WORKSHOP MEETING OF THE
BOARD OF DIRECTORS WITH MET DIRECTORS
MUNICIPAL WATER DISTRICT OF ORANGE COUNTY
18700 Ward Street, Board Room, Fountain Valley, California
September 6, 2017, 8:30 a.m.

AGENDA

PLEDGE OF ALLEGIANCE

ROLL CALL

PUBLIC PARTICIPATION/COMMENTS

At this time members of the public will be given an opportunity to address the Board concerning items within the subject matter jurisdiction of the Board. Members of the public may also address the Board about a particular Agenda item at the time it is considered by the Board and before action is taken.

The Board requests, but does not require, that members of the public who want to address the Board complete a voluntary "Request to be Heard" form available from the Board Secretary prior to the meeting.

ITEMS RECEIVED TOO LATE TO BE AGENDIZED

Determine need and take action to agendize item(s), which arose subsequent to the posting of the Agenda. (ROLL CALL VOTE: Adoption of this recommendation requires a two-thirds vote of the Board members present or, if less than two-thirds of the Board members are present, a unanimous vote.)

ITEMS DISTRIBUTED TO THE BOARD LESS THAN 72 HOURS PRIOR TO MEETING

Pursuant to Government Code Section 54957.5, non-exempt public records that relate to open session agenda items and are distributed to a majority of the Board less than seventy-two (72) hours prior to the meeting will be available for public inspection in the lobby of the District's business office located at 18700 Ward Street, Fountain Valley, California 92708, during regular business hours. When practical, these public records will also be made available on the District's Internet Web site, accessible at http://www.mwdoc.com.

(NEXT RESOLUTION NO. 2060)

PRESENTATION/DISCUSSION/INFORMATION ITEMS

1. INPUT OR QUESTIONS ON MET ISSUES FROM THE MEMBER AGENCIES/MET DIRECTOR REPORTS REGARDING MET COMMITTEE PARTICIPATION

Recommendation: Receive input and discuss the information.

2. SERIES OF DISCUSSIONS ON THE CALIFORNIA WATERFIX – PRESENTATION BY METOPOLITAN CHIEF FINANCE OFFICER GARY BREAUX

Recommendation: Review and discuss the information presented.

3. MET ITEMS CRITICAL TO ORANGE COUNTY (The following items are for informational purposes only – a write up on each item is included in the packet. Discussion is not necessary unless requested by a Director)

a. MET's Water Supply Conditions
b. MET's Finance and Rate Issues
c. Colorado River Issues
d. Bay Delta/State Water Project Issues
e. MET's Ocean Desalination Policy and Potential Participation by MET in the Doheny Desalination Project and in the Huntington Beach Ocean Desalination Project (Poseidon Desalination Project)
f. Orange County Reliability Projects
g. East Orange County Feeder No. 2
h. South County Projects

Recommendation: Discuss and provide input on information relative to the MET items of critical interest to Orange County.

4. METROPOLITAN (MET) BOARD AND COMMITTEE AGENDA DISCUSSION ITEMS

a. Summary regarding August Board Meeting
b. Review items of significance for MET Board and Committee Agendas

Recommendation: Review and discuss the information presented.

CLOSED SESSION

5. CONFERENCE WITH LEGAL COUNSEL—ANTICIPATED LITIGATION
Significant exposure to litigation pursuant to paragraph (2) of subdivision (d) of Section 54956.9: (1 Case)

ADJOURNMENT

Note: Accommodations for the Disabled. Any person may make a request for a disability-related modification or accommodation needed for that person to be able to participate in the public meeting by telephoning Maribeth Goldsby, District Secretary, at (714) 963-3058, or writing to Municipal Water District of Orange County at P.O. Box 20895, Fountain Valley, CA 92728. Requests must specify the nature of the disability and the type of accommodation requested. A telephone number or other contact information should be included so that District staff may discuss appropriate arrangements. Persons requesting a disability-related accommodation should make the request with adequate time before the meeting for the District to provide the requested accommodation.

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Item No. 2

DISCUSSION ITEM
September 6, 2017

TO: **Board of Directors**

FROM: **Robert Hunter,**
General Manager

Staff Contact: Harvey De La Torre
Melissa Baum-Haley

SUBJECT: **SERIES OF DISCUSSIONS ON THE CALIFORNIA WATERFIX – PRESENTATION BY METOPOLITAN CHIEF FINANCE OFFICER GARY BREAUX**

STAFF RECOMMENDATION

Staff recommends the Board of Directors review and discuss this information

REPORT

This summer, the Metropolitan Water District of Southern California held a series of workshops on issues related to the construction, operations and financing for the California WaterFix. In concert, Metropolitan has issued three policy white paper addressing the physical infrastructure, operations, and costs of the project. Metropolitan has also scheduled a special Board meeting on September 26 to consider the investment decision on the California WaterFix.

In preparation to this Metropolitan Board action, MWDOC has concurrently been holding a series of discussions in Orange County on the CA WaterFix, with presentations from key Metropolitan staff:

- On July 5, Metropolitan Bay-Delta Manager Steve Arakawa presented the key terms and provisions of the recently completed Biological Opinion, the status of the EIR/EIS & Key Permits, State Water Resource Control Board Hearings, and Metropolitan Board review.
- On August 2, Metropolitan General Manager Jeff Kightlinger presented the findings of two of MET's whitepapers: 1) Physical Infrastructure and 2) Operations of the CA WaterFix.

Budgeted (Y/N): N	Budgeted amount: None	Core _X_	Choice __
Action item amount: N/A	Line item:		
Fiscal Impact (explain if unbudgeted):			

- On August 30, Roger Patterson, Assistant General Manager for MET overseeing Metropolitan's strategic water initiatives for the Colorado River and Sacramento-San Joaquin Bay Delta was the guest speaker at the MWDOC Policy Dinner.
- On September 6, we have scheduled MET Chief Finance Officer Gary Breaux to discuss the findings of MET's last whitepaper - Financing and Cost Allocation and MET's staff recommendation for the September Board action.

As shown below is the presentation schedule for both MET and MWDOC meetings and topics of discussion.

Presentation Topic	Description	Presentation Date	
		Metropolitan	MWDOC
Update	• Completion of the Biological Opinions • Status of the EIR/EIS & Key Permits and State Control Board Hearings	June 27	July 5
White Pater #1: **Physical Infrastructure**	• Project features including protection for seismic risks • Design and Construction Enterprise • Cost Estimate • Construction budget and schedule	July 10	August 2

White Pater #2: **Operations**	• Project operations
	• Biological opinions
	  ○ Section 7 Biological Opinion - Federally listed species
	  ○ Section 2081 Permit –State listed species
	• Range of supply/Expected yield
	• Water Quality
	• Ability to manage water transfers
		July 25	August 2

White Pater #3: **Finance/Cost Allocation**	• Proposed Cost Allocation and Financing Mechanisms
	  ○ State/Federal
	  ○ State Water Contractors
	• Cost share analysis and cost impact to rates
		August 14	September 6

Board Workshop/ General Discuss	Board Questions and Follow Up	September 26	August 30
Board Action		September 26	---

Attachments:
Metropolitan White Paper #1 Physical infrastructure (summary)
Metropolitan White Paper #2 Operations (summary)
Metropolitan White Paper #3 Finance and Cost Allocation (summary & full paper)

MODERNIZING THE SYSTEM:

CALIFORNIA WATERFIX INFRASTRUCTURE

1

The first in a series of three policy papers prepared for the consideration of Metropolitan's Board of Directors in advance of planned summer meetings and decisions in Fall 2017.

Modernizing and improving California's water system is essential for the reliable delivery of water supplies to much of the state. About 30 percent of the water that flows out of taps in Southern California homes and businesses comes from Northern California watersheds and flows through the Sacramento-San Joaquin Delta. But the Delta's declining ecosystem and 1,100 miles of levees are increasingly vulnerable to earthquakes, flooding, saltwater intrusion, climate change and further environmental degradation.

California WaterFix is the product of more than a decade of review, planning, and rigorous scientific and environmental analysis by water experts, engineers and conservationists, as well as unprecedented public comment. The proposed project will improve the security of our water system by fixing aging infrastructure and constructing new, state-of-the art facilities using innovative technologies and engineering practices. Significant planning work for the design and construction of the project has been performed by the state, water agencies, and construction and engineering firms, which have determined the project is buildable. Details of the project features, actions to address public comment, risk management, schedule projection and cost estimates are addressed in a new white paper and summarized below.

Approach to Design & Construction

An extensive planning process evaluated various alignments, facility configurations and system options.

- The system would be capable of diverting up to 9,000 cubic feet-per-second from the Sacramento River and capturing additional wet period water supplies after all environmental flow and water quality criteria are met.
- Proposed construction plans, including the use of dual 40-foot diameter tunnels, is well within common practices in the engineering construction industry and will provide operational redundancy.

Specific steps were taken during the design effort to reduce or eliminate the impact of the new facilities on the environment and Delta communities. As a result of input during the environmental planning process, the following changes were made:

- Reduced size of overall project
- Expanded use of tunnels for conveyance
- Revised tunnel alignment
- Reduced size and location of intermediate forebay
- Reduced pumping requirements
- Reduced construction impacts along Sacramento River

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Key Project Features

DUAL CONVEYANCE:
A flexible dual intake system will deliver water to state and federal pumping plants in the south Delta. New intakes farther upstream will reduce overall adverse environmental impacts on the Delta and provide higher quality water to water contractors' service areas.

MODERNIZED FACILITIES:
The existing system will be modernized with new facilities, equipment and technologies. State-of-the-art fish screens and intake structures will reduce harm to fish.

OPERATIONAL FLEXIBILITY:
The new intake facilities will work in conjunction with the existing south Delta intake system, delivering water from just one system or both, depending on fishery and water quality conditions. Dual intakes will provide greater flexibility to protect fish when they are present.

OPERATIONAL EFFICIENCY:
Gravity-fed tunnels will move water more naturally and efficiently. This will simplify overall operations and reduce long-term system and maintenance costs.

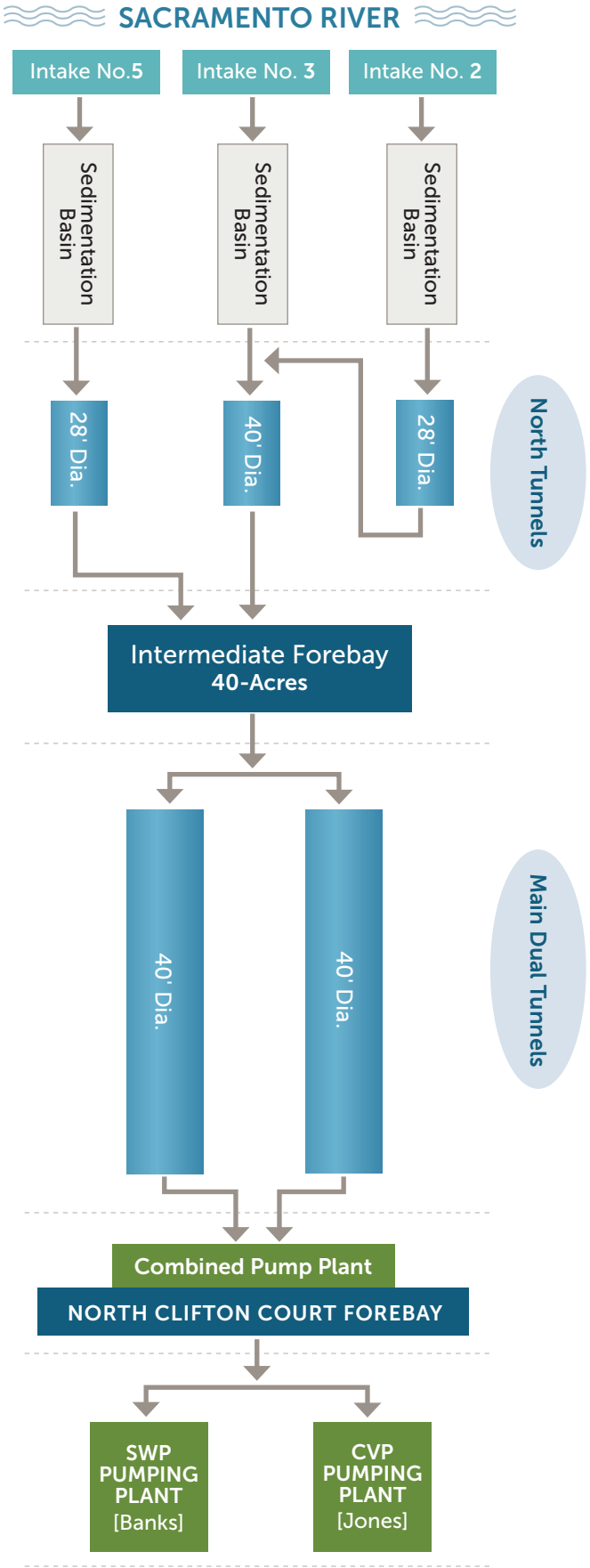
MAXIMIZES THE USE OF PUBLIC LANDS:
The project alignment uses more public lands, reducing the impact to private property and agriculture.

REDUCED ENVIRONMENTAL FOOTPRINT:
The proposed water facilities and operations have a greatly reduced project footprint compared to earlier proposals. This will reduce community impacts.

OTHER ENVIRONMENTAL CONSIDERATIONS:
The plan allows for a more natural flow direction in the Delta during critical fish protection periods and increases water supply reliability with greater flexibility to divert water in ways that protect sensitive fish species.

WATER SUPPLY RELIABILITY:
A modernized system can more reliably capture water from peak storms and flood flows to refill reservoirs and replenish groundwater basins.

EMERGENCY PREPAREDNESS:
A modernized system will ensure that water is available for drought and emergency needs and help protect supplies from earthquakes or other natural disasters that could disrupt the current system.



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Minimizing Risk

CRITICAL ISSUES RELATED TO DESIGN, CONSTRUCTION AND OPERATIONS HAVE BEEN ADDRESSED DURING THE PLANNING PROCESS:

Tunnels: Extensive work and surveys to identify best practices of large tunnel projects with similar design, construction and project management confirmed that the proposed California WaterFix tunnel boring machines are well within the existing industry knowledge and experience.

Leakage: The lining system will be designed to withstand the maximum internal pressure calculated for the conveyance system, resulting in negligible leakage.

Ground Vibration: Tunnels will be constructed at least 100 feet below ground. Material over the tunnels will dampen and absorb any energy generated during tunneling activities.

Surface Settlement: The project will use geotechnical information, monitoring and structure projection methods to mitigate the risk of settlement effects and structural damage.

Seismic Mitigation: Because the proposed tunnel alignment does not cross any major fault rupture or creep zones, the deep tunnels will not be subject to liquefaction potential. The tunnel design uses precast segmental lining systems which have been successfully used in seismically active areas around the world.

Geotechnical Considerations and Mitigations: At proposed tunnel depths, dense layers of silts, sands and clays are anticipated. This material will be suitable for the planned tunneling activities.

Flood Protection: Facilities will be engineered and designed to withstand water level rise resulting from both a 200-year storm event and from sea level rise of 18 inches in the Delta.

Construction Management

The Department of Water Resources is working with the State Water Contractors to resolve the final details of how the construction of California WaterFix will be managed to guarantee the project's safety and construction integrity and to ensure the project is delivered on time, on budget and in accordance with approved specifications, while managing risk prudently.

Cost

Cost estimates were determined through a rigorous analysis by industry professionals and will be updated as additional information becomes available.

Overall Cost	**$ 15.74 B**
Conveyance System Cost	**$ 14.94 B**
Program management, construction management and engineering	$ 1.91 B
Tunnels/shafts construction	$ 6.82 B
Remaining construction	$ 2.68 B
Contingency (~36% for tunnel/shafts and remaining construction)	$ 3.38 B
Land acquisition (includes 20% contingency)	$ 0.15 B
Environmental Mitigation (includes 35% contingency)*	**$ 0.80 B**

Program Estimate in 2014 Dollars

**Significant additional fishery habitat restoration will occur through California EcoRestore http://resources.ca.gov/ecorestore/*

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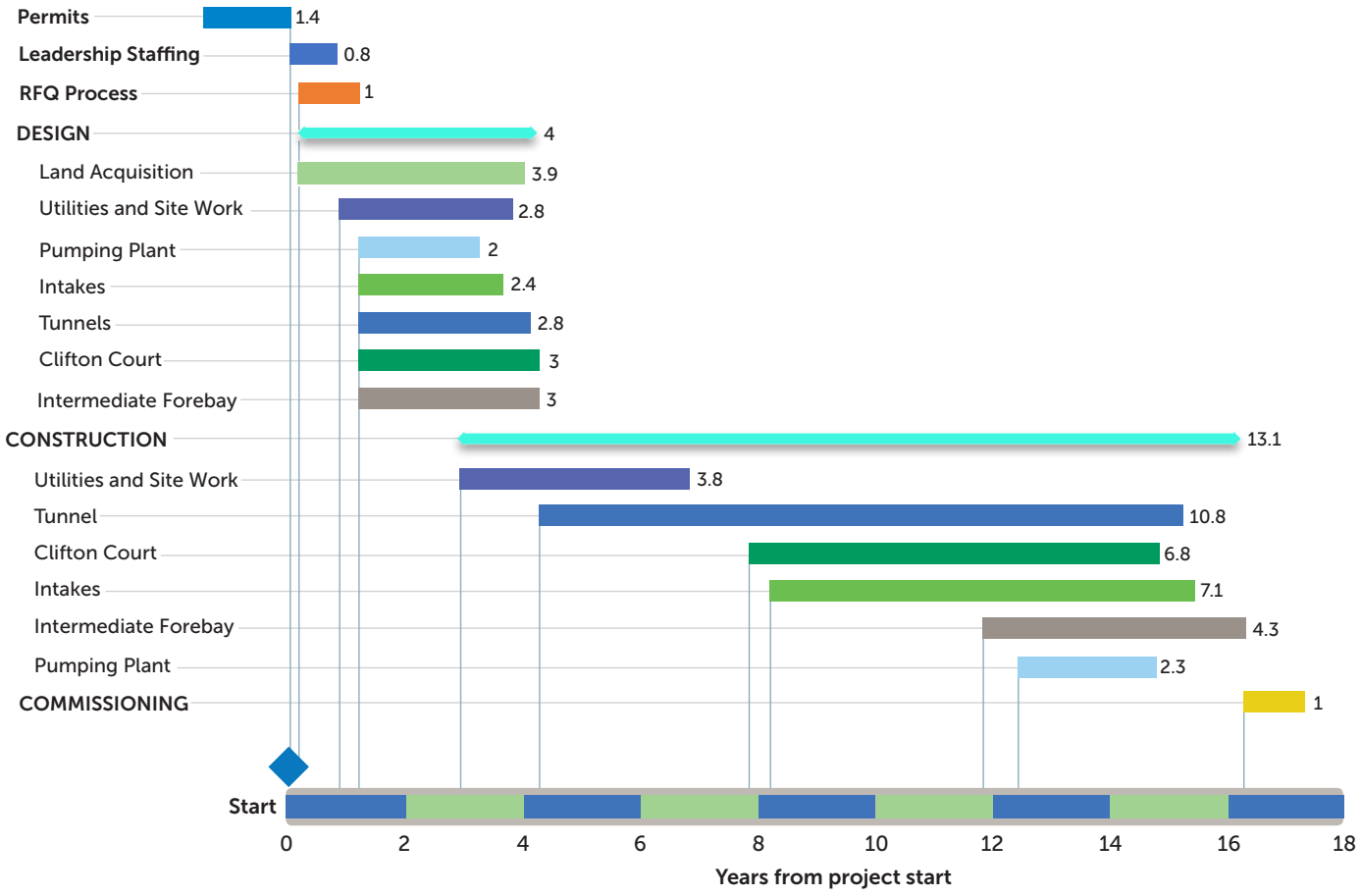
Schedule

The current schedule estimates it will take 12 to 15 months to fully staff the project, up to four years to complete the design phase and approximately 13 years to complete construction.

California WaterFix - Program Summary Schedule

Note: Years shown next to bars indicate task duration



OUR MISSION

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.

ABOUT METROPOLITAN

The Metropolitan Water District of Southern California is a state-established cooperative of 26 member agencies – cities and public water agencies – that serve nearly 19 million people in six counties. Metropolitan imports water from the Colorado River and Northern California to supplement local supplies and helps its members develop increased water conservation, recycling, storage and other resource management programs.

BE INFORMED, BE INVOLVED

www.mwdh2o.com

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Photos courtesy CA Department of Water Resources

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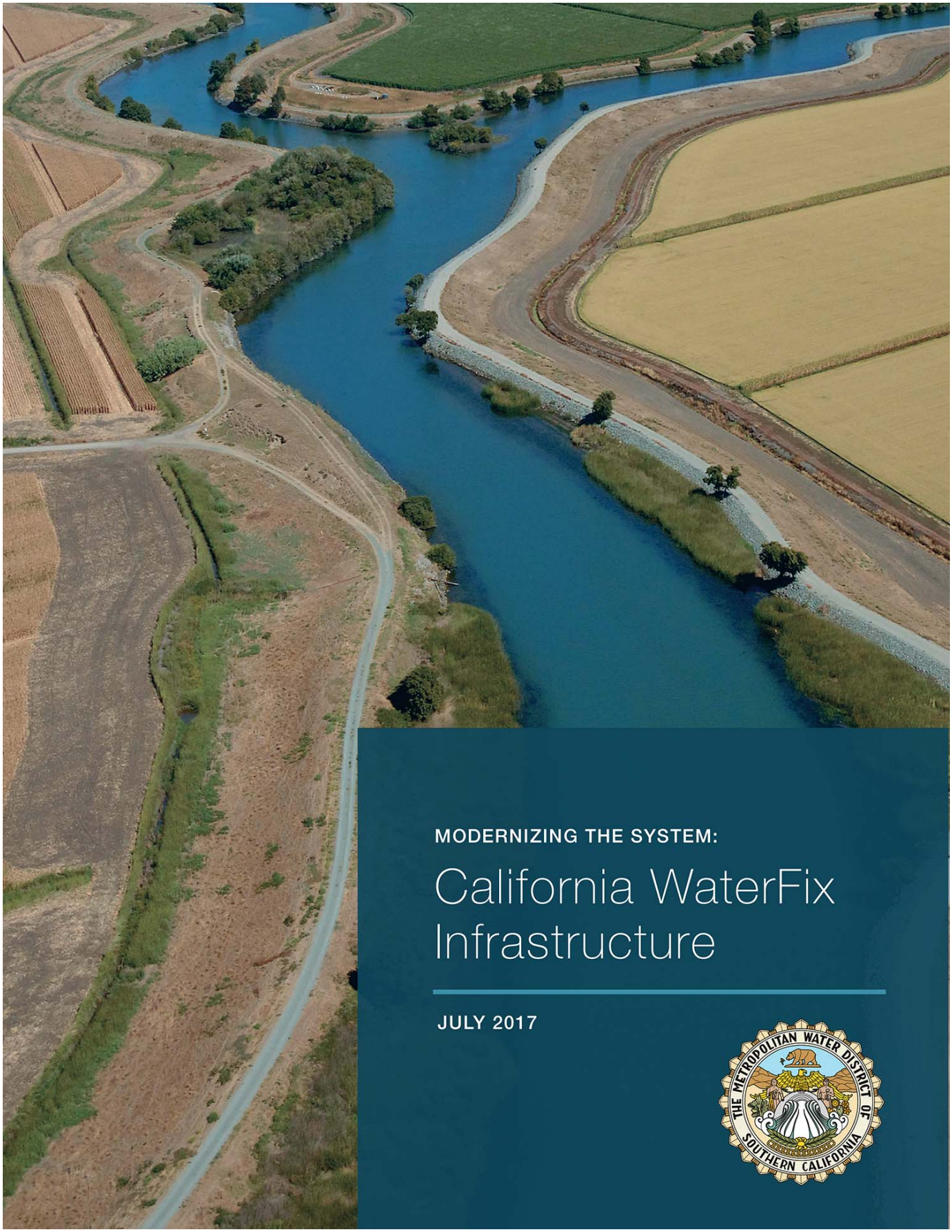

MODERNIZING THE SYSTEM:

California WaterFix Infrastructure

JULY 2017

Contents

Introduction

This is the first of three policy white papers prepared for the Metropolitan Water District of Southern California's Board of Directors on the proposed California WaterFix. The overall objective of these papers is to provide relevant information for the Board before the Board considers decisions on the project.

This initial paper focuses on the project's planned infrastructure improvements. It presents the key project features, including proposed facilities, governance structure, current cost estimates and implementation schedule, as well as the planned approach to managing and mitigating project risks. The remaining two policy white papers will focus on operations and financing/cost allocation.

Specific objectives of this paper are:

1. To review the physical infrastructure of California WaterFix, with a focus on the key project facilities (see Figure 1);
2. To outline the State's approach to managing and implementing the project through a proposed Delta Conveyance Design/Construction Joint Powers Authority, designated the Design and Construction Authority, or "DCA," and Metropolitan's potential role in the new DCA;
3. To outline the project's planned approach to risk management and present key risk-related issues, including steps being taken to mitigate potential risks to keep the project within cost and schedule targets.

Summary

Water from the State Water Project (SWP) flows through the Sacramento-San Joaquin Delta to the Bay Area, San Joaquin Valley, Central Coast and Southern California. Metropolitan and the 28 other State Water Project contractors rely on the Department of Water Resources (DWR) to deliver water from the State Water Project (SWP); 24 of the contractors, including Metropolitan, would directly benefit from receiving water via the Delta through California WaterFix facilities. The other five water contractors receive water further upstream in the watershed or from the North Bay Aqueduct.

As Metropolitan's Board and the state Legislature have recognized, the current water delivery system in the Delta, with its 700-mile web of waterways, sloughs, canals, and islands, supported by about 1,100 miles of earthen levees, is unsustainable. Threats of earthquakes, floods, subsidence, climate change, rising sea levels, and increasing regulatory constraints on water operations, as well as other risks and uncertainties in the Delta, are contributing to a decline in water supply reliability and in the ecosystem. The Delta's ecosystem and water supply reliability will continue to decline unless action is taken.

Delta conveyance has been studied extensively, and many solutions have been proposed over the last 50 years. A summary of these efforts is presented in Table 1.

In 2007, Metropolitan's Board adopted its Delta Action Plan (DAP) and Delta Conveyance Criteria as policy direction. The Delta Conveyance policy established six specific criteria for comparing Delta conveyance options: providing water supply reliability, enhancing the Delta ecosystem, improving export water quality, allowing flexible pumping operations in a dynamic fishery environment, reducing seismic risks to the water supply and reducing long-term risks from salinity intrusion associated with rising sea levels. As proposed, California WaterFix addresses each of these criteria.

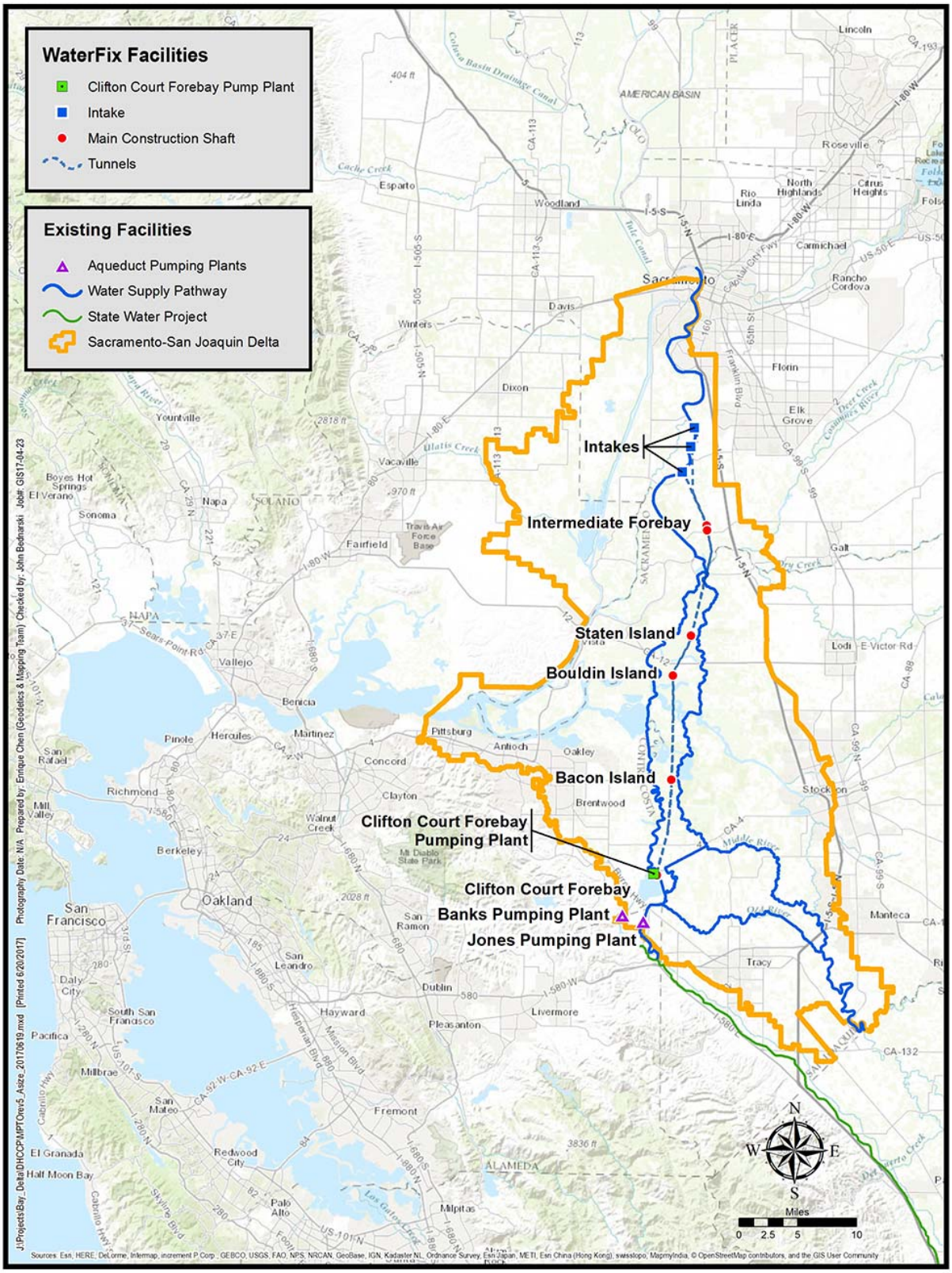

FIGURE 1: OVERVIEW OF THE DELTA AND CALIFORNIA WATERFIX FACILITIES

TABLE 1: DELTA CONVEYANCE STUDIES AND PROPOSALS TIMELINE

Year	Activity
1960s	California Department of Fish and Game, now known as the California Department of Fish and Wildlife, biologists publish an article in American Fisheries Society Special Publication #3, showing that the best protection for native fish populations, and solution to the Delta's environmental problems, is abandoning sensitive river channels for water transport. U.S. Fish and Wildlife Service backs the Peripheral Canal proposal, calling it the only engineering plan that would not have detrimental effects on fish and wildlife while offering the biggest opportunity for fish enhancement. Interagency Delta Committee completes its report recommending various Delta facilities, including the Peripheral Canal.
1994	Bay Delta Accord is signed, authorizing "CALFED," a joint state and federal agency process to develop water quality standards, coordinate operations of the SWP and CVP and work toward long-term Delta solutions.
1998	CALFED "Diversion Effects on Fish Team" finds that an isolated facility would substantially reduce entrainment and predation effects on the Delta's native fish populations.
2000	CALFED Bay-Delta Program releases "California's Water Future, a Framework for Action." Among the list of comprehensive actions, it identifies the need to evaluate a screened diversion facility on the Sacramento River to improve water quality in the Delta and at the export facilities. Construction would begin by late 2007.
2007	Delta Vision Blue Ribbon Task Force recommends an assessment of dual conveyance, saying new facilities for conveyance and storage, and better linkage between the two, are needed to better manage California's water resources for both the Delta and exports.
2008	Public Policy Institute of California states a peripheral canal is the best Delta conveyance option for meeting the coequal goals of a healthy Delta ecosystem and water supply reliability.
2009	The Governor enacts the Delta Reform Act, which includes the coequal goals of providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem in a way that protects the Delta's unique characteristics. The law directs state and federal officials to examine a reasonable range of ways to change Delta water project diversions, including isolated conveyance.
2010	The first administrative draft Bay Delta Conservation Plan (BDCP) was released.
2012	The second administrative draft Bay Delta Conservation Plan was released.
2013	Release of Draft BDCP and Draft EIR/EIS in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) for formal public review and comment.
2014	Announcement of further refinements to the water delivery facilities to reduce impacts to Delta communities, minimize disturbances or dislocation to Greater Sandhill Cranes and improve the long-term reliability and operation of the proposed infrastructure.
2015	Announcement of a modified preferred alternative, Alternative 4A, known as California WaterFix.
2015	Release of Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement on the Bay Delta Conservation Plan/California WaterFix.
2016	Final BDCP/CA WaterFix and EIR/S.

Sources:

1. The information from the 1960s to 2009 is from "The History of Water Project Conveyance in the Delta," which is a publication from the California WaterFix website. The following link is to a PDF version of this document: *http://cms.capitoltechsolutions.com/ClientData/CaliforniaWaterFix/uploads/83my6_FIX_FS_ConveyanceHistory.pdf*
2. The information from 2010 to 2016 is from the Bay Delta Conservation Plan (BDCP) website at the link: *http://baydeltaconservationplan.com/Library/BDCPLibrary/BDCPPlanningProcess/BDCPPlanningProcessHistory.aspx*.

California WaterFix aims to provide the facilities necessary to support Delta water exports through dual-conveyance operation. Dual conveyance would divert water from the Sacramento River in the north Delta under certain hydrologic conditions using new facilities, while retaining current south Delta diversions through existing facilities. To divert water from the north Delta, three new screened intakes would be constructed along the Sacramento River, along with associated tunnels and pumping facilities. The new facilities would allow water to be delivered directly from the Sacramento River intake locations to the existing south Delta export pumps located at the State Water Project's Banks and Central Valley Project's Jones pumping facilities. Under appropriate south Delta conditions, north Delta diversions can be appropriately modulated, and water from the north Delta can be diverted through the existing south Delta facilities. This dual conveyance capability would potentially allow for diversions from both north and south Delta locations while taking into account the presence and needs of fish species. As part of the planning process, potential impacts of the proposed system facilities have been identified and appropriate risk management measures have been incorporated into the project as mitigation.

Dependent on the approval of Metropolitan's Board and other public water agencies, a new special purpose Design and Construction Joint Powers Authority (the Design and Construction Authority, or "DCA") composed of public water agencies, including Metropolitan, would design and construct California WaterFix, subject to DWR's oversight and ultimate decision-making authority. The DCA would be responsible for day-to-day implementation of all project aspects. This includes the management, design, construction and commissioning of California WaterFix facilities; managing the overall project budget of $14.9 billion, plus about $800 million for project mitigation (both in 2014 dollars); and ensuring that the project is completed within the proposed schedule, which currently estimates project completion 16 years after authorization. The DCA is expected to employ an active risk management strategy that identifies and takes action to address potential issues that could pose significant risk to the project's overall scope, schedule and budget. Subject to Board approval, Metropolitan, as the largest contractor for State Water Project water, would play an important and direct role in the DCA and overall governance of the project team.

California WaterFix has undergone an unprecedented level of public outreach, review and comment, along with extensive scientific analysis as part of the environmental planning process. Significant changes and refinements to the physical configuration and operational characteristics were made to address issues raised during the environmental planning process and to address the outcomes from the biological assessment/opinion processes. Taken together, these revisions have refined and improved the project and have reduced environmental impacts, while maintaining the underlying core capabilities of the proposed system. The planning process has been completed, and the federal and state lead resource agencies for California WaterFix —the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation)— have completed the environmental review process under the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). In addition, the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NMFS) have issued biological opinions on the project.

Based on the information available to date, it is staff's view that the facilities as currently proposed would meet Metropolitan's adopted policy direction and, under the guidance of the DCA, the facilities could be completed within budget and on schedule with a high degree of confidence.

Why California WaterFix

THE CURRENT SITUATION IN THE DELTA

The Sacramento-San Joaquin Delta is where California's two largest rivers meet, an area where saltwater from the Pacific mixes with freshwater from the rivers. Water flowing through the Delta supplies water to about 25 million Californians and about 3 million acres of agricultural production. Some regions of California are 100 percent dependent on Delta diversions for their water supplies.

Current operations of the State Water Project (SWP) and Federal Central Valley Project (CVP) rely on a series of channelized waterways to convey water through the Delta to state and federal pumping facilities located at the south end of the Delta. The pumping facilities then lift the water into the SWP aqueduct and Federal CVP canal.

There are many stressors affecting the Delta. The 1,100 mile levee system was developed beginning in the late 1800s to support agricultural activities, which changed the tidal wetland environment of the Delta. The levees and other Delta infrastructure are increasingly vulnerable to failure caused by continued subsidence, natural degradation, earthquake risks, flood conditions and sea level rise. The current water delivery system in the Delta is also increasingly affected by regulatory constraints on water project operations, salinity intrusion due to sea level rise, the presence of non-native species and the presence of endangered fish near the southern export pumps at certain times of year, which limit when or at what rate the pumps can export water. The continued decline of the Delta's ecosystem has led to severe restrictions in water supply deliveries, resulting in the need to improve California's water reliability and restore the Delta's fragile ecosystem.

The Bay Delta Conservation Plan/California WaterFix Final EIR/Final EIS states that improvements to the water conveyance system are needed to respond to increased demands on the system and risks to water supply reliability, water quality, and the aquatic ecosystem. Improvements are also needed because sea water intrusion from sea level rise causes more need for Delta outflow, which results in impacts to water supply. Operational flexibility can be increased to provide improved water supply reliability and minimize and avoid adverse effects on listed species. DWR's fundamental purpose in proposing the proposed project is to make physical and operational improvements to the SWP system in the Delta that are necessary to restore and protect ecosystem health, water supplies of the SWP and CVP south of the Delta and water quality within a stable regulatory framework, consistent with statutory and contractual obligations. (Bay Delta Conservation Plan/California WaterFix Proposed Final EIR/Final EIS, 2016, Chapter 2).

THE DUAL CONVEYANCE SOLUTION

To address these current and potential threats to the existing Delta conveyance system, California WaterFix proposes a new dual conveyance system that would allow water from both the north Delta and south Delta to be delivered to the Banks and Jones pumping plants. The new north Delta facilities (see Figure 1 and Figure 2) could divert up to 9,000 cubic feet per second (cfs) from the Sacramento River, improving water supply reliability and export water quality. Retaining the current south Delta water exports under California WaterFix ensures an additional avenue to deliver water to the south Delta pumps when water quality and other environmental conditions (e.g., absence of fish species) permit. Providing flexibility in how water is conveyed across the Delta to the existing Banks and Jones pumping plants can avoid adverse impacts to sensitive fish species.

PROJECT FEATURES AND BENEFITS

California WaterFix would include the following features (see also Figure 2 and Figure 3):

A. **Isolated Deliveries:** Delivers water directly from the Sacramento River in the north Delta to pumping plants in the south Delta. This allows water delivered by California WaterFix facilities to flow to state and federal pumps without commingling with in-Delta channel water, thereby providing greater flexibility to protect fish when they are present.

B. **Operational Flexibility:** Works in conjunction with the existing south Delta delivery system. If desired, diversions from the Sacramento River in the north Delta could take place simultaneously with diversions from the existing south Delta facilities, or from one system or the other.

C. **Operational Efficiency:** Allows for water deliveries to occur entirely by gravity flow under certain hydraulic conditions. The remainder of the time, water would flow by gravity through the tunnels to the south Delta, where a new pumping plant would lift water into the North Clifton Court Forebay. Using gravity to make deliveries simplifies overall operations and reduces long-term system operation and maintenance costs.

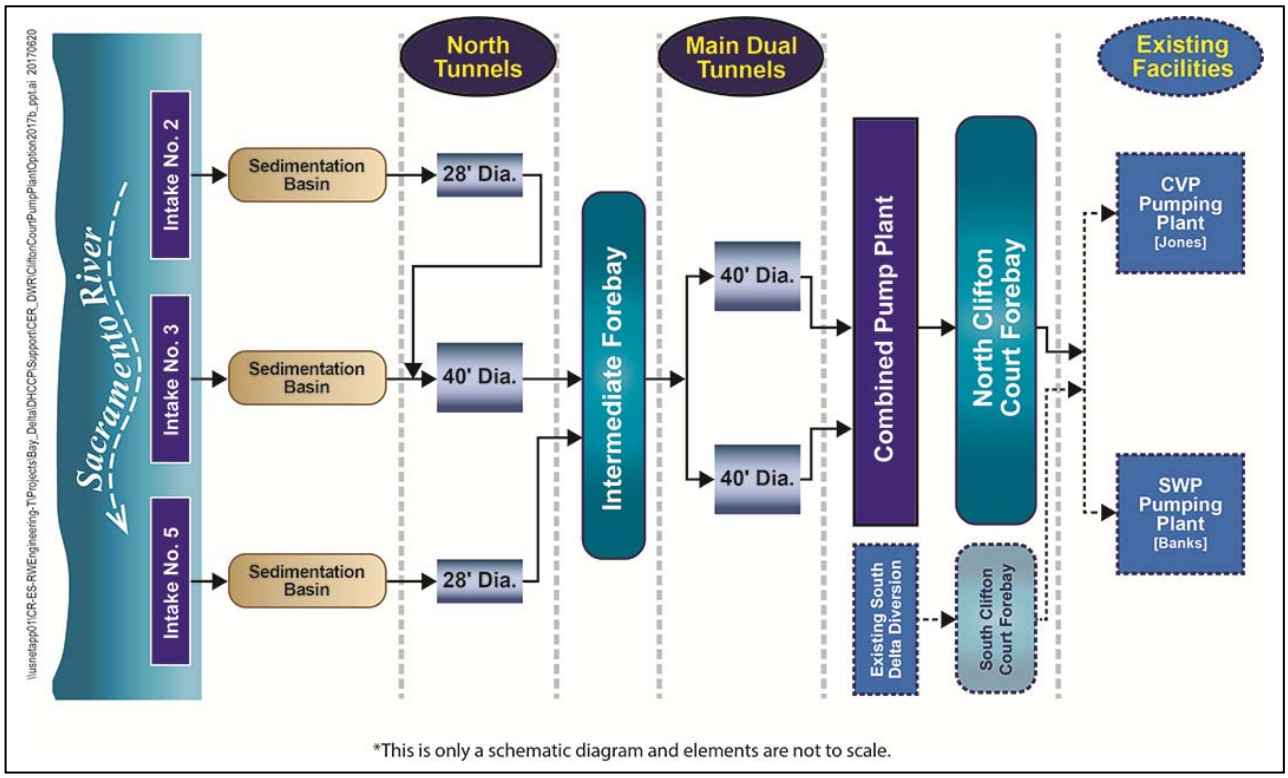

FIGURE 2: SYSTEM CONFIGURATION OF CALIFORNIA WATERFIX FACILITIES

D. **Modernized Facilities:** Upgrades a decades-old system with new facilities, equipment, and technologies that would improve and modernize operations. State-of-the-art fish screens and intake structures would allow for more efficient delivery of water from the new facilities, even when endangered species of fish are near the new intake structures.

E. **Use of Public Lands:** Maximizes the use of public lands, reducing the impact to agriculture and other resources. This reduces the time and cost associated with purchasing private property, easements or rights of way.

F. **Reduced Environmental Footprint:** Minimizes above-ground facilities by 1) using tunnels instead of canals to convey the water through the system, and 2) incorporating a number of refinements made during the design phase, such as eliminating the pumping stations at each of the three new intakes and reducing the size of the intermediate forebay. This represents a smaller footprint in comparison with other alternate intake facility proposals, reducing project impacts and mitigation costs.

G. **Other Environmental Considerations:** Considers the environment and incorporates refinements resulting from the environmental review process to reduce impacts to the environment. This approach was used throughout the design process, from the alignment chosen, to the conceptual design of the fish screens at the intake facilities, to the extensive environmental commitments, avoidance and minimization measures incorporated into the project. Mitigation measures also would be incorporated where potentially significant impacts cannot be avoided. As stated, the current configuration would minimize adverse environmental impacts by:

- Allowing for a more natural flow direction during fish-sensitive periods in the Delta to protect and benefit sensitive native fish species; and
- Providing the flexibility to divert water while complying with state and federal laws and regulations that protect sensitive fish species.

H. **Water Supply Reliability:** Safely and reliably captures water during periods of heavy rain and high Delta flows to refill reservoirs and replenish groundwater basins, with the flexibility to reduce pumping in dry periods, which would reduce impacts to sensitive fish species.

I. **Emergency Preparedness:** Ensures that more water is available for drought and emergency needs, including an earthquake or other natural disaster that collapses Delta levees or otherwise disrupts the current system. The facilities would also enable diversions that would mitigate the impacts of temporarily losing the ability to divert water from the south Delta.

California WaterFix Facilities

MAJOR COMPONENTS AND FACILITIES

Sacramento River Intakes

Three intakes, each with a capacity of 3,000 cfs, are proposed along the Sacramento River (see Figure 3). The location of each intake was determined by extensive collaboration between DWR and state and federal fishery agencies to identify locations that would minimize incidental take of listed species.

Each of the three intake facilities consists of on-bank screened intake structures; gravity-fed intake conduits; flow meters and control gates; sedimentation basins to allow suspended material from the river to be removed from the water before the water enters the tunnel system; and a drop-shaft at the far end of the sedimentation basins to connect the intakes to the adjacent tunnel network. The bottom-most portion of each intake screen would be situated three to five feet above the river bottom in order to prevent large debris and other heavy suspended materials from entering the intakes or becoming impinged on the screens.

A main factor in sizing and configuring the intake structures was the need to meet specific flow velocities for the water moving past and through the screens. To meet recommended criteria set by state and federal fishery agencies to protect Delta smelt and migrating salmon, the screen area has been set to ensure the approach velocity of the water toward the screens would be no greater than 0.2 feet per second under design flow conditions.

Tunnels and Shafts

The tunnel portions of California WaterFix have been divided into two general sections, the North Tunnels and the Main Tunnels (see Figure 2 and Figure 3). The North Tunnels extend from the intakes to the intermediate forebay and have been sized so water flows from the diversions could be equally split between any or among all of the three river intakes that are in operation at any given time. The two Main Tunnels extend from the intermediate forebay to the combined pump plant at Clifton Court Forebay and have been sized so that each tunnel would be capable of delivering up to 4,500 cfs under design conditions. Dual parallel tunnels for the Main Tunnel reaches are proposed to meet the total desired capacity of 9,000 cfs and ensure system reliability, allowing one tunnel to be isolated for maintenance or major repairs while the second tunnel is kept in operation.

All tunnels would be excavated using tunnel boring machines (TBMs) instead of cut-and-cover construction. Although the Main Tunnels span about 30 miles, the tunnels would be constructed in segments or reaches about six to eight miles long. Each reach would be connected to subsequent tunnel reaches at shaft structures located along the alignment, as shown in Figure 3. As the TBMs advance, soil would be removed from the tunnel and concrete segments would be installed to form the tunnel lining system. This concrete segmented liner serves as the final lining system for the tunnels. This approach is commonplace on construction projects throughout the world and is used in both transportation and water infrastructure projects. The liner would be sealed with a series of gaskets and bolted connections between the adjacent segments to avoid leakage.

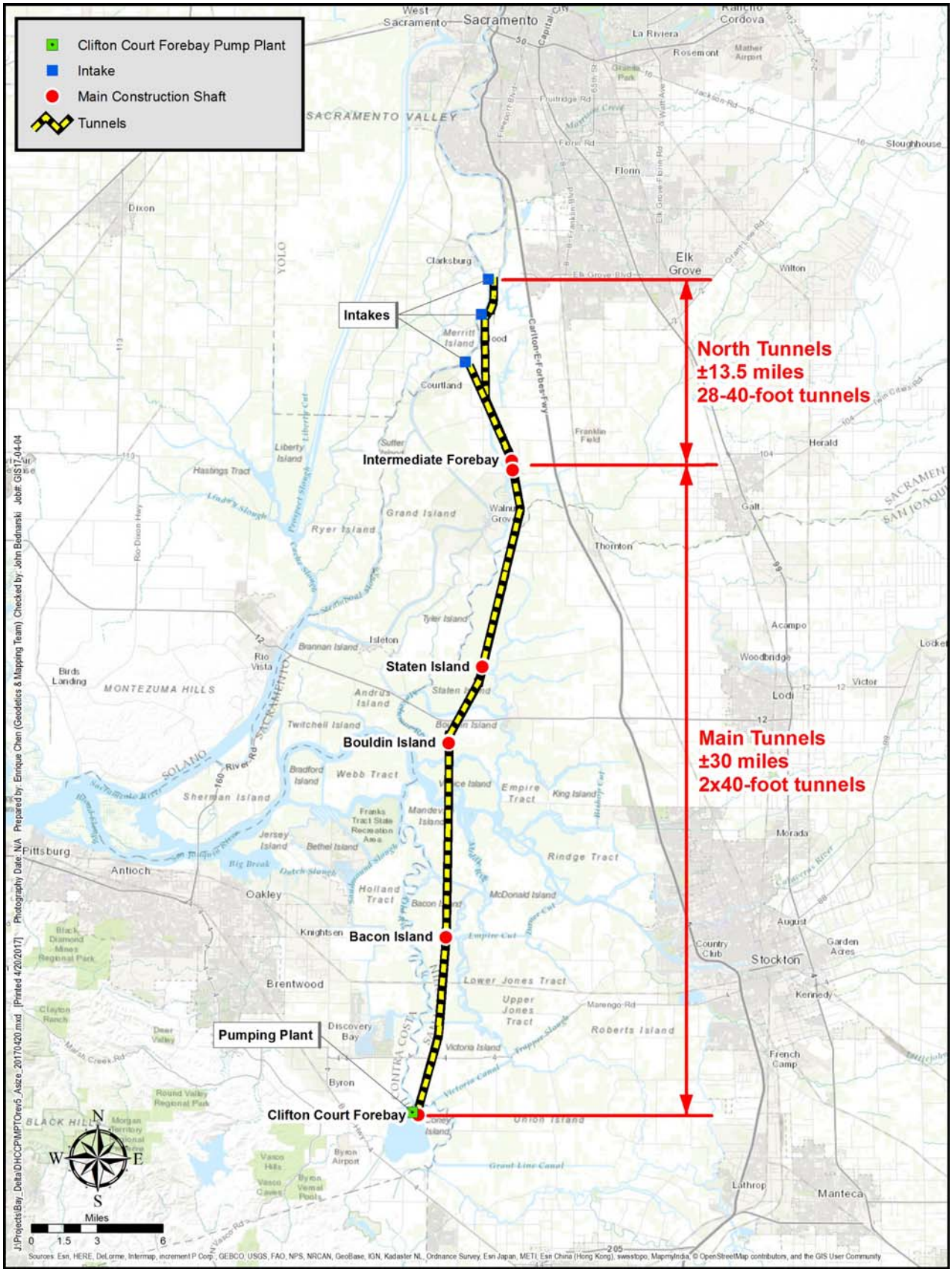

FIGURE 3: CALIFORNIA WATERFIX FACILITIES

Much of the Delta geology is covered with organic peat deposits. Although the peat deposits are very advantageous for agricultural purposes, they present a significant risk of liquefaction in a seismic event. However, the extent of the peat deposits is relatively well understood in the Delta, and ground conditions beneath the peat are generally characterized as dense deposits of silts, sands and clay layers. These dense layers would be very suitable for the planned tunnels because they would not be subject to liquefaction or settlement in the event of a seismic event. The tunnels would be constructed at sufficient depth below the ground surface (about 150 feet from ground surface to the bottom of the tunnel) to avoid existing surface infrastructure and liquefiable soil materials like peat. It is not anticipated that any cut-cover pipelines in the challenging Delta surface geology conditions would be part of California WaterFix facilities.

Deep shafts would be required along the tunnel alignments to facilitate construction, operation and maintenance of the conveyance system. During construction, the shafts would be used to launch and retrieve the TBMs, provide an access point into the tunnels for delivery of tunnel building supplies and labor, and provide a location to join adjacent tunnels to the larger tunnel system. After construction, some of the construction shafts would be modified and used to support long term operations and maintenance needs for the tunnels. Other shafts used in the construction process, such as maintenance shafts, would be sealed and buried to a depth that would support farming activities after construction concludes.

A significant area for investigation during the design activities would be developing the connection of the tunnels with the shafts. Special construction details would be developed through computer modeling to ensure that the tunnel-shaft connection points would be well understood, and so that the interaction of these two structures (tunnel and shaft) could sustain anticipated movement during a seismic event.

Intermediate Forebay

The 30-acre Intermediate Forebay allows for flows from the three separate intakes to be blended before entering the two Main Tunnels. The forebay would also help dampen hydraulic surge waves that could occur in the Main Tunnels if there is a power outage at the Clifton Court pump station. The forebay, along with flow meters and control gates in the intakes, would enhance the ability for independent operation of each river intake and the two Main Tunnels while providing for the overall operational stability of the system. The forebay would be comprised of earthen embankments and tunnel shaft structures, with the shaft structures allowing water to enter at the forebay's north end and exit at the forebay's south end.

Clifton Court Forebay

To achieve the dual goal of isolating delivery of water diverted from the Sacramento River to the pumps at the south end of the Delta while maintaining south Delta export capabilities, the existing Clifton Court Forebay would be separated into the North Clifton Court Forebay and the South Clifton Court Forebay (see Figure 4). Water from the new conveyance system would be pumped or flow from the tunnels into North Clifton Court. South delta diversions would enter South Clifton Court through the existing Old River gate structure.

The new South Clifton Court Forebay would be expanded by creating an additional storage area to the south of the existing levees, as shown in Figure 4. Separating the existing forebay into two sections allows fish-screened water from the north Delta intakes to be isolated from other waters throughout the delivery system. Additional new canals, gate structures and flow meters would also be constructed so water from the North and South Clifton Court Forebays can be conveyed to the existing Jones and Banks pumping plants. These canals and gates would be designed to allow single-mode diversion or simultaneous dual-mode deliveries of both waters to the pumping plants.

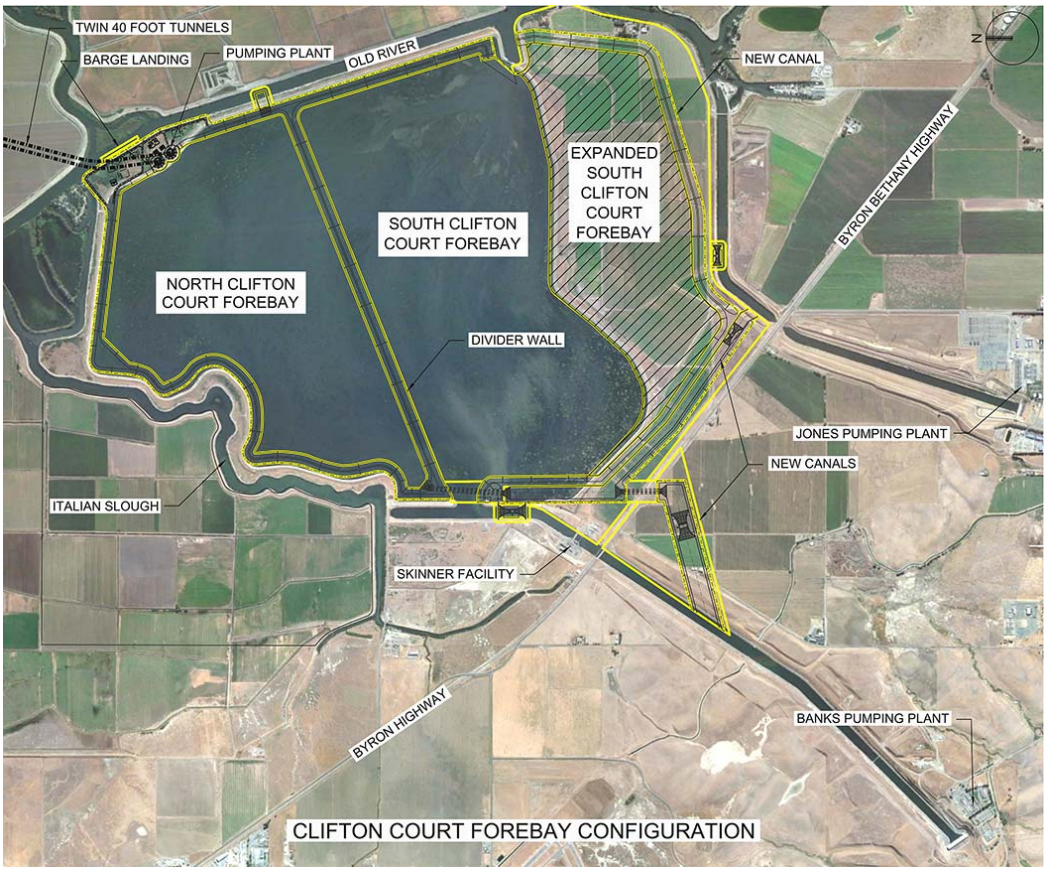

FIGURE 4: CLIFTON COURT FOREBAY, INCLUDING PROPOSED MODIFICATIONS

Pumping Station at Clifton Court Forebay

A 9,000 cfs pumping station would be constructed at the northeast corner of the Clifton Court Forebay to lift the water from the Main Tunnels into the North Clifton Court Forebay. The pumping station would consist of two pumping plants, each rated at 4,500 cfs capacity. Each pumping plant would be located directly above the end of the Main Tunnel (see Figure 5). Water flowing south in the Main Tunnels would fill up a pumping well in the bottom of each pump plant before vertical turbine pumps lift the water into North Clifton Court.

Under certain hydraulic conditions in the Sacramento River, water can flow by gravity from the Sacramento River into North Clifton Court without using the pumping station. In these conditions, the pumps would be shut off, and water would flow by gravity directly from the tunnels through the surge channel in the pump plant and into North Clifton Court. In the event of a power outage at the pump plant, hydraulic surge waves would be dissipated at the pump station by allowing water to flow over the surge channel and into North Clifton Court.

SUPPORTING INFRASTRUCTURE

In addition to the major components of the project, construction of supporting infrastructure would be required for the operation of the new facilities and as a prerequisite for construction activities. Some of the required permanent and temporary infrastructure includes:

- High voltage electrical power lines to run the TBMs and operate the pumping facilities;
- Initial site grading and site preparation work;
- Access roadways and barge landings at key work sites;
- Improvements to existing municipal/private roads to support anticipated construction traffic;
- Restoration of public and private roads used to support project activities to pre-construction conditions once the project is complete;

- Improvements around critical infrastructure, including levees, to ensure stability during subsequent work; and
- Removal/relocation of existing gas and water wells that could conflict with tunnel or intake construction.

Completing these activities prior to the major construction work would help ensure that the overall program schedule and budgets would be maintained.

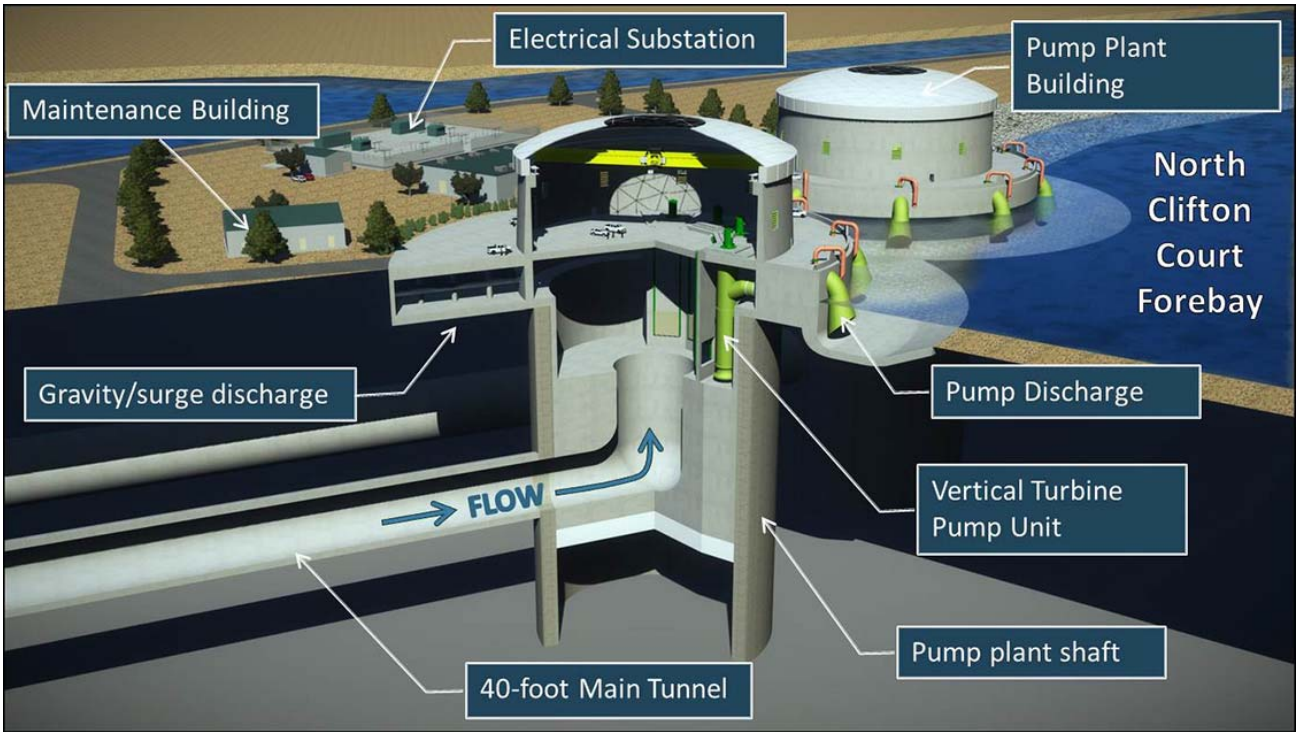

FIGURE 5: PROPOSED PUMPING FACILITIES AT CLIFTON COURT FOREBAY

APPROACH TO DESIGN AND CONSTRUCTION

The proposed configuration of California WaterFix is the result of an extensive planning process that evaluated various alignments, facility configurations and environmental considerations. The results of this conceptual planning/engineering effort are documented in a series of Conceptual Engineering Reports, with the final draft report being released in 2015, and in the EIR/EIS, which was released in 2016. As part of the environmental documentation process, all alternatives received extensive environmental analysis consistent with CEQA, NEPA, and the Delta Reform Act, which included consideration of comments received during initial scoping, and the public review periods of the draft EIR/EIS (2013), partially recirculated draft EIR/supplemental draft EIS (2015) and the proposed Final EIR/Final EIS (2016).

As mentioned earlier, having dual 40-foot main tunnels ensures system reliability by providing redundancy, and the construction approach would use technologies and methodologies that are well understood within the construction industry. Tunnels of this size have been successfully constructed, or are in the planning/design phase, in many locations throughout the world (see Figure 6). As shown in this figure, the planned California WaterFix tunneling machines are at the lower end of the range for large tunnel projects that have been implemented.

During the planning process, an alternative to a twin tunnel configuration for California WaterFix, a single bore main tunnel sized to convey up to 9,000 cfs, was also investigated. Preliminary analysis indicated that a single-bore tunnel would require a tunnel with an inside diameter of about 56 feet. This tunnel size would require a TBM size of 60 feet or more in diameter (assuming use of a 24-inch thick concrete segmental liner). Currently, the two largest TBMs in the world are the Tuen Mun-Chep Lap Kok Hong Kong TBM at 57.7 feet in diameter and the Alaska

Way TBM in Seattle, Washington at 57.3 feet in diameter. At the time, the TBM used in the Seattle project was the largest TBM ever built, and the issues and multi-year delays experienced on this project are well documented. A potential California WaterFix single bore TBM at about 60 feet in diameter would represent a machine that is four percent larger than current technology experience, and a tunnel that large would set an engineering design and construction precedent, increasing the overall project risk.

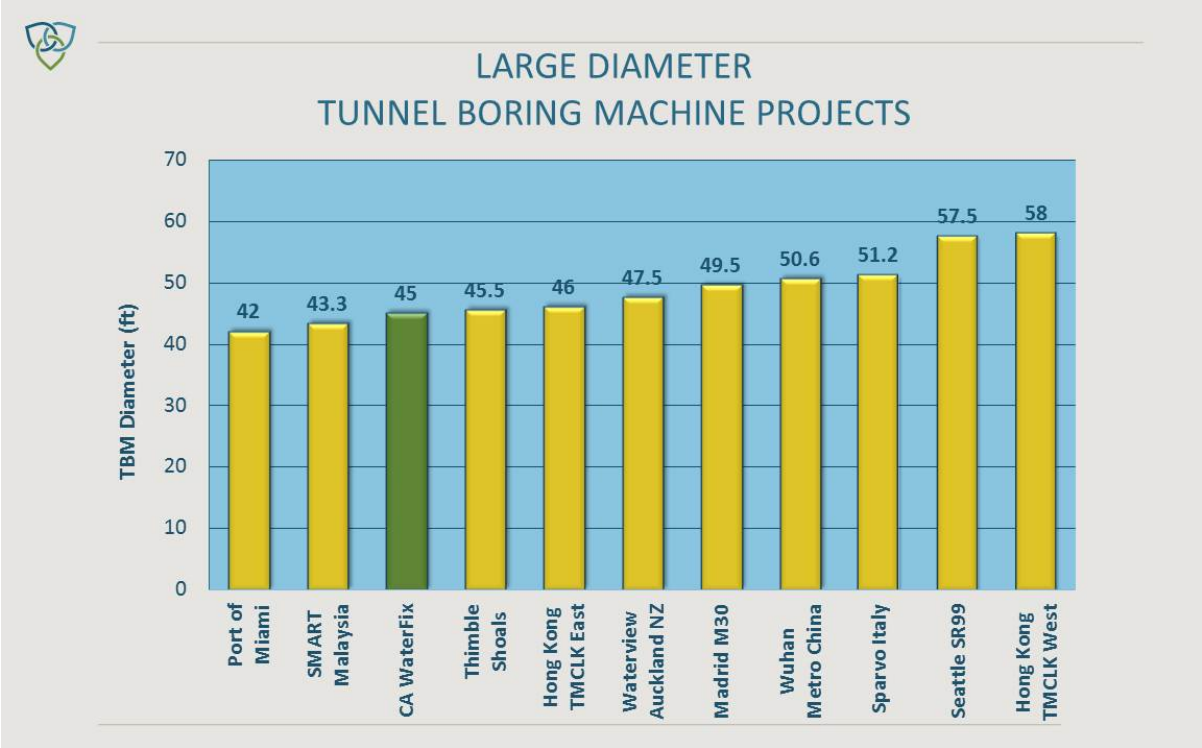

FIGURE 6: LARGE DIAMETER TUNNEL BORING MACHINE (TBM) PROJECTS

ENVIRONMENTAL CONSIDERATIONS

California WaterFix facilities have been planned and configured in response to comments and input received during the environmental planning process to reduce the impacts of construction and operation of the facilities on the existing Delta environment. Specific steps taken during the design effort to limit or eliminate the impact of the new facilities on the environment include:

A. **Reducing the Size of Overall Project:** As originally configured in the BDCP, water conveyance facilities consisted of five (5) screened intakes along the Sacramento River, each sized at 3,000 cfs, for a total system capacity of 15,000 cfs. The overall capacity was eventually reduced to 9,000 cfs, requiring only three of the original five intake locations.

B. **Using Tunnels instead of Open Canals:** The original alignment consisted of a series of large canals to convey water from the three intakes to Clifton Court. The main canal footprint was estimated to be approximately 1,400 feet wide (including the embankments, spoil stockpiling, and access roads). This project configuration would have caused significant impacts to surface features in the Delta. The surface impacts alone of this alternative totaled more than 19,000 acres. The surface canal approach would have split or eliminated many private property holdings, disrupted irrigation patterns, caused migration barriers for terrestrial species, been subject to potential deformation during seismic events and generated substantial quantities of air pollutants associated with earthmoving during construction. The proposed all-tunnel configuration reduces surface impacts by approximately 90 percent with the use of tunnels, a majority of the tunnel construction equipment is electric operated, subsurface tunnel easements will reduce disruptions to surface features and terrestrial migration patterns remain undisturbed.

C. **Expanding the Use of Tunnels Instead of Pipelines:** Early non-canal conveyance alignments relied on a combination of open-cut high-head pipelines and tunnels to convey water from the intakes to the intermediate forebay. Construction of the open-cut pipelines would have been very disruptive to local communities because of the size of the pipelines required. Under those conditions, excavations suitable for installation of double-barreled 16-foot high-head pipelines would be required in some locations, and would potentially run for several miles. In addition, it was anticipated that surface deposits of peat and high groundwater tables could be encountered during construction. Engineering refinements during the environmental process identified the use of tunnels as a preferred way to connect the river intakes to the intermediate forebay. Relatively short tunnels significantly reduce disruptions to the local communities and provide a way to efficiently address groundwater table conditions.

D. **Revising Tunnel Alignments and Tunnel Contracting**: As originally configured, the project's main 40-foot diameter tunnels crossed under numerous rivers, sloughs and other waterways. At each of these locations, additional construction activities would have been necessary to protect the levees that line each of the waterways while the tunnel boring machines (TBMs) were being operated, potentially leading to unnecessary project risks. Additionally, the original main tunnel alignment crossed under a number of sensitive surface features, travelled under many private property holdings and would have required nearly double the number of construction contracts when compared to the current revised plans. Mitigation measures employed during the planning and conceptual engineering process attempted to minimize as many of these issues as possible. The current alignment 1) reduces tunneling under most sensitive surface features and private property, instead tunneling under publically held lands and avoiding crossing Army Corps levees wherever feasible; 2) minimizes the number of water-feature crossings; and 3) reduces the number of tunnel contracts to avoid unnecessary surface disruptions.

E. **Revising the Size and Location of Intermediate Forebay:** The original forebay configuration consisted of about 750 acres of water surface area, along with the area required for the forebay embankments. Following input from local communities and reclamation districts, the size and location of this facility were revised. Current plans call for an intermediate forebay site of about 100 acres, which includes the forebay surface area, embankments and appurtenant facilities required for construction and operation.

F. **Reducing Pumping Requirements for the Overall System:** The original configuration of California WaterFix facilities relied on pumping plants at each of the three river intakes to lift water out of the Sacramento River and into the tunnel system for conveyance to Clifton Court in the south Delta. This configuration did not allow the system to be gravity fed, even under extremely high water levels in the Sacramento River. Based on input received during the planning process, and the need to address certain technical tunnel design issues, the configuration was changed so the three individual pump stations at the Sacramento River were consolidated and moved to a single pumping plant located at Clifton Court Forebay. As currently configured, under some hydraulic conditions in the Sacramento River, and under certain delivery scenarios, California WaterFix would operate as a fully gravity-fed delivery system that can divert up to 4,500 cfs to Clifton Court. The remainder of the time, the pumps at Clifton Court Forebay would be operated. This approach would reduce the overall conveyance system's energy consumption when compared to the original concept.

G. **Reducing Construction Impacts along Sacramento River:** Replacing the three river intake pumping plants with a consolidated pump plant at Clifton Court and revising the construction methods for the intake sedimentation basins would reduce temporary and permanent impacts to the communities that surround the intake locations. Eliminating the pump plants at the Sacramento River would also significantly reduce overall construction impacts at all three river intakes and avoids the permanent aesthetic impacts of the pump plants at each location, including the need for permanent overhead high voltage power lines and traffic impacts associated with DWR's operation of the pump plants. In addition, the design of the sedimentation basins, originally configured as pile-supported concrete basins, was revised to the current earthen configuration. This change would significantly reduce construction impacts at each intake site by eliminating the need to drive thousands of foundation support piles and the construction work associated with placing thousands of cubic yards of concrete in the basins.

H. **Optimizing Location of Key Construction Sites:** While located relatively close to major urban communities such as Sacramento and Stockton, the Delta is considered a uniquely remote environment from a construction standpoint because of its limited highway access. Two state highways cross the Delta in an east-west direction, but north-south transportation routes though the Delta are generally limited to water routes. The original configuration placed several of the key construction sites in areas that were logistically difficult to access for major construction purposes. To access these sites, new roads, along with the use of existing levee roads, or water access points, would have to be established, potentially impacting local residents and agricultural interests. Based on comments received during the planning process, some construction sites were relocated closer to major transportation routes, reducing potential disruptions to local communities and traffic patterns.

Incorporating these revisions and commitments into the overall project planning process has led to the development of modernized conveyance facilities that are sensitive to the environment, landowners and public use of the Delta, while retaining the operational features required to reliably and efficiently deliver water to the state and federal water projects.

Cost Estimate and Schedule

ESTIMATE

The current cost estimate for California WaterFix is summarized below in Figure 7. All costs have been adjusted by the state to July 2014 dollars. The cost estimate will be updated periodically as additional information becomes available, particularly with respect to environmental mitigation.

ITEM	AMOUNT ($BILLIONS)
Overall Cost	$ 15.74
Conveyance System Cost	$ 14.94
Program management, construction management, and engineering	$ 1.91
Tunnels/Shafts construction	$ 6.82
Remaining construction	$ 2.68
Contingency (~36% for Tunnel/Shafts and Remaining Construction)	$ 3.38
Land Acquisition (includes 20% contingency)	$ 0.15
Environmental Mitigation (includes 35% contingency)	$ 0.80

Program Estimate in 2014 Dollars

FIGURE 7: CALIFORNIA WATERFIX PROGRAM ESTIMATE

The resources used to develop the construction cost estimate include the items listed below:

1. Conceptual Engineering Report (CER), Modified Pipeline/Tunnel Option – Clifton Court Forebay Pumping Plant, Volume 2- Conceptual Engineering Report Drawings, Final Draft: April 1, 2015.
2. Wage and Workman's Compensation rates used by the consultant (5RMK) are Prevailing Rates as listed by the California Department of Industrial Relations, General Decision Number: CA140029 08/08/2014 CA29.
3. Equipment Ownership and Operating Cost. 5RMK used US Army Corps of Engineers rates EP-1110-1-8, Vol. 07 published April, 2014.

ESTIMATE METHODOLOGY

The methodology used to prepare the overall California WaterFix estimate was as follows:

A. **Program Management, Construction Management and Engineering:** The $1.91 billion cost is based on the anticipated program organization, the program schedule and the Conceptual Engineering Report (CER). For each organizational team, the number of full time equivalents needed to perform the functions of the team and the expected duration consistent with the program schedule was established. The program schedule accounts for staffing the organization in a sequential manner to allow for initiation, planning and execution of the needed functions. Costs for various levels of managers and staff were applied to the program schedule.

B. **Tunnels/Shafts and Remaining Construction:** The construction cost estimate for the tunnels and shafts and remaining construction was prepared by a consultant, 5RMK. The construction cost estimate is a detailed Class 3 bottoms-up cost estimate as defined by the Association for the Advancement of Cost Engineering International (AACEI). A Class 3 estimate requires a design definition between 10 to 30 percent complete; the design definition for California WaterFix currently is between 5 to 10 percent complete. The common design definition between the Class 3 requirement and the current design definition for California WaterFix was 10 percent, and 5RMK was instructed to use this value to provide a more detailed Class 3 estimate.

   Cost estimators used the same basic approach that a construction contractor would use if bidding the project. Based on information in the CER and past knowledge and experience, the cost estimators developed a work breakdown structure for all project features (such as intakes, tunnels, forebays, pump plants and utilities, etc.). Each feature was further broken down to components and systems to develop detailed quantities of material, labor and equipment to construct the facilities. Cost estimators established crews and equipment, production rates and assumed work schedules. Once these were established, the cost estimators applied prevailing wage rates, material and equipment costs based on vendor and subcontractor quotations.

   The cost estimate for the tunnels/shafts and remaining construction also includes the following:

   - Engineering, quality control and environmental staff time required to manage subcontracts;
   - Construction contractor's management, supervision and staff along with all support staff and expendables (office supplies, communications, utilities);
   - General automotive expenses for management and staff; and
   - General plant expenses including offices, warehouse, site roads and other administrative costs.

   Overhead, profit and General and Administrative (G&A) expenses were calculated as 12 percent of the construction cost.

C. **Contingency:** Contingency as a percent of construction was established at 35.6 percent, which is consistent with an AACEI design definition of 7.5 percent, and is consistent with the level of design completed for California WaterFix to date.

D. **Land Acquisition:** The land acquisition cost of $150 million was developed based on the number of acres for the surface footprint, staging, borrow and subsurface easements required for California WaterFix, multiplied by current market rate per acre. The costs include mineral rights, gas well relocation, due diligence and transaction costs. A 20 percent contingency for unknown expenses related to land acquisition is also included.

E. **Mitigation Cost:** The project is carrying a mitigation cost estimate of $800 million. This includes estimated costs for environmental commitments such as natural community protection, channel margin enhancement, tidal and riparian natural communities, grassland and non-tidal marsh restoration, natural communities management, localized reduction of predatory fish, protections for cultural and biological resources and air quality enhancements. The cost also includes program administration, monitoring of

terrestrial and aquatic species, and property tax revenue replacement. In addition, a 35 percent contingency was added to account for unknown expenses/scope related to this project component.

PROJECT SCHEDULE

The current high-level program summary schedule is presented in Figure 8. The schedule is primarily based on the information in the 2015 Conceptual Engineering Report as well as other available data for similar large-scale construction projects. The schedule includes estimates of 12 to 15 months to fully staff the DCA, up to four years to complete the design phase and about 13 years to complete construction. Once the DCA is established and the design is advanced, the design and construction teams would look for opportunities to reduce the overall schedule.

Upon project authorization, detailed schedules would be prepared for various project activities, based on the detailed Work Breakdown Structure (WBS) and applicable project documents. These detailed schedules would identify major milestones, time-sensitive areas and critical path activities. Any issues that have a real or potential impact on the schedule would be highlighted and would include the source of the issue and any mitigation measures taken to minimize or eliminate the impact. Schedule reports would be issued on a regular basis (at least monthly), as determined during program start-up.

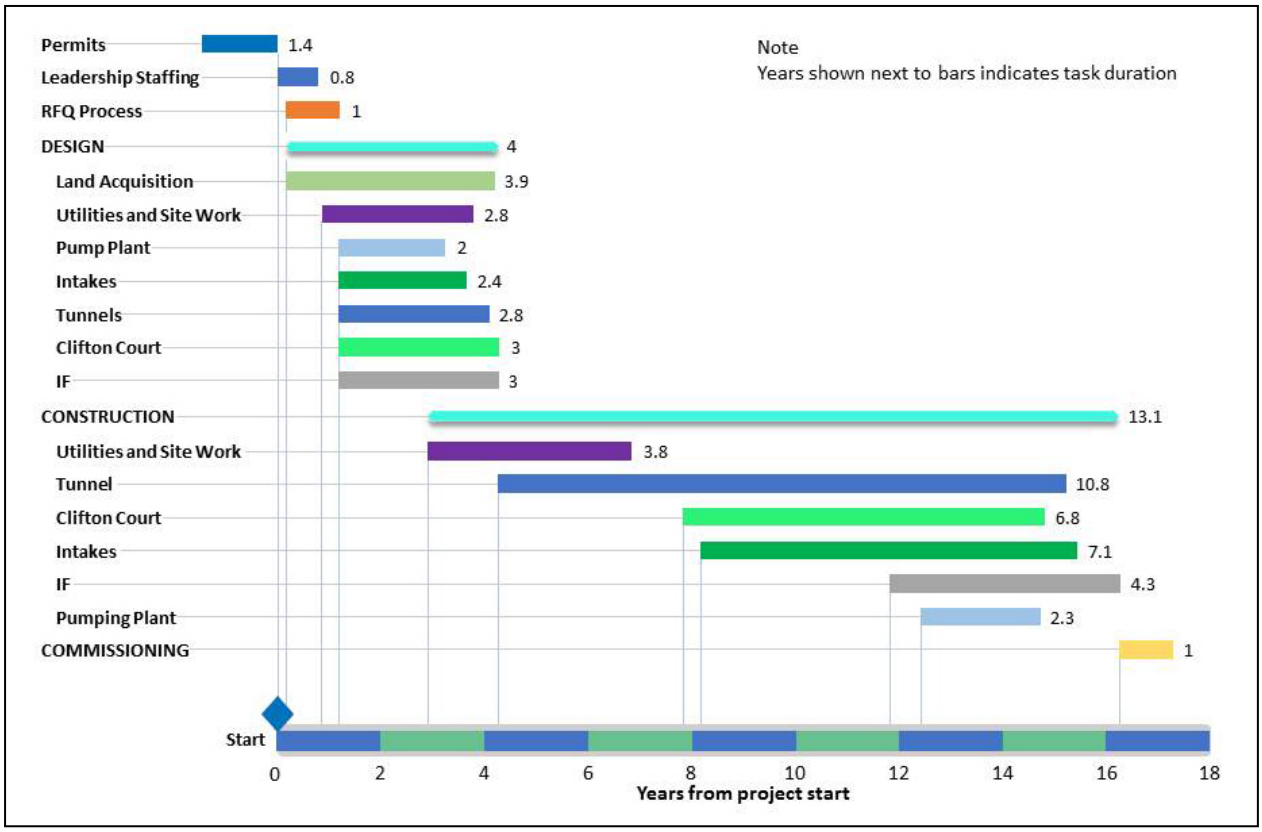

FIGURE 8: CALIFORNIA WATERFIX PROGRAM SUMMARY SCHEDULE

Key Risk Areas

Two key risk areas related to design and construction have been identified during the planning process for California WaterFix: the program's management structure –specifically, the ability of the program's management team to control cost and schedule– and the overall constructability and operation of the infrastructure. Table 2 summarizes the risk areas and provides a structure that includes tools to mitigate the risk associated with each area:

TABLE 2: KEY RISK AREAS AND MITIGATION TOOLS

Key Risk	Tools to Mitigate the Key Risk
Management for Cost and Schedule Containment	1. Forming the DCA as a new and separate purpose-driven organization with responsibility to implement the design and construction of California WaterFix. 2. Establishing key functions within the DCA structure that focus on critical areas, including: • Risk Management: Would ensure that all program risks are identified, tracked and mitigated throughout all phases of the program; • QA/QC: Would ensure that all design and construction work is conducted in strict accordance with program quality objectives; • Internal Audit: Would implement a continuous audit program to ensure that all program participants adhere to program policies, practices and protocols; • Program Controls: Would provide real-time budget, cost and schedule reports to the program teams and to the auditor on an as-needed basis; and • Cost Estimations Would provide new cost estimates on an as-needed basis and review cost information prepared by project designers and change order requests from contractors.
Infrastructure Constructability and Operations	1. Simplifying the configuration of the overall program infrastructure to utilize standard design and construction methodologies; 2. Utilizing gravity-fed operations when possible to simplify long-term system operation and reduce overall operational costs; 3. Where possible, locating key project features on publicly-owned properties to enhance access during construction and operation; 4. Establishing key construction work sites near existing, well-established transportation routes; 5. Utilizing tunnel boring machines consistent with current construction industry standard practices to reduce overall construction risks; 6. Stockpiling material excavated from tunnel construction in such a manner that the material would be potentially available for future Delta restoration projects; 7. Reducing the number of program facilities to be constructed near existing population centers or in environmentally sensitive areas such as wetlands; 8. Reducing the size of facilities and/or eliminating some facilities to reduce overall system complexity and cost; 9. Consolidating three pumping facilities into a single combined facility at Clifton Court to simplify construction and operational activities; and 10. Implementing a well-planned and thorough geotechnical investigation program as part of the preliminary and final design process for facilities.

Delta Conveyance Design and Construction Joint Powers Authority

The design and construction of California WaterFix would be managed under contract with DWR through a proposed Delta Conveyance Design and Construction Joint Powers Authority designated the Design and Construction Authority, or "DCA." This approach was successfully used in the mid-1990s when DWR contracted with the Central Coast Water Authority to design and construct a portion of the Coastal Branch of the California Aqueduct. The Central Coast Water Authority was established as a public entity organized under a joint exercise of powers agreement and constructed water treatment and conveyance facilities to bring State Water Project supplies to Santa Barbara and San Luis Obispo counties.

In coordination with DWR, the DCA would design, construct and deliver completed California WaterFix facilities to DWR upon completion of system commissioning. The DCA would be a public agency, organized as a special purpose public agency pursuant to the Joint Exercise of Powers Act, consisting of certain public water agency members. A detailed agreement between DWR and the DCA would govern the roles and responsibilities of the parties to carry out the design and construction of California WaterFix. The overall goal of the DCA would be to safely design, construct and deliver the project on time, on budget and in accordance with approved specifications, while managing risk prudently.

Recognizing DWR staff resources are stretched to an extreme level due to the necessary commitment to complete significant repairs to the Oroville Reservoir spillways as a result of damage during heavy runoff in 2017, there is a need to employ different but proven approaches to pool resources for the design and construction of California WaterFix. Staff resources are needed for a period of about 13 to 17 years and would ultimately be reduced at the end of construction. Pooling experienced expertise in a manner that avoids the need to hire significant additional new staff at DWR is prudent. In any major infrastructure process, there is a period of acquiring needed additional staff, and then once the project approaches completion, there is a period of downsizing. Utilizing the DCA to pool experienced resources to manage activities and contractors is preferable and can avoid the expansion and contraction of staff at DWR. The DCA would sunset as California WaterFix is completed.

ORGANIZATIONAL STRUCTURE

The anticipated organizational structure is shown in Figure 9 and the responsibilities of the offices within the structure are described below.

Note: The assumed organizational structure is based on a 2016 Draft Agreement Regarding Construction of Conveyance Project between the Department of Water Resources and the Conveyance Project Coordination Agency, which will no longer be executed. Nonetheless, it is expected that much of the organizational structure and functions described in that agreement would be adopted by the DCA.

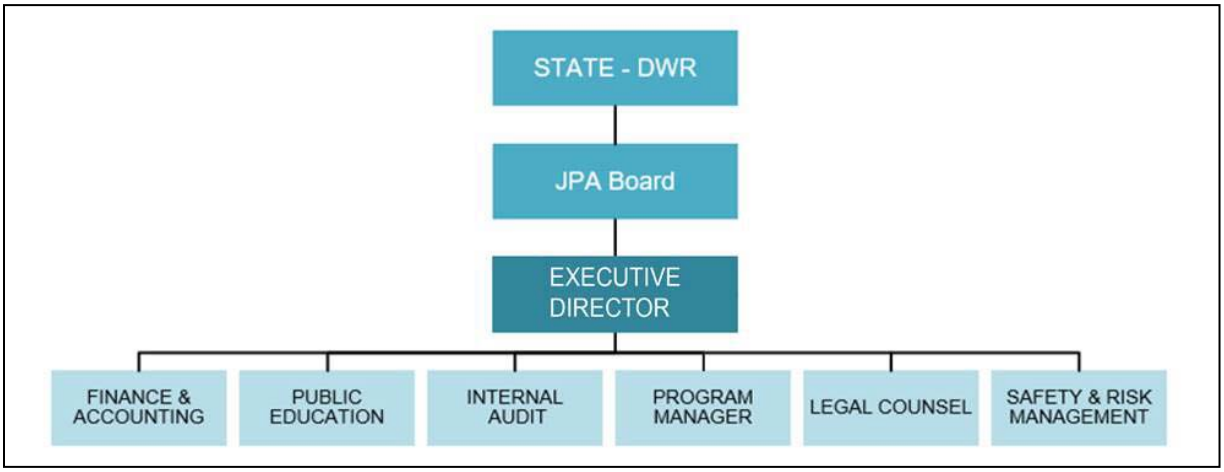

FIGURE 9: ORGANIZATION CHART

Executive Director

The Executive Director would be the single point of accountability to the Board of Directors for delivery of the program design and construction. The Executive Director would set the overall direction of the program, coordinate all program execution with the Program Manager and Chief Engineer and ensure activities are on schedule, within budget and adhere to specifications. In addition, the Executive Director would lead external interactions and administrative support functions of the program organization and interaction with the DCA directors and DWR.

Program Manager

The Program Manager would be responsible for all functions directly related to delivery of the facility. The Program Manager would:

- Provide program leadership, management and direction to ensure the design is completed according to the preferred project identified in the final EIR/EIS and consistent with mitigation requirements and plans;
- Establish and approve detailed program scope, schedule and budget activities;
- Be responsible for implementing team plans, staffing levels and setting team responsibilities;
- Ensure coordination and cooperation between teams; and
- Represent the program in interactions with the Board, DWR and external stakeholders as needed.

Finance and Accounting

The Finance and Accounting group would manage cash flow requirement forecasts, monitor program funding and handle payments.

Public Education

A dedicated Public Education group would initiate, coordinate, monitor and report on local public outreach and support DWR's Public Affairs Office on program related matters.

Internal Audit

The Internal Audit group would assure conformance with approved processes and procedures. It would also review the various team actions/documents, develop monitoring and audit reports, review corrective action plans and verify corrections.

Legal Counsel

The Legal Counsel would provide the program with legal direction and ensure compliance with applicable laws and regulations. They would also review each Request for Qualifications (RFQ), entity agreements, contracts, task orders and scope of services to assess compliance.

Safety and Risk Management

The Safety and Risk Management team would minimize program risks to control costs and schedule. In addition, the team would identify the program insurance requirements and enforce safety program requirements.

Workgroups

In addition to the above organizations, it is anticipated under the DCA structure that multiple workgroups would be formed from time-to-time to address specific aspects of the project. Workgroups would include a Technical Review Workgroup for purposes of reviewing and resolving technical design issues at the staff level. The workgroups would be focused in nature and may be formed and dissolved depending upon the subject matter and project status.

PROJECT GOVERNANCE

The DCA would be responsible for delivering the project in accordance with baseline specifications for the project, including design specification, budget, schedule and mitigation obligations. As design work progresses, changes to the baseline specifications would be requested by the DCA at its discretion for approval by DWR. In addition, certain "material changes" on the project would require DWR approval. These include:

A. **Cost:** Any actions that cumulatively could cause more than a 5% increase in budgeted costs for each major design feature or management item;

B. **Schedule:** Any actions that could cumulatively add 6 months to the approved project schedule;

C. **Operation:** Any actions that could impact the water delivery capability, reduce project life, or significantly increase operations and maintenance costs of the project; and

D. **Permits:** Any actions that could be inconsistent with, or would require an amendment of, a major permit for the project.

Coordination with DWR and Reporting

DWR's Delta Conveyance Office would be responsible for managing the agreement with the DCA on behalf of DWR and be the DCA's primary point of contact within DWR for all matters relating to project design and construction.

The DCA would provide detailed written reports at least monthly to DWR and the state and federal contractors regarding progress made toward completing the project, including 1) actual and forecasted expenditures, 2) the DCA's review of expenditures and forecasts against the approved budget and 3) progress relative to the approved schedule. The DCA would prepare an annual report describing the DCA's activities during the immediately preceding calendar year as well as project status. A draft of the annual report would be provided to DWR for review and comment.

Dispute Resolution

A Technical Review Workgroup would be used to resolve technical and design-related disputes within the DCA and between the DCA and DWR and material changes to baseline specifications. All other disputes would be resolved at the staff level if possible. If the dispute cannot be resolved through the Technical Review Workgroup or at the staff level, a defined meet-and-confer process would be used to consider options and determine whether agreement can be reached on the matter, with ultimate escalation to the Director of DWR and Executive Director for resolution.

At any time, DWR or the DCA may initiate a non-binding review process concerning the dispute. In this process, DWR and the DCA would form a three member panel of experts, with one panel member selected by DWR, one by the DCA and a third by mutual agreement of the first two panel members. If a dispute between DWR and the DCA cannot be resolved, the Director of DWR would make the final decision after considering the recommendations of the non-binding review panel, as well as any other relevant information concerning the issue.

Risk Management and Mitigation

RISK MANAGEMENT PROCESS

The goal of the risk management process for California WaterFix would be to identify problem areas early. Each identified risk would be evaluated for its potential impact to cost, schedule, quality and safety. Risks that have the potential to have a significant impact on any of these items would be highlighted. The Risk and Safety Management Team, in coordination with program staff, would develop a methodology to identify and quantify

specific risks to the project, determine their consequences and associated probability and develop mitigation strategies. The overall risk management process is summarized in Figure 10.

FIGURE 10: RISK MANAGEMENT PROCESS

The Safety and Risk Management Team would be responsible for initially identifying project risks, with input as necessary from other groups and teams. The focus would be on risks that could impact project scope, schedule or budget, with each identified risk being added to a Project Risk Register for further discussion and evaluation. The Risk Register would be the basis for developing a "Risk Dashboard," which would provide a simplified list of high-priority risks, a summary of the associated action plan and a summary of any known impacts. If a risk moves from "potential" to "actual," the risk would become part of the Project Change Authorization process and incorporated into the project estimate.

DESIGN, CONSTRUCTION AND OPERATION

A number of critical issues related to the design, construction and operation of California WaterFix were investigated and addressed through the course of the planning and conceptual engineering efforts. These issues included the following:

1. The ability to successfully design and construct large tunnels;
2. The suitability of facilities to withstand anticipated seismic events that may occur in the Delta;
3. The risk of flooding and future sea level rise in the Delta;
4. The potential for various tunnel-related issues, including leakage, surface settlement and tunnel induced vibrations; and
5. The risks associated with levels of understanding regarding Delta geology.

Each issue and potential mitigation measures are described below.

Large Tunnels: As part of planning and conceptual engineering for California WaterFix, the engineering team performed a survey of large-diameter tunnel projects to determine if other large tunnel projects used TBMs similar in size to the 45-foot diameter machines that would be used as part of California WaterFix. The survey confirmed that numerous large-diameter (greater than 40 feet) soft-ground TBM projects have been successfully performed throughout the world and that several more large-diameter tunnel projects are planned in the near future. The survey results confirmed that the proposed California WaterFix TBMs are well within the existing industry knowledge and experience.

A separate survey was undertaken to gain a better understanding of recent challenges on large tunnel projects and to identify best management practices to ensure project success. This survey attempted to identify tunnel projects that were similar to California WaterFix tunnels in key areas such as design, construction and project management in order to anticipate and manage similar issues that could occur. A total of nine projects were surveyed, including projects in the United States, Asia and Europe. Each of these projects is well documented by media and industry coverage, and each has been recently completed or is considered substantially complete from a tunneling perspective. The survey results provided valuable lessons-learned that would be evaluated as part of the design process for California WaterFix, including the following:

- Extensive and high quality geotechnical information is the key for success on any tunnel project; and
- A proactive risk identification and management program is critical to success of large- or mega-projects.

Tunnel Leakage: The segmented lining system to be used for California WaterFix tunnels would be designed to withstand the maximum internal pressure calculated for the conveyance system, which is anticipated to be present in the northern-most reaches of the tunnel system, as well as all applicable static and ground loads. The individual segments would be fitted with embedded gaskets that would be compressed against one another as the tunnel rings are constructed. The installation of the tunnel segments, along with the compression of the gaskets during the tunnel ring building process, would be designed and constructed to minimize inflows or outflows from the tunnel under a wide range of operational and maintenance conditions.

An assessment completed in February 2017 of the potential leakage rates from the tunnels concluded that there would be negligible leakage from the tunnels or inflow to the tunnels. In fact, when taken as a complete system, it is estimated that there would be a net inflow of 3 cfs to the tunnel over the roughly 73.5 miles of project tunnels, or an inflow rate of 18 gallons per minute per mile of tunnel. Inflow to the tunnels and leakage from the tunnels calculated based on anticipated conditions for filling, dewatering and operation are anticipated to be minimal and well within typical ranges for tunnels of the size and length proposed for California WaterFix.

Tunnel-Induced Ground Vibration: California WaterFix tunnel alignments pass under or near sensitive surface structures such as historic buildings, levees, aqueducts and residential communities. In these locations, it is anticipated that the proposed tunnels would be constructed a minimum of 100 feet below ground. That depth would ensure that material over the tunnels would dampen and absorb any energy generated during tunneling and construction activities. Induced vibration to structures should be minimal and would not likely be perceptible to the communities on the surface and is not anticipated to have any impact on any of these structures.

Surface Settlement Along the Tunnel Alignment: California WaterFix would use the following to mitigate the risk of settlement effects and structural damage:

- Detailed geotechnical exploration;
- Pre-construction surveys for critical and settlement-sensitive facilities, utilities and surface features;
- Development and implementation of acceptable tunneling protocols and permissible settlement criteria;
- Real-time sophisticated TBM control and monitoring systems;
- Improved structure protection methodologies, including pre-excavation grouting; and
- Advanced ground settlement and vibration monitoring systems.

Seismic Considerations and Mitigation: Preliminary modeling of active and potentially active earthquake faults in the region was developed and evaluated as part of the Delta Risk Management Strategy (DRMS) study conducted in 2007. The results of this study are summarized below.

A. **Tunnel Alignment:** The proposed Delta tunnel alignment does not cross any major fault rupture or creep zones.

B. **Seismic Sources:** Potential seismic sources in the form of “blind” faults were identified. These blind faults have no surface features and limited information or data is available to characterize these fault zones.

C. **Ground Motion Estimates:** Estimates of potential ground motion during a seismic event were developed as part of the conceptual engineering studies based on a 1,000 year event (85th percentile) and adjusted for buried tunnel lining systems.

D. **Liquefaction:** Liquefaction was investigated, primarily as it would potentially affect surface facilities such as intakes, forebays, pumping stations and tunnel shafts. Studies indicate the deep tunnels would not be subject to liquefaction potential because they would be constructed below the elevation where liquefiable materials occur.

E. **Lined and Grouted Tunnels:** Studies indicate that lined and grouted tunnels, such as those utilized in California WaterFix, perform better than unlined tunnels. Performance can be further enhanced by improving the contact between the liner and the ground (grouting of annular space between the liner and the surrounding soil).

Based on the results of the studies already conducted, seismic mitigation would be addressed as follows:

- For surface facilities and tunnel shafts, additional geotechnical investigations would be conducted on a site-specific basis to gain a more complete understanding of the expanse and depth of liquefiable material at each site. Based on the investigation results, appropriate design and construction methodologies would be used to eliminate or minimize the impacts of liquefaction on surface facilities.
- Additional field explorations and design solutions, including finite element modeling of the tunnels and shafts, would occur in the design phase of the project. These measures would address any seismically induced liquefaction or deformation potential at the specific locations where the tunnels connect to the shafts.
- The tunnel design concept includes the use of precast segmental lining systems. This system was selected because the same concept has been successfully used on an extensive basis in seismically active areas such as Japan, Puerto Rico, Taiwan, Turkey, Italy, Greece and the United States since the 1980s. Results of segmentally lined tunnel performance in seismic events show the tunnels would perform very well during and after such an event.

Geotechnical Considerations and Mitigations

The Delta is an arm of the San Francisco Bay estuary that extends into the Central Valley. The geology of the Delta has been shaped by the landward spread of tidal environments resulting from sea level rise after the last glacial period. Since the last glacial age, flood-borne deposits, supplied by the major river systems in the Delta, have overlaid the region with sediment deposits and biomass accumulations. Taken together, the region, prior to the advent of agricultural interests in the late-1800s, was largely a tidal wetland and alluvial floodplain consisting of consolidated silts, sands and clays overlain with peat and peat muds.

During the development of the planning documents for California WaterFix, approximately 240 boring and cone penetrometer tests were conducted at the intakes, forebays and along the various conveyance alignments. Most of the investigations were conducted at depths between 100 and 200 feet, well within the foundational depth of planned facilities, including the tunnels and pump plants. Based on these investigations, and the use of existing historical information on the Delta, a preliminary geologic understanding of the Delta in the vicinity of California WaterFix facilities was developed.

At tunnel depths ranging from 100 to 150 feet below the ground surface, dense layers of silts, sands and clays are anticipated. This material would be suitable for the planned tunneling activities. At the ground surface, widely varying depths of peat and other organic material are expected. Data indicates that depths of peat in the Delta along the alignment vary from non-existent to about 40 feet deep, with the deepest deposits located in the center of the Delta near Bouldin, Venice and Mandeville islands. Construction in peat conditions would require specialized design approaches because of the unstable nature of the material.

In some locations along the alignment, there are geotechnical data gaps of several miles, due to the inability to gain access to private property during the planning phase of the project for geotechnical investigations. To

mitigate these data gaps and other known uncertainties related to geology along the alignment, the project would rely on existing information, along with the implementation of a new two-phase geotechnical investigation program. Under this multi-phased investigation plan, up to 2,000 additional investigations would be conducted, consisting of borings, cone penetrometer and other physical data collection methods. The initial phase of the effort would focus on determining if variations exist in what otherwise appear to be relatively consistent subsurface conditions. Based on the findings from the first phase of work, additional investigations are planned to fine-tune information and gather sufficient information so that accurate estimates of subsurface construction methods and costs can be determined. Additionally, this information would be used to finalize methods to successfully address constructing in ground conditions that are overlain with peat and contain high groundwater levels.

Flood Protection Considerations

Flood protection for California WaterFix facilities would be consistent with DWR's *Proposed Interim Levee Design for Urban and Urbanizing Area State-Federal Project Levees* (DWR 2009). The conceptual engineering completed to date includes plans that the facilities would be engineered and designed to withstand water level rise resulting from both a 200 year storm event plus sea level rise of 18 inches in the Delta. This sea level rise estimate corresponds with 55 inches of sea level rise at the Golden Gate that has been used in the State's long term planning criteria over the next 100 years. Such protection would be provided by constructing the new facilities at elevations above those identified for flooding or sea level rise through a combination of raising and strengthening levees in all project construction locations, as well as other embankment and equipment pad layouts and elevations.

ENVIRONMENTAL MITIGATION

Upon project approval, DWR will adopt a Mitigation Monitoring and Reporting Program (MMRP) that includes Avoidance and Minimization Measures, Environmental Commitments and Mitigation Measures to avoid or substantially lessen construction and operational impacts of California WaterFix. Mitigation may also be required to fulfill conditions in the biological opinions, CESA incidental take permits and other project permits.

California WaterFix is designed to mitigate its own construction impacts and for operations to not jeopardize any species listed under the Federal Endangered Species Act. This project and its mitigation complement other important state efforts to address the coequal goal of a restored Delta, including California EcoRestore, the Smelt Resiliency Plan and the Salmon Resiliency Plan.

PROJECT CONFIDENCE

As a component of the risk assessment process, and to assist with creating the budget contingency, the California WaterFix project team evaluated the risks associated with the project budget to establish a baseline confidence level that the project would be completed within the estimated budget. This is a common practice with large construction projects, with the resulting confidence curves being used as one of the factors in determining overall project risk.

For California WaterFix, Aldea Services developed confidence curves for a variety of different cost scenarios, ranging from base cost, which does not consider mitigation costs or risk, to a total cost that includes the base cost, risk, mitigation and inflation. The resulting confidence curves, which were based in part on the risk assessment workshops and probabilistic analyses conducted by Aldea Service and the project team, are presented below in Figure 11. The results of these analyses indicate a 75 percent confidence level that the project would be completed within the budget estimate, based on information available at this stage of the project. A typical confidence level for projects of similar scope and size is 60 percent; however, because of the size and complexity of the program; a more conservative confidence interval of 75 percent was targeted.

At a 75 percent confidence level, the chart in Figure 12 shows how the base costs (blue) along with risk costs (red) and inflation costs (purple) are distributed over the estimated construction period on a year-by-year basis. The risk (red) costs are a direct calculation from the risk analysis and inflation is based on the average inflation rate

over 20 years prior to the analysis and applied to the scheduled construction period. The chart is consistent with the risk adjusted cost estimate and schedule included in the conceptual engineering report. As funding is available, additional information would be gathered, the program would be refined during design and the risk management process would be adjusted to the charted confidence curves.

Table 3 shows the comparison between the risk adjusted cost at a 75 percent confidence level in the second column and the 5RMK construction cost estimate in the third column. The table also includes the results of Class 3 bottoms-up construction estimate prepared by Jacobs Engineering as a check estimate. Jacobs Engineering prepared its estimate independent of the 5RMK estimate. The 5RMK and Jacobs Engineering estimates include a contingency of approximately 36 percent. Program Management (PM), Construction Management (CM), and Engineering (ENG) costs are held constant at $1.91 billion and land acquisition costs at $150 million. This table used three separate estimates to show the program can be completed within the proposed budget of $14.94 billion.

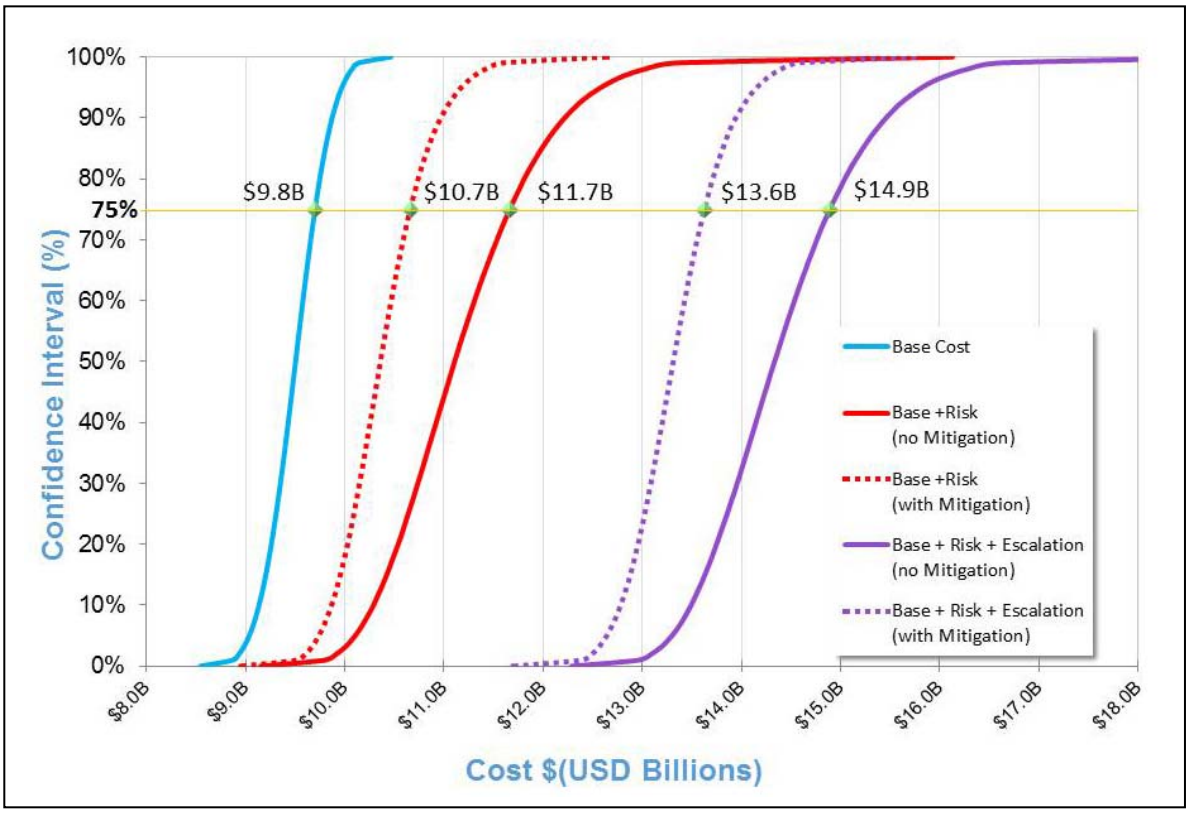

FIGURE 11: CONFIDENCE CURVES SHOWING 75% CONFIDENCE INTERVAL

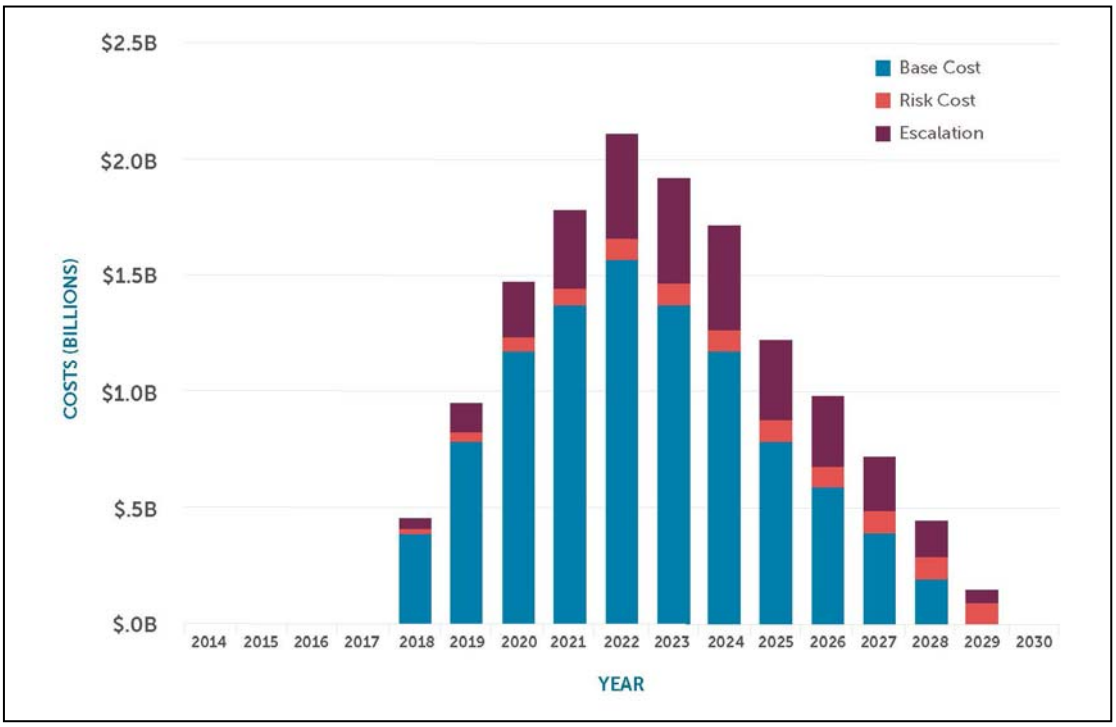

FIGURE 12: ANNUAL CONSTRUCTION EXPENDITURES FOR BASE, RISK AND ESCALATION

TABLE 3: COST COMPARISON, RISK ADJUSTED COST AT 75% CONFIDENCE LEVEL VS. INITIAL COST ESTIMATES

Item	(1) 5RMK Estimate (*),(**) (Billions)	(2) Jacobs Eng Estimate (*),(**) (Billions)	(3) Risk Adjusted Estimate with Mitigation at 75% Confidence Interval (*)(***) (Billions)
Construction	$9.50	$8.86	$10.66
Contingency	$3.38	$3.15	—
Construction Subtotal	$12.88	$12.01	$10.66
PM/CM/Eng	$1.91	$1.91	$1.91
Land acquisition	$0.15	$0.15	$0.15
Grand Total	$14.94	$14.07	$12.72

(*) Program estimates in 2014 dollars
(**) ~36% Contingency on construction for 5RMK and Jacob Engineering estimates
(***) Based on risks known at time of assessment

Conclusion

Note: This is first of three policy white papers related to California WaterFix. The second white paper will address the operational aspects of California WaterFix as well as potential water supply and risk mitigation measures related to operational requirements and regulations. The third white paper will focus on how California WaterFix can be financed through different funding mechanisms and the allocation of costs between state and federal contractors and between the State Water Project contractors.

The reliable and continued supply of high quality water through the Delta faces many risks, including fishery declines, earthquakes, floods and rising sea levels. Despite previous actions and efforts by local, state and federal entities to address these issues, as well as other challenges in the Delta, the region's ecosystem has continued to decline. California WaterFix addresses these long-standing issues by providing a pathway to reliable water supplies with infrastructure that is designed to withstand earthquakes and adapt to flood and rising sea levels, while protecting habitat, species and the Delta ecosystem.

The project has undergone an unprecedented level of public review, comment and scientific input. Extensive analyses and risk assessments have been conducted to better understand and mitigate risks commonly associated with infrastructure projects of this size. For California WaterFix, the key risk areas have been identified, and tools to mitigate these risks have been incorporated into the project's risk management process.

In addition to meeting the needs of the state, California WaterFix as presented meets all of the Delta Conveyance Criteria adopted by Metropolitan's Board in 2007.

Metropolitan's 2015 Integrated Resources Plan Update, as adopted by Metropolitan's Board in 2016, includes a goal to stabilize SWP supplies, to pursue a successful outcome in California WaterFix and to establish efforts for long-term average supplies of about 1.2 million acre-feet. The proposed project is expected to achieve this goal.

The physical project meets the attributes of a potentially successful project based on staff analysis and comparison to the Board's Delta Conveyance Criteria. The proposed program management has evolved in a way to increase staff confidence in the ability to minimize and manage risks.

MODERNIZING THE SYSTEM:

CALIFORNIA WATERFIX OPERATIONS

2

The second in a series of three policy papers prepared for the consideration of Metropolitan's Board of Directors in advance of planned summer meetings and decisions in fall 2017.

Modernizing and improving California's water system are essential for the reliable delivery of water supplies to much of the state. About 30 percent of the water that flows out of taps in Southern California homes and businesses comes from Northern California watersheds and flows through the Sacramento-San Joaquin Delta. But the Delta's declining ecosystem and 1,100 miles of levees are increasingly vulnerable to earthquakes, flooding, saltwater intrusion, climate change and further environmental degradation. California WaterFix is the product of more than a decade of review, planning, rigorous scientific and environmental analysis in collaboration with fishery agencies and an unprecedented level of public comment.

Extensive analysis and work has been performed by state and federal water agencies and fish and wildlife agencies to determine conveyance system improvements and an operations framework to improve the direction of river flows in ways that will help native fish species, protect water supplies from climate change impacts and help restore the Delta ecosystem. Details of the proposed operations are addressed in Metropolitan's second white paper and summarized below.

WaterFix Operations Objectives

California WaterFix proposes a strong operations plan based on sound, collaborative science and adaptive management to meet the following objectives:

- Improve water supply reliability
- Enhance ecosystem fishery habitat throughout the Delta
- Allow flexible pumping operations in a dynamic fishery environment
- Improve export water quality
- Respond to climate change risks
- Reduce seismic risks

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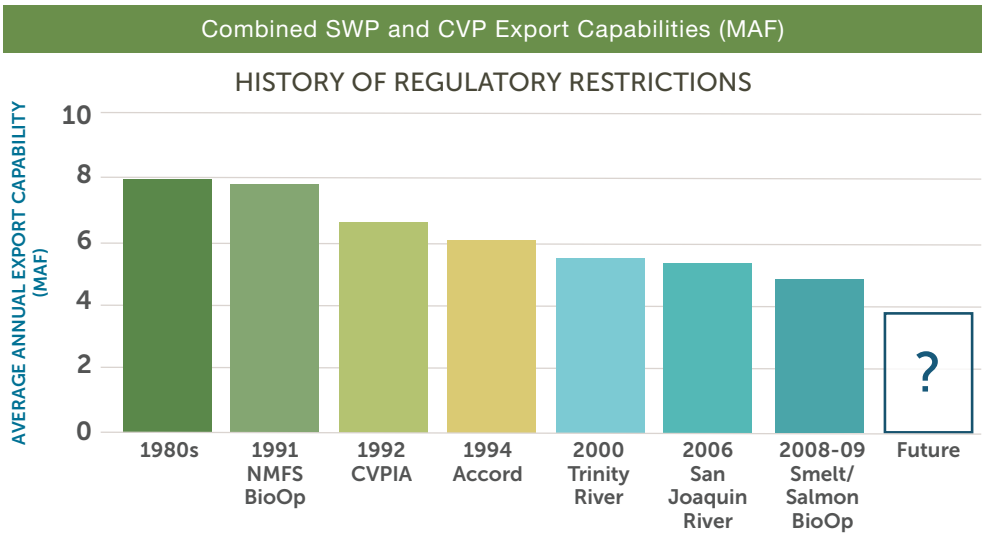
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

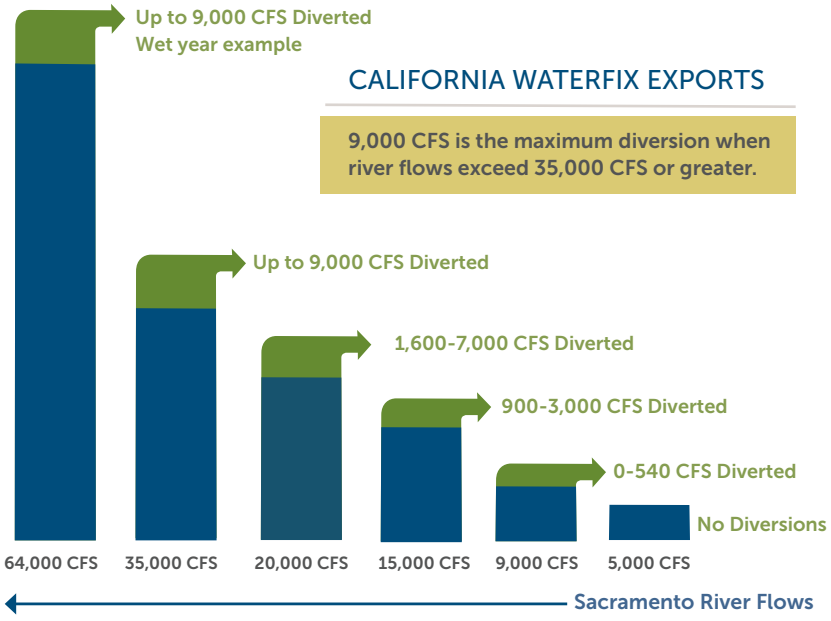
Regulatory Impacts

State Water Project and Central Valley Project operations have been, and continue to be, affected by regulations that seek to change flow regimes in the Delta by setting rules for outflow variables. This has decreased operational flexibility and reduced exports to 25 million Californians who receive water from the SWP and CVP south of the Delta and millions of acres of irrigated farmland.



Science-based Operations

As part of the California WaterFix planning process, extensive modeling and analysis has been done to evaluate the potential operational and water supply benefits and to determine the preferred project alternative that will advance the coequal goals of water supply reliability and protecting the Delta ecosystem. Creating a dual conveyance system with additional points of diversion for water exports in the Delta will improve river flow patterns, restore natural tidal fluctuations, reduce entrainment and improve habitat for native fish.



THE BAY-DELTA IS AN EVOLVING PLACE. UNCERTAINTY FROM CLIMATE CHANGE AND OTHER FACTORS WILL BE ADDRESSED BY CALIFORNIA WATERFIX THROUGH AN ADAPTIVE MANAGEMENT STRATEGY.

The most sensitive time of the year for Delta fisheries is December to June. Operations criteria would require a minimum Sacramento River flow before any water could be diverted at the north Delta intakes. The criteria also include biologically-based triggers to benefit fish species. A maximum possible diversion of 9,000 cfs is reached at river flows of 35,000 cfs or greater under the proposed operations.

Source: California WaterFix, State of California
CFS=cubic feet per second

Key Operational Benefits

California WaterFix is an environmentally responsible plan that improves water supply reliability and operational flexibility. Many supply and environmental benefits that have been incorporated into the proposed project operations will:

IMPROVE WATER SUPPLY RELIABILITY

New intakes in the north Delta would provide greater flexibility and reliability by capturing more water in wet and above-normal years. Predicted future water supply for SWP and CVP with California WaterFix would range from 4.7 to 5.3 million acre-feet.

PROTECT FLOWS IN THE DELTA

A more natural flow direction in the Delta during critical fish protection periods will increase water supply reliability and minimize reverse flows. North Delta diversions, fish screen designs, bypass flow criteria and real time operations will be managed to limit effects on listed fish species.

IMPROVE EXPORT AND IN-DELTA WATER QUALITY

With the new north Delta intakes, the quality of water for exports would improve. The project will also protect in-Delta agricultural water quality by maintaining standards and limiting north Delta diversions when river flows are low.

REDUCE CLIMATE CHANGE RISKS

The SWP and CVP pumps in the south Delta are vulnerable to increased salinity from rising sea levels. New northern intakes would greatly improve water quality under future changing conditions.

ADHERE TO INTEGRATED WATER RESOURCE PLAN

Improved water supply reliability would advance Metropolitan's 2015 Integrated Water Resources Plan Update strategy and leverage investments made to the regional storage portfolio over the past two decades.

MINIMIZE ADVERSE IMPACTS TO COMMUNITIES

The footprint, construction activities and proposed operations reflect numerous efforts to minimize adverse impacts to Delta communities and areas of sensitive habitat for fish and wildlife.

OPERATIONAL AND ENVIRONMENTAL BENEFITS

WATER DELIVERY FORECAST

PREDICTED FUTURE WATER SUPPLY FOR SWP/CVP
WITHOUT CALIFORNIA WATERFIX
3.5 TO 3.9 MILLION ACRE-FEET/YEAR*

PREDICTED FUTURE WATER SUPPLY FOR SWP/CVP
WITH CALIFORNIA WATERFIX
4.7 TO 5.3 MILLION ACRE-FEET/YEAR**

Total SWP and CVP water deliveries
* Proposed w/o northern intake (existing conditions high outflow scenario)
** California WaterFix preferred alternative 4A H3-H4

Reinstate a more natural direction of river flows in the south Delta, minimizing reverse flows.

Protect against saltwater intrusion.

Safeguard against vulnerabilities that threaten water reliability such as earthquake risk and climate change.

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Environmental Benefits

MITIGATION

The biological opinions and EIR/EIS for California WaterFix outline mitigation measures related to the construction and future operations of the project. Some of the benefits of the fishery habitat that will be created and restored include:

- Improved habitat conditions along important juvenile salmon migration routes
- Restored tidal and non-tidal wetlands, and native riparian forest habitat
- Increased food production, spawning and rearing areas
- Natural refuge from predators and changing climate conditions
- Improved connectivity between existing areas of natural habitat

These measures will enhance other state-sponsored programs to restore natural communities and ecological processes including California EcoRestore and the Delta Smelt and Sacramento Valley Salmon Resiliency Plans, both of which contain actions to improve the status of the species. Metropolitan is a strong proponent and active participant with the state on these programs.

CALIFORNIA ECORESTORE

California EcoRestore represents the state's near-term effort to accelerate habitat restoration in the Delta. California EcoRestore is being developed in parallel to California WaterFix, but separate from the mitigation requirements of the project, to improve the long-term health of the Delta. EcoRestore seeks to advance at least 30,000 acres of habitat restoration including 3,500 acres of managed wetlands, at least 17,500 acres of floodplain restoration, 9,000 acres of tidal and sub-tidal habitat restoration and at least 1,000 acres of aquatic, riparian and upland habitat projects and multi-benefit flood management projects.

AFTER TWO YEARS IN OPERATION, CALIFORNIA ECORESTORE HAS MADE SIGNIFICANT PROGRESS:

2 RESTORATION PROJECTS STARTED CONSTRUCTION IN 2016

600+
Acres of tidal restoration

Fish passage improvement in the Yolo Bypass

4 PROJECTS IN 2017

2
Multi-benefit floodplain projects

2
Tidal marsh restoration efforts

over 1,300
Acres acquired from willing sellers for restoration projects

OUR MISSION

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.

For a full version of the Operations Policy Paper, visit mwdh2o.com/waterfix

ABOUT METROPOLITAN

The Metropolitan Water District of Southern California is a state-established cooperative of 26 member agencies – cities and public water agencies – that serve nearly 19 million people in six counties. Metropolitan imports water from the Colorado River and Northern California to supplement local supplies and helps its members develop increased water conservation, recycling, storage and other resource management programs.

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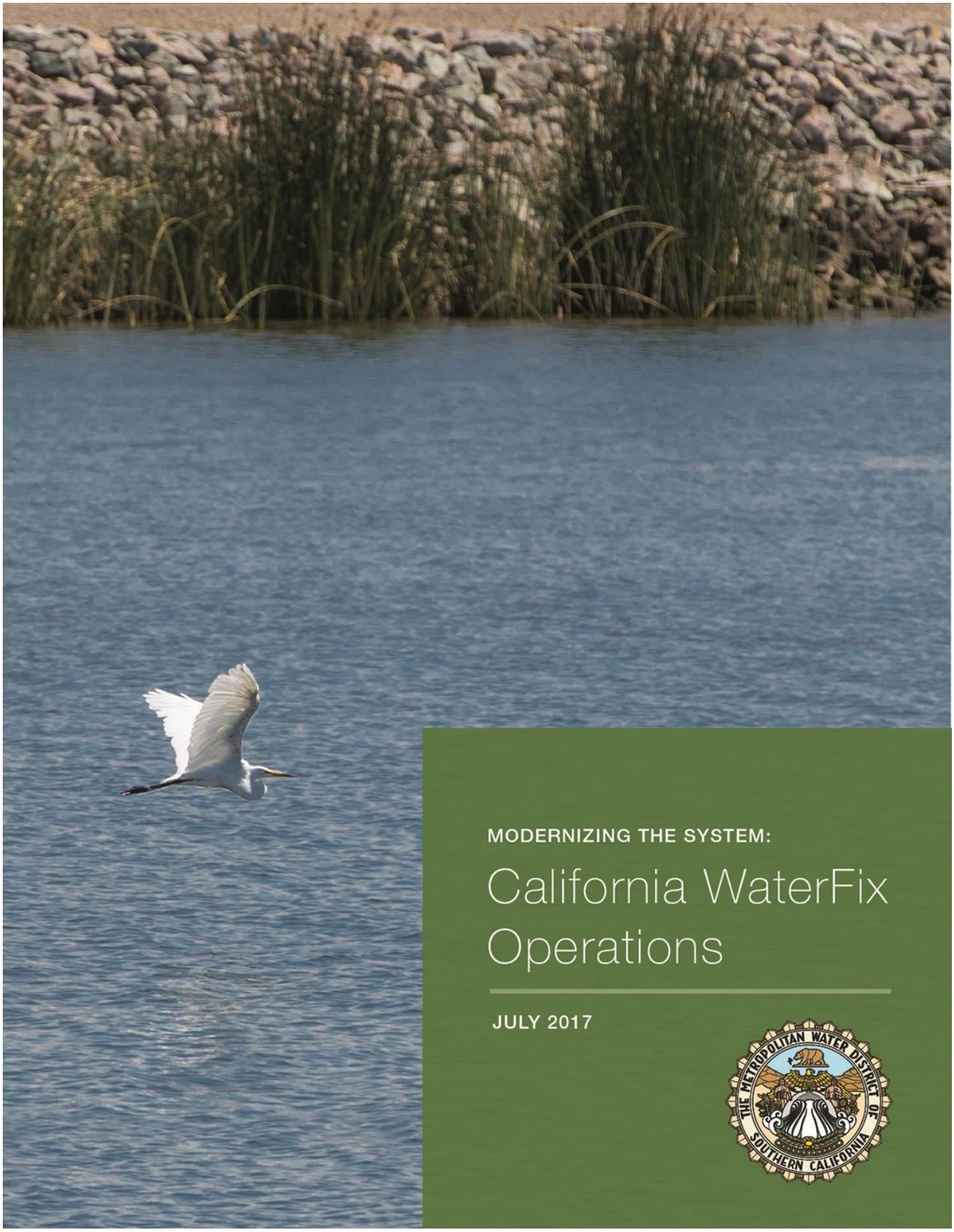


MODERNIZING THE SYSTEM:

California WaterFix Operations

JULY 2017

Contents

Introduction

This is the second of three policy white papers prepared for the Metropolitan Water District of Southern California's Board of Directors on the proposed California WaterFix. The overall objective of these papers is to provide relevant information in preparation for the Board's decisions on the project.

This paper focuses on the proposed operations and performance of California WaterFix to advance the state's coequal goals of improving water supply reliability and the Delta ecosystem. It describes how the planned operations of California WaterFix's proposed three new intakes in the northern Sacramento-San Joaquin Delta (Delta) are to be operated in conjunction with existing State Water Project (SWP) and Central Valley Project (CVP) facilities in the south Delta. The paper also describes elements of the proposed project that aim to reduce risks and uncertainties regarding operations and ecological processes and to improve environmental conditions. The other two white papers focus on the project's infrastructure improvements and the financing/cost allocation.

The objectives of this white paper are:

A. Describe the regulatory requirements and the challenges and issues that are imposed on the operation of existing SWP and CVP facilities;
B. Describe the new features and the proposed operation of California WaterFix under the requirements of current and projected state and federal regulations;
C. Describe the impact of operating California WaterFix on overall SWP and CVP performance and identify the major risk elements and risk management approaches;
D. Describe California WaterFix and its relationship to ongoing efforts to restore the Delta ecosystem, to preserve the Delta as an evolving place, and to prepare California for an evolving Delta future.

Summary

The Sacramento River and San Joaquin River meet in the Delta, which is the hub of the state's water distribution system. Both of California's two largest water projects – SWP and CVP – operate within the Delta and deliver water to about two-thirds of all Californians and millions of acres of irrigated farmland.

The Delta is a vitally important ecosystem that supports hundreds of aquatic and terrestrial species, some of which are protected under federal and state endangered species laws. To protect listed species, the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the California Department of Fish and Wildlife (CDFW) have issued biological opinions and incidental take permits requiring the state Department of Water Resources (DWR) and federal Bureau of Reclamation (Reclamation) to substantially alter the way the agencies operate the SWP and CVP facilities. These operational changes have reduced SWP and CVP deliveries and water supply reliability south of the Delta. In addition, the Delta is at risk from earthquake damage, persistent land subsidence, floods and rising sea levels.

The existing Delta water conveyance system needs to be improved and modernized to address these issues. For example, the current system has diversions in the south Delta. Many of the operational and environmental challenges with the current system would be addressed by the California WaterFix, which proposes three new diversion structures in the north Delta. The structures would have state-of-the-art fish screens that would be operated in coordination with the existing south Delta SWP and CVP diversion facilities. These infrastructure and operational improvements would help restore and protect ecosystem health, improve the reliability of SWP and CVP deliveries, and protect water quality consistent with statutory and contractual obligations.

The SWP supplies from Northern California account for about 30 percent of the water used in Southern California. Recognizing the need to modernize the state's conveyance system, Metropolitan's Board of Directors adopted the Delta Action Plan and Delta Conveyance Criteria in 2007 (Conveyance Criteria). The following Conveyance Criteria serve as benchmarks for evaluating the effectiveness of the proposed California WaterFix:

- Provide water supply reliability;
- Allow flexible pumping operations in a dynamic fishery environment;
- Improve export water quality;
- Reduce seismic risks;
- Reduce climate change risks;
- Enhance ecosystem fishery habitat throughout the Delta.

Underlying all these benchmarks is the principle that they would be achieved in an environmentally responsible manner.

California WaterFix would improve system operational capability to support more reliable Delta water exports, and greater assurances to guard against risks. Increased flexibility to strategically move water from either the north or south Delta and better real-time management of export operations in response to actual conditions would better protect fish. The proposed dual conveyance system would improve river flow patterns with a more natural upstream to downstream flow pattern during periods important for fishery protection and less fish entrainment in the south Delta diversion facilities. Having flexibility to divert in the north or the south Delta will help native fish species migrate to and from the ocean and better utilize Delta habitat. It also would ensure greater water supply certainty for the 25 million Californians and millions of acres of agriculture receiving water from the Delta, and offer greater resiliency to climate change and seismic events. With these physical and operational changes, California WaterFix would help advance and achieve the state's co-equal goals of ecosystem restoration and water supply reliability.

The potential impacts of the proposed system facilities and operations have been carefully and thoroughly reviewed. Appropriate risk management measures have been incorporated into the project to restore and protect ecosystem health, water supplies, and water quality within a stable regulatory framework, consistent with statutory and contractual obligations. An Adaptive Management Program would be implemented through a collaborative process with regulatory agencies, project operators, and water contractors. This would provide a structured science process to develop adaptive means of improving conditions for both the ecosystem and water supply. Project operations that respond to real-time Delta conditions would also advance these objectives and provide greater certainty for water deliveries.

With the proposed conveyance improvements, management actions, and framework for operation, the project would have a significant positive impact on water supplies and water quality when compared to current conditions. Without California WaterFix, it is estimated that combined future SWP and CVP average annual exports could potentially decrease to 3.5 to 3.9 million acre-feet (MAF) from the current average annual supply of 4.9 MAF. With California WaterFix, the range of combined annual exports in future years is projected to be 4.7 to 5.3 MAF.

California WaterFix has undergone an unprecedented level of public outreach, review, and comment, along with extensive scientific analysis as part of the environmental planning process. Significant refinements to both the physical configuration and operational characteristics were made to address issues raised during the environmental review to reduce impacts and to better protect species. These refinements have accomplished that while maintaining the underlying core capabilities of the proposed system.

DWR and Reclamation have completed the environmental review documents under the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). In addition, USFWS and NMFS have issued biological opinions on the project. These biological opinions determined that California WaterFix as proposed would neither jeopardize the continued existence of species listed under the federal Endangered Species Act (ESA) nor destroy or adversely modify critical habitat for those species.

Based on the information available to date, it is staff's assessment that California WaterFix operation, system capabilities and adaptive management would meet Metropolitan's adopted policy direction and achieve greater supply reliability.

Challenges and Issues with the Existing System

The location of the existing SWP and CVP diversion facilities in the south Delta, within habitat for protected fish species, leads to a significant problem: unreliable water supplies. This is because the rules to protect beneficial uses in the Delta and the listed species greatly restrict operations.

The Bay-Delta Water Quality Control Plan (WQCP) identifies the beneficial uses of water in the Delta and establishes the water quality objectives necessary to protect those uses. The current WQCP, as implemented through Water Rights Decision-1641 (D-1641), requires the SWP and CVP to meet the protective standards established by the State Water Resources Control Board (SWRCB).

In addition, DWR and Reclamation operate their respective projects pursuant to biological opinions issued by USFWS and NMFS under the federal Endangered Species Act. DWR operates the SWP pursuant to an incidental take permit for longfin smelt issued by the CDFW under the state Endangered Species Act, California Fish and Game Code section 2081(b), and consistency determinations under California Fish and Game Code, section 2080.1.

The SWP and CVP facilities have long been impacted by changing regulations governing both projects' diversion facilities in the south Delta. On average, D-1641 has reduced SWP and CVP diversions and increased Delta outflows to the San Francisco Bay by about 300,000 acre-feet a year as compared to the SWRCB's prior requirements. Compounding the impacts, the biological opinions have decreased diversions and increased outflows by about another 1 MAF a year (Source: MBK Engineers and HDR "Retrospective Analysis of Changed Central Valley Project and State Water Project Conditions Due to Changes in Delta Regulations," January 2013).

The increased Delta requirements and export constraints have further affected SWP and CVP operations by decreasing operational flexibility and increasing water supply vulnerabilities during dry conditions. This, in turn, reduces project reservoir storage, water deliveries, and supply reliability. Figure 1 illustrates the decrease in average SWP and CVP delivery capability over time due to additional regulatory requirements. As shown in the figure, over a period of a little more than 25 years, the export capability of the two projects has been reduced by over 3 MAF per year. California WaterFix is intended to reverse this downward trend.

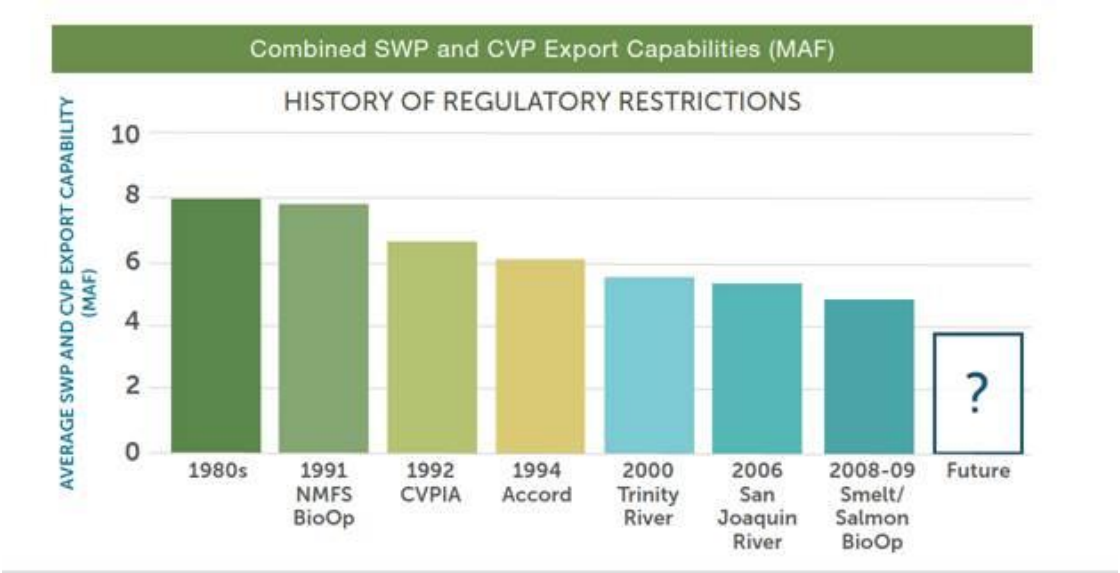


FIGURE 1: HISTORY OF SWP AND CVP EXPORT RESTRICTIONS DUE TO ENVIRONMENTAL REGULATIONS

California WaterFix Components

DESCRIPTION OF CALIFORNIA WATERFIX PHYSICAL COMPONENTS

The proposed infrastructure improvements are described in the first policy white paper ("Modernizing the System: California WaterFix Infrastructure"). The proposed facilities include three intake facilities along the east bank of the Sacramento River between the communities of Clarksburg and Courtland in the north Delta and dual tunnels that would carry water from the intakes to a pumping plant at Clifton Court Forebay. From there, water moved through these proposed facilities would connect with the SWP's existing California Aqueduct and the CVP's Delta-Mendota Canal for downstream deliveries (see Figure 2). Under California WaterFix, DWR and Reclamation would continue to use the existing south Delta facilities as appropriate in coordination with the north Delta facilities.

ADDITIONAL CALIFORNIA WATERFIX COMPONENTS

In addition to the physical facilities, California WaterFix includes a number of operational elements and environmental commitments to protect the Delta ecosystem. These include:

- A collaborative science and adaptive management program to address uncertainties and make adjustments over time;
- Continued real-time operation that makes adjustments to limit effects on listed species while maximizing water supply benefits;
- Environmental commitments to mitigate potential construction and operational impacts and to protect the Delta environment.

Each of these elements is described in more detail in the following sections of this paper.

Regulations and California WaterFix Proposed Operations

DESCRIPTION OF PROPOSED CALIFORNIA WATERFIX OPERATIONS

In the future, the SWP and CVP would continue to operate under regulatory conditions imposed for water quality and fisheries protection.

Operating criteria for California WaterFix would include both existing regulatory requirements and new criteria and requirements associated with the proposed new facilities.

California WaterFix facilities would not become operational for many years. Because evolving science and changing conditions may lead to changes in the criteria during this time, a robust collaborative science and adaptive management program to respond to such changes is a prominent feature of the overall operations strategy. In summary, the strategy involves the following steps:

A. A set of criteria that would govern California WaterFix when it initially becomes operational was assumed to evaluate project effects for the environmental documents and biological opinions.
B. A robust collaborative science and adaptive management program that includes water contractor representatives would evaluate initial operating criteria in light of additional focused studies and evolving science and propose appropriate changes in the criteria before and after California WaterFix becomes operational.
C. Flexible real-time operations would respond to day-to-day conditions to maximize water supply and fish protection within the bounds of existing criteria.

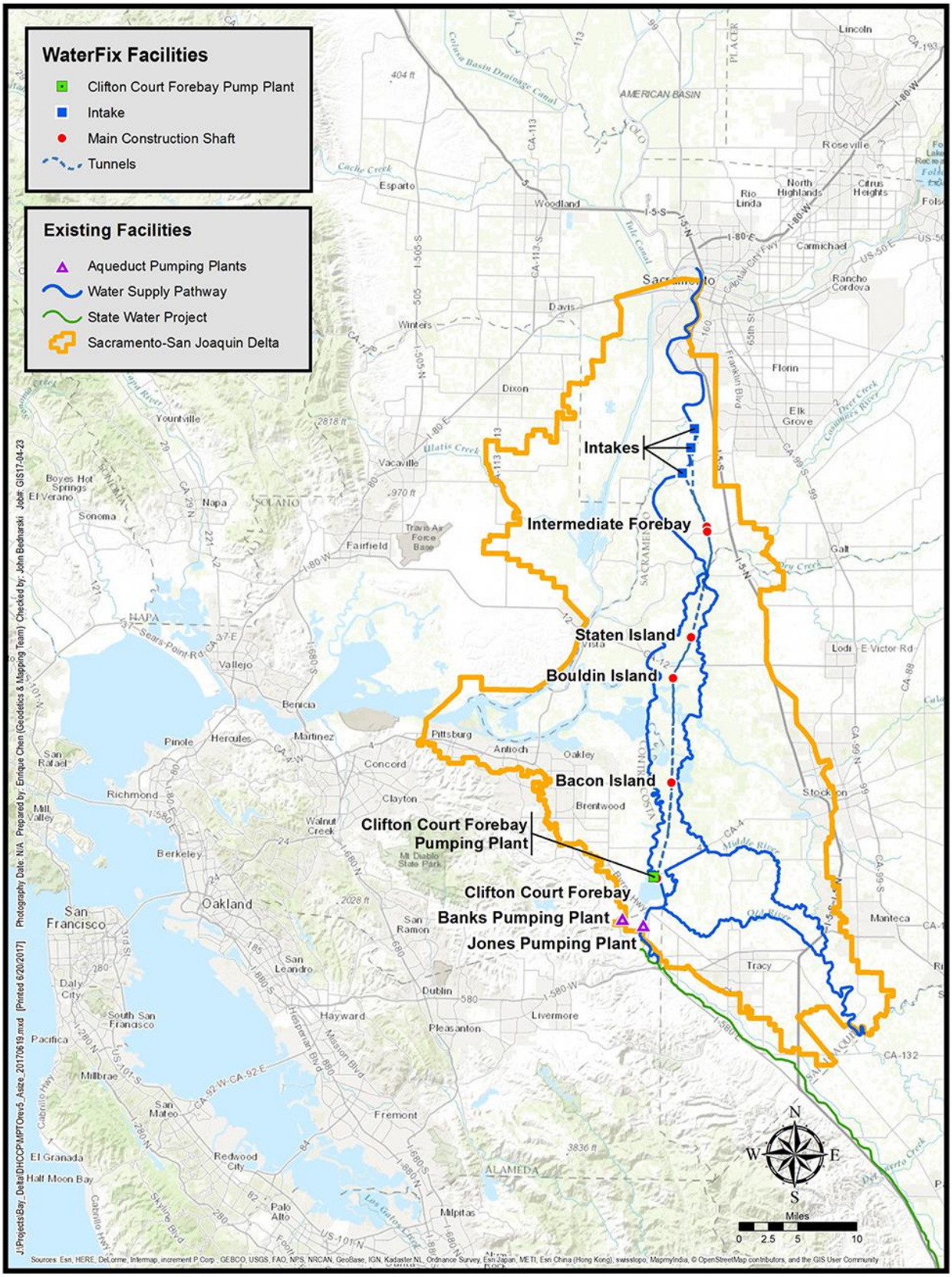


FIGURE 2: OVERVIEW OF THE DELTA AND CALIFORNIA WATERFIX FACILITIES

Initial Operating Criteria for California WaterFix

The initial operating criteria for California WaterFix includes regulatory requirements that were established through D-1641, the 2008 and 2009 biological opinions for existing water project operations, and new criteria developed through California WaterFix's environmental permitting process.

Existing regulatory requirements in the assumed initial operating criteria include:

- Salinity standards;
- Spring and fall outflow to manage the overall salinity gradient (known as "X2");
- Cross Channel Gate, Suisun Marsh Gate, and temporary agricultural barrier operations;
- Limits on SWP and CVP diversions to manage flows in Old and Middle Rivers and entrainment;
- Rio Vista flow.

New regulatory requirements in the assumed initial operation include additional limits on SWP and CVP diversions (i.e., Old and Middle River flow reversals) and flow (i.e., spring outflow, North Delta Diversion Bypass flow). California WaterFix also includes a permanent operable gate at the Head of Old River for fish migration protection and criteria for its operation.

Range of Potential Operations for Environmental Review

The California WaterFix preferred alternative is identified in the final Environmental Impact Report/Environmental Impact Statement (EIR/EIS) as Alternative 4A. The proposed initial operations scenario, known as H3+, falls within a range of initial Delta outflows known as H3 to H4. Before California WaterFix begins operation, specific initial operating criteria would be established as set forth in the related biological opinions. These criteria may change based on adaptive management.

To support the potential changes, an analysis was adopted during SWRCB water rights proceedings to identify potential effects of California WaterFix over a broad range of operating criteria. As presented to the SWRCB, this range is defined as Boundary 1 and Boundary 2. Boundary 1's operational scenario has most of the existing regulatory constraints but does not include the additional Old and Middle River criteria and spring outflows that are included with in the H3-H4 range. Boundary 2's operational scenario assumes a significant increase in Delta outflows, similar to a scenario presented in the EIR/EIS that was developed in coordination with SWRCB staff.

The final state-federal environmental documents also evaluated other alternatives, including alternatives outside of Boundary 1 and Boundary 2.

These different assumed initial operating alternatives and each boundary are illustrated in Figure 3. Figure 4 presents a summary comparison of the key assumptions for these different scenarios.

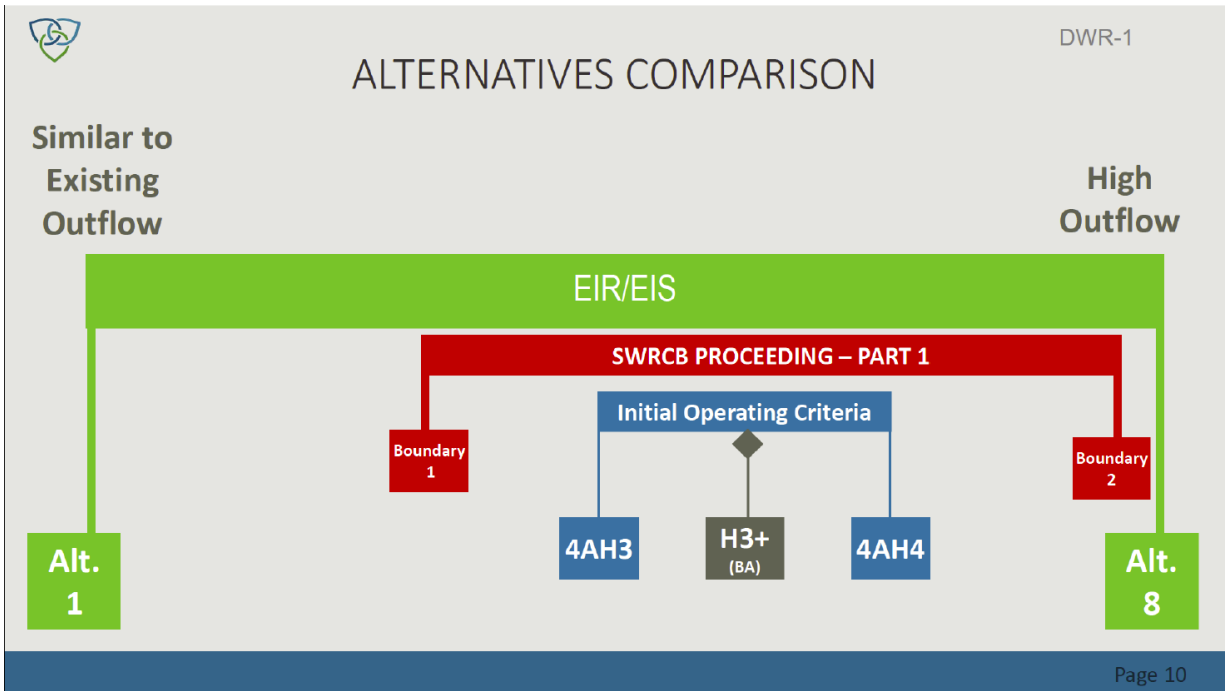


FIGURE 3: ALTERNATIVES COMPARISON

	9,000 cfs North Delta Diversion	Fall X2	Delta Outflow requirements	NMFS BiOp SJR i/e ratio	OMR Requirements	Head of Old River Barrier/Gate
No Action Alternative	No	Yes	Per D-1641	Yes	Yes; per BiOps	Temporary barrier installed in fall months
Boundary 1	Yes	No	Per D-1641	No	Yes; per BiOps	Permanent gate operating in fall months consistent with NAA
H3	Yes	Yes	Per D-1641	No	Yes; more restrictive of either BiOps or new OMR requirements identified in the RDEIR/SDEIS for Alternative 4A	Permanent gate operating in fall, winter and spring months (partial closure)
H4	Yes	Yes	Per D-1641 and increased Delta Outflow requirements during March-May	No		
Boundary 2	Yes	Yes	Per D-1641 and increased Delta Outflow goals in all months	No	Yes; more restrictive of either BiOps or new OMR requirements identified in the RDEIR/SDEIS Appendix C	Permanent gate operating in fall, winter and spring months (full closure)

Note: The term "BiOp" refers to the 2008 Fish and Wildlife Service biological opinion and 2009 National Marine Fisheries Service biological opinion on SWP and CVP operations.

FIGURE 4: PROPOSED OPERATING ALTERNATIVES AND BOUNDARIES

SWP and CVP Operations and Performance with California WaterFix

The facilities and operational features of California WaterFix would have a positive impact on water supply and water quality and provide significant capability to adapt to climate change and seismic concerns.

SWP AND CVP SUPPLY RELIABILITY

Extensive modeling and analysis has evaluated the potential operational and water supply benefits of California WaterFix. This work involved developing forecasts of SWP and CVP deliveries for a number of scenarios involving climate change, both with and without California WaterFix. The total water supply from the SWP and CVP under current conditions averages about 4.9 MAF of water per year. The No Action Alternative evaluated in the California WaterFix EIR/EIS is estimated to average about 4.7 MAF per year in year 2025 with climate change effects considered. The No Action Alternative incorporates an estimate of climate change and sea level rise that is consistent with the future cases with and without California WaterFix. In this way, the No Action Alternative isolates the impact of California WaterFix from the impact of climate change, and allows for direct comparisons between future cases.

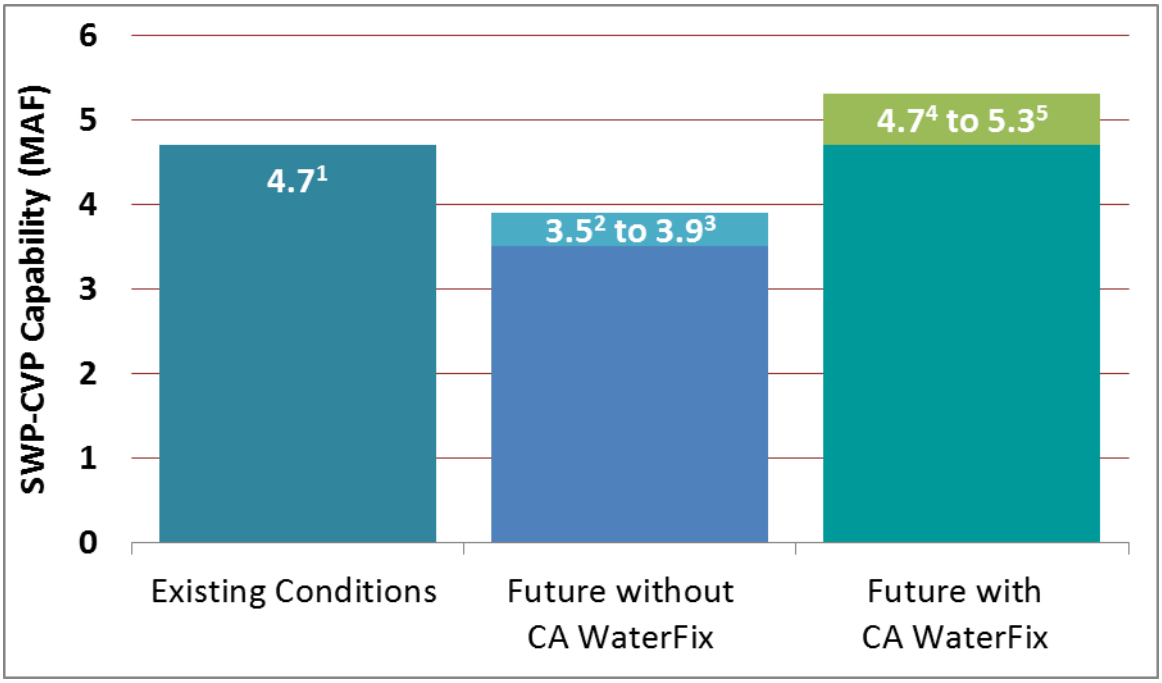
The estimated future supply without California WaterFix assumes increasing future regulatory constraints. Since the long-term trend has been toward increased regulation and reduced supply of the SWP and CVP, it is assumed that this trend would continue into the future. For example, the SWRCB is reviewing its Water Quality Control Plan (WQCP), which includes analysis of several new outflow scenarios as part of that process. The USFWS and NMFS also are reviewing the existing 2008 and 2009 biological opinions for existing SWP and CVP operations, which could lead to new operational restrictions. Next year, CDFW will review its Fish and Game Code Section 2081 permit regarding ongoing SWP operations, which could impose further restrictions on exports.

More specifically, it is assumed that future regulatory restrictions could include further reductions in direct diversions, as regulated using Old and Middle River flow, as well as increased outflow, as measured by outflow or X2. To approximate a future without California WaterFix, Alternative 4A without the proposed north Delta diversions was used in this report. This approach is consistent with DWR's planning activities, as evidenced by its 2015 DWR Delivery Capability Report (Capability Report), which used the same approach to estimate future regulatory constraints on SWP and CVP pumping for its Existing Conveyance High Outflow (ECHO) and Existing Conveyance Low Outflow (ECLO) scenarios. The predicted future water supply without California WaterFix under the ECHO Scenario is estimated to be 3.5 MAF per year on average, and 3.9 MAF under the ECLO Scenario.

Total deliveries with California WaterFix are estimated to range from 4.7 MAF under Alternative 4A-H4 to 5.3 MAF under Alternative 4A-H3 per year on average.

California WaterFix and Metropolitan's Integrated Water Resource Plan

Southern California's plan for a reliable water supply future depends on a reliable SWP supply and conveyance system, which requires much greater capability to move water into storage in wet periods and more flexibly to manage around fishery needs. Metropolitan's 1996 Integrated Water Resources Plan (IRP) identified the risk and variability associated with future SWP supplies, accurately projecting declines in water supplies because of projected future regulatory restrictions on SWP operations. As a result, Metropolitan embarked on a diversified strategy of local supply development, conservation, storage, and transfers to reduce future reliance on imported supplies, particularly reduced SWP deliveries in dry years. Much of the long-term investments in local supply development, conservation, storage, and transfers identified in the 1996 IRP have been made. Metropolitan today has more than 5.5 MAF of total storage capacity to help manage the highly variable imported supplies, particularly SWP deliveries. Reliable SWP supplies and flexibility of project operations remain key elements in the 2015 IRP Update.



[1]California WaterFix EIR/EIS No Action Alternative, existing conditions with 2025 climate change impacts
[2]2015 Delivery Capability Report Existing Conveyance High Outflow scenario
[3]2015 Delivery Capability Report Existing Conveyance Low Outflow scenario
[4]California WaterFix EIR/EIS Alternative 4A-H4, initial operating criteria lower range
[5]California WaterFix EIR/EIS Alternative 4A-H3, initial operating criteria upper range

FIGURE 5: TOTAL DELIVERIES WITH AND WITHOUT CALIFORNIA WATERFIX

The 2015 IRP Update was grounded with a "Do Nothing" or "No New Investment" case for the SWP to identify the resource development needed to secure supply reliability to 2040. Under a "Do Nothing" or no new investment forecast for the SWP, notable changes would occur over time that would affect deliveries under the current system configuration.

The most notable change was the projected decline of SWP supply reliability that would take place because of climate change and the probability of more restrictive regulatory and operating conditions. Under current conditions, in 2016, total projected SWP and CVP water deliveries of 4.9 MAF on average translate to estimated SWP deliveries to Metropolitan of 1.2 MAF on average. Consistent with the prior discussion regarding increasing regulation and Delta flow restrictions, that projection was assumed to decline over time.

To reflect a future with no new actions or investments in the SWP, conservative approach was taken by estimating the decline using the Existing Conveyance High Outflow (ECHO) Scenario from the 2015 DWR Delivery Capability Report (Capability Report). Under this scenario, with total SWP and CVP water deliveries projected to be 3.5 MAF on average, SWP deliveries available to Metropolitan would drop to 837,000 acre-feet on average.

The 2015 IRP Update found that California WaterFix would improve the long-term reliability of Metropolitan's water supplies, comparing projected supplies in Table 1 with Table 2. One of the key reliability goals of the 2015 IRP Update is to stabilize SWP supplies. The IRP describes an approach for achieving this goal that includes adaptive management of flow and export regulations in the near-term and attainment of a long-term Delta solution through California WaterFix.

TABLE 1: SUMMARY OF SWP SUPPLIES AVAILABLE TO METROPOLITAN WITHOUT ADDITIONAL INVESTMENTS (ACRE-FEET)

SWP	2016	2020	2025	2030	2035	2040
Minimum	210,000	154,000	154,000	154,000	154,000	154,000
Average	1,202,000	837,000	837,000	837,000	837,000	837,000
Maximum	2,022,000	1,695,000	1,695,000	1,695,000	1,695,000	1,695,000

The 2015 IRP Update developed assumptions for SWP supplies with California WaterFix and evaluated the resulting reliability improvements in comparison to the "Do Nothing" case. In a manner similar to the "Do Nothing" case, SWP supplies were also estimated to decline in the near-term, but assumed to be less severe than in the "Do Nothing" scenario. The declines were assumed to be less due to the commitment to California WaterFix near-term adaptive management efforts. In this scenario, Metropolitan used the Existing Conveyance Low Outflow (ECLO) Scenario from the Capability Report as a proxy for near-term SWP supplies under less restrictive conditions. Under the ECLO Scenario, total SWP and CVP water deliveries were projected to be 3.9 MAF per year on average. Under this scenario, SWP deliveries to Metropolitan drop to 984,000 acre-feet on average (Table 2, Year 2025).

At the time of the 2015 IRP Update, Alternative 4A provided the best available estimate of total SWP and CVP yield, based on long-term land-use and climate change and assumed operating and regulatory conditions. It also factored in a change in project facilities to include conveyance consistent with California WaterFix. The IRP update analyses used Alternative 4A-H4 as the estimated deliveries with California WaterFix. It was estimated that the flexible operations from California WaterFix facility improvements would provide total average SWP and CVP deliveries of 4.9 MAF, with average SWP deliveries available to Metropolitan of 1.2 MAF starting in 2030 (Table 2).

TABLE 2: SUMMARY OF SWP SUPPLIES AVAILABLE TO METROPOLITAN WITH CALIFORNIA WATERFIX (ACRE-FEET)

SWP	2016	2020	2025	2030	2035	2040
Minimum	210,000	229,000	229,000	314,000	314,000	314,000
Average	1,202,000	984,000	984,000	1,213,000	1,213,000	1,213,000
Maximum	2,022,000	1,695,000	1,695,000	1,863,000	1,863,000	1,863,000

The IRP analyses showed that California WaterFix would have a significant positive impact on the total supply reliability for Metropolitan's service area. Under the "Do Nothing" case, IRP analyses showed that Metropolitan's service area would experience water shortages 33 percent of the time in 2035 and 58 percent of the time in 2040. In addition, the region's dry-year storage reserves would be drawn down to critical levels (less than 1 MAF dry year supplies) 55 percent of the time in 2035 and 80 percent of the time in 2040.

Under Alternative 4A-H4, the likelihood of water shortages would be reduced to 4 percent in 2035 and 10 percent in 2040. Storage reserves also improved under the proposed plan, with reserves being drawn down to critical levels 9 percent of the time in 2035 and 8 percent of the time in 2040. These findings were the primary driver in the development of the 2015 IRP Update's target to stabilize the reliability of SWP supplies through California WaterFix.

California WaterFix advances the overall 2015 IRP Update strategy, leveraging the investments Metropolitan has made in regional storage capacity over the past two decades to provide supply reliability into the future. The data and estimates for available water supply from the SWP and the impacts of increased regulation used in the 2015 IRP Update analyses were based on the best available information and modeling at the time. Updated modeling

results of water deliveries that incorporate the latest information on future regulations and project facilities, shown in this paper, are consistent with (and improved over) those used in the 2015 IRP Update analyses. These findings confirm that California WaterFix remains an important part of the overall portfolio of water resource development strategy that is key to Southern California's water supply future.

OPERATIONAL FLEXIBILITY WITH CALIFORNIA WATERFIX

There are two ways that the operational flexibility provided by California WaterFix can increase water supply reliability within a given year. The first is through the increased ability to manage intermittent high-flow events in the Delta watershed. The second is through the increased conveyance capacity that could facilitate voluntary water transfers between north and south Delta interests.

Management of High Flow Events

The California WaterFix is intended to capture additional flow during wetter periods when unregulated flow is available. Metropolitan has analyzed the ability of California WaterFix to divert during such high flow events.

Using the winter of 2012/2013 as an example, Figure 6 shows that major storm flows produced significant volumes of water flowing through the Sacramento River past the location of the new intakes, through the Delta, and out to the San Francisco Bay. One 14-day storm event in December 2012 resulted in about 880,000 acre-feet of water flowing out to the Pacific Ocean. A second 14-day storm event resulted in about 1.1 MAF of Sacramento River outflow. As shown in Figure 6, state and federal water project exports were relatively minor in comparison to the outflows of the two storms. With the additional flexibility of California WaterFix's proposed north Delta intakes, Metropolitan's analysis estimates that several hundred thousand acre-feet of additional water could have been captured in these two storm events (as shown by the difference between the green and white lines on Figure 6). These results suggest that periodic high flow events could potentially provide reoperation benefits consistent with existing delivery contracts while at the same time meeting all criteria intended to protect fish, water quality, and existing water rights.

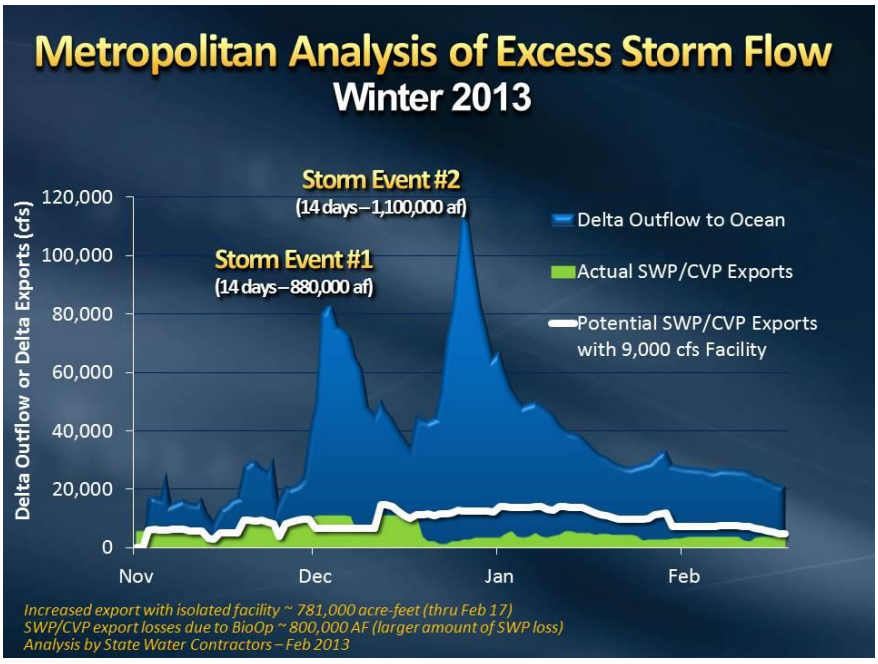


FIGURE 6: WINTER 2013 REOPERATION ANALYSIS WITH CALIFORNIA WATERFIX

As part of SWCRB's California WaterFix petition process, DWR presented a similar analysis illustrating the flexibility of the proposed project using water year 2016 as an example. DWR's analysis showed that an additional 1.2 MAF could have been diverted if California WaterFix had been operational in 2016. (Source: J. Leahigh

testimony, SWRCB Hearing Proceedings Regarding Changes in Water Rights for the California WaterFix Project, DWR Exhibit 61.)

This analysis is consistent with the average annual analysis presented in the environmental documents. All of the existing and new operating criteria for California WaterFix that are intended to protect fish and water quality would be maintained. Consequently, any diversions during high flow events would take place consistent with criteria intended to protect fish, water quality, and existing water rights. The analysis did not account for available south Delta storage or demand, so the actual quantity that may be diverted under similar circumstances in the future could be less than predicted.

Increased Capacity for Water Transfer Agreements

The flexibility provided by California WaterFix also improves the capability of moving water transfer supplies across the Delta. The increased conveyance and operational flexibility would significantly increase the amount of available capacity to accommodate the movement of water transfers across the Delta and the SWP and CVP system. Figure 7 shows the estimated increase in available transfer capacity with and without California WaterFix.

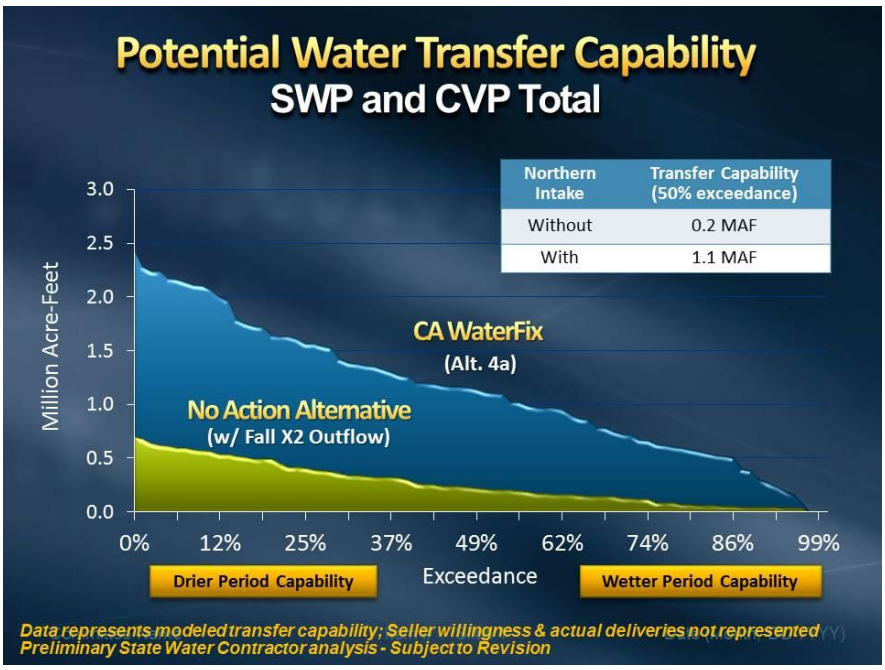


FIGURE 7: POTENTIAL WATER TRANSFER CAPABILITY, SWP AND CVP TOTAL

It is important to note that California WaterFix only serves to improve the available capacity and capability to accommodate water transfer agreements. Future water transfers or particular quantities of transfers are not components of California WaterFix. Because specific, future transactions for water transfers and other non-project voluntary water market transactions depend on future water supply, market, and other conditions, any amounts and locations of future water transfers are speculative. Future transactions and water transfer agreements would be subject to regulatory approvals and environmental review. Even with these considerations, California WaterFix would provide much greater capability to manage transfers.

COMPLIANCE WITH D-1641 WATER QUALITY STANDARDS WITH CALIFORNIA WATERFIX

California WaterFix would provide added flexibility to comply with flow and salinity criteria required by the SWRCB and other regulatory obligations, including for the protection of fish species. The additional location for SWP and CVP diversion in the north Delta enhances the flexibility of the water management system, allowing state and federal water system operators to balance flows for more optimal and precise salinity management. With California WaterFix, pursuant to D-1641, the SWP and CVP would still be required to meet all salinity and

flow objectives regardless of which diversion location is being used. However, the variable split between north and south diversions would allow a flexible and improved approach toward compliance with flow and salinity standards. For example, if salinity increased on the lower Sacramento River, the SWP and CVP could opt to increase diversions in the south Delta and thereby allow greater flow down the lower Sacramento River. In contrast, if salinity increased on the lower San Joaquin River, the SWP and CVP could decrease water diverted in the south Delta and increase diversions in the north Delta, thereby increasing flow in the lower San Joaquin River and south Delta. The flexibility offered by this example would limit reverse flows in the central Delta near Jersey Point, which in the past have drawn saltier water from the San Francisco Bay into the central Delta.

With California WaterFix, the SWP and CVP would continue to meet existing Delta water quality, fishery objectives, and any future regulatory requirements. Increased diversion flexibility afforded through the approval of California WaterFix would only enhance the capabilities of SWP and CVP projects to meet existing Bay-Delta requirements. Because California WaterFix can take advantage of opportunities to divert and store wet-period storm flows and allow for south Delta diversions in drier periods, in-Delta water quality can be better managed. As a result, the proposed California WaterFix operations would continue to be as protective, if not more, of existing beneficial uses.

EXPORT WATER QUALITY

California WaterFix would improve SWP and CVP export water quality. Urban water users, including Metropolitan, are concerned with the levels of salinity (electrical conductivity (EC), bromide, and total dissolved solids (TDS)), organic carbon, and nutrients in their imported supplies. The concern is related to meeting state and federal drinking water regulations to protect human health, preventing taste and odor complaints, and enhancing local water management programs.

California WaterFix would improve SWP and CVP export water quality through the use of the dual intake system. This is because water quality on the Sacramento River at the proposed intakes is generally lower in salinity, organic carbon, and nitrates as compared to the San Joaquin River and south Delta. As shown in Table 3, modeling of Alternative 4A compared to no action shows lower levels of EC (18-22% improvement), TDS (17-22% improvement), bromide (31-43% improvement), organic carbon (2-11% improvement), and nitrates (5-27% improvement).

With these improvements, source water quality would be improved both for human health protection as well as regional water management.

ALLOW FLEXIBLE PUMPING OPERATIONS IN A DYNAMIC FISHERY ENVIRONMENT

The proposed north Delta diversion would allow SWP water exports, consistent with applicable criteria, during high-flow periods. Accordingly, north Delta diversions would be greatest in wetter years and lowest in drier years. North Delta bypass flow criteria and the south Delta initial operations were developed with fishery agency involvement and are based on the scientific information available at the time of document preparation. These criteria are intended minimize project effects on listed fish species while providing water supply reliability gains, with the following considerations:

- Proposed initial operations would include a preference for south Delta facility pumping from July through September to manage water quality conditions in the south Delta. Additionally, real-time operations would be used to adjust operations and further protect listed species, while maximizing water supply benefits.
- The objectives of the north Delta diversion bypass flow criteria include regulation of flows to maintain fish screen sweeping velocities; minimize potential increase in upstream transport of productivity in the channels downstream of the intakes; support salmonid and pelagic fish movements to regions of suitable habitat; reduce losses to predation downstream of the diversions; and maintain or improve rearing habitat conditions in the north Delta.

TABLE 3: WATER QUALITY CONSTITUENTS

Banks Pumping Plant	No Action (Early Long-Term)	Alternative 4A (Early Long-Term)
Electrical Conductivity (µmohs/cm)[1]		
All	505	395
Drought	632	518
Total Dissolved Solids (TDS) (mg/L)[2,3]		
All	286	228
Drought	354	293
Bromide (µg/L)[4,5]		
All	391	223
Drought	482	334
Dissolved Organic Carbon (mg/L)[6]		
All	3.8	3.4
Drought	4.1	4.0
Nitrate (mg/L-N)[7]		
All	0.70	0.51
Drought	0.55	0.52

[1]Source: Final EIR/S at Appendix 8H, p. 8H-32.
[2]Source: Conversion from EC using conversion formula: (TDS (mg/L) = 19.2 + (0.529 * EC).
[3]EC data from Final EIR/S at Appendix 8H, p. 8H-32.
[4]Source: Final EIR/S, Appendix 8E, p. 8E-23.
[5]Mass-balance approach.
[6]Source: Final EIR/S, Appendix 8K, p. 8K-12.
[7]Source: Final EIR/S, Appendix 8J, p. 8J-43.

- To meet bypass flow objectives, diversions must be restricted at certain times of the year that support the main juvenile salmon migration period (mostly from December through June).
- The proposed operational north Delta bypass criteria also protect water quality and flow for downstream water users. The north Delta diversion would not be operated during low-flow periods on the Sacramento River. Generally, during the period from December through June, as illustrated in Figure 8, the full 9,000 cfs diversion rate would not occur until Sacramento River flows are approximately 35,000 cfs. Compliance with D-1641 standards further restricts the north Delta diversion rate.

As a result of the limitation on north Delta diversion, there would be sufficient water downstream for both the fishery and water quality requirements. Overall, the flexibility provided by California WaterFix would better respond to the needs of the fishery.

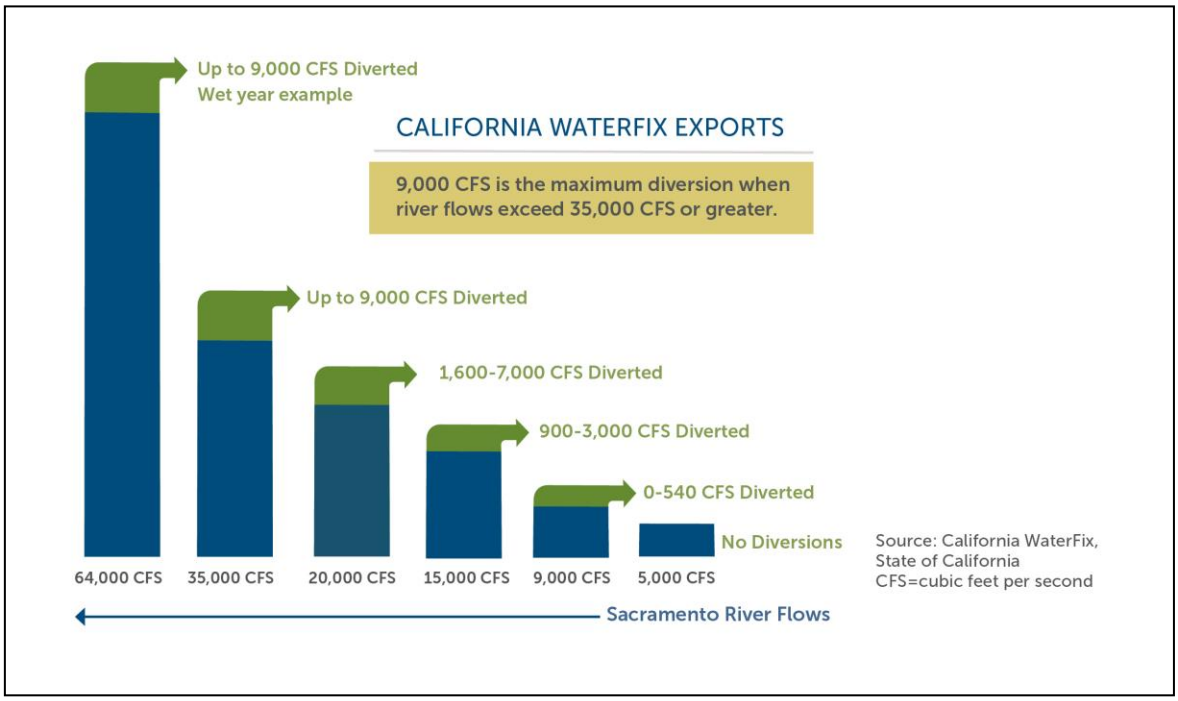


FIGURE 8: NORTH DELTA DIVERSION BYPASS CRITERIA

REDUCING CLIMATE CHANGE RISKS

Climate change will affect Northern California watersheds and the Delta region in a number of ways. Questions remain about the exact timing, magnitude, and regional impacts of temperature and precipitation changes, but climate researchers have identified several areas that could affect water supply availability and the future operation of SWP and CVP facilities. These areas include:

- Reduction in Sierra Nevada snowpack and loss of natural storage from snowpack;
- Increased intensity and frequency of extreme precipitation events;
- Rising sea levels and seawater intrusion into the Bay-Delta.

The past 10 years have heightened the concerns and associated challenges that future climate change may bring. The Northern California watershed in the Sierra and the Delta have already experienced the range of higher temperatures and reduced snowpack that was predicted by climate change scientists. The hot and dry records experienced in the recent drought, followed by the extreme wet conditions in 2016/17, highlighted the challenges that SWP and CVP storage and conveyance facilities face in managing increasingly variable water supplies and conditions.

Current SWP and CVP pumping plant locations in the south Delta are vulnerable to the increased salinity levels that rising sea levels could bring. For example, rising sea levels could increase the pressure on the existing levee system, making the levees more vulnerable to failure. Because of their age and general methods of original construction, many Delta levees are at risk of failure as a result of continued land subsidence, flood conditions, sea level rise, and seismic events. Failure of the Delta levee system would inundate the surrounding islands, allowing saline water from San Francisco Bay to intrude into the Delta and contaminate freshwater supplies that are delivered by the SWP and CVP. If climate change and rising sea levels lead to such a levee failure in the future, California WaterFix would allow continued diversions at the north Delta intakes.

The new northern Delta intakes provided by California WaterFix would greatly improve the reliability of SWP and CVP deliveries under future climate change conditions. California WaterFix would allow for additional water diversions during extreme wet periods or rapid snowmelt events, both of which are predicted to increase in

frequency with climate change. Additionally, the location of the north Delta diversion intakes is less vulnerable to the effects of saltwater intrusion.

REDUCING SEISMIC RISKS

In 2009, DWR released the final Delta Risk Management Strategy (DRMS) Phase 1 Report. The report evaluated the risk and consequences to California and the Delta associated with the failure of Delta levees and concluded that a seismic event is the single greatest risk to levee integrity. The US Geological Survey found a 62 percent probability of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area between 2003 and 2032. The DRMS Phase 1 Report estimated that a major earthquake could result in multiple levee failures that would simultaneously flood 20 or more Delta islands. Under such a scenario, SWP and CVP exports could be interrupted for up to one and a half years.

Implementing California WaterFix would help reduce the risks from a catastrophic seismic event in the Delta. With the uncertainty of where a seismic event might occur, the addition of the new north Delta diversion and conveyance facilities provides redundancy in critical water supply infrastructure. Additionally, all California WaterFix infrastructure would be built to meet current seismic standards, as applicable.

ENHANCE ECOSYSTEM FISHERY HABITAT THROUGHOUT DELTA

The environmental benefits of California WaterFix include reduced south Delta pumping, providing a more natural upstream-to-downstream flow pattern during periods important for fishery protection and less direct fish entrainment in the south Delta diversion facilities. The proposed project also offers mitigation measures that would improve the existing environmental conditions as well as mitigate the effects of the proposed project.

Improved Flow Patterns in the Delta

Current pumping in the south Delta causes water from the Sacramento, Feather and American rivers to be pulled across the Delta into the south Delta. This cross-Delta water movement can confuse migrating salmon heading for the ocean or trying to return to their natal streams. As a result, migrating salmon may take longer to reach the sea or have difficulty finding their spawning grounds. With California WaterFix, south Delta water diversions would be reduced, improving flow and habitat conditions for salmonids.

Reduced south Delta pumping also could lessen direct entrainment in existing south Delta water facilities. For example, when a high turbidity pulse flow comes down the Sacramento River, diversions could be switched to the north Delta. This operational flexibility would help avoid drawing that turbidity, and potentially Delta smelt, toward the south Delta pumping facilities. Conversely, when salmon are migrating out of the upper tributaries and into the Sacramento River, diversions could be switched to the south Delta, away from the main migratory routes. The flexibility of having diversion facilities in the north and the south would provide opportunities to preferentially operate the facilities to minimize effects to sensitive fish species.

Physical Habitat Actions

The California WaterFix biological opinions and the EIR/EIS incorporate a variety of measures designed to mitigate potential construction and operation impacts and to enhance environmental conditions in the Delta.

With the State-directed pivot from the Bay-Delta Conservation Plan (BDCP) to California WaterFix in April 2015, many of the previously proposed BDCP Conservation Measures were no longer applicable to the newly proposed preferred alternative. However, some actions were adopted as part of the California WaterFix alternative. These actions, identified in the Table 4, below, consist primarily of habitat restoration, protection, enhancement, and management activities.

TABLE 4: ENVIRONMENTAL COMMITMENTS UNDER CALIFORNIA WATERFIX

Environmental Commitment 3: Natural Communities Protection and Restoration	
Valley/Foothill Riparian	Up to 103 acres
Grassland	Up to 1,060 acres
Vernal Pool Complex and Alkali Seasonal Wetland Complex	Up to 188 acres
Nontidal Marsh	Up to 119 acres
Cultivated Lands	Up to 11,870 acres
Total:	**Up to 13,340 acres**
Environmental Commitment 4: Tidal Natural Communities Restoration	Up to 295 acres
Environmental Commitment 6: Channel Margin Enhancement	Up to 4.6 levee miles
Environmental Commitment 7: Riparian Natural Community Restoration	Up to 251 acres
Environmental Commitment 8: Grassland Natural Community	Up to 1,070 acres
Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration	Up to 48 acres
Environmental Commitment 10: Nontidal Marsh Restoration	Up to 832 acres
Environmental Commitment 11: Natural Communities Enhancement and Management	At sites protected or restored under Environmental Commitments 3–10
Environmental Commitment 12: Methylmercury Management	At sites restored under Environmental Commitment 4
Environmental Commitment 15: Localized Reduction of Predatory Fishes	At north Delta intakes and at Clifton Court Forebay
Environmental Commitment 16: Nonphysical Fish Barrier	At Georgiana Slough

[Source: Final EIR/EIS (2016), Table 3-9, Page 3-55)

The final biological opinions add 80 acres of rearing habitat upstream on the Sacramento River and an additional 1,800 acres of tidal habitat restoration in the Delta.

In addition to the enhancement actions identified above, a variety of construction-related environmental commitments, best management practices, and avoidance and minimization measures have been incorporated that would be implemented as part of the construction activities. These actions have been designed to lessen or eliminate potential effects to environmental resources during construction of the new conveyance infrastructure and ancillary facilities. Some measures have been specifically developed to provide enhanced protection to sensitive species and their habitats. These include measures for the following resources: vernal pool crustaceans, California tiger salamander, California red-legged frog, valley elderberry longhorn beetle, Swainson's hawk, California clapper rail, Greater sandhill crane, tricolored blackbird, Suisun song sparrow, yellow-breasted chat, least Bell's vireo, western yellow-billed cuckoo, western burrowing owl, San Joaquin kit fix, riparian woodrat and riparian bush rabbit, salt marsh harvest mouse, and Suisun shrew.

The benefits of the fishery habitat created and restored through California WaterFix include:

- Improved habitat conditions along important juvenile salmon migration routes;
- Restored tidal and non-tidal wetlands;
- Restored native riparian forest habitat;

- Increased food production;
- Increase spawning and rearing areas;
- Natural refuge from predators and changing climate conditions;
- Improved connectivity between existing areas of natural habitat.

These environmental benefits combined with other State-sponsored programs currently underway to restore natural communities and ecological processes throughout the Delta. Three such programs include California EcoRestore, Delta Smelt Resiliency Strategy, and Sacramento Valley Salmon Resiliency Strategy. Highlights of the restoration goals of these programs are outlined below.

In addition to the mitigation activities above, California EcoRestore represents the state's near-term effort to accelerate habitat restoration in the Delta. California EcoRestore is being developed in parallel to California WaterFix, but separate from the mitigation requirements related to the construction and operation of the project. EcoRestore includes the restoration necessary to achieve regulatory requirements of the 2008 and 2009 biological opinions for existing SWP and CVP operations as well as additional projects to help improve the long-term health of the Delta unrelated to the operations of the water projects. In total, EcoRestore seeks to advance at least 30,000 acres of habitat restoration. Those 30,000 acres include:

- 3,500 acres of managed wetlands;
- At least 17,500 acres of floodplain restoration;
- 9,000 acres of tidal and sub-tidal habitat restoration;
- At least 1,000 acres of aquatic, riparian and upland habitat projects and multi-benefit flood management projects.

The state of California also has committed to improving conditions for species through the Delta Smelt Resiliency Strategy and the Sacramento Valley Salmon Resiliency Strategy. These plans contain actions that can be achieved in the near-term to improve the status of the species.

The Delta Smelt Resiliency Strategy was developed by the State in 2016 to voluntarily address the immediate and near-term needs of Delta smelt to promote their resiliency to drought and variable habitat conditions. The primary objective of the Delta smelt strategy is to improve the status of the species through management actions meant to address many of the environmental and habitat stressor of the species. Although specific implementation details are still under development, the actions included in the Delta Smelt Resiliency Strategy include:

- Aquatic weed control;
- North Delta food web adaptive management projects;
- Outflow augmentation;
- Reoperation of the Suisun Marsh salinity control gates;
- Sediment supplementation in the low salinity zone;
- Spawning habitat augmentation;
- Roaring River distribution system food production;
- Coordinated and managed wetland food and drain operations in Suisun Marsh;
- Franks Tract Restoration Feasibility Study;
- Adult fish salvage operation during summer and fall;
- Stormwater discharge management;
- Rio Vista Research Station and Fish Technology Center;
- Near-term Delta smelt habitat restoration.

The Sacramento Valley Salmon Resiliency Strategy has been prepared by the State to voluntarily address the needs of sensitive Chinook and steelhead salmon. The actions included in this strategy represent a variety of habitat restoration management actions necessary to improve the immediate and long-term resiliency of Sacramento Valley salmonids. Although not all known stressors affecting salmonids can be addressed, this strategy is intended to focus on habitat restoration actions critical to improving population resiliency to known and future stressors associated with spawning and rearing habitat, through-Delta survival, and adult fish passage. The actions contained in the Sacramento Valley Salmon Resiliency Strategy include:

- Multiple actions on Battle Creek;
- Provide instream flows to protect Chinook salmon and steelhead on Deer Creek, Mill Creek, Antelope Creek and Butte Creek;
- Restore fish passage and habitat in Upper Sacramento tributaries;
- Implement McCloud reintroduction plan;
- Improve fish habitat by removing Sunset Pumps Rock Dam on Feather River;
- Restore off-channel rearing, streambank, and riparian habitats and migratory conditions along Upper, Middle, and Lower Reaches of the Sacramento River;
- Complete fish screen construction on major diversions along the Sacramento River;
- Improve Sutter Bypass and associated infrastructure to facilitate adult fish passage and improved stream flow monitoring;
- Improve Yolo Bypass adult fish passage;
- Increase juvenile salmonid access to Yolo Bypass, and increase duration and frequency of Yolo Bypass floodplain inundation;
- Construct permanent Georgiana Slough non-physical barrier;
- Restore tidal habitat in the Delta.

California WaterFix would include implementation of portions of both of the resiliency plans.

Consistency with Delta Conveyance Criteria

Recognizing the significance of the supply, and the need to modernize the state's conveyance system, Metropolitan's Board of Directors adopted the Delta Action Plan and Delta Conveyance Criteria ("Conveyance Criteria") in June 2007 and September 2007, respectively. As described in earlier sections of this white paper, and summarized in Table 5, the operational aspects of California WaterFix meet the Board's adopted Delta Conveyance Criteria by providing water supply reliability and improved water quality in an environmentally responsible manner.

TABLE 5: DELTA CONVEYANCE CRITERIA

Board-Adopted Delta Conveyance Criteria	California WaterFix
Enhance Ecosystem Fishery Habitat Throughout Delta	• Provides extensive restoration of tidal marshes and channel margin habitat.
Allow Flexible Pumping Operations in a Dynamic Fishery Environment	• Three new intakes in the northern Delta, along with the existing State Water Project intake in southern Delta, create the necessary flexibility to avoid conflicts between different fishery needs. • The ability to manage the system using north and south Delta diversion locations, allow for improved flow patterns in the Delta to benefit fish during fish sensitive times.
Provide Water Supply Reliability	• The California WaterFix proposal is consistent with Metropolitan's IRP.
Improve Export Water Quality	• Water quality from new northern Delta intakes is improved; salinity, for example, is improved approximately 20 percent.
Reduce Seismic Risks	• Twin tunnels to convey water from northern Delta would protect future critical supply needs from natural disasters.
Reduce Climate Change Risks	• Intakes in northern Delta are upstream of predicted long-term salinity intrusion due to climate change.

Considering Delta Communities and Environment

CALIFORNIA WATERFIX IS SIZED TO PROTECT THE DELTA ENVIRONMENT

The proposed California WaterFix was originally planned as a 15,000 cfs diversion facility. In response to consideration by the fishery agencies regarding intake size, and issues raised in the environmental review process that included Delta community concerns, the project was reduced to a 9,000 cfs diversion facility. A 9,000 cfs facility was selected over a smaller facility (i.e., 3,000 cfs) because the smaller facility would not serve the project purposes of a more reliable water supply and protection of the environment. A copy of the letter from the California Natural Resources Agency dated February 19, 2014 and memorandum providing analysis and the need for the importance of a 9,000 cfs facility is available at the following link:

http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Natural_Resources_Agency_Response_Re_NRDC_Portfolio_2-19-14.sflb.ashx

According to the agency, a 3,000 cfs facility would not meet the project purposes because a facility of that reduced size would lack redundancy and would not provide sufficient benefits to justify the cost. A 3,000 cfs facility would also fail to provide fishery benefits because pumping would continue to be predominantly in the south Delta. Operational flexibility to better manage water quality and species concerns would also be largely non-existent with a smaller facility.

CALIFORNIA WATERFIX IS DESIGNED TO AVOID IMPACTS TO DELTA COMMUNITIES

As detailed in the first white paper, numerous refinements over the years have dramatically reduced the short- and long-term project impacts. Switching from a canal to tunnel conveyance design was the largest such modification, which preserves Delta farms, avoids every Delta community, maximizes the use of public lands, and minimizes the need to acquire private property.

California WaterFix was refined to include other important modifications to reduce or avoid impacts to the Delta area:

- Reducing visual impacts near the community of Hood;
- Increase the use of state-owned property;
- Eliminating all pumping plant facilities adjacent to the three proposed intakes and consolidating all necessary pumping at the existing SWP site at Clifton Court Forebay;
- Eliminating numerous permanent power lines in the Delta and reduce power requirements;
- Eliminating tunnel launch facilities on Staten Island, a popular destination for Sandhill Cranes and bird watchers, to protect wildlife habitat;
- Removing planned power transmission lines near the Stone Lakes Wildlife Refuge.

The construction footprint of California WaterFix – less than 2,000 acres – represents about one-third of 1 percent of the acreage in the Delta region. Significant changes to the proposed California WaterFix facilities and operations made throughout the planning process reduced the overall project footprint by one-half of its original size, greatly minimizing community impacts.

California WaterFix Would Protect In-Delta Agricultural and Municipal Water Quality

California WaterFix must adhere to the in-Delta water quality objectives and criteria set by the State Water Board for the protection of urban, agricultural, and fishery beneficial uses. DWR and Reclamation constantly monitor Delta water quality conditions. Their water system operational decisions take into account real-time conditions as well as regulatory requirements.

The state and federal water projects have been in compliance with SWRCB water quality standards in the Delta 98.9 percent of the time over the past 37 years. (Source: J. Leahigh Power Point, SWRCB Hearing Proceedings Regarding Changes in Water Rights for the California WaterFix Project, DWR-4, errata, p. 18). The SWP and CVP exceed water quality standards from time-to-time because of extreme and sometimes uncontrollable circumstances or unforeseen weather conditions. There are some D-1641 standards that are currently met 100 percent of the time, while some are met less often. For example, the agricultural salinity standard at the Old River at Tracy is met less often because of local sources of salinity and because the SWP and CVP are generally unable to control salinity at that location.

With California WaterFix, the SWP would continue to provide fresh water to in-Delta agricultural and municipal diverters by continuing to satisfy the water quality requirements contained in D-1641 to protect each of the beneficial uses defined by the SWRCB.

Modeling of future water quality under California WaterFix generally shows that compliance with D-1641 water quality standards is the same under California WaterFix as compared to the future without the project. The only potential exception is agricultural water quality at the Emmaton compliance location. Under certain limited conditions, modeling shows water quality at Emmaton is somewhat more saline with the project than without. However, as DWR testified before the SWCRB, real-time actions that project operators take to avoid water quality exceedances cannot be modeled. Thus the modeled Emmaton results are modeling anomalies that would not actually occur in the future under actual operations.

Managing Uncertainties

Given the uncertainties involving the effects of water operations on listed species and the ecological benefits from enhanced outflow and habitat restoration, California WaterFix incorporates processes designed to address uncertainty in scientific understanding and reduce risks to sensitive resources and critical water supplies.

Table 6 highlights some of the key uncertainties and mitigation measures associated with the operations of California WaterFix. The addition of north Delta diversions, and the operational flexibility provided by dual conveyance facilities would help to mitigate some of these uncertainties directly. In addition, a commitment to continue collaborative science efforts and a robust Adaptive Management Program would play an essential role in managing many of these future uncertainties.

TABLE 6: KEY UNCERTAINTIES AND MITIGATION MEASURES

Key Uncertainties	Mitigation Measures
Regulatory Uncertainties	• Adaptive Management Program would inform SWP and CVP operations under existing regulations, inform implementation of California WaterFix initial operational criteria, and inform SWP and CVP operations under future regulations with California WaterFix. • North Delta diversions would allow flexibility to minimize fish and water quality impacts. • Real-time operations would adjust to observed conditions to limit effects on fisheries.
Fisheries and Ecosystem Uncertainties	• Adaptive Management Program would inform habitat restoration and other mitigation measures. • Collaborative science efforts would continue to advance the field of knowledge surrounding project operations and fisheries. • Efforts to restore habitat and decrease other stressors would help improve the health of the Delta ecosystem and fisheries. • Real-time operations would adjust to observed conditions to limit effects on fisheries.
Seismic Risks	• North Delta diversions would be physically isolated from the water quality impacts of a catastrophic levee failure event. • Infrastructure would be built to a high seismic resiliency level. • Additional conveyance would be available following seismic events to restore supplies to project users.
Climate Change Risks	• North Delta Diversions would be physically isolated from the impacts of salinity intrusion due to sea-level rise. • Additional diversion capacity and operational flexibility would allow for increased diversion to reduce impacts of lost natural storage from snowpack. • Additional operational flexibility would allow for increased diversions during high-flow storm events. • Increased diversion and storage of high river-flow events would help protect against more frequent and extreme dry conditions.

ADAPTIVE MANAGEMENT

Scientific uncertainty exists regarding the Delta ecosystem, including the needs of protected fish species, the effects of SWP and CVP operations on those species and their habitats, and the related operating criteria and other actions intended to minimize or mitigate those effects. To address these uncertainties, California WaterFix proposes a structured program for conducting collaborative science and adaptive management.

The Adaptive Management Program would be implemented consistent with an agreement between DWR, Reclamation, USFWS, NMFS, CDFW, and water contractors. The Adaptive Management Program would be implemented to enhance application of science to support decision making related to the operations of the SWP and CVP. The California WaterFix Adaptive Management Program includes a collaborative process for decision-making that would be essential to the success of the overall program. Key to this is the establishment of the Interagency Implementation and Coordination Group (IICG). Convened by Reclamation and DWR, the IICG would have primary responsibility for coordinating and implementing the Adaptive Management Program. The IICG would be composed of one representative from each of the "Five Agencies" (DWR, Reclamation, USFWS, NMFS, and CDFW) as well as one each from the participating SWP and participating CVP contractors. Metropolitan would participate in the Adaptive Management Program through its representation by the water contractors.

The Adaptive Management Program's broad purposes include the ability to (1) undertake collaborative science, (2) guide the development and implementation of scientific investigations and monitoring for both compliance and adaptive management, and (3) apply new information and insights to management decisions and actions. Adaptive management would determine the effectiveness and necessity of the operational criteria based on the best scientific and commercial data available when California WaterFix becomes operational.

The Adaptive Management Program includes monitoring and studies to determine the effectiveness and necessity for the initial operating criteria that would be enacted as part of the federal and state Endangered Species Act authorizations. These scientific investigations may lead to changes in the initial operating criteria prior to or after California WaterFix becomes operational. This approach would help address scientific uncertainty and identify opportunities to better refine operations of the new water conveyance facility to further species needs while improving water supply.

The adaptive management approach for the California WaterFix describes the interrelationship between the identification of uncertainties, development of management questions, objectives, management alternatives, monitoring and research design, synthesis, and decision making. The four-phase process diagram shown in Figure 9 illustrates the major components of the proposed adaptive management process.

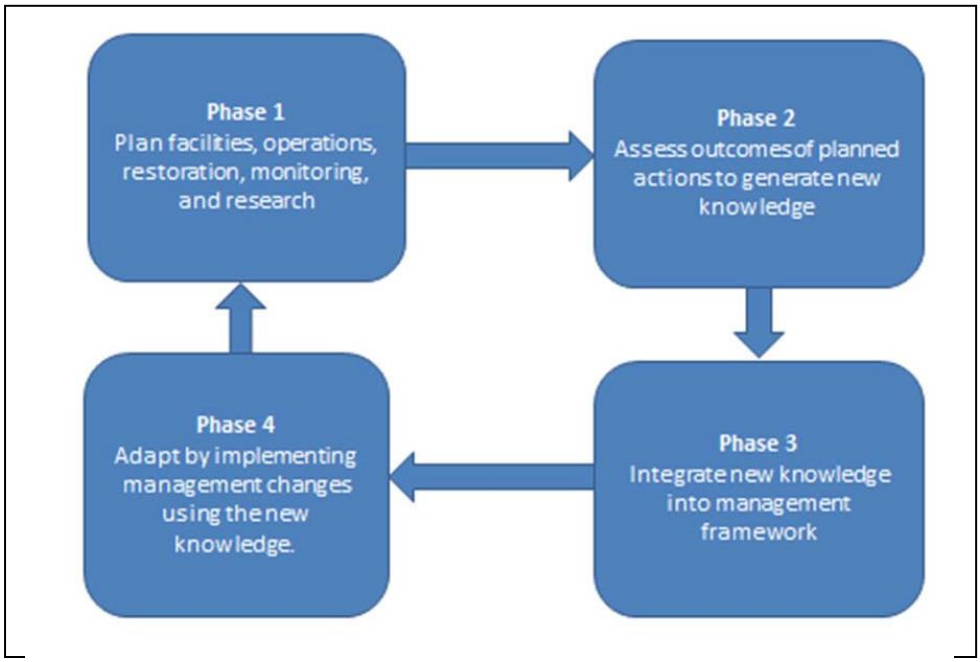


FIGURE 9: ADAPTIVE MANAGEMENT PROCESS

REAL-TIME OPERATIONS

As part of California WaterFix, real-time operations for existing Delta facilities and the new north Delta diversion facilities would be a part of the California WaterFix operating criteria. Real-time operations are meant to provide short-term adjustment to operations in response to observed environmental conditions to enhance endangered species protections while maximizing water supply benefits.

UPDATING SCIENCE TO SUPPORT DELTA FISH

In addition to the efforts of the Adaptive Management Program to advance science associated with operation of the SWP and CVP, Metropolitan would continue its independent science efforts for the Delta. Metropolitan's proactive science efforts supports water supply reliability and ecosystem restoration by reducing scientific uncertainty, driving better management decisions and project operations, and fostering effective policies and regulations.

An example of how such science efforts has resulted in real and meaningful change in the Delta is with respect to nutrients. Nutrient discharges to the Bay-Delta Estuary can affect phytoplankton growth and the composition of the phytoplankton community. Scientific studies addressing nutrient effects on phytoplankton and the food web that supports Delta fish led to more stringent water quality regulatory requirements and to investments to upgrade the Sacramento Regional County Sanitation District wastewater treatment plant.

As another example, Metropolitan participates in the Delta Condition Team process coordinated by the state and federal agencies to closely monitor trawl and turbidity data and evaluate turbidity forecast information as it relates to spawning conditions for Delta smelt. As part of its participation, staff collaborated with other technical scientists and experts to identify water project measures to reduce movement of turbidity toward the export pumps during the first significant storm of the wet season. Taking such measures to reduce the intrusion of turbidity into the south Delta reduced the number of adult Delta smelt spawning near the water project pumps and greatly reduced the need to reduce exports later in the season. This management action allowed more effective operations that protected the fish while at the same time preventing unnecessary restrictions on the SWP and CVP projects.

Conclusion

The reliable delivery of high-quality water through the Delta faces many challenges and risks, including fishery declines, earthquakes, floods, and rising sea levels. Despite previous actions and efforts by local, state, and federal agencies to address these issues, the region's ecosystem has continued to decline. California WaterFix addresses these long-standing issues with increased operational flexibility, new system capacity that provides more assurances, and adaptive management strategies to ensure improved water supply reliability while protecting habitat, species, and the Delta ecosystem. The project has undergone an unprecedented level of public review, comment, and scientific input. Extensive analyses and risk assessments have been conducted to better understand and address risks commonly associated with infrastructure projects of this size. For California WaterFix, the key risk areas have been identified, and tools to mitigate these risks have been incorporated into the project's risk management process and operating criteria.

In addition to meeting the needs of the state, California WaterFix as proposed meets all of the Delta Conveyance Criteria adopted by Metropolitan's Board in 2007. Metropolitan's 2015 Integrated Resources Plan Update, as adopted by Metropolitan's Board in 2016, includes a goal to stabilize SWP supplies, to pursue a successful outcome in California WaterFix, and to establish efforts for long-term average supplies of about 1.2 million acre-feet. The proposed project would achieve this goal. The physical project and the operational criteria meet the attributes of a successful project based on staff analysis, Metropolitan's long-term objectives, and the state's coequal goals.

Note: For additional information on Metropolitan's policies related to California WaterFix, including a policy white paper on infrastructure improvements that would modernize the state's water system, see http://mwdh2o.com/ or http://www.mwdh2o.com/DocSvcsPubs/WaterFix/

Attachment to
Modernizing the System: California WaterFix Operations

ACRONYM/TERMINOLOGY LIST

ITEM	DESCRIPTION
AMMs	Avoidance and minimization measures
BDCP	Bay Delta Conservation Plan
BiOps	Biological Opinions from the Fish and Wildlife Service and the National Marine Fisheries Service
BMPs	Best management practices
CALSIM	DWR modeling tool used to simulate SWP and CVP operations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFS	Cubic feet per second
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
D-1641	Water Rights Decision-1641, implements the Bay-Delta Water Quality Control Plan (WQCP)
DRMS	Delta Risk Management Strategy
DWR	Department of Water Resources
EC	Electrical Conductivity
ECHO	2015 Delivery Capability Report Existing Conveyance High Outflow scenario
ECLO	2015 Delivery Capability Report Existing Conveyance Low Outflow scenario
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
IICG	Interagency Implementation and Coordination Group
IRP	Integrated Water Resources Plan, Metropolitan's blueprint for long-term water supply reliability
MAF	Million Acre-Feet
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OMR	Old and Middle River
RDEIR	Recirculated Draft Environmental Impact Report

ITEM	DESCRIPTION
Reclamation	Federal Bureau of Reclamation
SDEIS	Supplemental Draft Environmental Impact Statement
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
USFWS	U.S. Fish and Wildlife Service
WQCP	Bay-Delta Water Quality Control Plan
X2	Indicator of the location of the low salinity zone, thought to be biologically important to Delta species

MODERNIZING THE SYSTEM:

CALIFORNIA WATERFIX FINANCE AND COST ALLOCATION

3

The third in a series of policy papers prepared for the consideration of Metropolitan's Board of Directors in advance of planned summer meetings and decisions in fall 2017.

Modernizing and improving California's water system is essential for the reliable delivery of water supplies to much of the state. About 30 percent of the water that flows out of taps in Southern California homes and businesses comes from Northern California watersheds and flows through the Sacramento-San Joaquin Delta. But the Delta's declining ecosystem and 1,100 miles of levees are increasingly vulnerable to earthquakes, flooding, saltwater intrusion, climate change and further environmental degradation. California WaterFix is the product of more than a decade of review, planning, rigorous scientific and environmental analysis and unprecedented public comment.

This white paper provides information about the costs of the project, including adjustments of capital, mitigation and O&M costs to 2017 dollars. The financing plan is presented with financial assumptions and a range of financing scenarios. The cost allocation information covers Metropolitan's anticipated financial commitment, an estimate of member agency wholesale rate impacts, and metrics to assess retail level impacts. Using this information and when compared to costs for other local supply alternatives, California WaterFix would provide a cost-effective supply for Southern California's water portfolio.

A Cost-Effective Approach to Reliability

- California WaterFix is a sound investment to maintain a reliable source of water for Southern California.
- The proposed project would provide measureable and quantifiable water supply and water quality benefits.
- Costs will be fairly allocated among participating agencies using the 'beneficiary pays' principle.
- Metropolitan will coordinate with the California Department of Water Resources (DWR) and the other state and federal water contractors to evaluate options to optimize financing and reduce costs while minimizing risks.

CALIFORNIA WATER FIX
RELIABLE. CLEAN. WATER.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

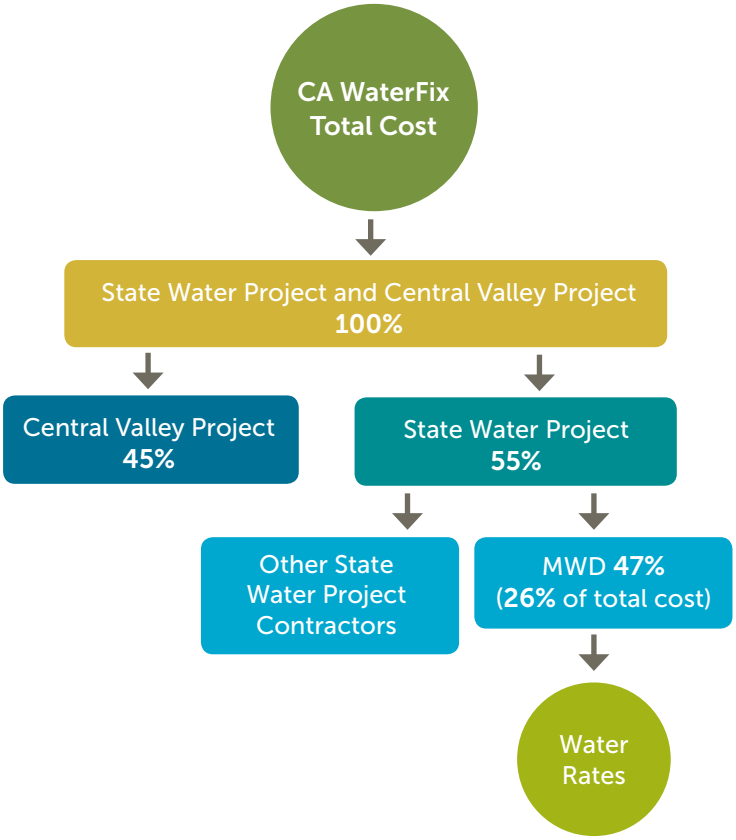
Cost Estimate and Cost Allocation

CAPITAL COSTS		
	2014 Dollars	2017 Dollars
Environmental Mitigation*	$ 367 M	$ 401 M
Conveyance System Cost	$ 14.9 B	$16.33 B
Overall Cost	$ 15.3 B	$ 16.7 B

*The mitigation costs for capital and O&M for 25 years equals $796M in 2014 dollars or $870M in 2017 dollars.

- Cost estimates were determined through a rigorous analysis by industry professionals and will be updated as additional information becomes available.
- Estimated costs for mitigation and associated environmental commitments are preliminary and will be revised as costs are refined.

CA WaterFix Cost Allocation



Costs and Financing Approach

Costs and financing considerations include the following:

- Planning, design, construction and other capital costs will be financed with revenue bonds beginning in mid-2019.
- A validation action has been filed by DWR to, among other things, provide the requisite assurance to the financial community for the sale of revenue bonds.
- Anticipated cost increases for California WaterFix have already been incorporated into Metropolitan's ten-year Financial Forecast and are included as part of the long-term projected average 4.5% rate increases.

Approximate average household cost of California WaterFix within the **MWD Service Area**

$2-3/PER MONTH

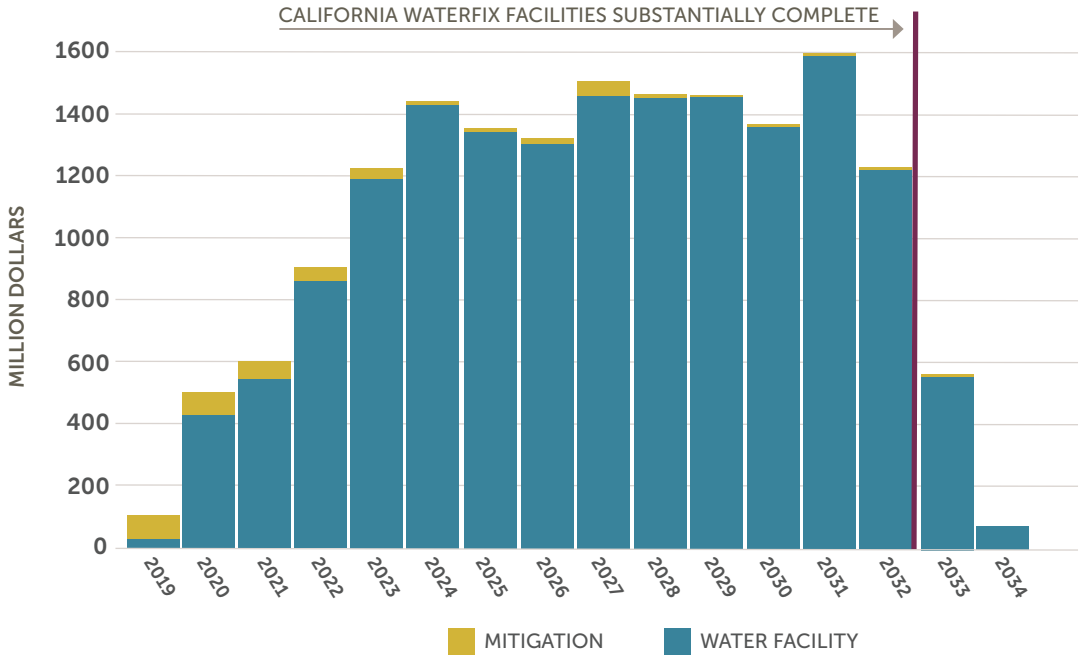
(BASED ON 6.2 MILLION HOUSEHOLDS AND RESIDENTIAL SECTOR PAYING 70 PERCENT OF COSTS)

CALIFORNIA WATER FIX
RELIABLE. CLEAN. WATER.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Financing and Funding Structure

ESTIMATED CASH FLOW FOR CAPITAL EXPENDITURES



Construction of the facilities is expected to be substantially complete in 2032 and fully operational in 2033.

Key Uncertainties And Mitigation Measures

FINANCING OPTIONS

In addition to revenue bonds, a range of other financing options will be evaluated to optimize financing and reduce costs, such as short-term borrowing and pursuing WIFIA (federal loan program) supplemental funding.

SWP CONTRACTOR DEFAULTS ON PAYMENTS

Mitigation is included in SWP delivery contracts, obligating contractors to make payments and if necessary compel contractor to levy taxes or assessments in the event of non-payment.

REIMBURSEMENT OF DIRECT CONTRACTOR FUNDING CONTRIBUTIONS

The first issuance of revenue bonds will include funds to reimburse contractor-provided gap funding and prior funding contributions for planning costs.

JUDICIAL DETERMINATION ON DWR AUTHORITY TO ISSUE BONDS

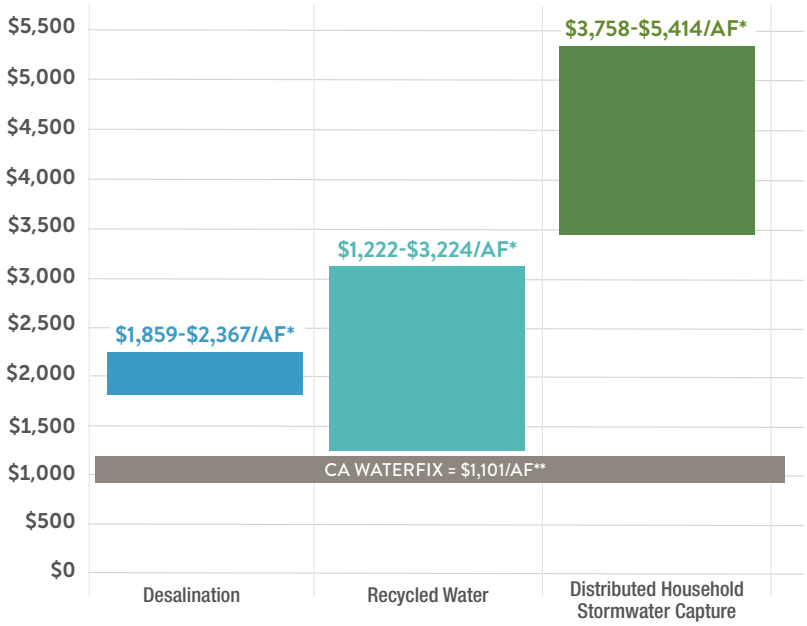
- Pending completion of the validation action, private placement bond sales with the Finance Joint Powers Authority (JPA) would allow funding for project implementation to proceed.
- If DWR does not have the authority, a process would be established leading to the potential conveyance of interest in the project to the Finance JPA or designee to proceed.

CVP CONTRACTOR PARTICIPATION

- DWR will not move forward with project implementation without the commitment of a sufficient number of SWP and CVP contractors.
- Discussions are ongoing concerning the risk of a participating CVP contractor defaulting during project implementation.

Ensuring Affordable, Reliable Water Supplies

COST OF STATE WATER PROJECT SUPPLIES COMPARED TO DEVELOPING FUTURE LOCAL SUPPLIES



* Range is based on the 25-75% percentiles of projected project costs as reported in 2015 IRP
** Estimated MWD Tier 1 treated water rate with Delta improvements

California WaterFix is the most cost-effective alternative

If we keep our existing imported water supply, made more reliable with California WaterFix, it would cost approximately $2-3/mo. per average household in the Metropolitan service area.

If we tried to develop new local supplies to replace the imported water supply we would lose without California WaterFix, it would cost two or more times as much per average household in the Metropolitan service area.

JOBS AND ECONOMIC BENEFITS

SECURING CLEAN WATER SUPPLIES

4.7-5.3 MILLION

ACRE-FEET ON AVERAGE ANNUALLY (Combined SWP and CVP)

Enough to supply 9-11 million households with water for one year

CREATING & PROTECTING JOBS

1.1 MILLION

FULL-TIME EQUIVALENT JOBS CREATED AND SAVED FOR CALIFORNIA

Based on a year-by-year estimate

SUPPORTING THE ECONOMY

$1 TRILLION

SOUTHERN CALIFORNIA ECONOMY DEPENDS ON DELTA-CONVEYED WATER

OUR MISSION

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.

ABOUT METROPOLITAN

The Metropolitan Water District of Southern California is a state-established cooperative of 26 member agencies – cities and public water agencies – that serve nearly 19 million people in six counties. Metropolitan imports water from the Colorado River and Northern California to supplement local supplies and helps its members develop increased water conservation, recycling, storage and other resource management programs.

For a full version of the Finance and Cost Allocation Paper, visit mwdh2o.com/waterfix

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Cover photo courtesy CA Department of Water Resources

CALIFORNIA WATER FIX
RELIABLE. CLEAN. WATER.

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

MODERNIZING THE SYSTEM:

California WaterFix Finance & Cost Allocation

AUGUST 2017

Contents

Introduction

This is the third of three policy white papers prepared for the Metropolitan Water District of Southern California's Board of Directors on the proposed California WaterFix. The overall objective of these papers is to provide relevant information as the Board considers decisions on the project.

This paper focuses on the financing plan and the allocation of California WaterFix costs. The discussion of the financing plan includes a financing scenario for the issuance of revenue bonds to finance the project. The cost allocation analysis includes the proposed mechanisms to ensure a financial commitment from the state and federal water contractors that would benefit from the project. The cost allocation examination also covers Metropolitan's proposed financial commitment and responsibilities, an estimate of member agency wholesale cost impacts, and metrics to assess household impacts.

The two previous white papers focused on the project's planned infrastructure improvements, the impacts of regulatory requirements on water project operations in the Sacramento-San Joaquin Delta (Delta), and the overall effects of the proposed project's operations on State Water Project (SWP) and Central Valley Project (CVP) performance.

The specific objectives of this paper are to:

A. Describe the existing funding and cost allocation structures under the State Water Contracts used to pay for the construction costs of SWP facilities;

B. Describe the financing plan for California WaterFix that would make use of both revenue bond proceeds and short-term gap funding contributions from the state water contractors;

C. Describe Metropolitan's potential share of California WaterFix costs and the potential cost impacts to Metropolitan's member agencies and households within Metropolitan's service area; and

D. Describe the implementation and management approaches for cost allocation and financing that would address uncertainties and mitigate financial risks.

Summary and Overview of Cost Allocation Process

One of the major sources of water for Californians is the SWP, which is owned by the State of California and operated and maintained by the California Department of Water Resources (DWR). The SWP is comprised of a series of interconnected facilities that transport water from the Feather River and through the Delta to 25 million water users throughout much of California. Today, the SWP includes 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 700 miles of open canals and pipelines. These facilities deliver water to the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. The SWP's 444-mile California Aqueduct delivers water to four connections in Metropolitan's water distribution system.

California WaterFix addresses a long-standing deficiency in the SWP system – the inability to convey water around the Delta. As described in the second policy white paper, "Modernizing the System: California WaterFix Operations," the operational flexibility afforded by California WaterFix would help native fish species, protect and restore water supply reliability, address climate change and seismic risks to water supply, and help restore the Delta ecosystem. Although the project has wide-ranging benefits, its costs would be entirely funded by water agencies.

While California WaterFix would be a component of the SWP and owned and operated by DWR, it would provide benefits to SWP Contractors as well as CVP Contractors. Consistent with the "beneficiary pays" principle, SWP Contractors and participating CVP Contractors would fund California WaterFix. California WaterFix supply[1]

[1] The term "supply" is used to distinguish between other functions of the SWP such as recreation and flood control. The term is not used to distinguish between the conservation (supply) and transportation (conveyance) functions of the SWP under the State Water Contracts.

benefits have been allocated 55 percent to the SWP Contractors and 45 percent to the CVP Contractors (55/45 split). Under this allocation, funding for capital costs and operations and maintenance (O&M) would also follow this same 55/45 split.

As discussed in the first policy white paper, "Modernizing the System: California WaterFix Infrastructure," capital costs for California WaterFix are estimated at $14.9 billion in 2014 dollars. As described in this paper, with mitigation project capital costs and escalation to 2017 dollars, the total capital costs are $16.7 billion. Total annual O&M costs when the project is fully operational are $64 million in 2017 dollars. Based on the 55/45 split, SWP Contractor project costs would be $9.2 billion in capital and $35 million in annual O&M.

With the exception of five north of Delta contractors that would not receive direct California WaterFix benefits, all SWP Contractors are expected to pay for the SWP share of project costs. The financing plan for the SWP share relies on the existing long-term State Water Contracts as the vehicle for DWR to allocate costs to the SWP Contractors and to pay the debt service for its bonds. Based on the schedule of maximum water allocations in these State Water Contracts (known as Table A), Metropolitan's share among the SWP Contractors is 47 percent (meaning Metropolitan's share of the total project costs would be 26 percent). Figure 1 shows the overall allocation of costs described above.

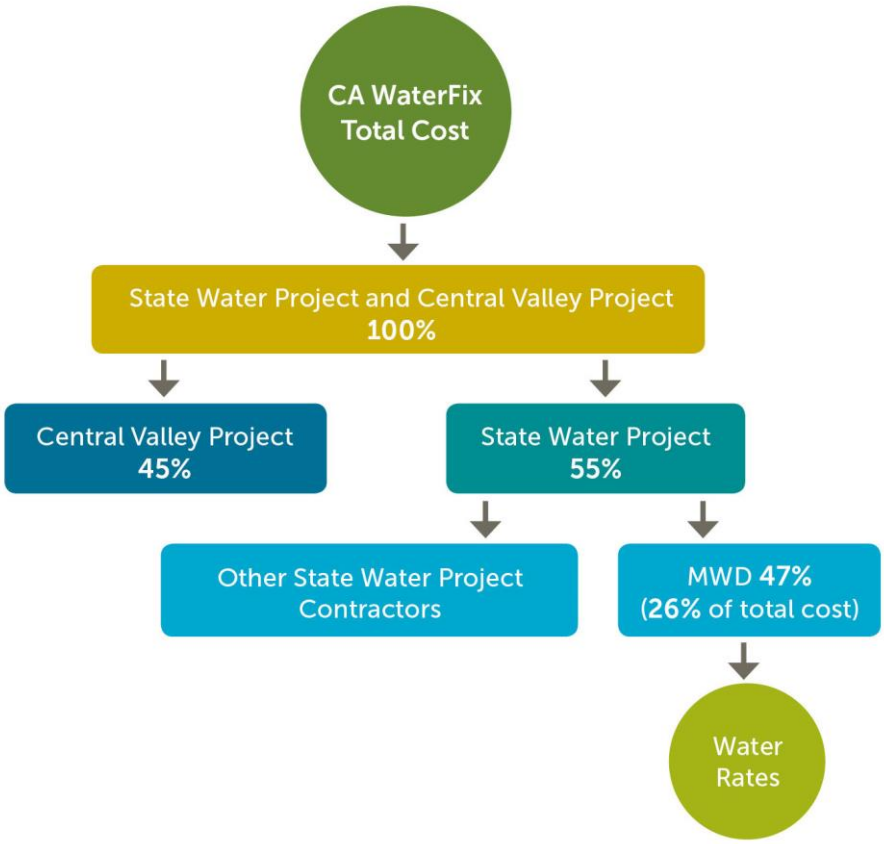


FIGURE 1: CALIFORNIA WATERFIX COST ALLOCATION FRAMEWORK

The cost impacts on Metropolitan would vary principally based on the interest rate assumed for project financing. The analysis presented in this policy paper assumed a range of interest rates, from today's base case interest rate of 4 percent to 8 percent for a sensitivity analysis. Along with other financing assumptions, the peak annual increase in Metropolitan's costs would range from an average of $122 per acre-foot of water sold for the 4-percent scenario to an average of $196 for the 8-percent scenario. On an estimated per household basis across Metropolitan's service area, this represents an average monthly cost of $1.90 to $3.10.

Metropolitan's annual cost increase due to California WaterFix over a 15-year ramp-up to the maximum yearly expenditure is expected to be between 0.9 and 1.4 percent, depending on the interest rate sensitivity analysis.

Metropolitan previously estimated California WaterFix costs into its ten-year rate projection and those projections remain appropriate. The ten-year forecast estimates annual rate increases for all anticipated Metropolitan expenditures, including California WaterFix, at 4.5 percent for 2019 through 2026.

California WaterFix Cost Estimates

CAPITAL AND O&M COSTS

The overall costs for California WaterFix's proposed infrastructure improvements and environmental mitigation are described in the first policy white paper, "Modernizing the System: California WaterFix Infrastructure." These materials are drawn from cost estimates developed by DWR and rigorously analyzed by industry professionals.

These cost estimates reflect a significant engineering analysis that formulates and defines the design criteria for each major component of California WaterFix, resulting in the optimal alignment and other features. Based on these estimates, California WaterFix's capital costs are estimated to total $14.9 billion in 2014 dollars. For this white paper, the cost estimates have been converted to 2017 dollars based on an annual escalation rate of 3 percent. In 2017 dollars, the capital cost for California WaterFix is estimated to be $16.3 billion, excluding mitigation costs.

Estimated costs for mitigation and associated environmental commitments take into consideration the measures adopted in the Final Environmental Impact Report/Environmental Impact Statement and likely requirements for the US Army Corps of Engineers (U.S. Army Corps) Section 404 permit. The preliminary mitigation cost estimate would be revised to incorporate all mitigation-related costs, including those associated with Endangered Species authorizations and U.S. Army Corps and other regulatory permits when finalized. The estimated mitigation costs total $796 million in 2014 dollars, of which $367 million is capital and the remainder represents O&M for 25 years. In 2017 dollars, mitigation costs total $870 million, with $401 million of that being capital.

The estimated operating costs for the water facility come from Chapter 8 of the November 2013 Bay Delta Conservation Plan. Because of subsequent project refinements, California WaterFix operating costs should be lower than these estimates. Operating costs are composed of three components: (1) power costs for pumping and other operations, (2) other facility O&M, and (3) capital replacement. Annual operating costs are estimated to be $40.3 million in 2014 dollars and $44.1 million in 2017 dollars.

A cost summary showing the capital, mitigation, and O&M costs for California WaterFix in both 2014 and 2017 dollars is shown in Table 1.

CAPITAL COSTS CASH FLOW

The estimated cash flow requirements for the $16.7 billion (2017 dollars) capital expenditures is shown in Figure 2. Assuming a construction start date of 2019, California WaterFix is expected to be substantially completed (96 percent complete) in 2032. Capital expenditures signficantly decrease the following year (2033) when the facility is assumed to be fully operational. Some minor capital expenditures are shown for 2034 to reflect project close-out costs.

TABLE 1: CALIFORNIA WATERFIX COST SUMMARY

	2014 $M	2017$M
CAPITAL COSTS		
Water Facility		
Construction	9,499	10,380
Contingency (36%)	3,378	3,692
Program Management/Construction Management/Engineering	1,920	2,098
Land Acquisition (includes 20% contingency)	146	160
Sub-Total Water Facility	**14,943**	**16,330**
Mitigation (includes 35% contingency) (1)	**367**	**401**
Total Water Facility and Mitigation Capital Costs	**15,310**	**16,731**
ANNUAL OPERATIONS AND MAINTENANCE COSTS		
Water Facility		
Facility O&M (2)	20.0	21.9
Power (2)	6.6	7.2
Capital Replacement (2)	13.7	15.0
Sub-Total Water Facility	**40.3**	**44.1**
Mitigation (1,2)	**18.6**	**20.3**
Total Annual O&M Costs	**58.9**	**64.4**

(1) The mitigation costs for capital and O&M for 25 years equals $796M in 2014 dollars or $870M in 2017 dollars.
(2) When project is fully operational.

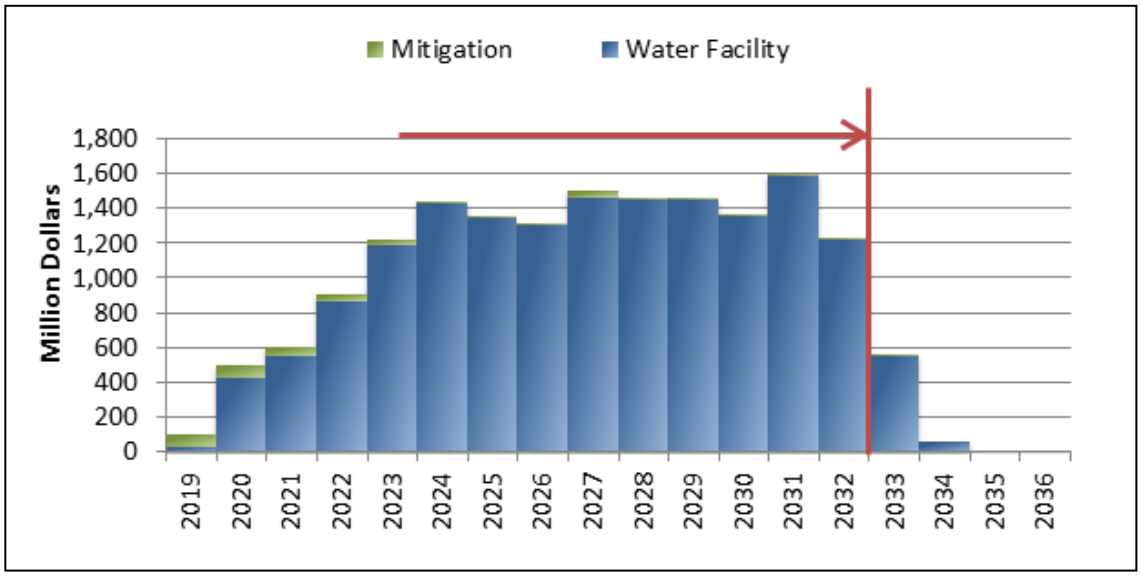


FIGURE 2: CALIFORNIA WATERFIX CAPITAL COSTS IN 2017 DOLLARS

Financing Plan for California WaterFix

As previously stated, the cost share split between the SWP Contractors and the participating CVP Contractors is assumed to be a 55/45 split, respectively.

For the SWP share, the project would be treated like any other major improvement to the SWP system. Under the California Water Code, DWR is responsible for the construction, maintenance, and operation of the SWP and for securing funding for related costs. The SWP share of California WaterFix costs would be paid by the SWP Contractors in accordance with the long-term DWR State Water Contracts.

In addition to establishing payment and other provisions for the SWP Contractors' participation, the existing State Water Contracts offer flexibility to allow individual SWP Contractors to adjust their level of water reliability and financial responsibility through voluntary water transfers and other arrangements. The potential for these management actions are discussed later in this policy white paper.

The participating CVP Contractors' share of California WaterFix costs would be funded by direct payments from them.

FUNDING ARRANGEMENTS FOR CONSTRUCTION OF SWP FACILITIES UNDER THE STATE WATER CONTRACTS

DWR has signed long-term State Water Contracts with Metropolitan and 28 other public agency SWP Contractors. These State Water Contracts provide each agency with access to the SWP conveyance system and an annual proportional allotment of available water. The maximum amount of SWP water that a SWP Contractor may request for delivery each year is set forth in Table A of its State Water Contract. However, the amount of water that a SWP Contractor actually receives is often much less than the contracted amount. Water deliveries are affected by hydrological conditions, State Water Resources Control Board regulations, restrictions imposed under federal or California Endangered Species Acts, operational decisions, and other limitations.

SWP Contractors must make payments regardless of the amount of SWP water actually received. The State Water Contracts require payments to DWR in return for participation in the SWP storage and conveyance system. All SWP Contractors must make payments according to their respective Table A contract amounts and for the portion of the SWP conveyance system needed to deliver their contracted water. The amount of the base payment is not tied to the amount of water actually received. The cost of power to deliver water varies with the amount of water delivered.

SWP Contractors whose service areas are farther from the Sacramento-San Joaquin area must pay more SWP system costs than those that are located closer to it, because of the capital costs associated with the California Aqueduct and other transportation facilities as well as the increased pumping and O&M costs.

In exchange for SWP Contractor payments, DWR is required to make all reasonable efforts to complete facilities necessary for water deliveries, subject to fiscal, construction scheduling, and operating constraints. DWR is authorized to accept SWP Contractor advances to complete design and construction of SWP facilities if DWR, for whatever reason, does not have the funds on hand. In such cases, the amount provided by a SWP Contractor is credited by DWR against the Contractor's obligation under the State Water Contracts.

The charges paid by the SWP Contractors pay for the debt service and costs of revenue bonds issued by DWR to finance the cost of constructing SWP facilities. About 78 percent of the construction costs for the SWP system have been financed by the sale of general obligation and revenue bonds. The debt service for these bonds is paid by DWR through collections from the SWP Contractors, not the general state taxpayer. The SWP Contractors that are the beneficiaries are responsible for all water development and transportation-related costs, including those pertaining to the O&M of SWP facilities. General O&M costs are not financed through bonds.

The current State Water Contracts would remain in effect for: (1) 75 years from the effective date of an individual agency's contract; (2) December 31, 2035: or (3) until all bonds issued to finance construction costs of SWP facilities have been repaid, whichever period is longer. DWR and the SWP Contractors are currently negotiating details of an extension of the State Water Contracts. The parties reached an agreement in principle for this amendment in June 2014. The proposed amended agreement between the parties would extend the term of the State Water Contracts until December 31, 2085. In addition, the proposed agreement would amend the State Water Contracts' current treatment of capital costs on an amortized basis to an annualized, "pay as you go" basis for revenues needed by DWR in a given year for scheduled debt service to repay capital costs.

For California WaterFix, the existing State Water Contracts between DWR and the individual SWP Contractors would be the mechanism to recover the SWP share of California WaterFix costs from all contractors downstream of the Sacramento-San Joaquin Delta. The five SWP Contractors that are north of the Delta – County of Butte, City of Yuba City, Plumas County Flood Control & Water Conservation District, Napa County Flood Control & Water Conservation District, and Solano County Water Agency – would not receive direct benefits from California WaterFix and would be excused from payment of project costs.

Costs are assumed to be recovered in proportion to each SWP Contractor's baseline Table A contract amount.

FINANCING THE SWP CONTRACTOR SHARE OF CALIFORNIA WATERFIX

The ultimate source of funds for the SWP Contractors' share of California WaterFix costs would be revenue bonds. DWR plans to issue a series of new bonds, California WaterFix Revenue Bonds, for the SWP share of the total capital costs. Based on the 55/45 SWP/CVP split, this amount is $8.4 billion in 2014 dollars, or $9.2 billion in 2017 dollars. Bond proceeds would fund construction, planning, and other preconstruction costs (including the reimbursement of funds and services previously provided by various state and federal contractors, including Metropolitan), and would pay for the costs of bond issuance. Scheduled principal and interest on California WaterFix bonds would be secured by a portion of revenues collected by DWR under its long-term SWP State Water Contracts. Pledged funds under the State Water Contracts would be deposited into a Revenue Fund maintained by DWR to ensure payment of the debt service.

Initially, for the SWP Contractors' share of the costs, DWR proposes to sell revenue bonds to a finance joint powers authority (Finance JPA) comprised of certain SWP and CVP Contractors. This would facilitate the financing and marketability of its revenue bonds. DWR's direct sale of these revenue bonds is targeted for the middle of calendar year 2018.

CONTRIBUTIONS BY CVP CONTRACTORS

The overall financing plan calls for the remaining amount of California WaterFix costs to be contributed by the CVP Contractors that would participate in the project. Based on the 55/45 SWP/CVP split, this amount is $6.8 billion in 2014 dollars, or $7.5 billion in 2017 dollars. DWR and the participating CVP Contractors are negotiating terms of a master agreement for use of California WaterFix facilities. This agreement would allow CVP Contractors to purchase an interest in a set amount of capacity in California WaterFix facilities. Under the proposed agreement, and based on the 55/45 split, CVP Contractors would pay for (1) 45 percent of all capital and fixed O&M costs for California WaterFix, regardless of use; and (2) all variable O&M costs associated with the CVP Contractors' actual use of facilities. This agreement also would provide a payment mechanism for variable O&M costs incurred to move CVP water that is not classified as California WaterFix water.

Pursuant to the terms of the proposed master agreement, CVP Contractors would be entitled to transfer or convey portions of their rights to use the facility to other CVP or SWP Contractors, but would not be allowed to sell, exchange or transfer their rights outside of the state and federal water contractor families.

WATER CONTRACTOR FINANCE JOINT POWERS AUTHORITY

The marketability of California WaterFix Revenue Bonds to private investors may be affected by judicial challenges to DWR's authority over the project. DWR therefore proposes to make direct placement sales of California WaterFix Revenue Bonds to a Finance JPA consisting of certain SWP and CVP Contractors until resolution of such legal challenges.

Under this approach, the Finance JPA would purchase California WaterFix Revenue Bonds directly from DWR in phases. The proceeds would be used to pay California WaterFix capital costs. In turn, the Finance JPA would finance its purchase of California WaterFix Revenue Bonds by issuing its own bonds (Finance JPA Bonds).

The debt service for the Finance JPA Bonds would be secured by DWR's pledge to pay a portion of the amounts collected under the State Water Contracts and paid to the Finance JPA as debt service payments for the DWR-issued California WaterFix Revenue Bonds.

ARTICLE 51(E) AND GAP FUNDING CONTRIBUTIONS

To fund continuing design and preconstruction costs prior to the issuance of revenue bonds for California Water Fix, DWR proposes a pair of interim funding mechanisms. Through the end of the 2017 calendar year, DWR proposes the use of so-called Article 51(e) funds. Under Article 51(e) of the State Water Contracts, DWR may allocate certain additional funds to mutually-agreed SWP purposes after conferring with SWP Contractors on the appropriate use. DWR's proposed use of Article 51(e) funds through December 31, 2017, is subject to the DWR Director's discretion.

From January 2018 until the issuance of the first revenue bonds for the project, DWR plans to request the short-term contribution of additional funds from willing SWP and CVP Contractors, or a joint powers agency representing such contractors, for continuing pre-construction costs. Such additional contributions would be similar in concept to prior advances made for the California WaterFix's planning, study, design and environmental assessment costs. Additional contractor contributions would be made pursuant to a Gap Funding Agreement with DWR. Gap funding contributions would be subject to reimbursement from the first issuance of bonds by DWR. Under the current schedule, Metropolitan staff would provide options for Metropolitan's participation in a Gap Funding Agreement to the Board for its consideration when it considers taking action on California WaterFix.

Financed Costs of the SWP Contractor Share

In implementing the financing plan, there is a range of possible cost impacts to the SWP Contractors. Capital financing costs would extend over the term of the bonds, while O&M costs would continue through the operating life of the facilities.

The following analysis focuses on the financing of the 55 percent SWP share of California WaterFix. The financing scenarios assume that 100 percent of capital costs for the water facility and mitigation are debt financed and annual O&M costs are paid as incurred. Project and financing assumptions common to all scenarios are shown in Table 2. The financial assumptions reflect values typically used in Metropolitan's financial analysis of projects or DWR requirements.

TABLE 2: PROJECT AND FINANCIAL ASSUMPTIONS

PROJECT ASSUMPTIONS	
Project Start	2019
Water Facility Substantially Complete	2032
First Year Project Operational	2033 (Year 15)
Average Improvement in Project Water Supply	1.3 MAF/Year
State Water Project/Central Valley Project Share	55%/45%
Metropolitan's Share of State Water Project	47.13%
Metropolitan's Overall Share of Project	25.92%
FINANCIAL ASSUMPTIONS	
Escalation Rate	3.00%
Discount Rate	3.00%
Level Annual Debt Service	
Fixed Interest Rate	4%, 6%, and 8% Scenarios
Underwriters Discount	$2.50 per $1,000
Cost of Issuance	$0.5M per issue
Bond Reserve	½ max annual debt service
Bond Cover	25%

FINANCING SCENARIOS

All financing scenarios assume that bonds would be issued annually, with the final bond sale in year 15 of project construction when California WaterFix is scheduled to be operational. All bond issues would be fixed rate debt issues with level annual debt service and no interest or principal deferment during construction. All bond issues are assumed to have a 40-year term.

The only thing that changes in the three scenarios is the interest rate paid on the bond issuances. The interest rate is the most influential factor in determining the financing cost of the project. Current interest rates for AA rated municipal bonds are about 3.88 percent. The base case financing scenario, "Base Case 4% Interest Scenario," estimates the cost of the project using an approximation of current interest rates of 4 percent. The second "6% Interest Scenario" is consistent with Metropolitan's 2013 estimate of California WaterFix costs. The 6 percent interest approximates the 6.135 percent assumption used for Metropolitan's first cost estimate.[2] The 6.135 percent interest rate was based on a 95 percent confidence interval of interest rates over the past decade. This means that 95 percent of the time interest rates were less than 6.135 percent. The third "8% Interest Scenario" shows the sensitivity of California WaterFix financing costs and the effect of a doubling of interest rates from current market conditions.

[2] "Bay Delta Conservation Plan Impacts on Integrated Water Resources Plan & Water Rates." Special Committee on Bay-Delta. Item 3b, August 27, 2013.

Base Case 4% Interest Scenario

The Base Case 4% Interest Scenario finances the SWP Contractors' share of California WaterFix, with 40-year fixed rate bonds at an interest rate of 4 percent. The 4 percent interest rate represents current market rates for an AA rated California utility. Figure 3 displays the annual payments, in nominal dollars, required to pay for the capital financing costs for California WaterFix and the project's O&M costs. The annual payments increase as annual bond issuances would be made to pay for construction. In the 15th year (2033), the final bond issuance would be made when construction is substantially complete and the project becomes operational. Full O&M costs also begin in 2033. In 2033, when the project is fully operational, annual payments equal $703 million per year, which equates to $438 million in 2017 dollars.

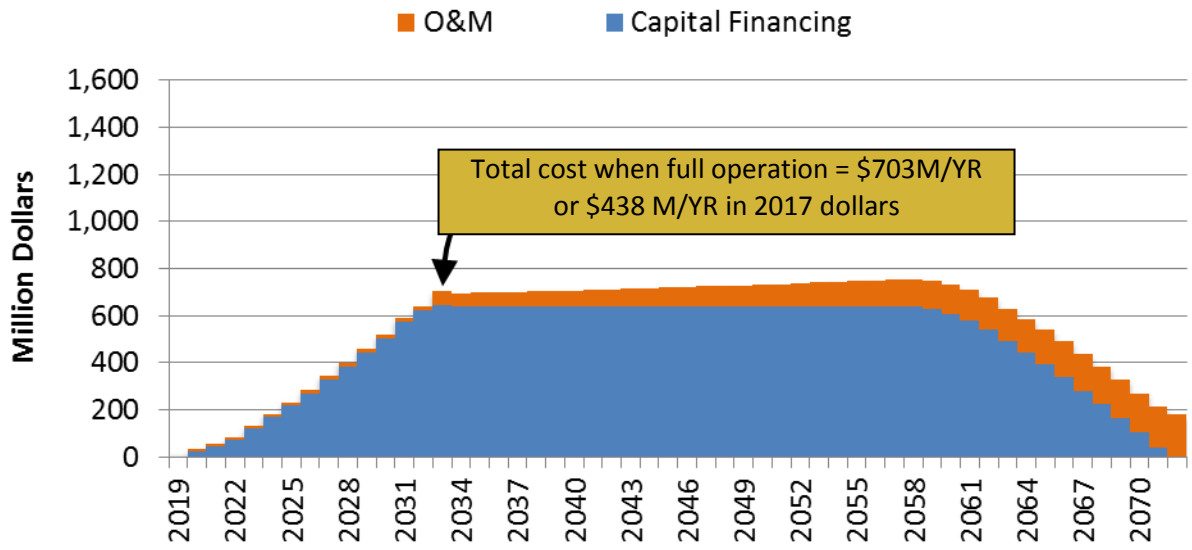


FIGURE 3: BASE CASE 4% INTEREST SCENARIO – CAPITAL FINANCING AND O&M COSTS

6% Interest Scenario

The 6% Interest Scenario has identical project and financing assumptions as the Base Case, except that the bonds have a higher interest rate of 6 percent. Figure 4 displays the annual payments, in nominal dollars, required for the capital financing costs for California WaterFix and the O&M to operate the facility. This financing scenario results in annual payments of $910 million per year in 2033 when the project is fully operational, which equates to $567 million in 2017 dollars.

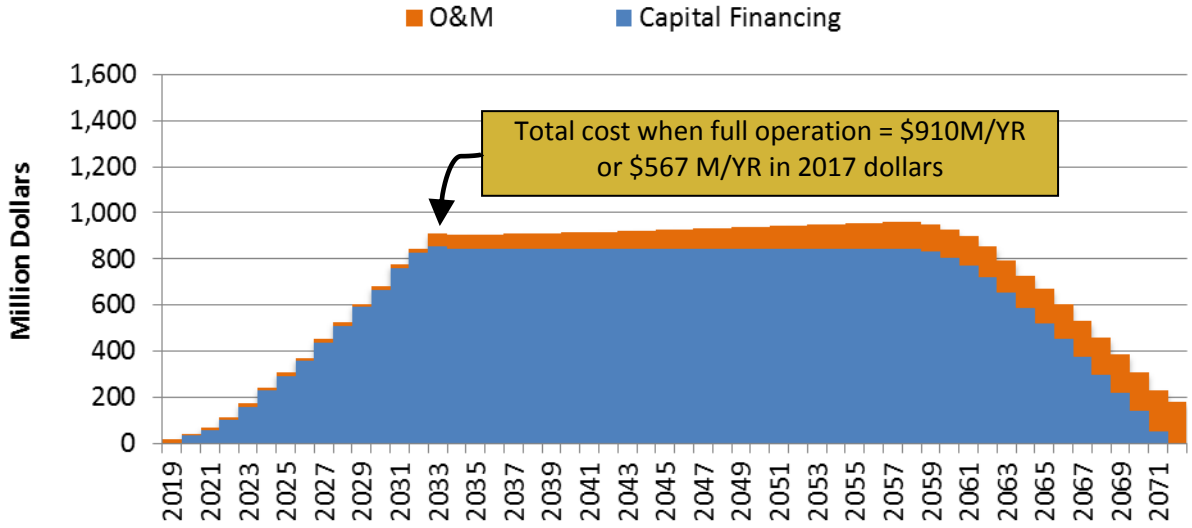


FIGURE 4: 6% INTEREST SCENARIO – CAPITAL FINANCING AND O&M COSTS

8% Interest Scenario

The 8% Interest Scenario shows the financing impacts of a much higher interest rate compared to the Base Case. The high interest rate scenario is provided to show the effect of a doubling of interest rates from current market conditions. Figure 5 displays the annual payments required to pay for the capital financing costs for California WaterFix and the O&M to operate the facility. This financing scenario results in annual payments reaching the maximum amount of $1.137 billion per year in 2033, which equates to $709 million in 2017 dollars.

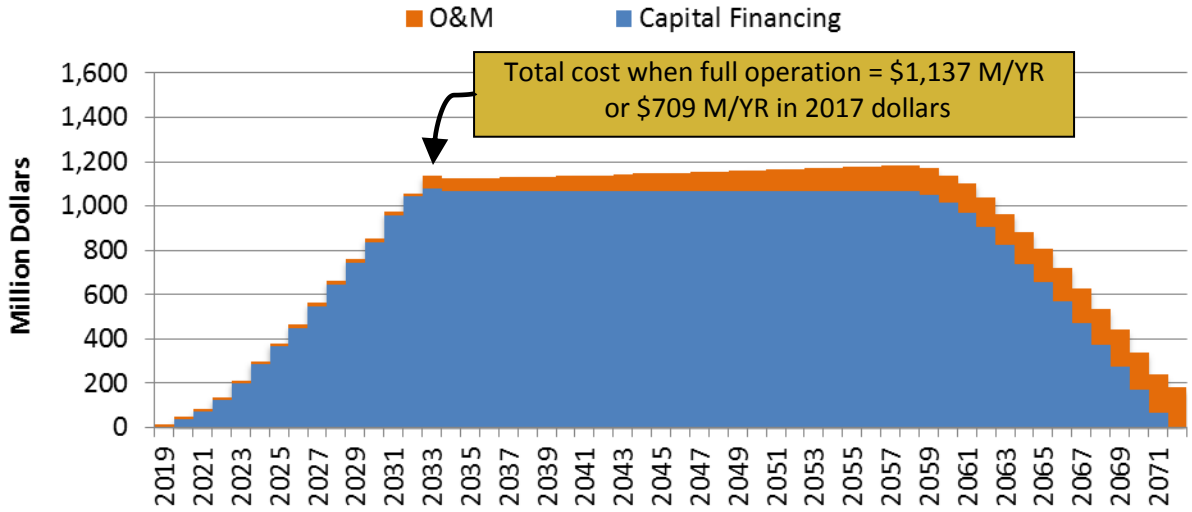


FIGURE 5: 8% INTEREST SCENARIO – CAPITAL FINANCING AND O&M COSTS

COST IMPACT SUMMARY

The three financing scenarios described above outline the annual payments required for the financing of capital construction costs and annual O&M costs. The cost impact analysis is based on the annual costs incurred when the project is fully operational in 2033. This point is used for cost impact analysis because it is the year when the full cost impact of the project is incurred. Costs from 2033 to 2059 are mostly level, with small increases in O&M costs because of inflation.

Figures 3, 4 and 5 above show the annual California WaterFix costs in nominal dollars. While nominal dollars represent the actual dollar outlays that would be expended at various points in time, they have not been adjusted for inflation and therefore cannot be compared to today's costs. Since the costs occur in the future they are discounted to 2017 dollars to (1) calculate comparative cost impacts by comparing to today's costs and (2) compare the cost of California WaterFix to alternatives with costs estimated in today's dollars.

A summary of the cost impacts for the Base Case, 6% Interest Scenario and 8% Interest Scenario in 2017 dollars is shown in Tables 3 and 4.

The total annual costs for the SWP share of California WaterFix when the project is fully operational are expected to range from $438 million in the Base Case to $709 million in the 8% Interest Scenario in 2017 dollars. About 92-95 percent of these costs are capital financing costs and 5-8 percent of costs are annual O&M costs.

TABLE 3: FINANCING STATE WATER PROJECT SHARE OF CALIFORNIA WATERFIX IN 2017 DOLLARS

	Base Case 4% Interest	6% Interest Scenario	8% Interest Scenario	Units
CALIFORNIA WATERFIX CAPITAL COST				
Total Water Facility & Mitigation Capital Costs	16.7	16.7	16.7	2017 $B
FINANCING STATE WATER PROJECT (SWP) PORTION				
SWP SHARE	**55%**	**55%**	**55%**	
SWP Share of Capital Costs	9.2	9.2	9.2	2017 $B
FINANCING RATE	**4%**	**6%**	**8%**	
Term	40	40	40	years
Annual Financing Costs (1)	403	532	673	2017 $M
Annual O&M Costs (1)	35	35	35	2017 $M
TOTAL ANNUAL COSTS	**438**	**567**	**708**	**2017 $M**

(1) When project is fully operational in 2033 (year 15).

Analyses of Cost Impacts

METROPOLITAN SHARE OF PROJECT COST

When excluding the five north-of-Delta contractors, Metropolitan's share of the SWP Table A Contract Amounts is 47.13 percent. Metropolitan's 47.13 percent share can be used to calculate the annual cost impact to Metropolitan from the total financing of the SWP share of California WaterFix. The annual cost impact to Metropolitan for the three scenarios ranges from $207 million in the Base Case to $334 in the 8% Interest Scenario in 2017 dollars. See Table 4.

When compared to Metropolitan's current costs, as represented by the 2017/2018 Revenue Requirement of $1.574 billion, the total annual percentage cost increase to Metropolitan from California WaterFix ranges from 13 percent in the Base Case to 21 percent in the 8% Interest Scenario. Spreading the total annual percentage cost increase over the 15-year period to 2033 when the maximum annual cost impact would be incurred results in an annual average percentage cost increase ranging from 0.9 percent in the Base Case to 1.4 percent in the 8% Interest Scenario.

Dividing the annual cost impact by Metropolitan's 2017/2018 budgeted 1.7 million acre-feet (MAF)[3] sales base provides an estimate of the increase in Metropolitan's average water cost required to recover the annual California WaterFix cost. The increase in Metropolitan's average water cost would range from $122/AF in the Base Case to $196/AF in the 8% Interest Scenario in 2017 dollars. This increase is the largest increase that would be required once the project is fully operational in 2033. Annual increases would be approximated by the annual average percentage cost increases of 0.9 percent in the Base Case to 1.4 percent in the 8% Interest Scenario. Estimates of the annual cost increases have already been incorporated into Metropolitan's ten-year Financial Forecast as part of the planning for California WaterFix. Their impact on rates are also included as part of the long-term projected average 4.5 percent rate increases that have been previously published (see section on Impact on Metropolitan's Ten-Year Financial Forecast).

[3] Based on Metropolitan's 2017/18 Budget.

TABLE 4: METROPOLITAN SHARE OF CALIFORNIA WATERFIX COSTS IN 2017 DOLLARS

	Base Case 4% Interest	6% Interest Scenario	8% Interest Scenario	Units
METROPOLITAN'S SHARE OF ANNUAL PROJECT COSTS				
METROPOLITAN'S SHARE OF SWP	**47.13%**	**47.13%**	**47.13%**	
Financing Costs (1)	190	251	317	2017 $M
O&M Costs (1)	17	17	17	2017 $M
TOTAL COSTS	**207**	**268**	**334**	**2017 $M**
METROPOLITAN'S COST IMPACT				
METROPOLITAN'S OVERALL COST INCREASE	**13%**	**17%**	**21%**	
Annual Cost Increase Over 15 Years	0.9%	1.1%	1.4%	
Average Cost Increase per AF (1,3)	122	157	196	2017 $/AF
Metropolitan's 2017 Full Service Tier 1 Treated Water Rate with California WaterFix (1,3,4)	1,101	1,136	1,175	2017 $/AF
Average Monthly Household Impact (1,3,5)	1.90	2.50	3.10	2017 $
ILLUSTRATIVE MARGINAL COST (UNIT COST)				
Marginal Cost at Clifton Court Forebay (6)	613	793	991	2017 $/AF
Marginal Cost when Treated and Conveyed to Service Area (6,7)	840	1,020	1,218	2017 $/AF

(1) When project is fully operational in 2033 (year 15).
(2) Based on Metropolitan's 2017/18 Revenue Requirement of $1,574M.
(3) Based on Metropolitan's 2017/18 Budget of 1.7 million acre-feet (MAF).
(4) Metropolitan's 2017 Full Service Treated Volumetric Rate = $979/AF.
(5) Based on 6.2 million occupied residential households in the Metropolitan service area and 70 percent residential/30 percent commercial split.
(6) Based on projected average supply improvement of 1.3 MAF/YR.
(7) Based on 2017/18 Budget, $197/AF State Water Contract Power costs and $30/AF variable treatment costs.

Residential Household Impacts in the Service Area:

One measure of the relative cost of California WaterFix is the approximate cost impact to residential households. While it is not possible to calculate the precise water rate impacts at the retail level because of the wide variation in water rates and differential costs and sources of water supplies from retail purveyors, it is possible to approximate an average household impact using basic planning assumptions and data.[4]

There are an estimated 6.2 million residential households in Metropolitan's six-county service area. Residential water use comprises about 70 percent of the total Municipal and Industrial (M&I) water use. By allocating 70 percent of the calculated annual California WaterFix cost to Metropolitan to M&I sector and dividing by the number of residential households, an average household cost impact can be estimated. By this method, the average annual household impact within Metropolitan's service area is estimated to range from $23.30 in the Base Case to $37.70 in the 8% Interest Scenario. On a monthly basis, this presents a range of household impacts of $1.90 in the Base Case to $3.10 in the 8% Interest Scenario.

[4] Metropolitan is a regional wholesale water provider and provides water service only to its 26 member agencies. Some of those agencies provide retail service, but others are only wholesale water providers. Thus, Metropolitan does not provide water directly to retail customers and it has no control over the manner by which any retail water agency recovers its costs for Metropolitan water.

Illustrative Marginal Cost Per Acre-Foot

SWP Contractors do not purchase units of water from the SWP, as previously noted. However, the estimated marginal cost per acre-foot for California WaterFix is still useful for comparing to the marginal costs of other resources and for evaluation purposes.

The total annual costs for the SWP share of California WaterFix when the project is fully operational is expected to range from $438 million in the Base Case to $709 million in the 8% Interest Scenario in 2017 dollars. The project's water supply reliability benefits are described in detail in the second policy white paper, "Modernizing the System: California WaterFix Operations." California WaterFix is estimated to bring an average water supply yield improvement of 1.3 MAF per year based on a range of 1.2 MAF to 1.4 MAF, depending on future regulatory and operating requirements, of which about 55 percent would be the SWP share. Dividing the total annual costs by the average water supply yield results in an estimated marginal cost of $613/AF in the Base Case to $991/AF in the 8% Interest Case in 2017 dollars. This would represent the marginal cost of the supply at the Clifton Court Forebay. To compare the marginal cost of California WaterFix to the marginal costs of other resources within Metropolitan's service area, variable conveyance and treatment costs must be added. The marginal cost of California WaterFix when treated and conveyed to Metropolitan's service area ranges from $840/AF in the Base Case to $1,218/AF in the 8% Interest Case in 2017 dollars[5].

IMPACT ON METROPOLITAN'S TEN-YEAR FINANCIAL FORECAST

Metropolitan's latest Ten-Year Financial Forecast was produced as part of the fiscal year 2016/17 and 2017/18 Biennial Budget. As part of the ongoing planning for California WaterFix, Metropolitan's Ten-Year Financial Forecast included costs for the project that were estimated in 2015. The Ten-Year Financial Forecast costs assumed California WaterFix financing with terms similar to the 6% Interest Scenario but with a construction schedule that had an earlier start and completion date. As a result, the cost projection that was included in the Ten-Year Financial Forecast is higher than each of the three scenarios included in this paper. A comparison of cost estimates of Metropolitan's share of California WaterFix is shown in Figure 6.

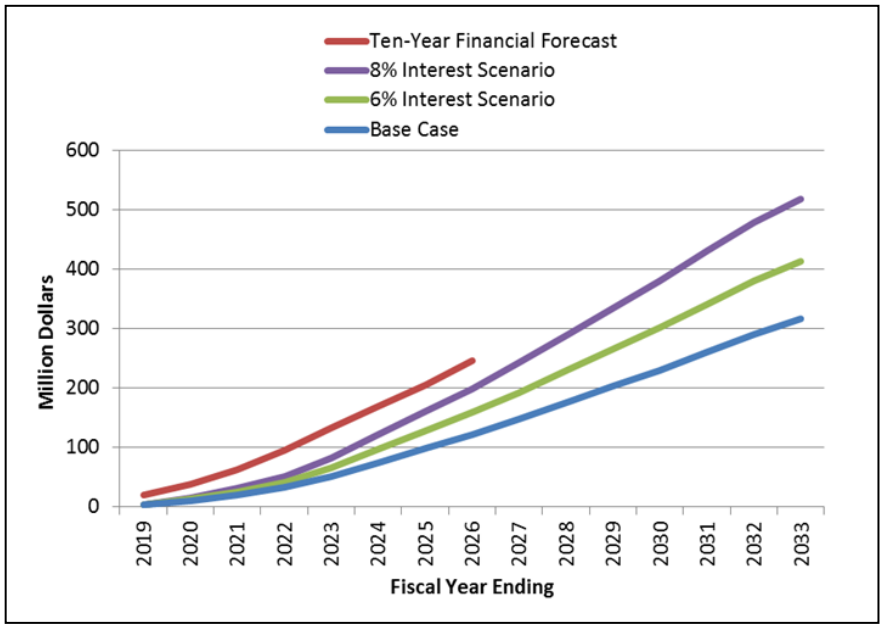


FIGURE 6: COST ESTIMATE COMPARISON OF METROPOLITAN'S SHARE OF CALIFORNIA WATERFIX

The Ten-Year Financial Forecast estimated annual rate increases of 4.5 percent for 2019 through 2026, which included cost estimates for California WaterFix that were higher than those shown in this paper. Thus, the projected rate increases in the Ten-Year Financial Forecast are conservative with respect to California WaterFix, and need not be revised at this time. The projected rate increases from the Financial Forecast are shown below in Table 5.

[5] Based on Metropolitan's 2017/18 Budget, $197/AF State Water Contract Power costs and $30/AF variable treatment costs

TABLE 5: SUMMARY OF PROJECTED RATE INCREASES FROM METROPOLITAN'S 10-YEAR FORECAST

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Avg Rate Increase	1.5%	1.5%	4.0%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%

COMPARISONS OF CALIFORNIA WATERFIX COSTS TO OTHER LARGE WATER INFRASTRUCTURE PROJECTS IN THE STATE

The project costs and impacts of California WaterFix on individual public agencies are comparable to the construction of other large water infrastructure projects and underscores the project's economic value.

A survey of both the funding mechanisms used for other public water projects as well as the capital cost impacts of those projects was previously considered in Chapter 8 of the Bay Delta Conservation Plan. As shown in Table 6, per capita costs for California WaterFix facilities compare favorably with other large-scale water projects in California.

TABLE 6: COSTS OF LARGE-SCALE WATER PROJECTS IN CALIFORNIA, SORTED BY PER CAPITA COSTS IN 2017 DOLLARS

Project	Agency	Date Completed	Capital Cost in Billions (1)	Population within Service Area in Millions (2)	Project Cost per Capita
Diamond Valley Reservoir/Inland Feeder	Metropolitan Water District	2000	$3.6	18	$198
Freeport Project	East Bay Municipal Utility District	2010	$0.6	1.3	$481
Emergency Storage Project	San Diego County Water Agency	Est. 2014	$1.7	2.8	$598
Capital Improvement Program	Santa Clara Valley Water District	Ongoing	$1.1	1.8	$620
California WaterFix	**CA Department of Water Resources**	**Est. 2033**	**$16.7**	**25**	**$669**
Los Vaqueros Reservoir Expansion Project	Contra Costa Water District	2012	$0.7	0.55	$1,186
State Water Project	State of California	1965	$19.2	13	$1,476
Coastal Branch Aqueduct	Department of Water Resources and Central Coast Water Authority	1997	$1.1	0.43	$2,444
Hetch Hetchy Aqueduct Improvement Project	San Francisco Public Utilities Commission	Ongoing	$5.1	2.5	$2,052

Source: BDCP Public Draft, November 2013, Chapter 8, Table 8-44.

(1) Capital costs presented in 2017 based on ENR Construction Cost Index – 20 Cities.

(2) Population at time of completion or 2017 for projects not yet completed.

COMPARISON OF CALIFORNIA WATERFIX TO OTHER WATER SUPPLY ALTERNATIVES

Concerns have been raised that California WaterFix is costly and that other local supply alternatives should be developed in its place. To address this, an analysis of potential local supply alternatives is necessary to determine comparable costs. A significant amount of local resources have already been developed through Metropolitan's Integrated Resources Plan (IRP). The 2015 IRP Update continues to target future local resource development in addition to California WaterFix. The 2015 IRP Update process included a comprehensive review of potential local project alternatives and a survey of actual and estimated development costs. Given the range of cost resulting from the financing analyses detailed in this white paper, California WaterFix is a cost-effective component of Metropolitan's IRP. Potential local project alternatives would be more costly than California WaterFix and would result in much higher costs to ratepayers. See Table 7.

Comparing the Cost of California WaterFix with the Cost of Local Resource Alternatives

As presented in the second policy white paper, "Modernizing the System: California WaterFix Operations," the future total water supply from the SWP and CVP with California WaterFix is estimated to range from 4.7 to 5.3 MAF on a long-term average annual basis, while a future condition without California Water Fix is assumed to be 3.5 to 3.9 MAF.

This average increment of 1.3 MAF per year in total SWP and CVP supplies translates to 337,000 AF[6] of supplies available to Metropolitan based on cost and water allocation methodology. Although California WaterFix provides reliability and water quality benefits for all SWP supplies made available to Metropolitan, for purposes of comparing California WaterFix to the costs of alternatives, only the 337,000 AF increment is used.

As shown in Table 4, the marginal cost of a 337,000 AF increment with California WaterFix under the Base Case is calculated at $613/AF in 2017 dollars[7]. The estimated annual cost for California WaterFix to Metropolitan under the Base Case is $207 million in 2017 dollars.

In the 2015 IRP Update, Metropolitan updated its survey of potential local resources projects and local resource development costs. For the purposes of comparing to California WaterFix, rather than developing and analyzing a specific alternative mix of local resources that could be developed to replace a 337,000 AF increment of water supplies from California WaterFix, the cost of two focused alternatives were developed: recycled water and seawater desalination. The estimated cost of developing the two focused alternatives is based on the estimated costs of two specific project examples; the cost of each falls within the range of surveyed costs from the IRP. For the recycled water alternative, the estimated cost of the proposed Regional Recycled Water Project (RRWP) was used. For the seawater desalination alternative, the projected cost of the Carlsbad Desalination Plant was used. Other local supply alternatives, such as distributed stormwater capture, have surveyed cost ranges that are equal to or greater than recycled water or seawater desalination and thus would have total costs that are represented by the two focused alternatives.

Recycled Water Alternative

Based on the 2015 IRP Update survey of local resource development cost, recycled water development ranges in cost between $526/AF and $8,412/AF in 2015 dollars. In addition, Metropolitan recently completed a feasibility study for the Regional Recycled Water Project (RRWP), a large-scale indirect potable reuse project that could provide 165,000 AF per year of water. Based on the feasibility study, the RRWP is estimated to cost $1,610/AF in 2016 dollars. Escalating the cost of the RRWP to 2017 dollars results in a cost of $1,658/AF. After accounting for the offset cost of treating and distributing SWP water supplies from California WaterFix to be equivalent to locally delivered water, the resulting net unit cost of $1,431 can be multiplied by the 337,000 AF increment to obtain a total annual cost of $482 million in 2017.

This annual cost increase is more than twice the annual cost of California Water Fix of $207 million under the Base Case. Using the same method as used previously in this paper to estimate household impact of California WaterFix

[6] Based on Metropolitan's 25.92 percent share of the project.
[7] Based on Metropolitan's 2017/18 Budget, $197/AF SWP power costs and $30/AF SWP variable treatment costs.

at $1.90 per household per month, the recycled water alternative would have a household impact of $4.50 per household per month, an increase of $2.60 over the household impact of California WaterFix.

Seawater Desalination Alternative

Based on the 2015 IRP Update survey of local resource development cost, seawater desalination ranges between $1,530/AF and $2,985/AF in 2015 dollars. The San Diego County Water Authority released a projection of the 2017 unit costs for the Carlsbad Desalination Plant, with an estimated unit cost of $2,412/AF. After accounting for the offset cost of treating and distributing SWP water supplies from California WaterFix to be equivalent to locally delivered water, the resulting net unit cost of $2,185 can be multiplied by the 337,000 AF increment to estimate a total annual cost of $736 million in 2017 dollars. This represents an increase of 256 percent in the additional annual cost over the annual cost of California WaterFix of $207 million under the Base Case. Using the same method as used previously in this paper to estimate household impacts, the seawater desalination alternative would have a household impact of $6.90 per household per month, an increase of $5.00 over the household impact of California WaterFix.

TABLE 7: COST OF ALTERNATIVES TO CALIFORNIA WATERFIX

	California WaterFix Base Case	Recycling Alternative*	Desalination Alternative**	Units
Unit Cost	$613	$1,658	$2,412	2017 $/AF
Loss SWP Power and Variable Treatment Cost (1)	---	($227)	($227)	2017 $/AF
Net Unit Cost	**$613**	**$1,431**	**$2,185**	**2017 $/AF**
Yield (2)	337	337	337	TAF
Annual Cost	**207**	**482**	**736**	**2017 $M**
Cost Increase over California WaterFix		**133%**	**256%**	
Metropolitan's Overall Cost Increase (3)	**13%**	**31%**	**47%**	
Average Cost Increase per AF (4)	122	284	433	
Average Monthly Household Impact (4,5)	**$1.90**	**$4.50**	**$6.90**	**2017 $**

* Based on Regional Recycled Water Program Feasibility Study, base case scenario $1,610/AF in 2016 dollars escalated to 2017 dollars (3 percent). Assumed financing with annual debt service for 30 years at 4 percent.

** Based on projected 2017 unit cost of Carlsbad Desalination Plant as reported by San Diego County Water Authority, unit cost would increase as debt service increases over time (not level debt service). First principle payment deferred until 2020.

(1) Based on 2017/18 Budget, $197/AF State Water Contract Power costs and $30/AF variable treatment costs.

(2) Based on 1.3 MAF average improvement in project water supply x 25.92 percent (Metropolitan's overall share of project)

(3) Based on 2017/18 Revenue Requirement of $1,574 million.

(4) Based on Metropolitan's 2017/18 Budget of 1.70 MAF.

(5) Based on 6.2 million residential households in the Metropolitan service area and 70% residential/30% industrial split.

California WaterFix has been identified in the IRP as part of a balanced and diversified approach to providing a reliable water supply to Southern California. The IRP approach relies upon continued development of local resources and conservation development to meet the growing demands of the service area. Developing additional local resources as an alternative to California WaterFix would be significantly more expensive and result in much higher cost and household impacts.

Implementation and Management Approaches

As noted throughout this policy white paper, many assumptions have been made in Metropolitan's analysis of the project's financial aspects. These include assumptions that have been explicitly stated, such as assumed interest rates and the type of financing, as well as assumptions that have been implied, such as whether the SWP and CVP Contractors assumed to participate in the project and its funding will actually do so. As the project moves forward, these assumptions would be tested, revised, or replaced. This section outlines the implementation and management approaches to cost allocation and financing that will be used as the California WaterFix plans are put into effect.

FINANCING OPTIONS

Assuming California WaterFix moves forward, Metropolitan would coordinate with DWR and the other SWP and CVP Contractors to evaluate options to optimize financing and reduce costs. One way would be to use short-term borrowing (like commercial paper) to finance construction and then periodically replace short-term borrowing with fixed rate bonds. This example would reduce debt service costs by taking advantage of the lower interest rates on the short-term borrowing and eliminating the negative carry[8] on a long-term, fixed bond. Alternative financing options such as those potentially available under the Water Infrastructure Finance and Innovation Act Program (WIFIA) and the Water Infrastructure Loan Act (WILA) would also be explored.

Water Infrastructure Finance and Innovation Act Program

In addition to the outlined revenue bond financing structures, DWR and the SWP and CVP Contractors may also leverage monies that may be available under the Water Infrastructure Finance and Innovation Act Program (WIFIA).

Authorized under the Water Resources Reform and Development Act of 2014 (WRRDA), WIFIA is modeled after 1998's successful Transportation Infrastructure Finance and Innovation Act (TIFIA) to provide low-interest financing (secured loans or loan guarantees) for the construction of water and wastewater infrastructure. WIFIA is similar to State Revolving Fund (SRF) programs, but is intended to provide subsidized financing for large-dollar-value projects. Eligible recipients include corporations, partnerships, municipal entities, and SRF programs.

For fiscal year 2017, WIFIA received initial funding of $20 million, of which $3 million is to be used for administrative purposes, leaving $17 million to subsidize loans. WIFIA leverages federal dollars, so for every dollar Congress appropriates, $50 to $60 is expected to be loaned out. That means the $17 million would leverage an estimated $1 billion in federal loans based on an average rate subsidy of about 2 percent. On May 5, 2017, as part of an omnibus spending bill, Congress appropriated an additional $10 million for WIFIA. The additional $10 million brings WIFIA funding in 2017 to $30 million, which can leverage an estimated $1.5 billion in federal loans. For fiscal year 2018, WIFIA is budgeted to again receive initial funding of $20 million.

Given the funding allocations and eligibility requirements, WIFIA may provide supplemental funding for the project and serve as part of the suite of funding tools. It would not, however, serve as the sole source of project funding.

Water Infrastructure Loan Act

The proposed Water Infrastructure Loan Act (WILA) is modeled after the existing Railroad Rehabilitation Improvement and Financing program. The proposed WILA program is designed to provide financial resources for the maintenance, development, and enhancement of water infrastructure while protecting the interest of the taxpayers. WILA is draft legislation and as such the program does not currently exist. However, with federal legislative action to authorize WILA, the program could provide alternative or supplemental California WaterFix financing with the following benefits:

[8] Negative Carry is a situation in which the cost of holding a security exceeds the yield earned. A negative carry situation is typically undesirable because it means the investor is losing money.

- Low Rate – Reduced Cost
- Locked Rate – Reduced Interest Rate Risk
- Draw Down Feature – Reduced Interest Carry
- Delayed Repayment – Repayment can be deferred until 5 years after substantial completion of the project
- 100 percent of project construction costs financed through WILA.

Metropolitan will continue to monitor the proposed legislation. If WILA becomes available, Metropolitan would work with DWR and the other contractors to evaluate and pursue financing as appropriate.

COST AND WATER SUPPLY MANAGEMENT MEASURES UNDER SWP CONTRACTS

The costs of California WaterFix are substantial. However, as outlined in this policy white paper, the costs that would be allocated to Metropolitan are reasonable and affordable, given the water supply reliability improvements. Indeed, California WaterFix is the least-cost alternative compared with other new long-term water supply options. However, each water contractor is differently situated. For some, the calculations are not as clear as for others, and some SWP Contractors may look to the flexibility under their SWP State Water Contracts as a means of managing their overall reliability needs and cost exposure.

The State Water Contracts have provisions and flexibility that provide SWP Contractors with tools to manage their long-term costs and reliability through various methods, including the purchase and sale of Table A water, exchanges of supplies and transfers of supplies.

While all SWP Contractors south of the Delta would participate in California WaterFix, some contractors may wish to balance the increased reliability of California WaterFix against the increased costs. This would be accomplished by adjusting their contractual rights to Table A water on either a permanent or temporary basis through the mechanisms noted below.

Permanent Table A Adjustment

The State Water Contract provides for permanent transfers of Table A between SWP Contractors. Each transfer involves a price for the transferred Table A that the acquiring contractor pays to the relinquishing contractor. The acquiring contractor also assumes all prospective charges associated with the transferred Table A. In addition, if the contractor needs additional aqueduct capacity to convey the acquired Table A water, there are additional transportation, capital, and O&M charges for additional use of facilities. Finally, in SWP reaches where additional capacity is required, the acquiring contractor would have a one-time obligation for retroactive SWP transportation capital charges. This charge is redistributed among contractors based on repayment reach participation. The SWP retroactive capital charge is similar in concept to Metropolitan's annexation fee.

The SWP Contractor relinquishing Table A is relieved of the prospective charges for the amount of Table A relinquished. That contractor also receives the negotiated price for each acre foot of Table A relinquished.

To make the purchase of Table A more manageable in the future, the SWP Contractors have proposed reducing the period used to calculate the retroactive SWP transportation capital charge. This period is proposed to be changed from all past years to a lesser period, between 30 and 50 years. These discussions, however, are in the early stages and not associated with California WaterFix.

Short Term Adjustment

There is flexibility under the State Water Contract for short and medium term adjustments to Contract payment obligations, while still retaining Table A participation rights. Historically, these adjustments included the Turnback Pool and, for 2013/14 and 2015/16, the Multi-year Market Pool. The price for water in the Turnback Pool is a fraction of the Delta Water Charge. The price for water in the Multi-year Market Pool was market-based.

Additional areas of flexibility under the existing contract include extending the return period for water exchanges, allowing higher return ratios for exchanges; allowing one-year exchanges; and allowing flexibility in cost compensation for exchanges and allowing multi-year transfers and exchanges. Flexibility in the exchange and transfer programs would enable contractors to structure agreements between willing participants to meet the financial and water supply needs of each party. For example, a contractor that desires to have long-term reliability can participate in California WaterFix by entering into medium-term agreements that cover costs in the early stages of construction and operation through multi-year transfers that ensure financial integrity of the selling party and boost reliability of the purchasing party. Multi-year exchanges would serve the same purpose and provide similar benefits to parties entering into those agreements.

Contractor Payment Default

The SWP long-term State Water Contracts require the SWP Contractors to pay for all water supply-related costs of the infrastructure capital, operations, and maintenance of SWP facilities. Thus, a significant concern for the state is the risk of contractor default on their payment obligations. This concern has been addressed through the provisions of the long-term contracts themselves.

The SWP State Water Contracts include articles that obligate each SWP Contractor to make payments. The contract articles also include language that obligates, and if necessary compels, the SWP Contractor to levy taxes or assessments in the event of non-payment. Additionally, the State may suspend water deliveries, within health and safety limits, if the contractor is in default for a significant period.

There are additional provisions related to default on charges for SWP capital facilities financed with revenue bonds. The SWP State Water Contracts provide for the state to protect bondholders and non-defaulting contractors against costs resulting from any SWP Contractor's failure to make payments related to the revenue bonds.

In practice, the State administers this provision by maintaining a revenue bond reserve equal to one half the maximum annual revenue bond debt service for all outstanding revenue bonds and by adding a 25 percent refundable surcharge to the SWP Contractor's revenue bond capital charge.

For California WaterFix, the SWP long-term State Water Contracts would continue as the primary contracting vehicle between DWR and the SWP Contractors. As such, these contracts would address uncertainties relating to default on the payment obligations under the contracts.

MANAGING UNCERTAINTIES

Uncertainties involving financing assumptions and approaches for California WaterFix would largely be addressed through the development of new agreements among the SWP and CVP Contractors, the proposed joint powers authorities, and DWR, as well as through reliance on the considerable protections already in place under the existing SWP long-term State Water Contracts. Processes and commitments would be included in these agreements to reduce financial risks and uncertainties. These agreements will be summarized in detail for the Board's consideration at the time it is asked to render decisions on California WaterFix.

Table 8 highlights some key uncertainties and strategies to reduce risks associated with financing California WaterFix.

TABLE 8: KEY UNCERTAINTIES AND RISK REDUCTION STRATEGIES

Key Uncertainties	Risk Reduction
Interest Rates	• Other financing options would be evaluated to optimize financing and reduce costs, such as short-term borrowing, pursuing WIFIA supplemental funding, or pursuing financing through the potential WILA program.
SWP Contractor Default on Payments	• Protections are already built into the SWP State Water Contracts, obligating the Contractor to make payments, and if necessary, compels the Contractor to levy taxes or assessments in the event of non-payment.
Participation in and Solvency of Finance JPA	• Agreements would provide that in the event DWR cannot make its payments, SWP members would "step up" to pay their fair share of debt service. • Decisions of Finance JPA by a board of directors that would include Metropolitan.
Reimbursement of direct Contractor funding contributions	• DWR would include in its first issuance of revenue bonds an amount sufficient to reimburse Contractor-provided gap funding as well as all prior funding contributions for planning costs.
Judicial Determination on DWR Authority to Issue Bonds	• During pendency of litigation, private placement bond sales with Finance JPA would allow funding for project implementation to proceed. • If DWR is found not to have the requisite authority, a process would be established leading to potential conveyance of interest in the project to the Finance JPA or designee.
CVP Contractor Participation	• DWR would not move forward with project implementation without the commitment of a sufficient number of SWP and CVP Contractors. • Discussions are on-going concerning the risk of a participating CVP Contractor to default during project implementation.

Conclusion

The State Water Project is a vital source of water for Californians that needs reinvestment and modernization.

California WaterFix would be an important step in this effort and would provide wide-ranging benefits both in terms of water supply reliability and environmental improvements. The state and federal water contractors would fund all of the capital costs, associated mitigation, and operation and maintenance costs of the California WaterFix consistent with the beneficiary pays principles.

In looking at California WaterFix and evaluating economic factors, an overriding consideration is whether the benefits of the project's water supply reliability, water quality benefits, resiliency against natural events such as earthquakes and major flood events, and longer term climate change impacts and sea level rise outweigh the project costs and risks. The costs, financing options, and management considerations that have been presented provide a positive cost-benefit analysis and demonstrate that California WaterFix represents an investment in ensuring California's water future.

Note: For additional information on Metropolitan's policies related to California WaterFix, including a policy white paper on infrastructure improvements that would modernize the state's water system and a policy white paper on California WaterFix Operations, see http://mwdh2o.com/ or http://www.mwdh2o.com/DocSvcsPubs/WaterFix/

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Item No. 3

DISCUSSION ITEM
September 6, 2017

TO: **Board of Directors**

FROM: **Robert Hunter,**
General Manager

Staff Contact: Karl Seckel
Harvey De La Torre
Melissa Baum-Haley

SUBJECT: **METROPOLITAN WATER DISTRICT (MET) ITEMS CRITICAL TO ORANGE COUNTY**

STAFF RECOMMENDATION

Staff recommends the Board of Directors to review and discuss this information.

DETAILED REPORT

This report provides a brief update on the current status of the following key MET issues that may affect Orange County:

a) MET's Water Supply Conditions
b) MET's Finance and Rate Issues
c) Colorado River Issues
d) Bay Delta/State Water Project Issues
e) MET's Ocean Desalination Policy and Potential Participation in the Doheny and Huntington Beach Ocean (Poseidon) Desalination Projects
f) Orange County Reliability Projects
g) East Orange County Feeder No. 2
h) South Orange County Projects

Budgeted (Y/N): N	Budgeted amount: None	Core _X_	Choice __
Action item amount: N/A	Line item:		
Fiscal Impact (explain if unbudgeted):			

ISSUE BRIEF # A

SUBJECT: MET's Water Supply Conditions

RECENT ACTIVITY

2017 Water Supply Balance

With the Department of Water Resources (DWR) setting the State Water Project (SWP) "Table A" allocation at 85%, Metropolitan will have approximately 1.624 million acre-feet (MAF) in SWP deliveries this water year. In addition, Metropolitan has received approximately 124 TAF of Article 21 supplies through July. On the Colorado River system, MET estimates a total delivery of 960 TAF.

Metropolitan is projecting that supplies will exceed demand levels in CY 2017. With a current demand trend of 1.47 MAF, Metropolitan in expected to increase their dry-year supplies by 1.28 MAF, which is the highest they have ever stored. Based on this estimated recovery and a beginning dry-year storage balance of 1.3 MAF, this will bring Metropolitan's total dry-year storage to 2.5 MAF.

Limitations with recharging groundwater basins due to the "suspect" of quagga mussels and to secure all of the available imported water supplies for 2017, the Metropoilitan Board approved last month a one-year In-Lieu storage program. The purpose of this program is to store additional imported water locally that would have been otherwised been lost if no action was taken. For July 2017, MWDOC has requested that Metropolitan certify 2,954 AF of imported treated deliveries as In-Lieu. In-Lieu deliveries for August 2017 are estimated to be around 12,000 AF.

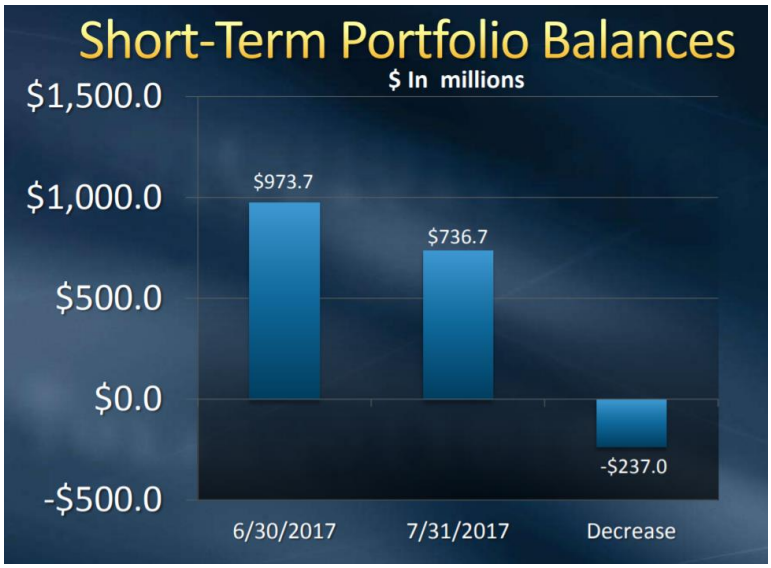
ISSUE BRIEF # B

SUBJECT: MET's Finance and Rate Issues

RECENT ACTIVITY

MET Financial Report

The financial portfolio performance report through the July 31, 2017 resulted in a short-term portfolio with a market value of $736.7 million, a decrease of $237.0 million since June 30, 2017. From inception, the short-term portfolio has outperformed the benchmark by 0.58% or $0.8 million.



For the month of July, the total return of the long-term portfolio resulted in an underperformance of the benchmark by -0.05%. However, from inception, the long term portfolio has outperformed the benchmark by 0.28%.

July water sales were 47.8 TAF lower than budget and 28.9 TAF lower than the 5-year average. Low sales in July are due in part of LA purchasing very little imported water as a result of this year's snow pack in the Eastern Sierras and lower than expected replenishment purchases due to the "suspect" of quagga mussels in the SWP system.

ISSUE BRIEF # C

SUBJECT: Colorado River Issues

RECENT ACTIVITY

Palo Verde Irrigation District Fallowing Program Call Issued

Under the terms of the Palo Verde Irrigation District Fallowing Program, Palo Verde farmers refrain from irrigating between 7 and 28 percent of their lands in any year at the request of Metropolitan, making water that would have been used for farming on these lands available to urban Southern California. Land taken out of production is maintained in accordance with approved soil and water management plans, and rotated back into production every one to five years. The program allows Metropolitan to obtain additional water, while providing stable income to the farming community. Annual payments to farmers vary in response to actual acreage fallowed.

In July each year, Metropolitan issues a fallowing call for the contract year, beginning August 1 of the following year. The current fallowing call of 100 percent will end July 31 and a 90 percent fallowing call, which was made in July of 2016, will begin for the contract year beginning August 1. On July 31, in response to improved storage conditions, Metropolitan issued a 40 percent fallowing call for the period beginning August 1, 2018.

Intentionally Created Surplus Plans for 2017 – 2018

Metropolitan originally submitted its 2017 Intentionally Created Surplus (ICS) plan to create 200,000 acre-feet of Extraordinary Conservation ICS for storage in Lake Mead in June of 2016. Metropolitan's ICS plan was approved by the U.S. Bureau of Reclamation (Reclamation) on November 30, 2016. In the intervening time, hydrologic conditions in California have gone from the driest period of historical record to the wettest single year on record. The extraordinary and unprecedented wet conditions of this water year have provided Metropolitan with the unanticipated opportunity to utilize ongoing conservation efforts to create and store additional ICS this year to the benefit of Lake Mead and the Colorado River Basin during an ongoing period of historic drought in the Basin. Metropolitan sent a letter to Reclamation this month providing notice of Metropolitan's proposal to amend its request and store up to 398,000 acre-feet of ICS during 2017. The actual amount of water stored will depend on the water usage of the higher priority agricultural water users on the Colorado River. In addition to revising its 2017 request, Metropolitan sent a letter describing its plan to create up to 398,000 acre-feet of ICS during 2018.

Minute 319 Successor Minute Update

In July, representatives of the United States and Mexico met in El Paso, Texas to finalize the language of the draft successor minute to Minute 319, pursuant to the International Boundary and Water Commission (IBWC) protocols. The representative of the U.S. domestic entities, including Metropolitan, has also been working to complete negotiation of

the necessary domestic implementation agreements that will be executed at the same time as the new minute. Before the minute can be signed, it will first be reviewed and considered by the Senate Foreign Relations Committee. This hearing has been scheduled for early August. If approved by all parties to the agreements, the U.S. and Mexico representatives of the IBWC anticipate signing the minute during the last two weeks of September. Metropolitan's Board is scheduled to consider approval of the implementation agreement during its September meeting.

ISSUE BRIEF # D

SUBJECT: Bay Delta/State Water Project Issues

RECENT ACTIVITY

California WaterFix

On July 21, the California Department of Water Resources (DWR) completed its environmental review process by certifying the 2016 Final Environmental Impact Report (EIR), along with adopting the findings of fact, statement of overriding considerations, and mitigation monitoring and reporting program. At the same time, DWR, as the lead agency in compliance with the California Environmental Quality Act (CEQA), approved California WaterFix and filed the Notice of Determination (NOD) with the State Clearinghouse in Sacramento. With the culmination of this action, focus now shifts toward actions to pursue implementation. Once the NOD is published, the statute of limitations for initiating litigation is 30 days. Relying on DWR's environmental documentation, Metropolitan as a responsible agency under CEQA will now be able to review and consider this information and deliberate on the next steps Metropolitan can take on California WaterFix. With three white papers (infrastructure, operations, and cost allocation) being presented to the Board in July and August outlining key aspects of the proposed project, the Board of Directors will be presented with a set of actions to consider for a Board decision on California WaterFix in September or October.

State Water Resources Control Board

The California WaterFix Petition proceedings before the State Water Resources Control Board (SWRCB) are ongoing. Part 1 of the hearings addresses the potential effects of the proposed project on legal users of water. Metropolitan staff is participating in the rebuttal phase of Part 1 in collaboration with the State Water Contractors. The Sur-Rebuttal for Part 1 of the hearing was completed in July. Metropolitan staff anticipates that the closing briefs for Part 1 will be scheduled by the SWRCB soon. Part 2 of the hearings, is expected to be scheduled soon since the EIR is approved and Federal Endangered Species Act permits have been issued addressing potential impacts to fish and wildlife from the proposed project.

Science Activities

Metropolitan staff continues to participate in the Collaborative Science and Adaptive Management Program (CSAMP). Metropolitan staff worked with the Delta Smelt Scoping Team to prepare briefing materials and presentations for the CSAMP Policy Group meeting in July, which was focused on discussing the science underlying the Fall X2 action in the U.S. Fish and Wildlife Service (USFWS) Biological Opinion for Delta smelt, and monitoring plans for this fall. Metropolitan staff also provided technical input to the design of monitoring studies to evaluate the outcomes of fall flow conditions in 2017.

Metropolitan staff continued science efforts related to longfin smelt. On June 27, Metropolitan staff provided a briefing to the Special Committee on Bay-Delta on Longfin smelt studies, and on July 11, the Metropolitan Board of Directors approved entering into an agreement with ICF consultants, utilizing funding from a Proposition 1 grant awarded to Metropolitan, to conduct a study investigating factors affecting longfin smelt. The longfin smelt research program is being conducted by Metropolitan staff in collaboration with state and federal agencies as well as research institutions and consulting firms. This month, Metropolitan staff participated in field work being conducted for the study examining the distribution of juvenile longfin smelt in the San Francisco Estuary. Metropolitan staff is also participating in the Longfin Smelt Management Analysis and Synthesis Team (LFS MAST), which is a collaborative effort to develop an overall conceptual model and report describing the biology and ecology of longfin smelt in the San Francisco Estuary.

Metropolitan staff continued to work with ESSA Technologies Ltd. on a project to evaluate the reliability of environmental correlations with fish populations in the Delta. The project includes a literature search of environmental correlations that have been used in the Delta, a re-analysis of the correlations to determine if they hold up in the face of updated data, and recommendations for best practices when using environmental correlations as policy tools. During June and July, staff provided ESSA with numerous historical correlations for use in the study.

In July, Metropolitan staff also continued efforts to develop salmon related science and restoration projects. Metropolitan staff hosted a tour of Butte Sink to identify science and restoration actions that will benefit Chinook salmon populations. Participants included local landowners and staff from state and federal agencies, local water districts, nongovernmental organizations, and university scientists. Science and restoration proposals will be identified in an upcoming workshop.

Metropolitan staff participated in the first in a series of workshops on the Winter-Run Life Cycle Model that has been used in the recent National Marine Fisheries Service (NMFS) Biological Opinion. The workshop provided stakeholders an opportunity to understand the model, identify knowledge gaps, and propose improvements. Metropolitan staff will be coordinating future workshops with representatives from the U.S. Bureau of Reclamation (USBR) and NMFS.

ISSUE BRIEF # E

SUBJECT: MET's Ocean Desalination Policy and Potential Participation in the Doheny and Huntington Beach Ocean (Poseidon) Desalination Projects

RECENT ACTIVITY

Doheny Desal

The details of this have been moved to briefing Issue H as it pertains only to South Orange County.

Poseidon Huntington Beach

(Nothing New to Report) Poseidon is still working on the permitting process. The public review period for the Draft Supplemental Environmental Impact Report (EIR) was extended to July 27, 2017. Poseidon anticipates a decision by the State Lands Commission on October 19 and then will continue working their way towards the Santa Ana Regional Water Quality Control permit and then on to the California Coastal Commission, likely in the first half of 2018. OCWD is still working on the system integration concepts.

ISSUE BRIEF # F

SUBJECT: Orange County Reliability Projects

RECENT ACTIVITY

Central Pool Augmentation Program

There are no updates to report.

Orange County Water Reliability Study

(Nothing New to Report) CDM-Smith and MWDOC staff are in the process of completing follow-up work to the 2016 study. The work includes modeling of more recently available information, updating Colorado River assumptions, assessment of additional scenarios for the Huntington Beach Desalination Plant, and assessment of the value of new storage. MWDOC staff met with CDM Smith on July 10, 2017 to discuss technical details of the climate modeling work. The update is expected to be completed in the next few months.

ISSUE BRIEF # G

SUBJECT: East Orange County Feeder No. 2

RECENT ACTIVITY

Use of East Orange County Feeder No. 2 for Conveyance of Groundwater and Poseidon Water

Karl Seckel has been asked to provide information at the August 30 meeting of the South Coast Water District Citizens Reliability Meeting on the potential to expand the Emergency Services Contract for groundwater to be delivered to South Orange County during outages of the MET system. MWDOC has continued to work with IRWD on their ability to extend the existing Emergency Services Contract beyond 2030 and to increase the amount of the contract. It appears from IRWD than an extension is possible but that the amount of emergency capacity may have to be augmented by way of a pump-in to the East Orange County Feeder No. 2. MWDOC is also working on what is required to utilize the East Orange County Feeder No. 2 for such a project.

ISSUE BRIEF # H

SUBJECT: South Orange County Projects

RECENT ACTIVITY

UPDATED - Doheny Desal Project

South Coast WD is continuing to move the project forward, as follows:

STATUS INFORMATION BY TASK ORDER

Task Order # 1 – Program Management

- DWR Water Desalination Grant Application is due September 1, 2017.
- Work continues on the MWD LRP Application.

Task Order # 5A – Public Outreach Phase 2

- The SCWD Water Reliability Public Working Group held a second meeting on August 2nd.

Task Order # 7 – Project Delivery Analysis Project Delivery Workshop 5

- To Be Determined.

Task Order # 8B– Environmental Impact Report

- -Sept 2017: 2nd NOP Scoping Meeting to discuss latest offshore geophysics and slant well implications
- November 13, 2017: Draft EIR Released for Public Comments
- April 30, 2018: SCWD Board of Directors Final EIR Certification
- June 4, 2018: End of NOD 30-day Period

Task Orders # 10 & 12– Geophysical Survey & Hydrology Reports

- Final Offshore Geophysical and Hydrology Reports are currently being reviewed by SCWD

Task Order # 13 – Value for Money Analysis (VfM)

- Final Value for Money (VfM) Report was submitted to SCWD August 15, 2017.

Task Order # 14 – Updated Slant Well Modeling

- Draft Report – September 27, 2017.
- Final Report – October 11, 2017.

Task Order # 15 – Alternative Power Supply Analysis

- Final Alternative Power Supply Analysis by August 31, 2017

Laguna Beach County Water District Groundwater Project with Newport Beach

MWDOC, MET, Laguna Beach County Water District and Newport Beach have been working to activate Laguna Beach County's access to 2,025 AF of groundwater from within the Orange County Water District Basin in a manner that does not cause water quality problems in the last reach of the Orange County Feeder. Groundwater deliveries by Newport Beach to LBCWD began in September 2016. MWDOC staff met individually with LBCWD and Newport Beach in August to discuss possible future facility and operational modifications to the MET system as LBCWD now sources some of its supplies from the basin. MWDOC is entering into a contract with Tetra Tech to evaluate several options.

San Juan Watershed Project

Santa Margarita WD continues working on the San Juan Watershed Project. Phase 1, which is being designed to capture wet and dry weather runoff, with subsequent phases looking to introduce recycled water into San Juan Creek for Indirect Potable Reuse. The relatively recent discovery of a geological rock formation (ancient landslide) near Stonehill Drive appears to be a partial barrier to sub-surface flow. This impacts the proposed location of the rubber dams and the ability for Phase I to capture and percolate water into the basin resulting in the estimated water capture for Phase I being reduced from 1,700 AFY to 700 AFY. The budget for Phase I has therefore increased to $20 million (approximately $1,400 to $1,600 per AF). The Draft Environmental Impact Report (DEIR) is now scheduled for public review in August 2017. A new video is available at: http://sanjuanwatershed.com/project-overview-video/

Camp Pendleton Seawater Desalination Project

San Diego County Water Authority (SDCWA) is studying the feasibility of a desalination project at the southwest corner of Camp Pendleton Marine Corps Base adjacent to the Santa Margarita River. The project is still in the feasibility study stage and SDCWA is conducting geological surveys, analyzing intake options, and studying the effect on ocean life and routes to bring desalinated water to SDCWA's delivery system. Michael Baker International has been retained to conduct the intake study and they are looking to lease the Doheny Mobile Test Facility from MWDOC and the Doheny Desal Participants. The intake study schedule for the testing phase has been pushed out to October 2018.

Other Information on South County Projects:

SMWD Trampas Canyon Recycled Water Reservoir

(Nothing New to Report). The Trampas Dam and Reservoir Construction Project was advertised for bids on June 19, 2017. Bids are due in August and a recommendation for project award is scheduled for the September 2017 SMWD Board meeting. Permits from Regional Board, Army Corps of Engineers, and Department of Fish and Wildlife for the project are complete.

Expansion of the Irvine Interconnection Project to South Orange County

(Nothing New to Report) An agreement completed in 2006 resulted in an investment by South Orange County (SOC) agencies in the Irvine Ranch Water District (IRWD) system to allow exchanges of water to be delivered by IRWD into SOC under emergency situations.

Project capacity was committed by IRWD to move up to 30 cfs of emergency supplies whereas the agreement allows moving up to 50 cfs, not to exceed 3,000 AF per emergency event. In accordance with the Agreement with IRWD, the emergency capacity committed to the SOC agencies declines over time and goes to zero by 2030. IRWD is examining their ability to increase the exchange and conveyance of water under this arrangement or extend the end date of the agreement and the capacity thereunder. MWDOC is working on other options to move groundwater via the EOCF#2 to SOC during emergency events.

If any agencies would like to have updates included herein on any projects within your service area, please email the updates to Karl Seckel at kseckel@mwdoc.com

Summary Report for
The Metropolitan Water District of Southern California
Board Meeting
August 15, 2017

COMMITTEE ASSIGNMENTS

None. **(Agenda Item 5D)**

FINANCE AND INSURANCE COMMITTEE

Adopted the Resolution Levying Ad Valorem Property Taxes for the Fiscal Year Commencing July 1, 2017 and ending June 30, 2018 for the Purposes of The Metropolitan Water District of Southern California maintaining the tax rate at .0035% of assessed valuation (exclusive of annexation levies), the same rate levied in FY 2015/16; and directed staff to transmit that resolution to the county auditors for the levy and collection of the ad valorem property tax. **(Agenda Item 8-1)**

ENGINEERING AND OPERATIONS COMMITTEE

Appropriated $3.3 million; awarded $1,296,091 contract to PCL Construction, Inc. to replace an expansion joint on the Upper Feeder at the Santa Ana River Bridge; and authorized agreement with Rincon Consultants, Inc., in an amount not to exceed $400,000, for environmental support. (Appropriation No. 15441) **(Agenda Item 8-2)**

Appropriated $4.9 million; authorized final design of the initial stage of building-related improvements for Metropolitan's Headquarters Building; and authorized increase of $2.3 million to an agreement with ABSG Consulting, Inc., for a new not-to-exceed total of $7.6 million, for design of the improvements. (Appropriation No. 15473) **(Agenda Item 8-3)**

Appropriated $5.6 million; awarded $3,097,927 contract to Stronghold Engineering, Inc. for electrical upgrades at the Mills plant; and authorized increase of $374,000 to an agreement with Lee & Ro, Inc., for a new not-to-exceed total of $1,097,000, for technical support. (Appropriation No. 15452) **(Agenda Item 8-4)**

Appropriated $39.5 million; awarded $19,362,000 construction contract to Kiewit Infrastructure West Co. to line a portion of the Second Lower Feeder; awarded $2,375,513 procurement contract to Southwest Valve and Equipment, Inc., for plug valves; authorized agreements with: (1) Pure Technologies US, Inc., in an amount not to exceed $4.2 million, to perform electromagnetic pipeline inspections; (2) GeoPentech, Inc., in an amount not to exceed $1.09 million, for geotechnical support; (3) Helix Environmental Planning, Inc., in an amount not to exceed $1.95 million, for environmental support; (4) lease agreement with Hooman Enterprises, Inc., in amount not to exceed $2,197,000, for property to be used as a construction storage area; (5) lease agreement with Sares-Regis Group, in an amount not to exceed $690,000, for property to be used as a construction storage area. (Appropriations Nos. 15471 and 15497) **(Agenda Item 8-5)**

Authorized a five-year reimbursable agreement with California Department of Water Resources to provide services for State Water Project operations and maintenance activities for an amount not to exceed $25 million; enter into subcontracts greater than $250,000 to complete work under the agreement; and enter into subcontracts as needed, not to exceed $1.5 million annually under the agreement. (**Agenda Item 8-6)**

Authorized the General Manager to execute the Transmission Interconnection Agreement and the five Interconnected Facilities Agreements with Southern California Edison.
(Agenda Item 8-7)

COMMUNICATIONS AND LEGISLATION COMMITTEE

Adopted the Legislative Policy Principles on Stormwater Capture. **(Agenda Item 8-8)**

The Board voted on an amended, substitute motion to watch HR 23, to negotiate potential amendments to the bill with the author and other stakeholders, and deferred decision on the bill until next month's meeting. **(Agenda Item 8-9)**

Adopt CEQA determination and express opposition, unless amended, to SB 623 (Monning, D-Carmel): Water Quality: Safe and Affordable Drinking Water Fund.
(Agenda Item 8-10 WITHDRAWN)

The Board voted on a substitute motion to watch SB 49, to negotiate potential amendments to the bill with the author and other stakeholders, and deferred decision on the bill until next month's meeting. **(Agenda Item 8-11)**

CONSENT CALENDAR

In other action, the Board:

Appropriated $1.95 million; and awarded $767,201 contract to Environmental Construction, Inc. to install valves at the Lakeview Pipeline/Inland Feeder Intertie. (Appropriation No. 15488) **(Agenda Item 7-1)**

Awarded $280,238 contract to PK Construction for erosion control improvements at Garvey Reservoir. (Appropriation No. 15480) **(Agenda Item 7-2)**

Authorized the General Manager to grant a permanent easement to the Southern California Gas Company. **(Agenda Item 7-3)**

Authorized Metropolitan to allow the Southern California Edison Company and Blythe Energy, Inc. land use and access rights to their facilities on Metropolitan fee-owned property via license agreements. **(Agenda Item 7-4)**

Authorized amendment of the contract for consulting services with GeoPentech, Inc. for the *In Re Tronox Incorporated, et al.* matter to increase the maximum amount payable by $100,000 to a maximum amount of $300,000. **(Agenda Item 7-5)**

THIS INFORMATION SHOULD NOT BE CONSIDERED THE OFFICIAL MINUTES OF THE MEETING.

Board letters related to the items in this summary are generally posted in the Board Letter Archive approximately one week after the board meeting. In order to view them and their attachments, please copy and paste the following into your browser http://edmsidm.mwdh2o.com/idmweb/home.asp

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Metropolitan Board & Committee Meetings

Board Meeting Live Streaming

Current month agendas are published for each meeting 72 hours prior to the meeting. Board and Committee supporting/background materials are linked from each meeting agenda item.

Meeting agendas and their associated materials are removed from this Web page at the end of each meeting and are posted in our Archives within 72 hours of removal.

Upcoming Board & Committee Meetings

Streaming Video Help

Name	Date
Finance and Insurance Committee	September 11, 2017 - 09:30 AM
Water Planning and Stewardship Committee	September 11, 2017 - 10:30 AM
Engineering and Operations Committee	September 11, 2017 - 12:00 PM
Communications and Legislation Committee	September 11, 2017 - 01:00 PM
Legal and Claims Committee	September 12, 2017 - 09:00 AM
Conservation and Local Resources Committee	September 12, 2017 - 10:00 AM
Organization, Personnel and Technology Committee	September 12, 2017 - 11:00 AM
Board Meeting	September 12, 2017 - 12:00 PM