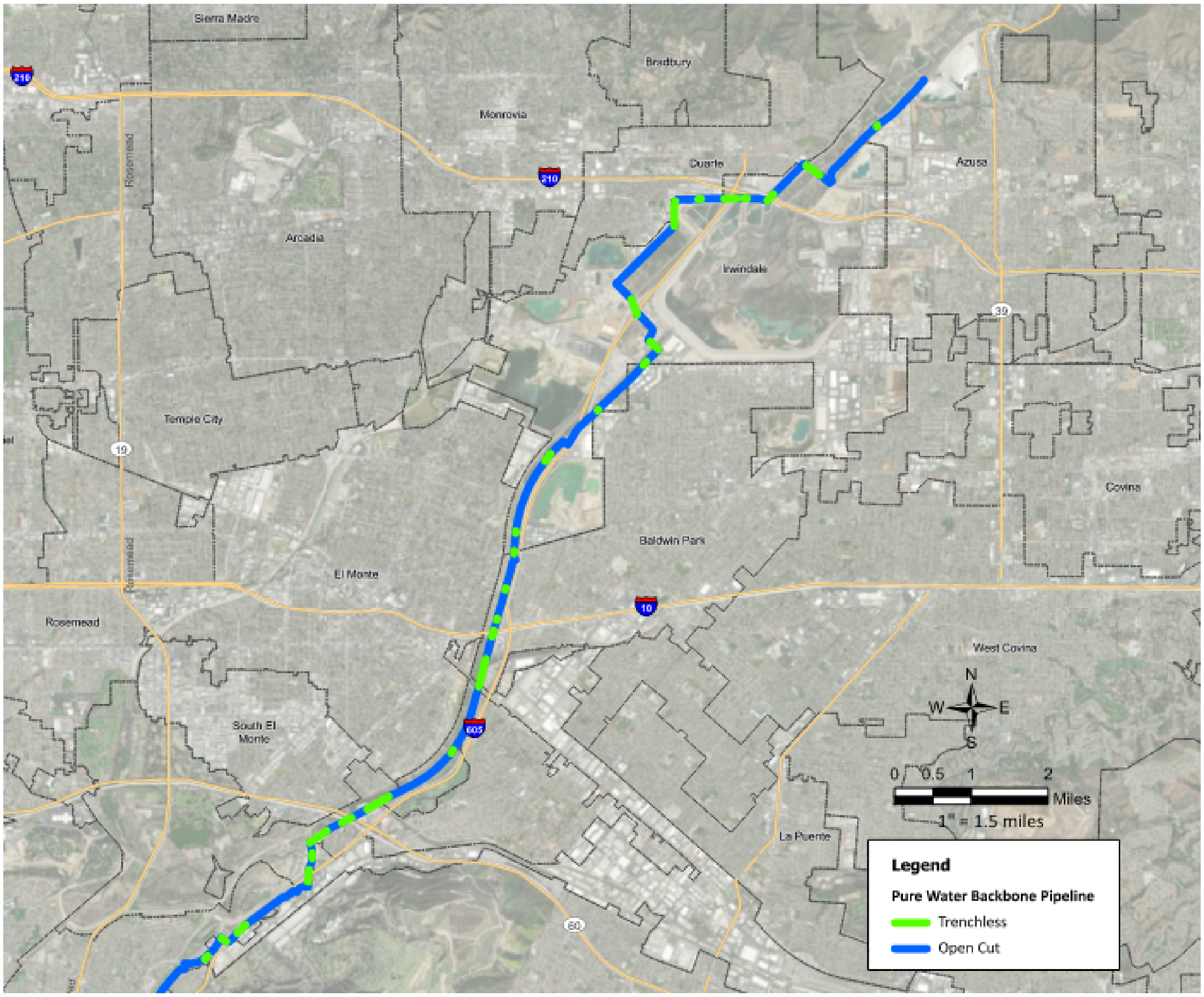


Figure 1-1. Map of Construction Methods for 84-inch Backbone Pipeline between Whittier Narrows and San Gabriel Canyon Spreading Grounds

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:

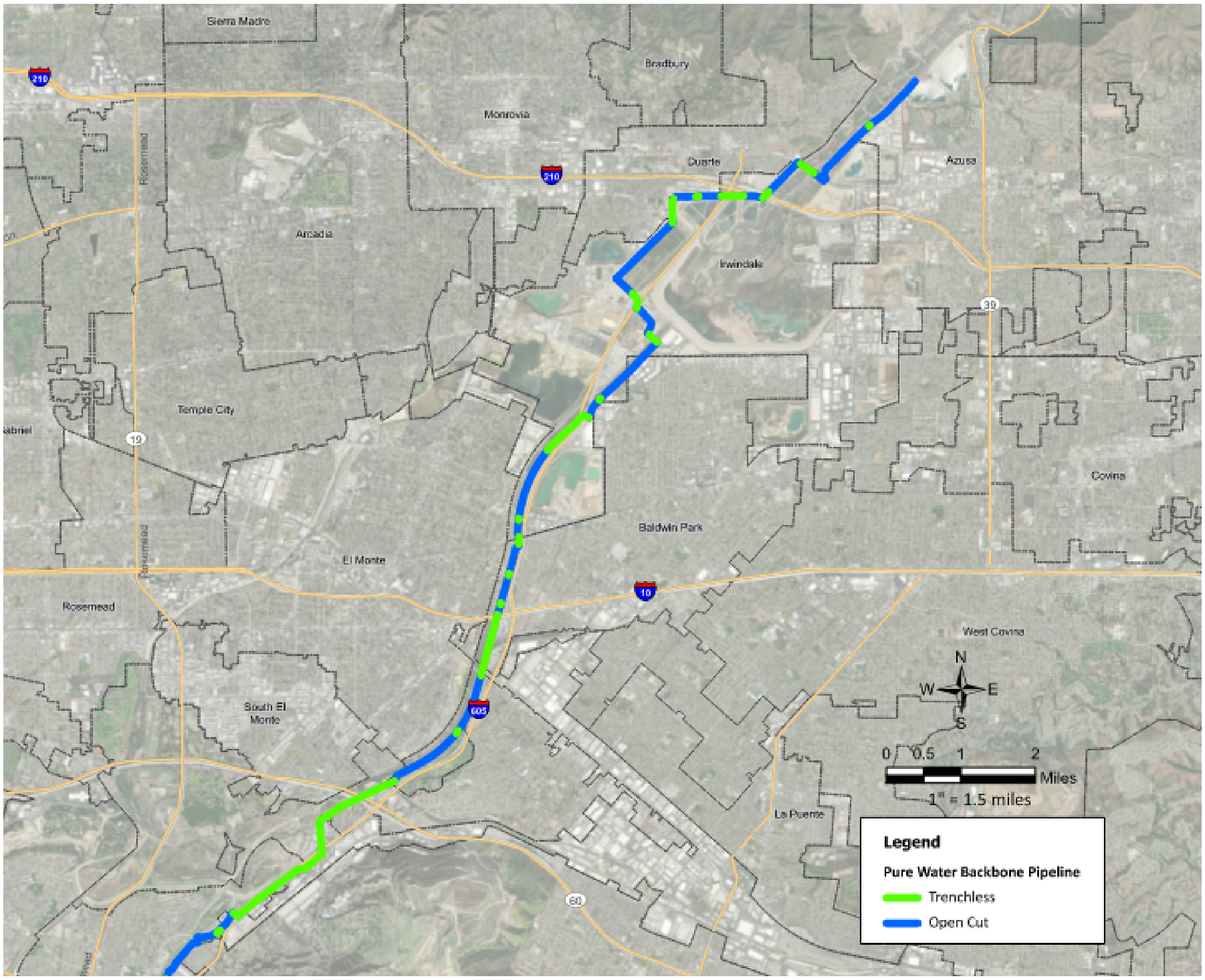


Figure 1-2. Map of Construction Methods for 108-inch Backbone Pipeline between Whittier Narrows and San Gabriel Canyon Spreading Grounds

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 Excavation 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 Excavation 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 Excavation 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 %	August 2018 ENR CCI for LA:	12000.25	Escalation from 2018	
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
	August 2018 ENR CCI for LA:	12000.3	
0.25912	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
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 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 %			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.

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)

Item	Quantity	Unit		Unit Cost		Amount	Notes
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
0.25912	August 2018 ENR CCI for LA:	12000.25	
	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

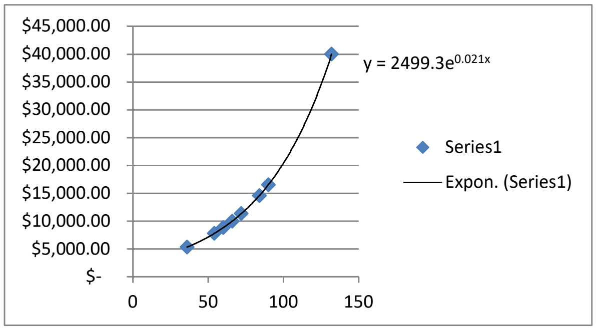
Cathodic Protection Unit Cost Data

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.

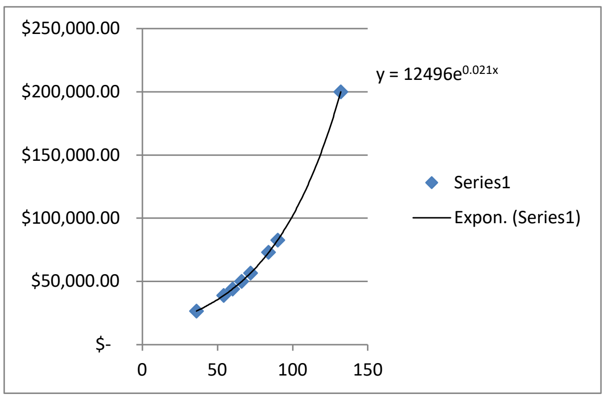
Determine anode bed costs for all pipe diameters outside of SCE Easement

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

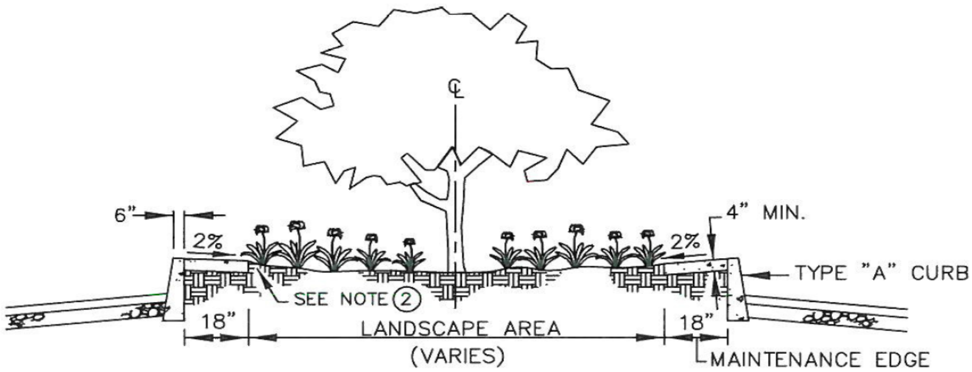
1 The cost for crossing a Major Intersection would be comparable to a trenchless installation regardless of whether it was installed with open trench methods or trenchless construction methods due to the slower construction rate.
2 Jacking length is 200 feet.
3 Costs are all inclusive and include:
- 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)



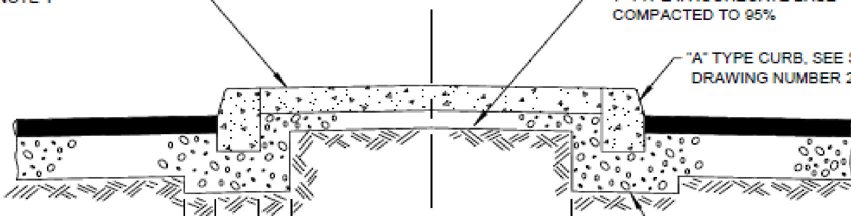
SECTION A–A

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

	Qty	Unit		Unit Cost (2023)		Cost	
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

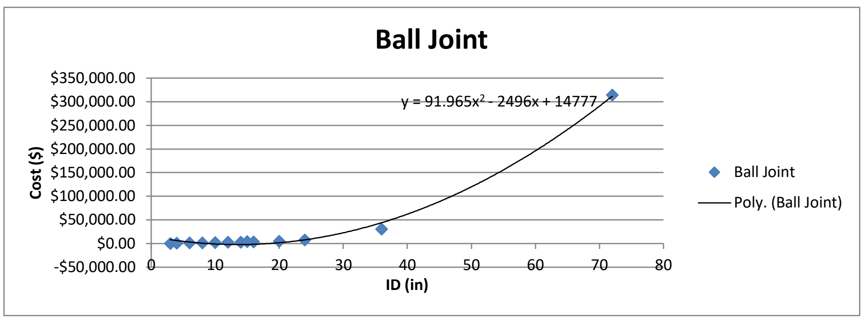
Calculate Cost per Linear Foot for 84-inch Pipe

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 %		
	August 2018 ENR CCI for LA:	12000.25
0.25912	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 D – LADWP OPERATION NEXT UPSIZING BACK-UP COST INFORMATION

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:

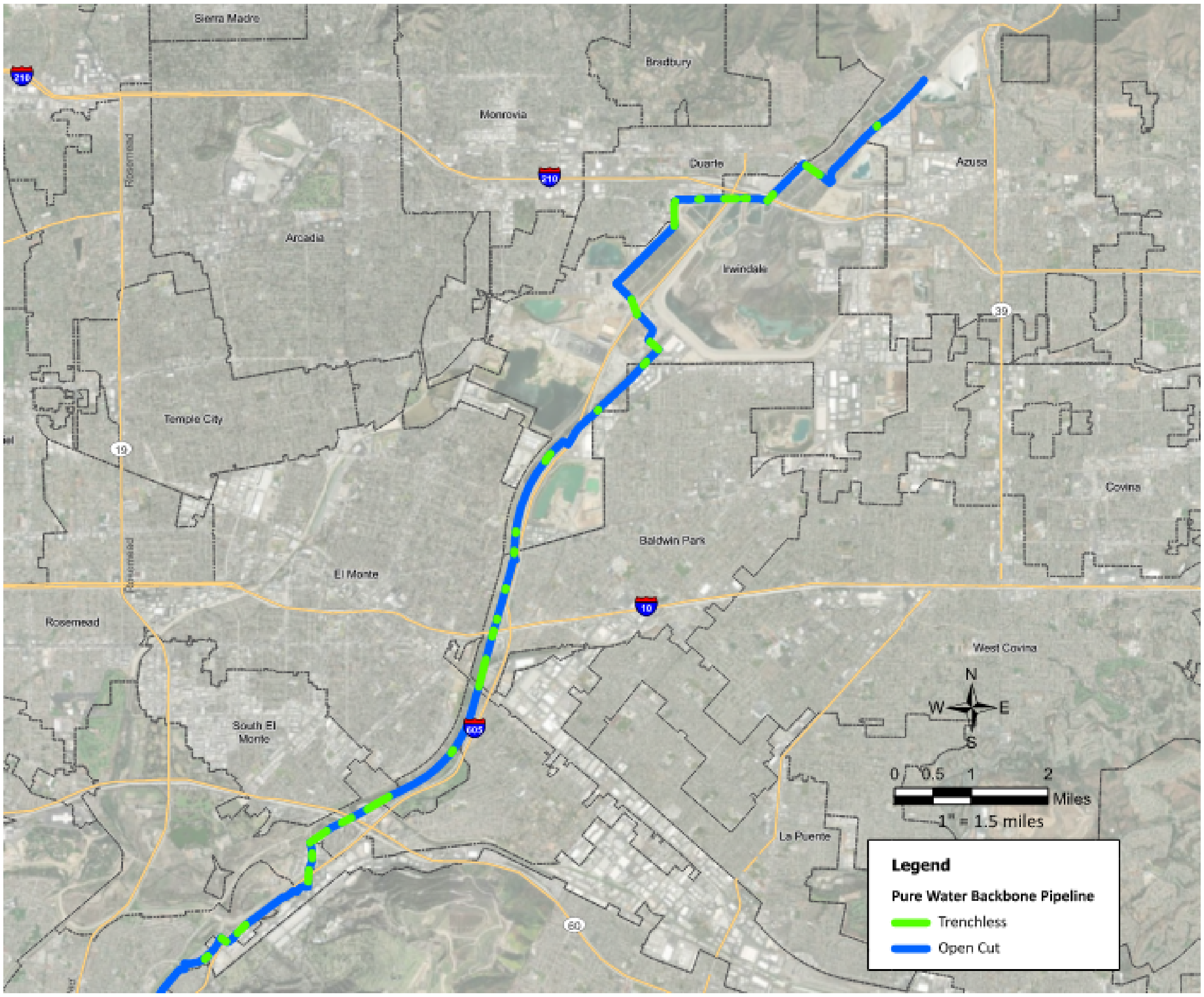


Figure 1-1. Map of Construction Methods for 84-inch Backbone Pipeline between Whittier Narrows and San Gabriel Canyon Spreading Grounds

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:

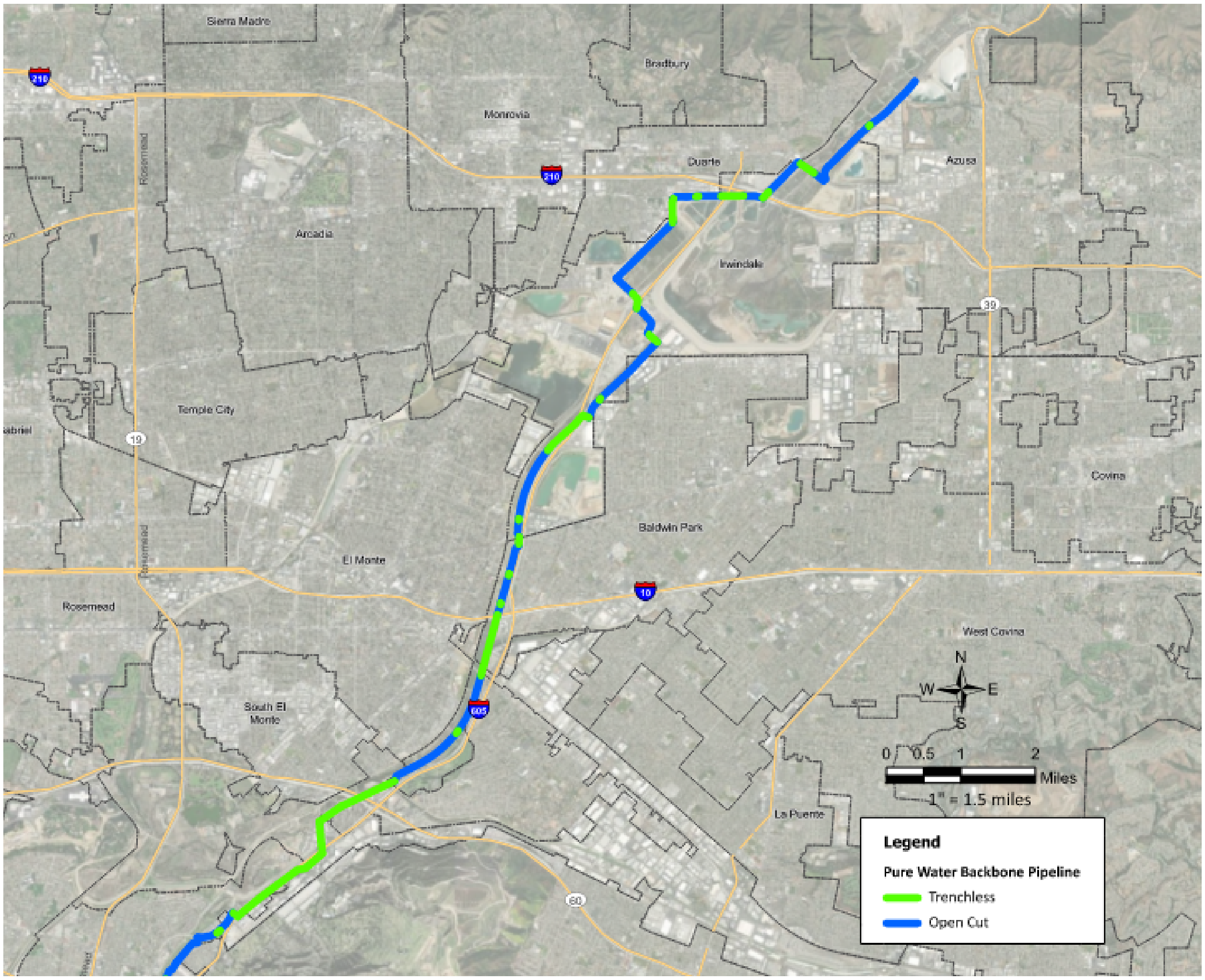


Figure 1-2. Map of Construction Methods for 108-inch Backbone Pipeline between Whittier Narrows and San Gabriel Canyon Spreading Grounds

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
	August 2018 ENR CCI for LA:	12000.3	
0.25912	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
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 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
0.25912	August 2018 ENR CCI for LA:	12000.3	
	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 %	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.

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
0.25912	August 2018 ENR CCI for LA:	12000.25	
	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**

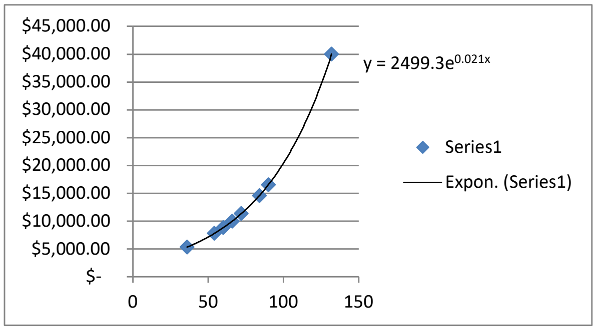
Details on "Cost Adders" Unit Cost

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.

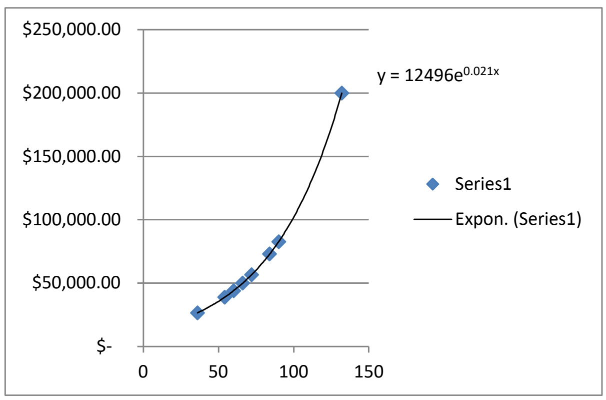
Determine anode bed costs for all pipe diameters outside of SCE Easement

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

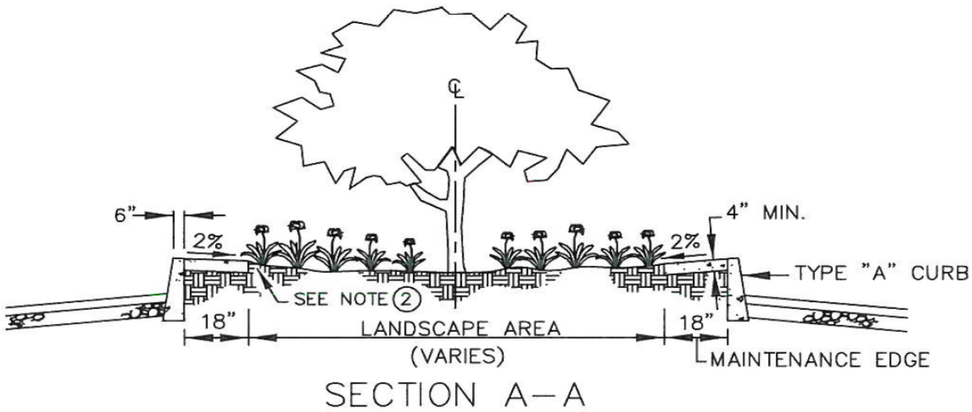
5 Receiving Pits are assumed to be 20 feet long and 16 feet wide

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)



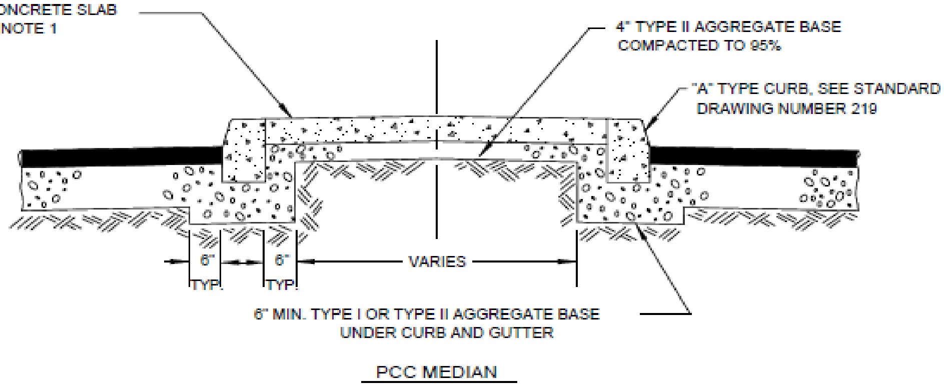
Assumptions

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 %		
0.25912	August 2018 ENR CCI for LA:	12000.25
	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

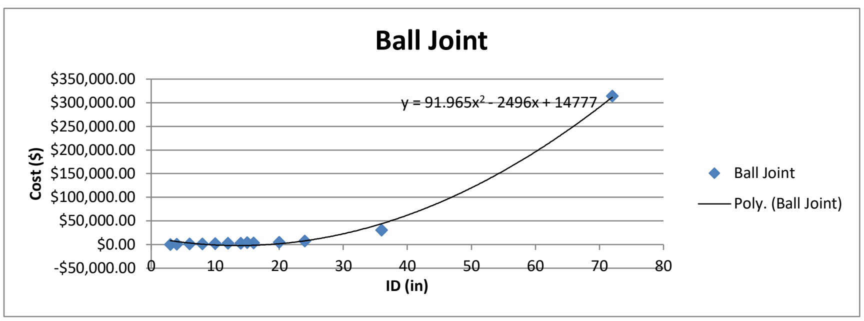
Calculate Cost per Linear Foot for 84-inch Pipe

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 %		
	August 2018 ENR CCI for LA:	12000.25
0.25912	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

Subcommittee on Pure Water Southern California and Regional Conveyance

Pure Water Southern California Program Quarterly Update and 2023 Cost Estimate Details

Item 3a

January 23, 2024

Item 3a
PWSC Quarterly Update

Subject

Pure Water Southern California Quarterly Program Update

Purpose

To provide an update on the PWSC recent program efforts, provide cost estimate back-up information, update status of LSWRP Grant Program and Feasibility Study, public outreach support and upcoming MetWorks Industry Day

Next Steps

Continue Environmental Phase planning efforts and Program work associated with the State funds

Item 3a
PWSC
Quarterly
Update

Agenda

- Summary of completed and ongoing work
- Cost Estimate Methodology memorandum
- Large Scale Water Recycling (LSWR) Grant
- Public Outreach Support
- MetWorks Industry Outreach Event

Program Implementation: Use of State Funds

Item 3a PWSC Quarterly Update

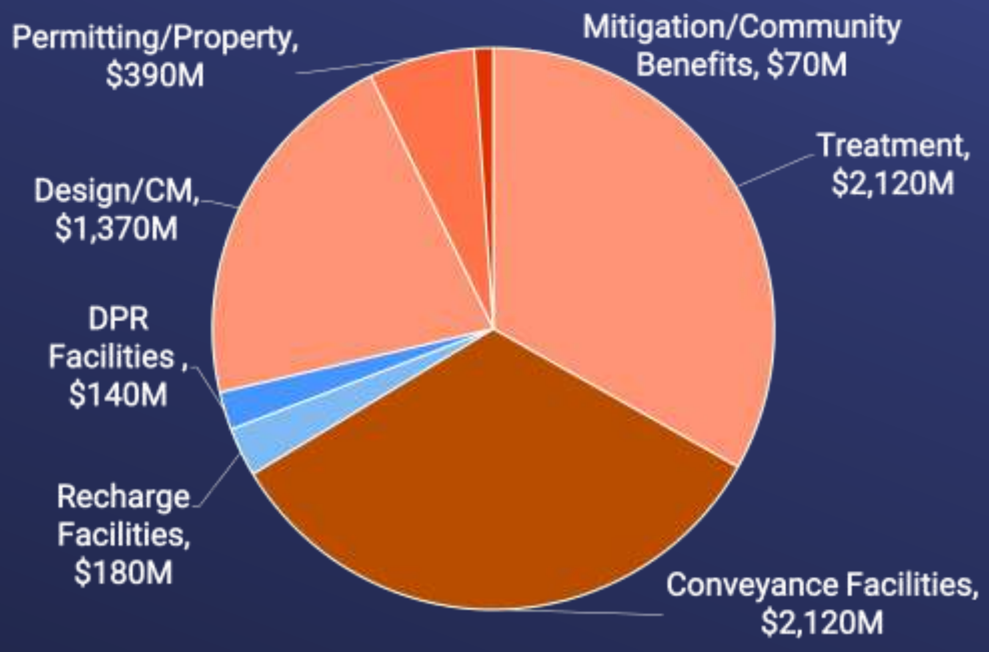
- Program Management efforts include:
  - Sequencing/implementation methodology
  - AWT Request for Qualifications development
  - LSWR Grant request development
- Preliminary Design of pipeline Reaches 1 & 2
- Demo plant tMBR optimization plan and testing
- Sustainability (Envision) approach & training
- Cost estimate details memo
- Public Outreach

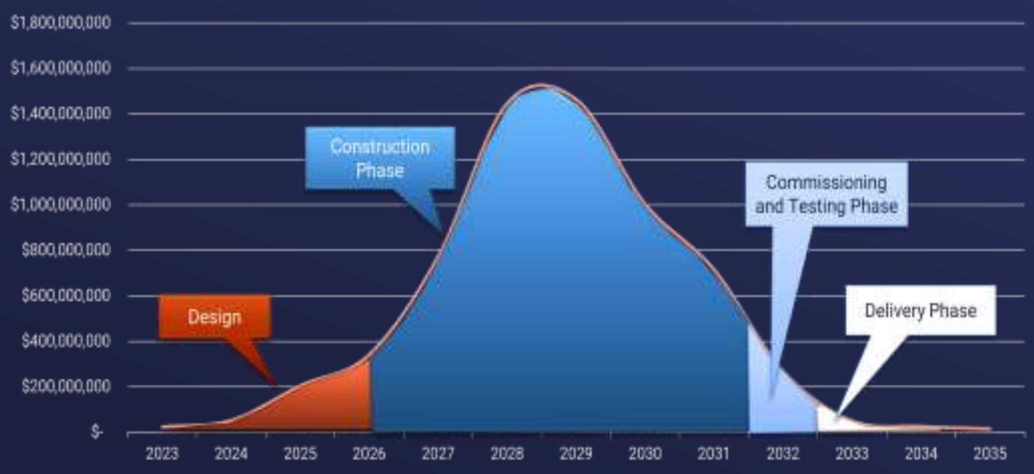
Current Expenditures and Budget Status

- All expenditures to date are O&M
- Environmental Planning phase work is to be complete by 3rd quarter 2025
- Budgets do not currently assume any federal grant funding

Budget Status	Environmental Planning Phase Funds	Project Implementation State Funds
Total Budgeted Funds	$30M	$80M
Expenditures to Date (12/23)	$20.6M	$5.2M
Total Third Party Commitments	$16.4M	N.A.
Third Party Contributions Invoiced to date	$5.3M	N.A.

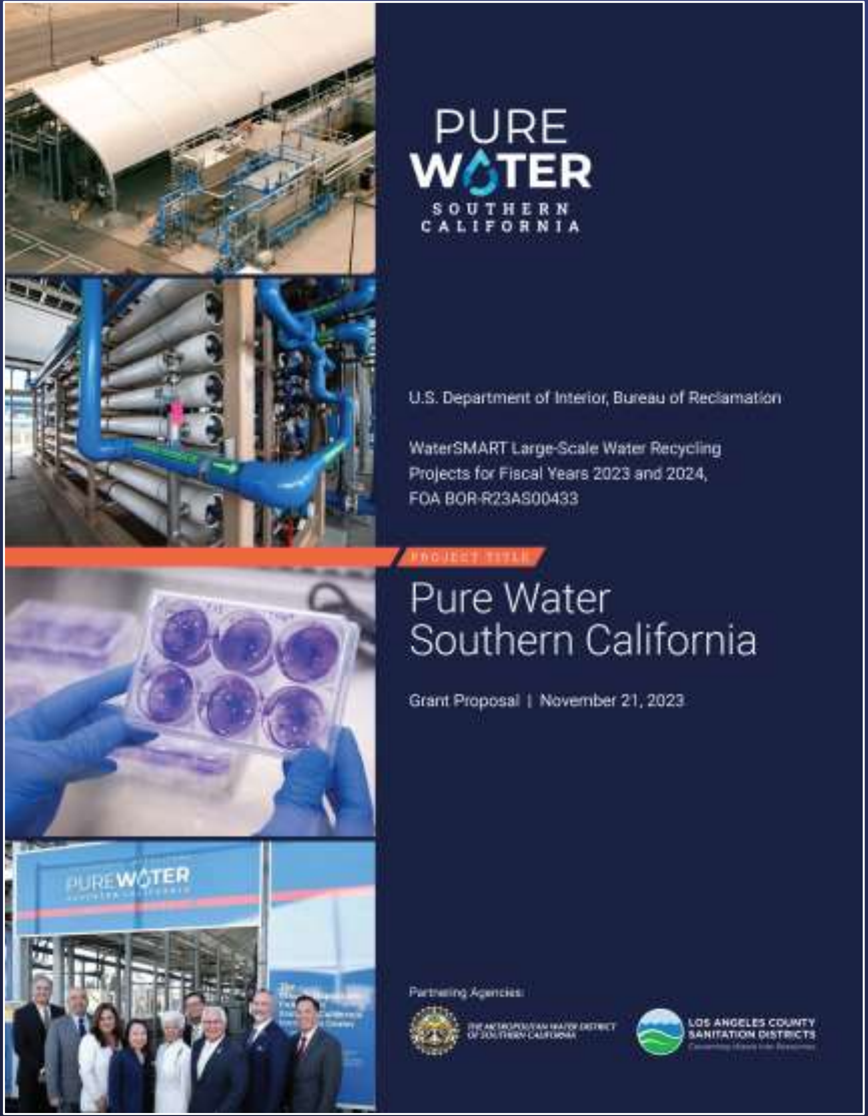
Cost Estimate Methodology Memorandum





- Memorandum is included in the Subcommittee packet
  - Response to November questions
  - Subcommittee request for back-up cost information
- Cost memo information includes:
  - Methodology/Approach
  - Cost Estimates
  - Appendices with supporting detailed cost development information

USBR Large Scale Water Recycling Grant Program



- Key LSWR Program Dates:
  - Grant application: November 21, 2023
  - Feasibility Study: January 19, 2024
  - Cost eligibility based on approval of Feasibility Study
- LSWR Total Program Authorization
  - FY 22-26 Funding: $450M
  - FY 23/24 Funding: $180M (initial issuance)
- Application submitted November 20, 2023
  - Requested $125M
  - Funds for work planned April 2024 through November 2026
  - Non-federal cost share required

LSWR Grant – Feasibility Study Project Definition

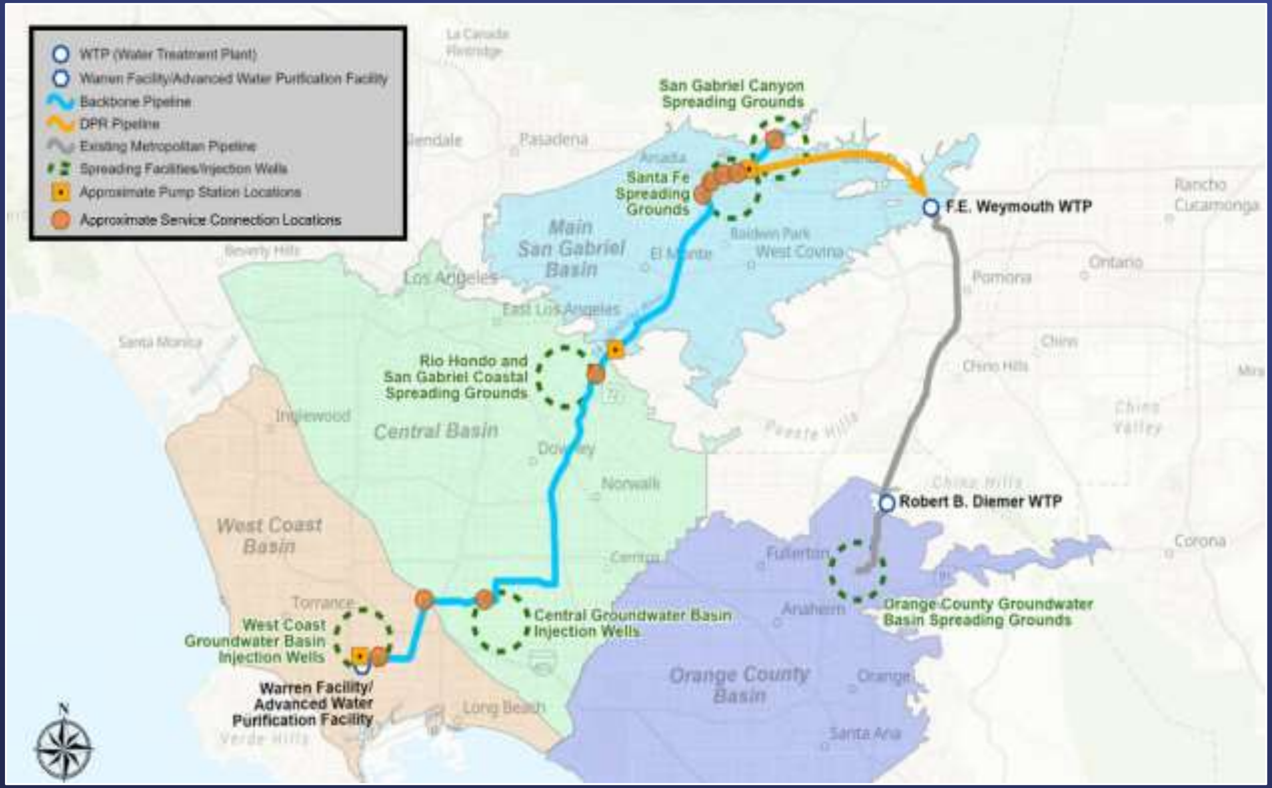
- Feasibility Study presents PWSC and includes:
  - Technical Proposal/Evaluation Criteria
  - Project Budget & Narrative
  - Environmental/Cultural Resources
  - Permits and Approvals
- Eligible costs for federal funding include collection/treatment/distribution
- PWSC Phase 1 Project Cost: $6.17B
- 47 Letters of Support
- Authorizing Resolution and Letter of Funding Commitment upon award

LSWR Grant – PWSC Project Definition

Sequencing Plan

Milestone	Date
Initiate Preliminary Design Phase	July 2023
Authorize AWPF PDB contract	End of 2024
Publish Draft EIR	End of 2024
Approve Final EIR	Fall 2025
Complete R1 and R2 Final Designs	End of 2025
Start Phase 1 Construction	Spring 2026
Start Testing and Commissioning	1st Quarter 2032
NPR/IPR Water Delivery	End of 2032
DPR Water Delivery	TBD

Anticipated Facilities



LSWR Grant - Proposed Scope of Work

A.K. Warren Facility- Sidestream Centrate

- 70%, 90% and 100% design, Bid documents

A.K. Warren Facility- Site Preparation

- 30% design

AWPF Process Design

- Progressive Design-Build procurement
- 60% design and guaranteed maximum price negotiation

Public Engagement & Interagency Coordination

- On-going public engagement activities including educational content, partner mtgs

Conveyance and Ancillary Facility

- 100% design (Reaches 1 & 2)
- 60% design (Reaches 3-8
- 30% design (Azusa Pipeline)
- 50%/100% design (Recharge Facilities)

Environmental & Permitting

- CEQA/NEPA documentation
- Permitting plan and initiate permitting
- Engineers Report (Indirect Potable Reuse Regulatory Approve)

Direct Potable Reuse/Reverse Osmosis Concentrate Pilot Testing

- Pilot testing and DPR treatment train
- Bench-scale ROC testing

Other

- Program management activities
- Property acquisition
- Easements / Right of Ways / Surveys

LSWR Grant: Anticipated Expenditures

Spending Year	Target Eligible Spending
2024	$30,000,000
2025	$200,000,000
2026	$270,000,000
TOTAL GRANT	**$500,000,000**

- Estimated PWSC Project expenditures from April 2024 through November 2026
  - No construction costs
  - Agency staff and consultant time
- Anticipated notification in February-April 2024
- Approved Feasibility Study required for reimbursement
- This schedule and level of spending is required to meet the 2032 completion milestone

LSWR Grant: Ask and Match Considerations

Activities	Total	25% Federal	75% Non-federal
Total LSWR Grant Request	$500,000,000	$125,000,000	$375,000,000
Available Matching Funds (State Grant)			$68,000,000
Non-Fed Match Component			$307,000,000

- Funding awarded by Reclamation may be different from the ask
- Three agencies known to have applied for LSWR grant funding
- Scope of work would be modified to match award amount
- Funding can also be requested during next 2 application periods
- Matching funds by Metropolitan, Sanitation Districts, other funding

PWSC Quarterly Update

Program Outreach Events & Tours

- Continued Napolitano Innovation Center tours
- Continued Stakeholder Outreach/Engagement
- Public Opinion Research on Direct Potable Reuse
- Community Benefits Research and Development
- Discussing EIR outreach plan

Industry Outreach Activities

PWSC
Industry Outreach & Collaboration

- WateReuse & WEFTEC Symposium presentations
- MetWorks Pure Water Networking Event
  - March 7, 2024
  - RFQ 1365 – AWPF PDB
  - Other upcoming PWSC projects will also be discussed

Carson Events Center

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

1928

Subcommittee on Pure Water Southern California and Regional Conveyance

Assessment of Reuse Alternatives for Pure Water Southern California

Item 3b

January 23, 2023

Item 3b

Assessment of Reuse Alternatives for Pure Water Southern California

Subject

Assessment of Reuse Alternatives for Pure Water Southern California

Purpose

Respond to questions received from Directors related to the application of direct potable reuse (DPR) for PWSC

Next Steps

- Continue to pursue flexible/hybrid DPR through raw water augmentation (RWA) for Phase 1
- Consider additional DPR alternatives for Phase 2

Reuse Alternatives for Pure Water Southern California

PURE WATER SOUTHERN CALIFORNIA

Questions received:

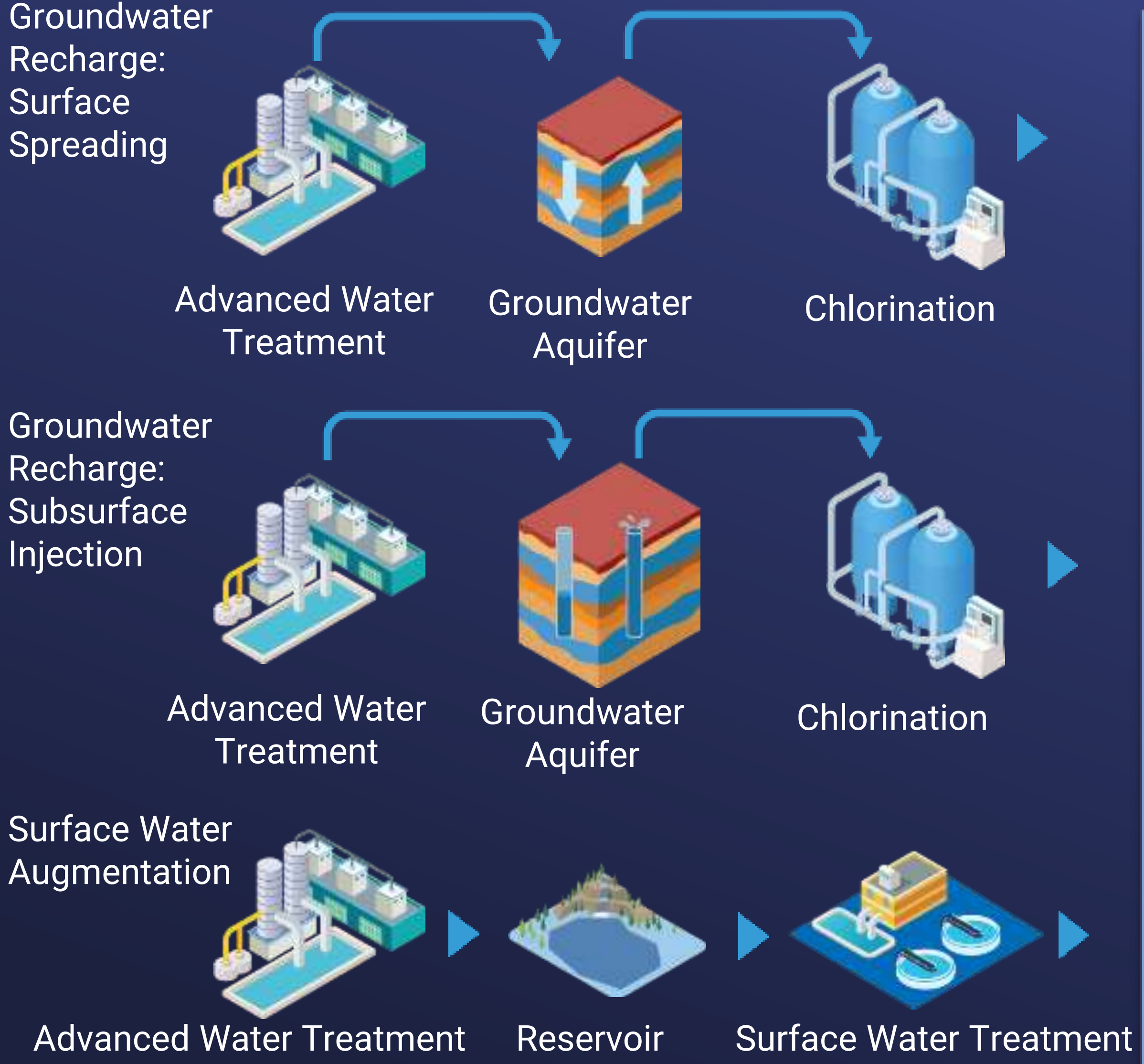
- *Has Metropolitan considered Treated Water Augmentation, given proposed DPR regulations could now allow for it?*
- *Why do we need to take the PWSC water (from Carson) up to the Water Treatment Plant?*

Response outline:

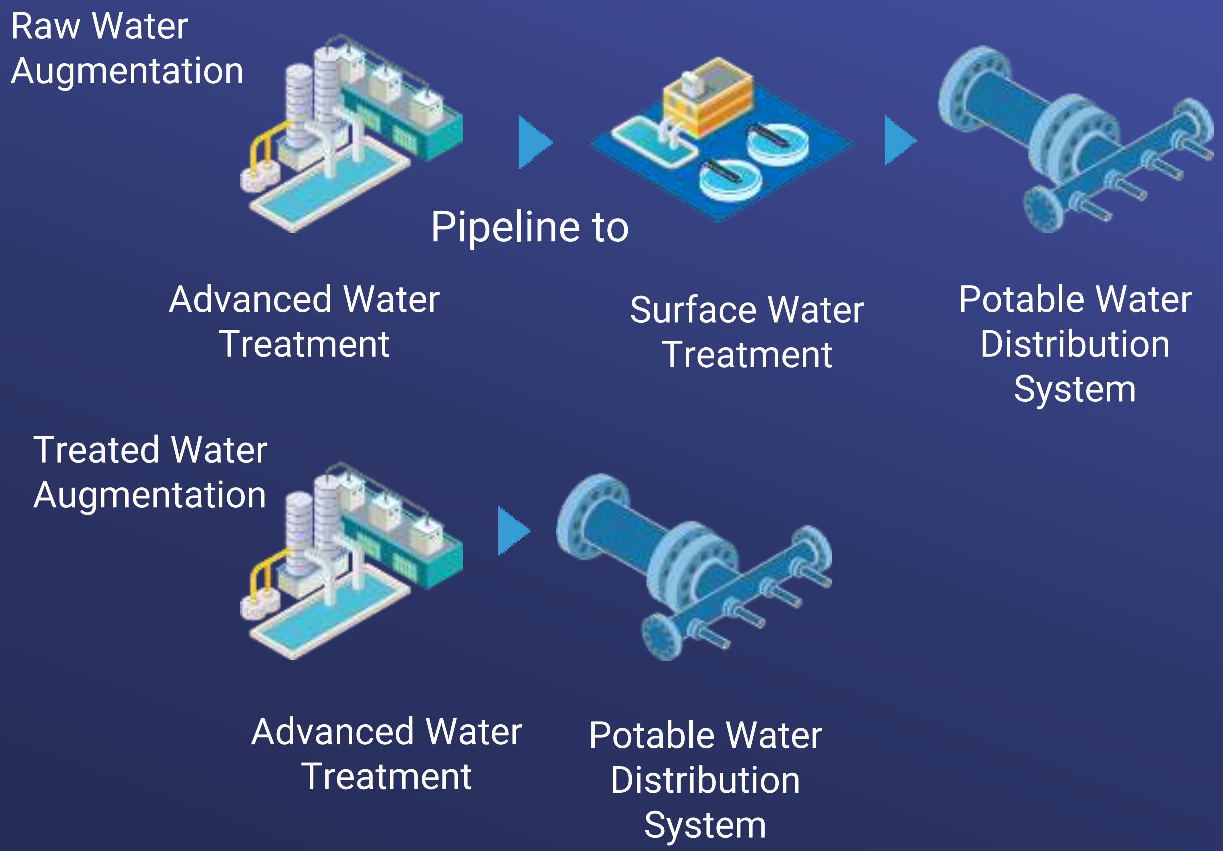
- California Recycled Water Regulations
- Progressive approach to DPR alternatives
- Considerations of DPR approaches
- Future opportunities to expand DPR approach

Progressive Approach to PWSC Reuse Alternatives

Indirect Potable Reuse



Direct Potable Reuse



SWRCB, DDW

California Recycled Water Regulations

Expansion of planned reuse projects resulting from decades of research and advancement in monitoring, treatment technologies, and compliance.

Non-Potable Reuse

Irrigation Industrial Uses

2000

Indirect Potable Reuse

Groundwater Replenishment

2014

Indirect Potable Reuse

Surface Water Augmentation

2018

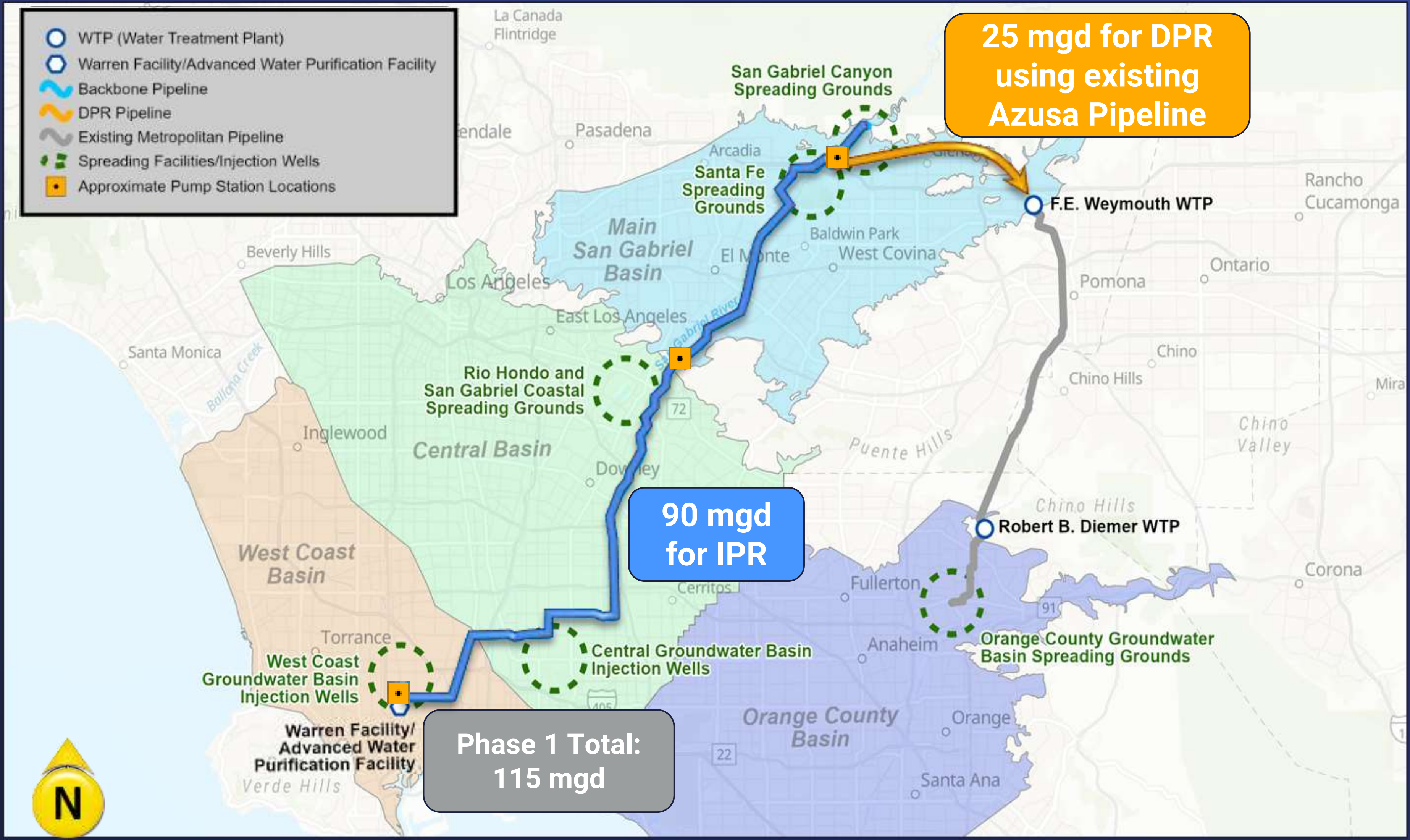
Direct Potable Reuse

Raw & Treated Water Augmentation

2024

Increasing requirements for public health protection

PWSC Program Overview – Phase 1 (25 mgd for DPR)



Phase 1 DPR RWA Approach at Weymouth

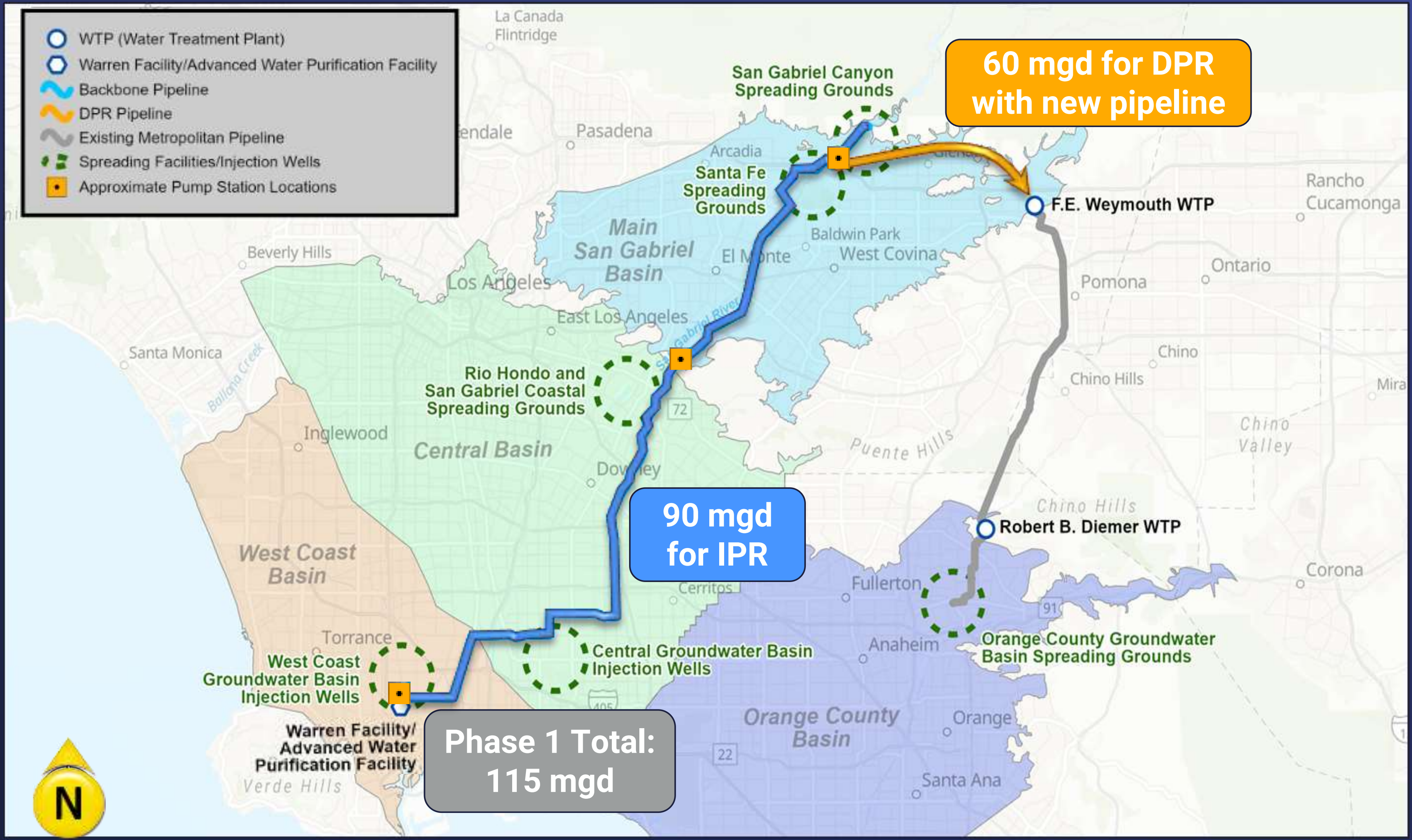
Convey AWT water to Weymouth/Diemer; Blending opportunities with:

- CRA
- SWP
- <10% AWT

Additional treatment for regulatory pathogen control requirements

- Chlorine dioxide
- Ultraviolet light

PWSC Program Overview – Phase 2 (60 mgd for DPR)



Phase 2 DPR RWA Approach

New pipeline to Weymouth WTP needed; can also go to Diemer

Increase in percent blend of AWT water (would be > 10%)

Triggers additional treatment for regulatory pathogen and chemical control requirements

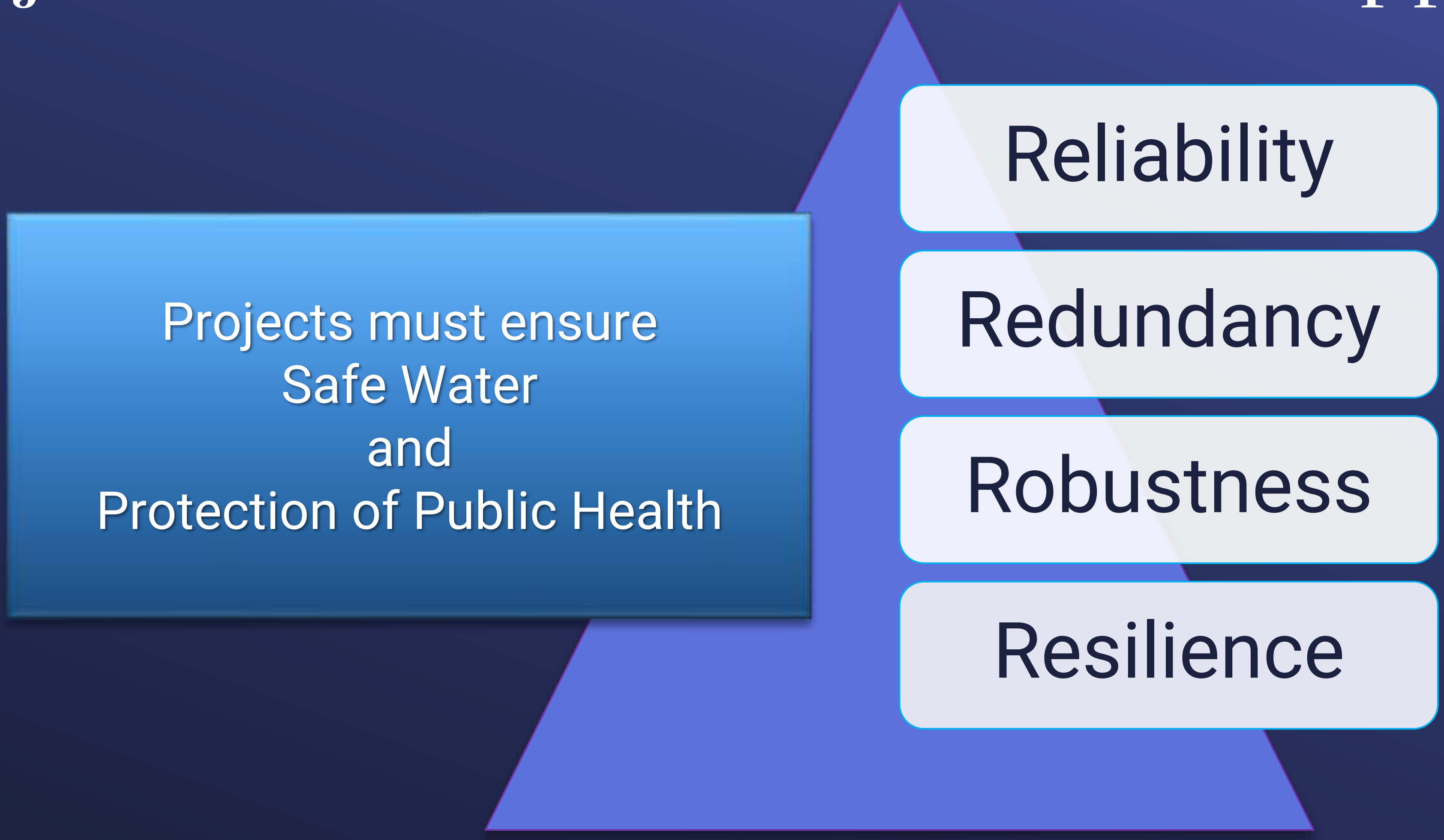
- Process - TBD
- Location -TBD

Considerations of Direct Potable Reuse

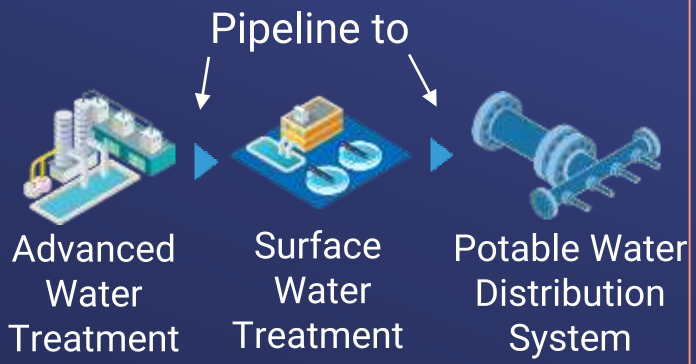
CA Direct Potable Reuse Regulations

- Greater Operational Control
- Response Time
- Water Quality
- Storage/Demand
- Infrastructure Costs
- Post-Treatment

Regulatory Requirements Balanced with Project Framework for Potable Reuse Approach



Credit: The Four R's, Pecson et al, JAWWA, 2015



Direct Potable Reuse Raw Water Augmentation

RWA – planned introduction of recycled water into a raw water supply immediately upstream of a Surface Water Treatment Plant

Benefits to PWSC pursuing RWA

- Provides Regional Accessibility
  - Leverages existing infrastructure
  - Potential integration with other reuse projects
- Increases Operational Control
  - Allows additional buffer in pipeline
  - Expands response time
  - Blending opportunities
  - Advantages and value of Surface Water Treatment Plant operations
    - Enhances water quality and process performance
    - Balances water quality objectives

Considerations for DPR Treated Water Augmentation

Response Time
(limited)

Hydraulics/Demands
(real-time monitoring, immature)

Storage Needs
(additional, onsite needs)

Risk Contingency
(increased consequence)

Level of Treatment
(additional redundancy)

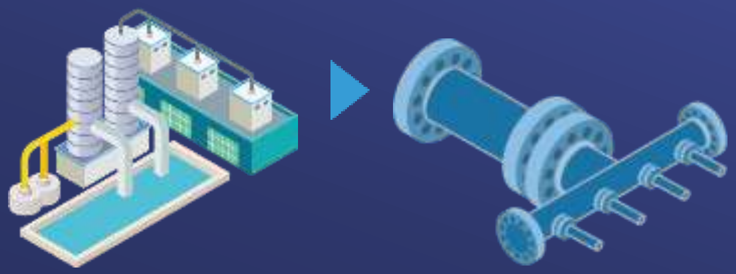
Control Logic
(complexity increases)

Monitoring
(real-time)

Post-Treatment
(prior to any delivery)

Direct Potable Reuse

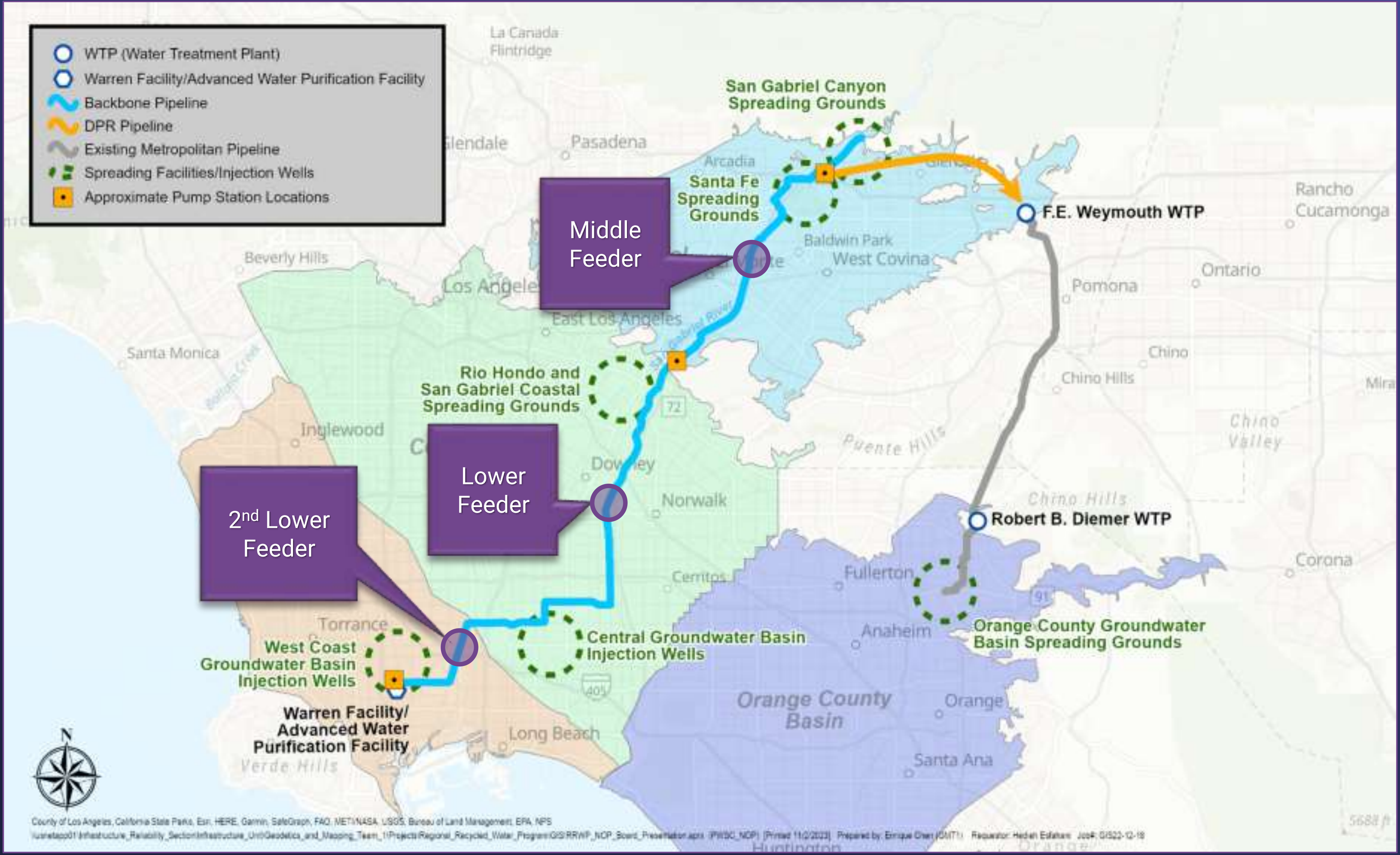
Treated Water Augmentation



Advanced Water Treatment

Potable Water Distribution System

Potential Metropolitan Feeder Tie-in Locations
DPR Treated Water Augmentation (TWA)



DPR by way of treated water augmentation is the planned introduction of recycled water **directly into** a public water system

Potential treated water feeder tie-in intersections along planned backbone pipeline for PWSC

- Middle Feeder
- Lower Feeder
- 2nd Lower Feeder

Next Steps for DPR Development

- Continue to pursue flexible/hybrid RWA approach for Phase 1
- Plan for additional testing and modifications at Demonstration Plant to help inform DPR full-scale operations
- Engage in DPR research/development and monitor/assess lessons learned with reuse sector
  - In consideration for future Treated Water Augmentation opportunities

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Subcommittee on Pure Water Southern California and Regional Conveyance

Drought Mitigation Portfolio Progress Update: An Operational Perspective

Item 3c

January 23, 2024

Item 3c

Drought Mitigation Progress An Operational Perspective

Subject

Update on Drought Mitigation Portfolio Progress

Purpose

Provide an operational perspective on how new drought mitigation programs and projects can be implemented in the next drought and how potential future projects can be operated for additional reliability

Next Steps

- Incorporate lessons learned from last drought
- Continue partnerships for drought and surplus year actions
- Participate in CAMP4W to inform decisions on future drought reliability projects

History of Continuous "Portfolio" Development

1987 – 1992 Drought

Colorado River QSA

SWP BiOPs

2009 – 2010 Drought

2014 – 2015 Drought

2020 – 2022 Drought

1992 | 2003 | 2007 | 2010 | 2015 | 2022

IRP
DVL
Banking Programs
Transfers
Conservation
LRP

Fallowing
Programs
Exchanges

Delta Programs
and
Improvements

5-Year Supply Actions
SBVMWD Groundwater
CVWD Agreements

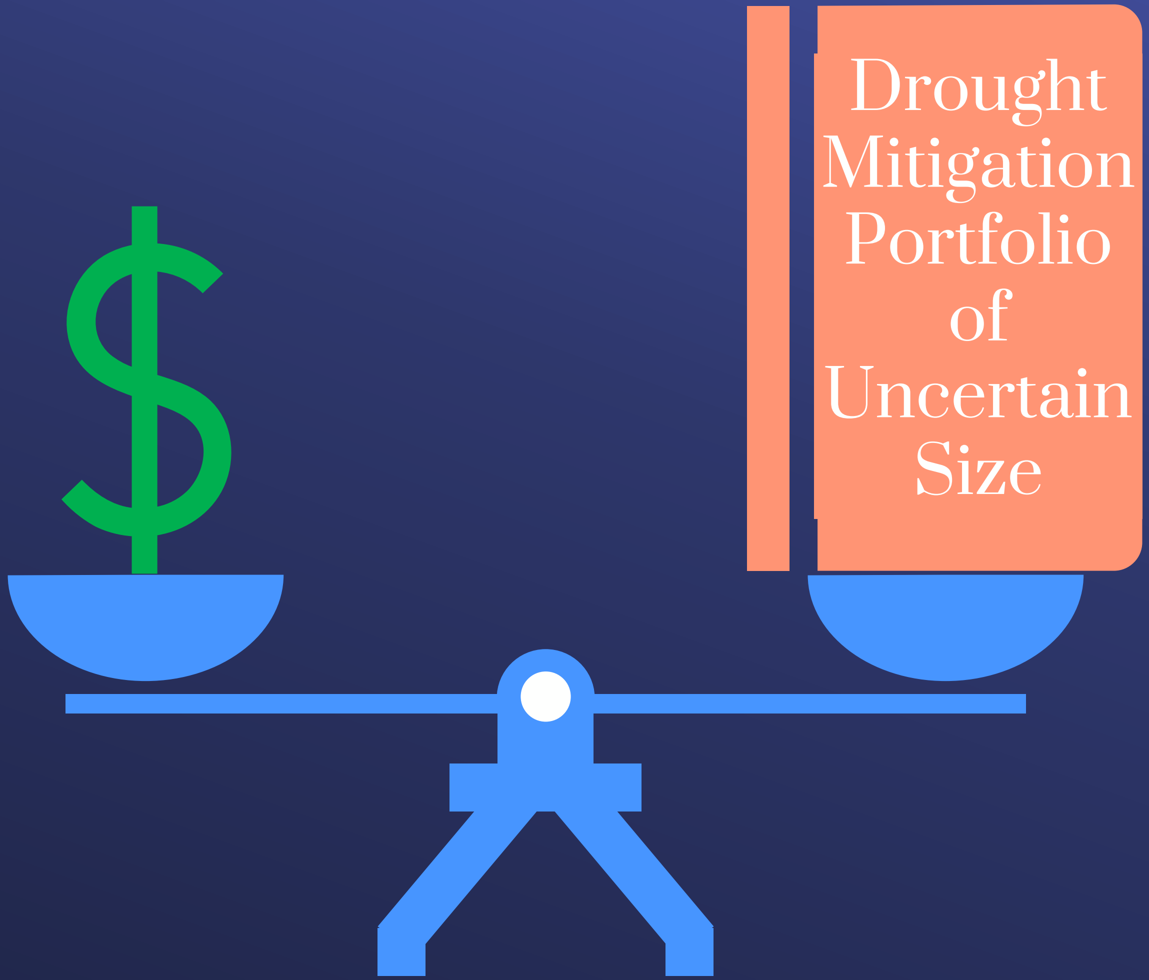
New Drought Actions
Greg Avenue Pumping
DVL to Mills
OSCOP

AVEK Storage
DVL to Rialto
B-5A
TVMWD Pumping
Sepulveda Pumping
New Operations

CAMP4W
(TBD)

Balancing Investments and Risk

Improving Drought Reliability



Questions Received during Drought Mitigation Workshops

Improving Drought Reliability

- How can we reoperate our system in another drought, like the one that occurred in 2020 through 2022?
- How will our new/near-term actions help?
- What if the next drought is worse?
- How would future long-term actions like new conveyance and reservoirs help?

Drought Mitigation Progress

An Operational Perspective

Outline for Today

Case Study: (1) Future three-year drought sequence with conditions like 2020 to 2022, and (2) a four-year drought

- Benefits of incorporating operational lessons learned from last drought
- Benefits of new near-term projects
- Benefits from long-term actions under consideration (examples)
  - Venice/Sepulveda Pumping - Phase 2
  - East/West Conveyance
  - Reservoir

Case Study Objective

Drought Mitigation Progress
An Operational Perspective

- Explore and increase understanding of operational, resource, and drought action concepts (less focus on specific numbers)
- Additional cases will be studied in the future with various demand, resource, and other assumptions
- Case studies coordinated with CAMP4W process

Drought Mitigation Progress
An Operational Perspective

Case Study Assumptions

- Re-operation of system, resources, and actions for a three-year drought sequence
- Same demands as 2020 through 2022 with no SWP Dependent Area allocation
- Annual SWP Allocations of 20%, 5%, and 5%, with no Health and Human Safety Allocation
- Surface and groundwater storage are “full” (like end of 2019) with the addition of AVEK groundwater storage
- Existing and new drought actions begin May of Year 2
- Fourth drought year added with same conditions as 2022

Applying Lessons Learned from the Last Drought

Improving Drought Reliability

- Keep Carryover at 300 TAF at end of Year 1 (rather than 200 TAF at end of 2020)
- Keep DVL at 800 TAF at end of Year 1 (rather than 700 TAF at end of 2020)
- How is this accomplished?
  - Draft SWP Banking Programs
  - Higher CRA diversion
- Pro: 200 TAF drought benefit
- Con: Could convert Carryover to Table A in a wet year

Review of Existing Drought Actions

Dry Year Operations

Actions implemented during last drought

Dry Year Operations

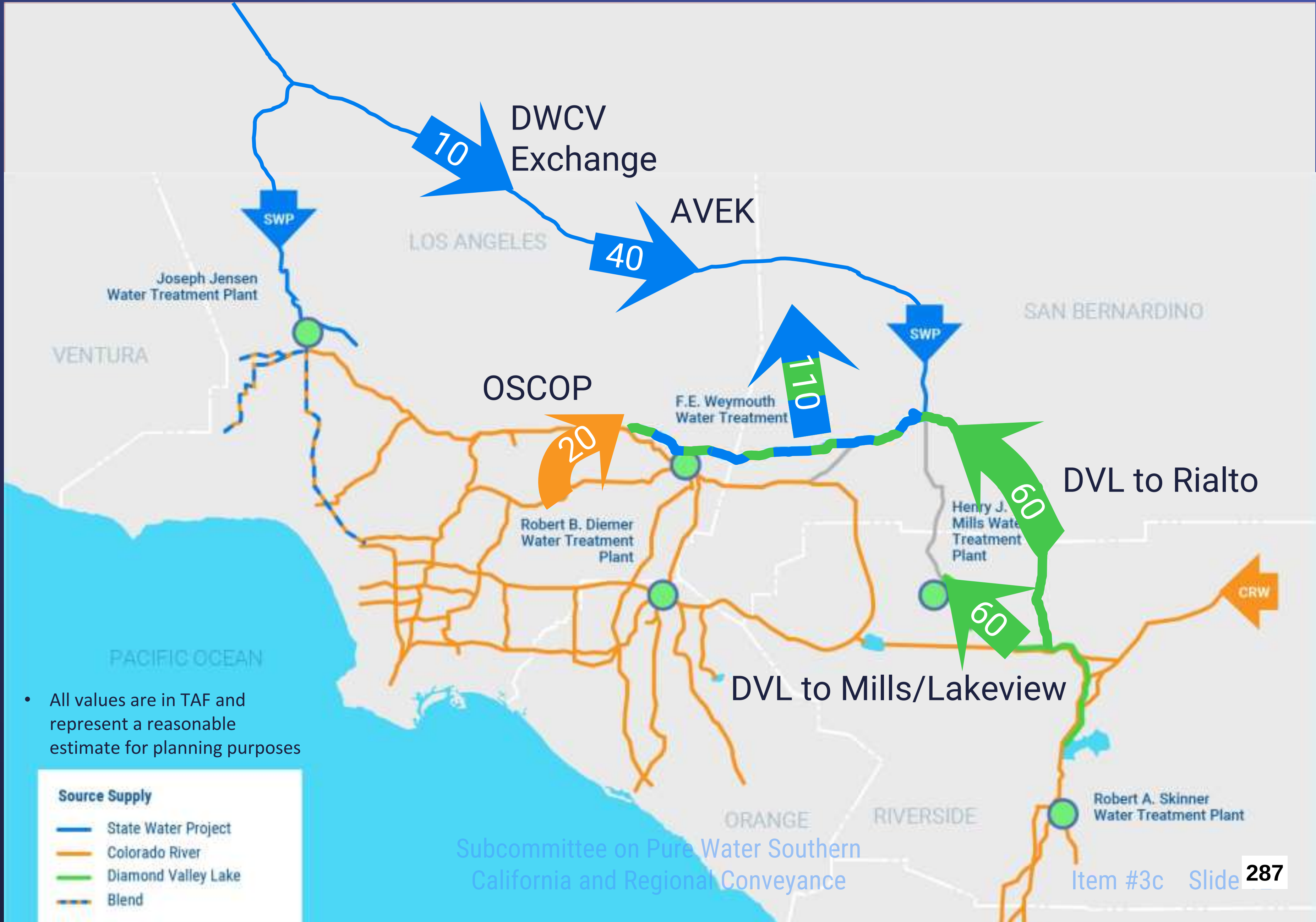
New actions to implement in next drought to increase reliability

New Drought Actions

Meeting East Branch Demands

Year 3 Drought Operations

- *Same replenishment as 2022*
- *Same OSCOP as 2022*
- *More DVL and AVEK supply available to Central Pool if needed*
- *SWP Banking supply used in 2022 is now available for West Branch*



- All values are in TAF and represent a reasonable estimate for planning purposes

Meeting West Branch Demands

Year 3 Drought Operations

- *Same replenishment as 2022*
- *Same OSCOP as 2022*
- *Same Greg Avenue pumping as 2022*

- All values are in TAF and represent a reasonable estimate for planning purposes

Meeting CRW Demands

Year 3 Drought Operations

- *Limited supply available after meeting CRW demands*

- All values are in TAF and represent a reasonable estimate for planning purposes

Summary of Case Study: Three-Year Drought Operation

Improved Future Reliability

- Year 1 re-operation saves Carryover storage for Year 3
- New actions cover East Branch demands
- East Branch supplies used in 2021 and 2022 are now available to the West Branch in Year 3
- No allocation is needed in Year 3

Key Milestone in Portfolio Development

What's Next?

?

Portfolio additions in place soon to survive a drought like 2020 - 2022 event without an allocation

AVEK Storage
DVL to Rialto
B-5A
TVMWD Pumping
Sepulveda Pumping
New Operations

- Near-term solutions
- Culmination of collaboration, partnering, planning that began in 2022
- Step forward in improved reliability

What happens if the next drought is worse than 2020 - 2022?

Further Improving Future Reliability

- Many possible scenarios and solutions
- Question for CAMP4W
- Examples of operational solutions assuming a 5% SWP allocation in Year 4 in our Case Study scenario
  - New conveyance
  - Further re-operation
  - New reservoir

Meeting Additional West Branch Demand

Year 4 Drought Operations

New Conveyance Options

- *Prevents geographic specific allocation*
- *However, new supply needed to avoid any allocation*
    - *Pure Water*
    - *Local Supply*
    - *Conservation*

Year 4 Drought Operations Further Re-operation

Additional Operational Actions in Year 1

- Build Carryover in Year 1 even higher
  - Start Greg Ave pumping and minimize SWP flow into Central Pool earlier
  - Draw SWP Banking including AVEK
  - Defer shutdowns that use SWP supply
- Pro: Ready to successfully operate in Year 4 with a 5% SWP allocation
- Con: Increased risk of converting Carryover to Table A in a wet year
- Further investigation and coordination needed

Meeting Additional West Branch Demand

Year 4 Drought Operations

New Reservoir Option

- *Fill in a wet condition like 2023*
- *Take water in a 4th drought year along with all other actions and operations*
- *Size to fit need to cover more drought years*
- *Some fill risk under severe climate change*

- All values are in TAF and represent a reasonable estimate for planning purposes

We've Come a Long Way, but There's More to be Done

- New operations and actions provide a successful *conceptual* plan to re-operate through a 2020-2022 condition with no allocation
  - Coordination, partnership, and planning still needed to refine plan

- New conveyance provides a means to avoid geographic-specific allocations, but additional supply may be needed to avoid *any* allocations

- A new reservoir acts as a new supply to avoid allocations, but additional supply may be needed under severe climate change

- CAMP4W process will evaluate new reliability projects– such as new conveyance, reservoirs, and supply– for implementation decisions

Next Steps on Coordinated Operations and Resource Management

Improving Drought Reliability

- Incorporate lessons learned into 2024 operations in case 2024 is the next "2020" start of a drought sequence
- Continue partnership and planning for actions; e.g., OSCOP, replenishment deferrals, and wet-year storage programs
- Participate in CAMP4W to inform decisions on further expanding the portfolio with future drought reliability projects

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Subcommittee on Pure Water Southern California and Regional Conveyance

State Water Project Dependent Areas Drought Mitigation Update

Item 3d

January 23, 2024

Item 3d

State Water Project Dependent Areas Drought Mitigation Update

Subject

State Water Project Dependent Areas Drought Mitigation Update

Purpose

To provide updates on regional conveyance improvements and solutions and the integration of drought mitigation actions with CAMP4W

Next Steps

Board report to outline implementation plan of drought mitigation actions

Board actions required to:

- Create a new CIP program to include selected drought mitigation projects
- Amend current CIP to include:
  - Sepulveda Feeder Pumping Phase 2
  - Removing network constraints

August 2022 Board Letter – Call to Action

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

BOARD ACTION

- **Board of Directors**
  Water Planning and Stewardship Committee

8/16/2022 Board Meeting

7-13

Subject

Adopt resolution affirming Metropolitan's call to action and commitment to regional reliability for all member agencies; the General Manager has determined that the proposed action is exempt or otherwise not subject to CEQA

Executive Summary

The Metropolitan Water District of Southern California endeavors to provide an adequate and reliable supply of high-quality water to meet the region's present and future needs in an environmentally and economically responsible way. As an example from 1930, Metropolitan's first Board Chair, W.P. Whitsett, provided a guiding principle for developing regional water supply reliability: "Whatever is done should be done for the benefit of the whole, and whatever is done for the benefit of the whole should be shared by all the parts."

Nearly a century after those aspirational words, a record-breaking drought has descended on the Southwest, and Southern California's water reliability is in crisis. This year, supply from the State Water Project (SWP) was cut to 5 percent of Metropolitan's total allocation for the second consecutive year—resulting in a 3-year water supply substantially below the California Department of Water Resources' worst-case projection. These conditions starkly highlight an infrastructure and water supply vulnerability that must now be addressed. Simply put, there is not enough pipeline connectivity or operational flexibility for imported supply and existing regional storage to meet the needs of six member agencies with a combined population greater than six million.

Because of this supply shortage and limits to its infrastructure, Metropolitan cannot provide equivalent supply reliability from one corner of the service area to another. In response, Metropolitan's Board declared a water shortage emergency and imposed a water conservation program in April of this year for the six SWP-dependent agencies. The impacted agencies include Calleguas Municipal Water District, Inland Empire Utilities Agency (IEUA), Las Virgenes Municipal Water District, the City of Los Angeles, Three Valleys Municipal Water District, and Upper San Gabriel Valley Municipal Water District.

These six SWP-dependent agencies have limited connection to Metropolitan's existing infrastructure, storage, and supplies. This constraint forced them to take mandatory and painful water supply cuts from their expected SWP use by an average of 35 percent—with some facing reductions up to 73 percent. If these agencies cannot limit their use of Metropolitan's supply from the SWP, then they face stiff volumetric penalties of $2,000 per acre-foot (AF) or the first-ever total ban on outdoor irrigation. Meanwhile, under statewide regulation, the 20 member agencies outside of this area must implement demand-reduction actions under Level 2 of their Water Shortage Contingency Plans. These actions are locally determined to achieve only a 10 to 20 percent water reduction (without volumetric penalties).

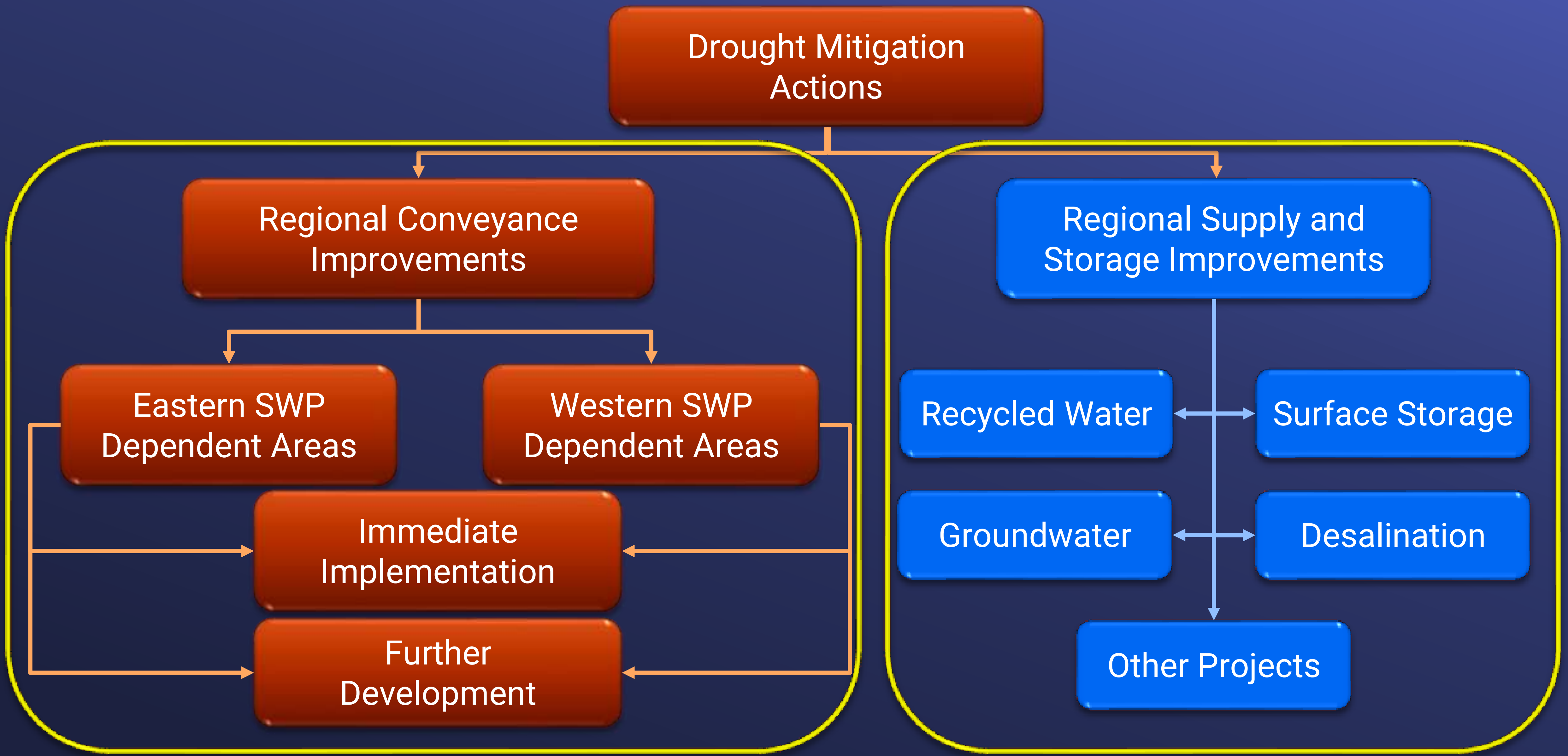
This disparity is unacceptable to Metropolitan and its member agencies. By adopting the proposed Resolution in Attachment 1, the Board would prioritize a policy to provide 100 percent and equitable reliability to all member agencies. Metropolitan would thus commit to taking all necessary actions to give the SWP-dependent member agencies a level of infrastructure and water supply reliability equivalent to that of Metropolitan's other member agencies. Equitable access will be achieved through the expedited and prioritized implementation of a balanced set of projects and programs that improve existing infrastructure, imported and local supplies, and demand management.

Call to Action

Metropolitan commits to ensuring equitable access to supply and storage assets by building infrastructure, increasing local supply availability, expanding partnerships, and advancing water use efficiency.

- *All member agencies must receive equivalent water supply reliability through an interconnected and robust system of supplies, storage, and programs.*
- *Metropolitan will reconfigure and expand its existing portfolio and infrastructure to provide sufficient access to the integrated system of water sources, conveyance and distribution, storage, and programs to achieve equivalent levels of reliability to all member agencies.*
- *Metropolitan will eliminate disparate water supply reliability through a One Water integrated planning and implementation approach to manage finite water resources for long-term resilience and reliability, meeting both community and ecosystem needs.*[23]

Proposed Drought Mitigation Actions Portfolio



Regional Conveyance Improvements Under Implementation

Project	Capacity	Estimated Cost	Planned Board Action	Anticipated Completion	Status
Wadsworth Bypass	Up to 120 cfs 87 TAF	$23 M	N/A	2025	In construction
Inland Feeder-Rialto Pipeline Intertie		$23 M	N/A	2025	In construction
IF/ Badlands Tunnel Surge Protection Facility		$26 M	N/A	2025	In construction
Foothill Pump Station Intertie		$26 M	Fall 2024	2026/27	In final design (two-stage construction)
Sepulveda Feeder Pumping Project - Phase 1	Up to 60 cfs* 42 TAF	$120 M	Fall 2024	2026	Progressive design-build contract awarded
Shift of Burbank B-5 Supply to B-5A	Up to 7 cfs 5 TAF	$7 M	Mid 2024	2026	Feasibility study completed
TVMWD Miramar Pumpback Upgrade	Up to 30 cfs 21 TAF	$10M**	Early 2025**	2027/28**	Feasibility study

* Capacity includes 30 cfs pump station capacity and 30 cfs water savings that would otherwise be delivered into the common pool to maintain water quality

** New Information as of December 2023

Bypass Line Construction at Wadsworth Pump Plant

Pouring of Mass Concrete at 96” Pipe Tie-in

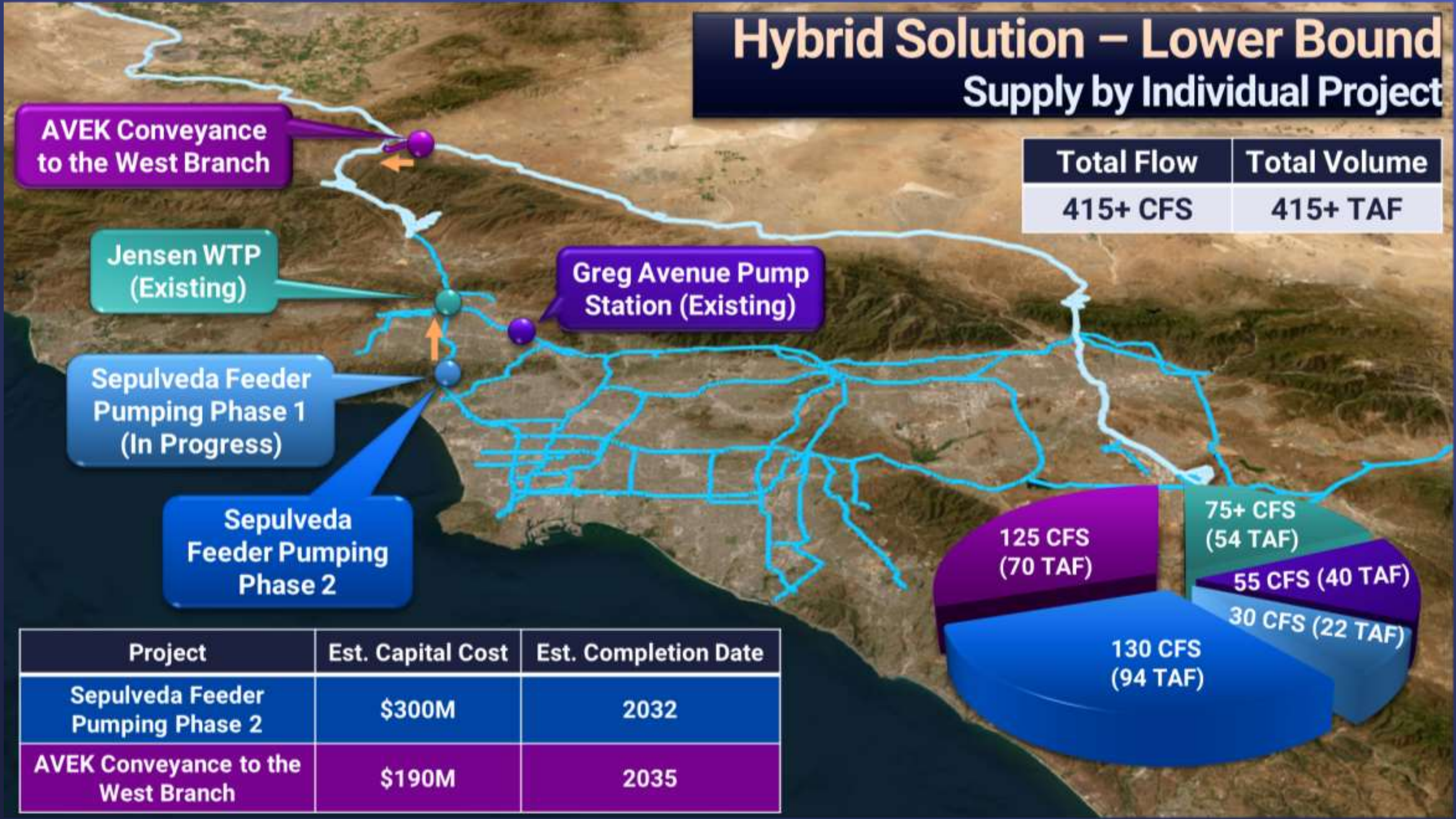
New Vault Structure

Proposed Regional Conveyance Solutions for Further Development

- Hybrid approach to combine raw and treated water alternatives
- Lower-bound solution provides flow capacity to meet equitable access/reliability commitment
  - Ensure SWPDA agencies have access to available flow
  - Prevent geographic-specific allocations
- Upper-bound solution provides flow capacity to enhance regional reliability
  - Allow SWPDA agencies access to new supply sources
  - Improve flexibility and resilience by allowing both surplus and drought operations
  - Meet estimated high-period demand during SWP supply shortage

Hybrid Solution – Lower Bound
Supply by Individual Project

Total Flow	Total Volume
415+ CFS	415+ TAF



Project	Est. Capital Cost	Est. Completion Date
Sepulveda Feeder Pumping Phase 2	$300M	2032
AVEK Conveyance to the West Branch	$190M	2035

Hybrid Solution – Upper Bound
Supply by Individual Project

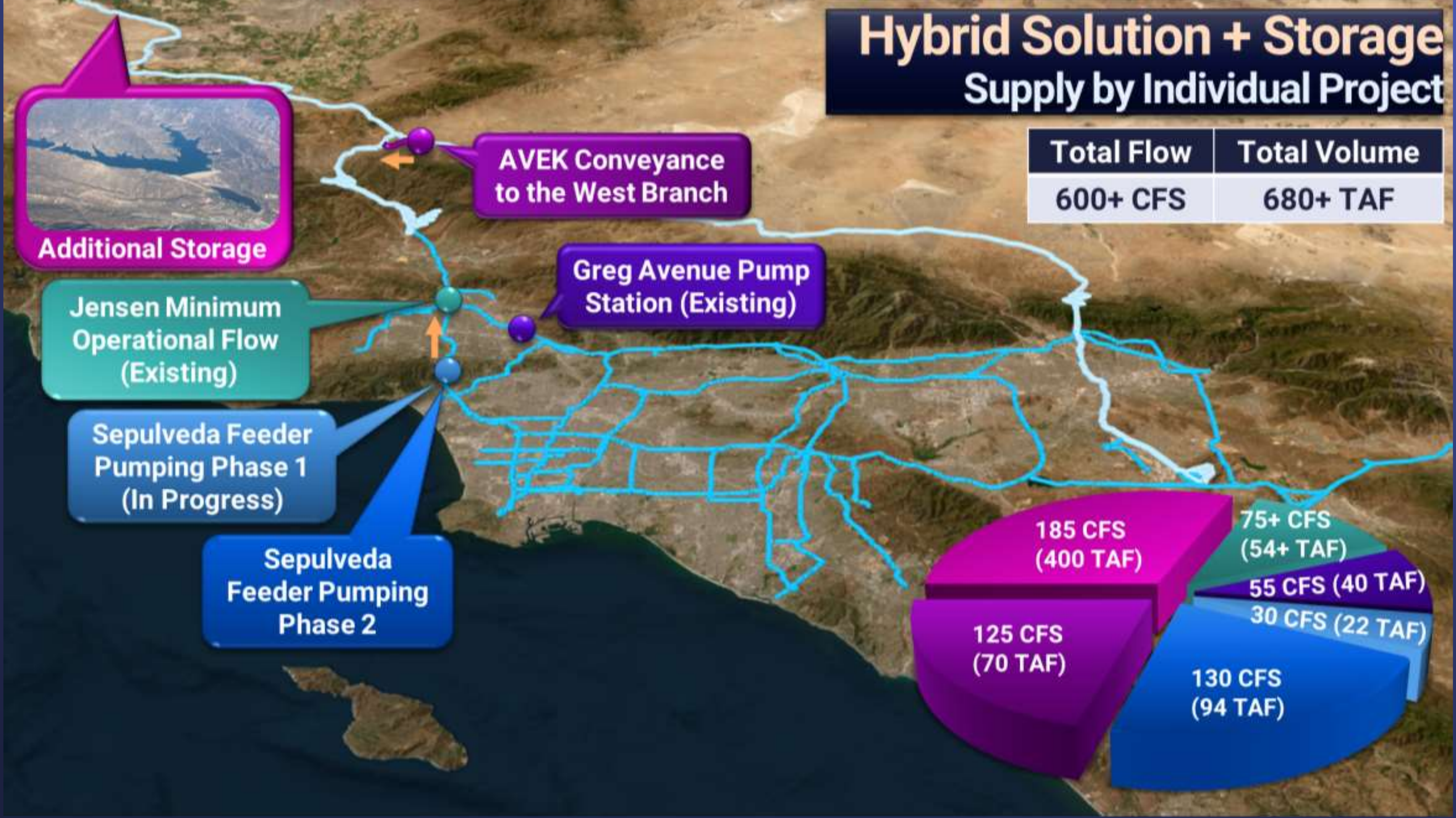
Total Flow	Total Volume
590+ CFS	590+ TAF

Project	Est. Capital Cost	Est. Completion Date
Sepulveda Feeder Pumping Phase 2	$300M	2032
E/W Raw Water Conveyance Line	$6,200M	2040

Summary of Conveyance Options

System Flexibility Options	Projects	Potential Sources of Supply	Supply To SWPDA* (cfs)	Estimated Cost ($M)
1	Sepulveda Pump Project Phase 2 & AVEK to West Branch	CRA, DVL from Common Pool; PureWater (via Weymouth); AVEK	415+	$490
2	Sepulveda Pump Project Phase 2 & East-West Conveyance (Raw)	CRA, DVL from Common Pool; PureWater; AVEK; Operation Next	590+	$6,500

*Includes 160+ cfs baseline supply from Greg Avenue Pump Station (55 cfs), Sepulveda Feeder Pump Project Phase 1 (30 cfs) and Jensen (75+ cfs)


Hybrid Solution + Storage
Supply by Individual Project
Total Flow
Total Volume
600+ CFS
680+ TAF
Additional Storage
AVEK Conveyance to the West Branch
Greg Avenue Pump Station (Existing)
Jensen Minimum Operational Flow (Existing)
Sepulveda Feeder Pumping Phase 1 (In Progress)
Sepulveda Feeder Pumping Phase 2
185 CFS (400 TAF)
75+ CFS (54+ TAF)
55 CFS (40 TAF)
30 CFS (22 TAF)
125 CFS (70 TAF)
130 CFS (94 TAF)

Drought Mitigation Portfolio Implementation Plan

- **Drought Mitigation Actions Portfolio**
  - **Cost-Effective Projects Providing Timely Relief**
    - **Projects Under Implementation**
      - DVL to Rialto Projects
      - Sepulveda Feeder Pumping Project - Phase 1
    - **Projects Prepared for Implementation**
      - Sepulveda Feeder Pumping Project - Phase 2
      - Shift of Burbank B-5 Supply to B-5A
      - TVMWD Miramar Pumpback Upgrade
  - **Projects for Further Consideration in CAMP4W**
    - **Projects for Targeted Improvements**
      - AVEK Conveyance to West Branch
      - In-Region Surface Storage Benefiting SWPDA Directly
      - Treated water Conveyance (East Valley Feeder Parallel)
      - In-Region Groundwater Storage
    - **Projects with Regional Benefits**
      - E-W Regional Raw-Water Conveyance Line
      - Surface Storage w/ Regional Benefit
      - Flex Storage w/ Regional Benefit
      - Groundwater (out of region) – AVEK Water Bank Expansion
      - New Supply (e.g. Recycled Water, Desalination)

Drought Mitigation Actions Portfolio
Cost-Effective Projects Providing Timely Relief (for Implementation)

Projects Under Implementation

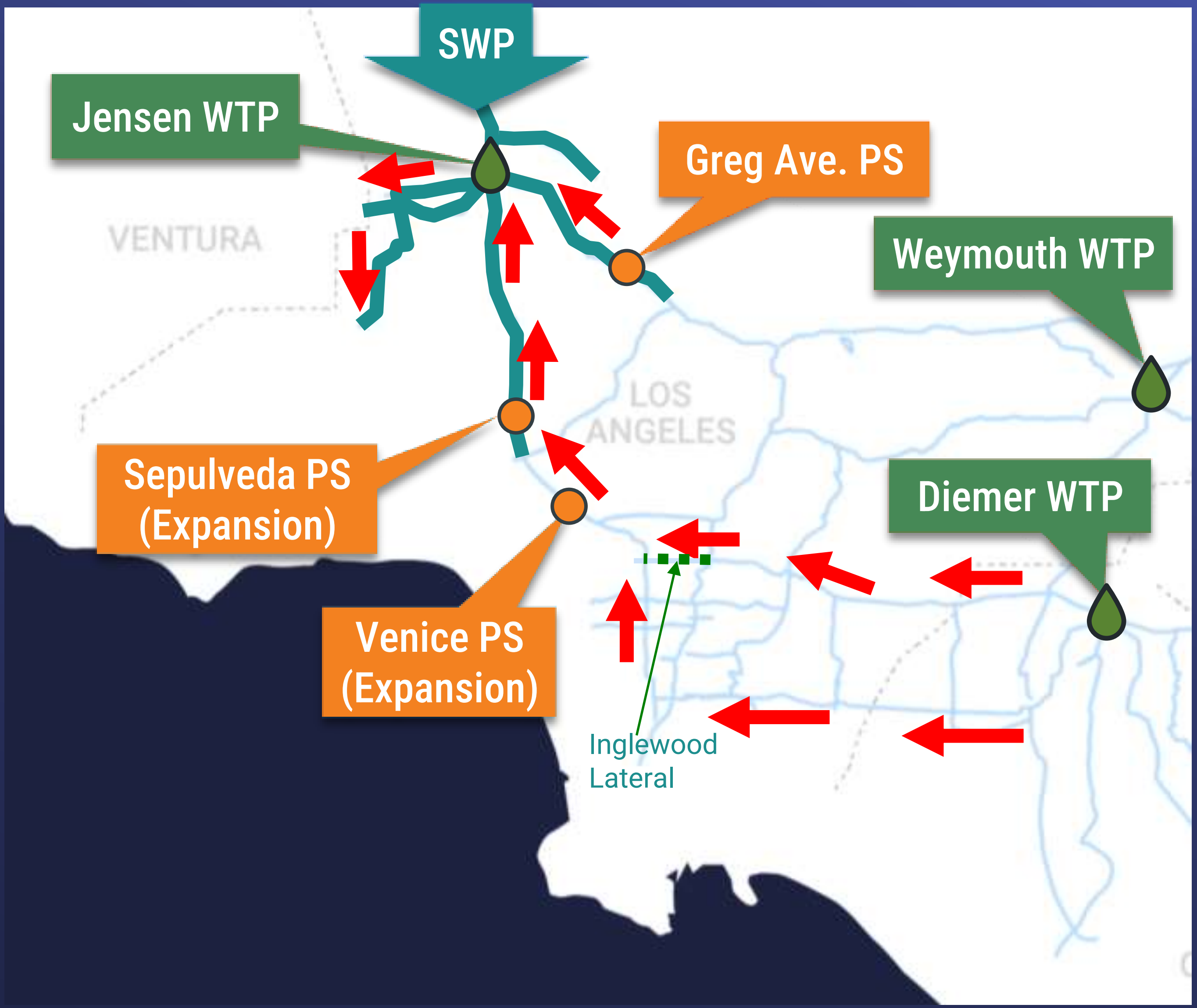
Project Title	Completion
DVL to Rialto Delivery	2026/2027
Sepulveda Feeder Pumping Phase 1	2026

Projects Prepared for Implementation

Project Title	Completion
Burbank B-5 to B-5A Shift	2026
TVMWD Miramar Pumpback Upgrades	2027/2028
Sepulveda Feeder Pumping Phase 2	2032

Sepulveda Feeder Pumping Phase 2

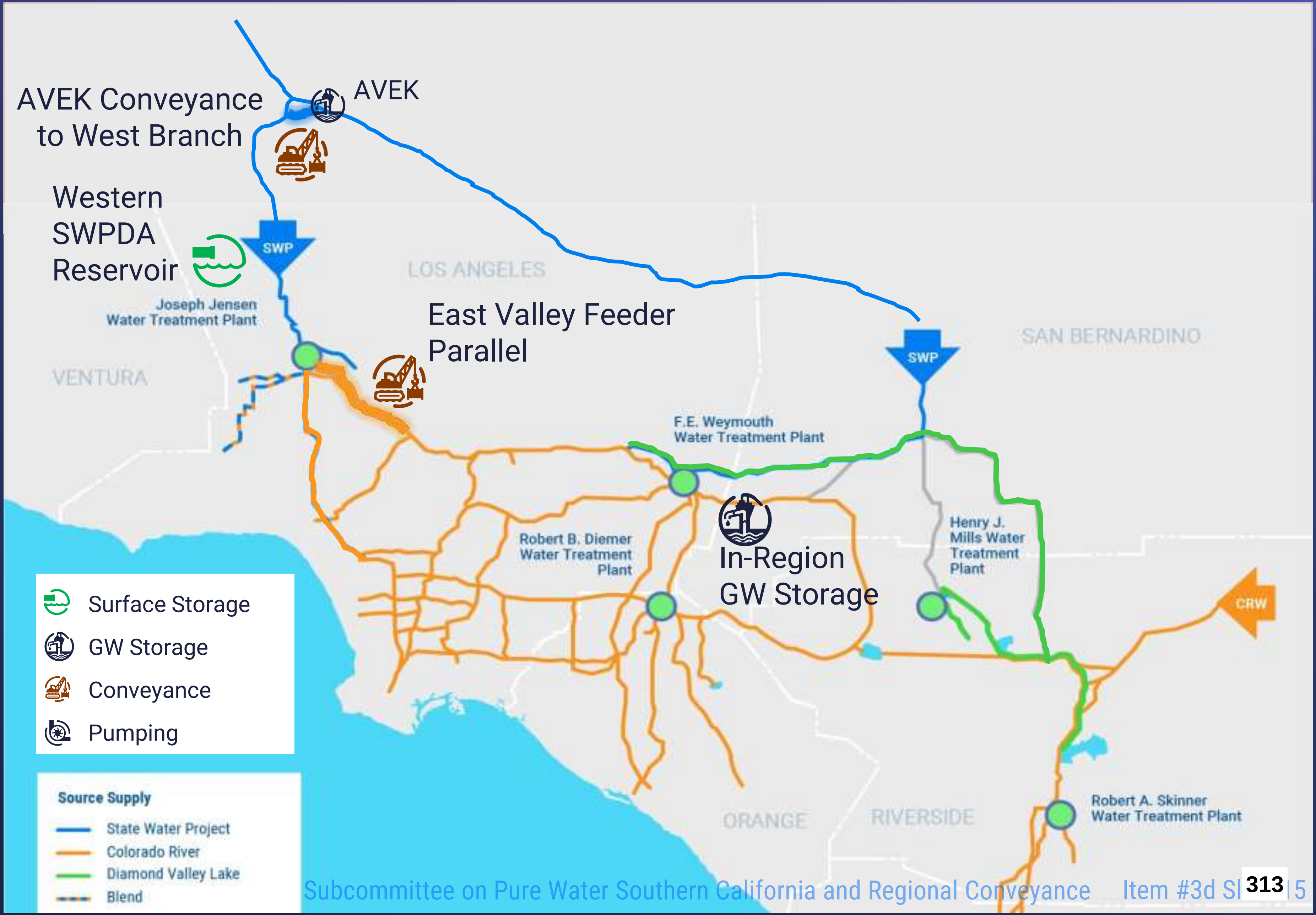
- Enhance SWPDA drought resilience
- Prerequisites
  - Complete Phase 1 (30 cfs)
  - Complete PCCP relining of North Sepulveda Feeder
  - Upgrade Inglewood Lateral
- Urgency to start conceptual design to sync with Phase 1 final design process
  - Future implementation pending on CAMP4W evaluation



Drought Mitigation Actions Portfolio Projects for Further Consideration

Projects for Targeted Improvements

Project Title	Category
AVEK to West Branch	Conveyance
East Valley Feeder Parallel Pipeline	Conveyance
Western SWPDA Reservoir	Surface Storage
In-Region Groundwater Storage	Groundwater Storage

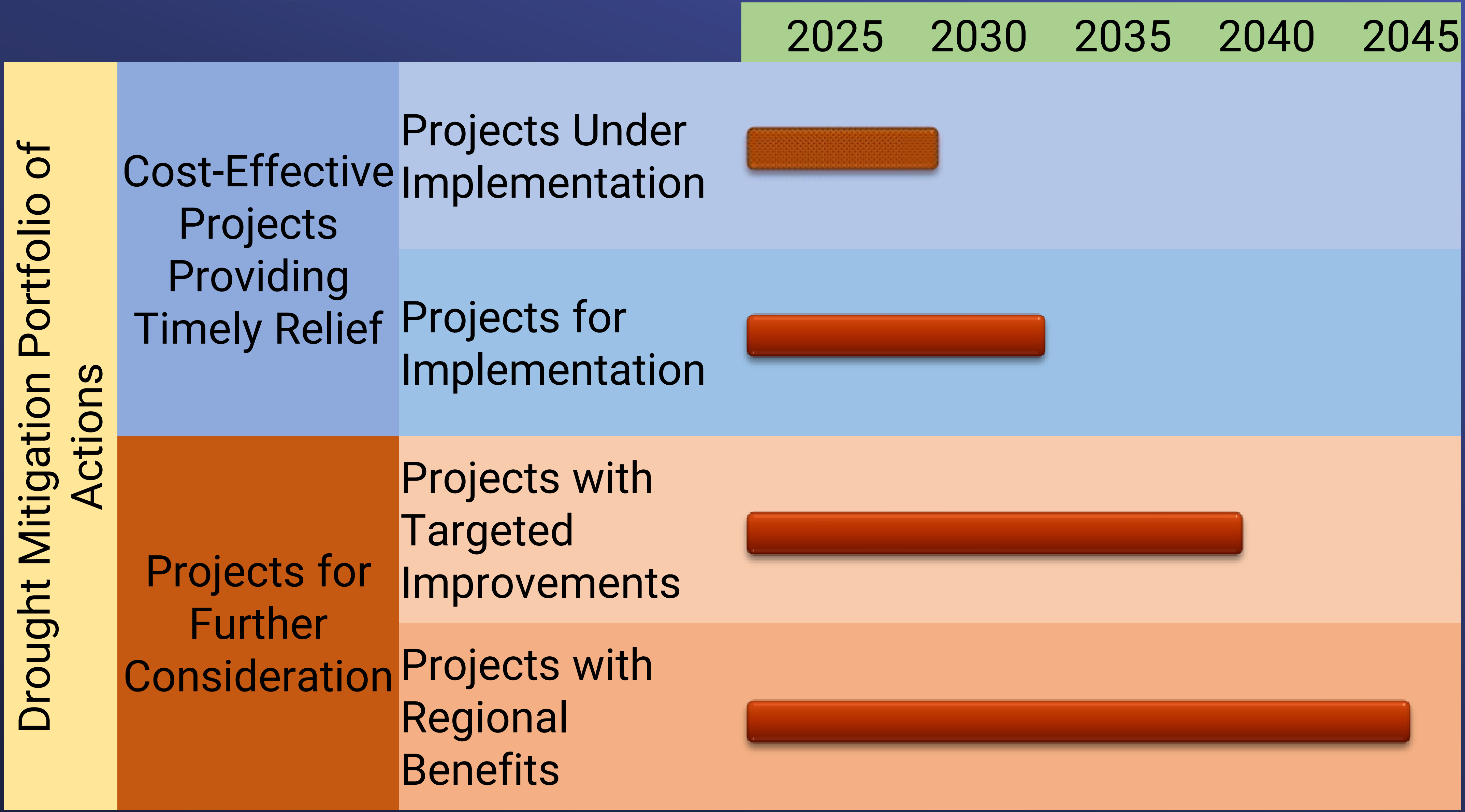


Drought Mitigation Actions Portfolio Projects for Further Consideration

Projects with Regional Benefits

Project Title	Category
E-W Regional Raw-Water Conveyance Line	Conveyance
SWP Storage - East San Joaquin Valley	Surface Storage
Flexible Storage (State & Federal Programs)	Surface Storage
AVEK Water Bank Expansion	Groundwater Storage
Recycled Water, Desalination	Local Supply

Portfolio Implementation Estimated Timeline



Planned Board Informational Items & Action - Implement Drought Mitigation Actions Portfolio

- Informational Item to the Engineering, Operations, and Technology Committee (February 2024)
  - Drought Mitigation Actions Implementation Plan
  - Integration of Drought Mitigation Actions in CAMP4W
- Action Item to the Engineering, Operations, and Technology Committee (March 2024)
  - Create a new CIP program for drought mitigation projects
  - Amend current CIP to include:
    - Sepulveda Feeder Pumping Phase 2 (160 cfs ultimate capacity)
    - Removing network constraints (e.g., Inglewood Lateral upgrade)

CIP Adjustments for Drought Mitigation Actions Portfolio

- Move projects under implementation to the new CIP program for better tracking of efforts and progress
  - DVL/Rialto delivery projects
  - Sepulveda Feeder Pumping Phase 1
- Add projects prepared for implementation to CIP
  - Burbank B-5 to B-5A Shift
  - TVMWD Miramar Pumpback Upgrade
  - Sepulveda Feeder Pumping Phase 2 (conceptual design)
- Allocate funding in CIP expenditure plan for continued development of Regional E-W Conveyance projects (pending CAM4W evaluation for implementation)
- Continue developing projects on the portfolio to provide attributes for CAMP4W evaluation and potential inclusion in future CIP

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA