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Subgroup: Improve Operational Efficiency and Transfers

Chapter 4 Conveyance—Delta

Conveyance provides for the movement of water. Conveyance infrastructure includes natural watercourses as well as constructed facilities like canals and pipelines, including control structures such as weirs. Examples of natural watercourses include streams, rivers, and groundwater aquifers. Conveyance facilities range in size from small local end-user distribution systems to the large systems that deliver water to or drain areas as large as multiple hydrologic regions. Conveyance facilities also require associated infrastructure such as pumping plants and power supply, diversion structures, fish ladders, and fish screens.

Conveyance through the Delta, located at the confluence of the Sacramento and San Joaquin rivers, naturally carries water westward from the upstream water drainage basins to the bays connected to the Pacific Ocean. The Delta, however, is also a highly manipulated network of natural streams and sloughs as well as constructed channels bordered by levees to prevent flooding of adjacent islands (see Figure 4-1, Sacramento-San Joaquin River Delta). The Delta is a critical element of both regional (e.g., Folsom South Canal) and interregional (the federal Central Valley Project and State Water Project) water conveyance systems and is essential to sustaining the state's economy.

The demands upon the Delta conveyance system are many. They include provision of beneficial uses such as agricultural supply, industrial service supply, industrial process supply, navigation, recreation, sport fishing, habitat, migration of aquatic species, estuarine habitat, flood water conveyance, wetland habitat, and municipal and domestic water supply. The State Water Project (SWP) and Central Valley Project (CVP) rely on the Delta conveyance system to provide water at their diversion facilities in the south Delta for beneficial uses in the San Francisco Bay Area, Central Valley, and Southern California. Similarly, the Contra Costa Water District, East Bay Municipal Utility District, and others rely on the Delta as a source of supply or transportation corridor for their water supply facilities. Other in-Delta diverters include Contra Costa Water District, City of Stockton, and local farmers. In addition, the East Bay Municipal Utility District and San Francisco Public Utilities Commission rely on the Delta as their major conveyance corridor for transporting water from the rivers of the **Sierra Nevada** directly to their service areas. A more thorough discussion of regional conveyance issues is discussed in the resource management strategy Conveyance Regional/Local of this volume.

The water flowing through the Delta to meet user needs must also be carefully managed to meet water quality standards set by the California State Water Resources Control Board. Some of the major constituents of concern are salinity, organic carbon, nutrients, dissolved oxygen, temperature, and turbidity. Special attention must also be given to meeting the needs of State and federally listed species of concern within the Delta. Water project operators manage inflows, exports, and in-Delta structures to control water as it moves into and through the Delta to meet the varying and growing demands.

All activities affecting or related to meeting the many demands on the Delta conveyance system will require thoughtful consideration of the Delta ecosystem health and how these actions will impact species of concern. Continuing declines in some native species populations, migrating through or living in the Delta, will increase the influence of the Delta ecosystem on exported water supply reliability, especially to the CVP and SWP. This influence has been highlighted with the ongoing investigations concerning the decline of pelagic Delta fish populations and associated federal court rulings. The recommendations of the pelagic organism investigations to

reverse the population trend and the federal court decisions to protect salmon runs and dwindling populations of delta smelt negatively impact major water supply exports. Any future activity proposed for Delta conveyance will need to consider the restoration and preservation of native habitat to benefit pelagic organisms and other native species.

The use of the Delta as a water supply conveyance requires that future planning achieve an optimal approach to operate and maintain natural channels and constructed conveyance infrastructure. This goal will require water managers, planners, engineers, and biologists to continue efforts to increase identification and understanding of the relationships between hydrodynamics, flow timing, fish timing and movement, water temperature, geomorphology, water quality, environmental responses, global climate change, and other conveyance-related considerations. They must also operate the conveyance facilities consistent with the Public Trust Doctrine while complying with various laws, regulatory processes, and statutes such as the Water Code's Area of Origin statutes, riparian and appropriative water rights, the California Environmental Quality Act, the National Environmental Protection Act, the Clean Water Act, and the State and federal Endangered Species Acts. Any proposed construction or operation of new facilities will be constrained by the same legal and regulatory framework.

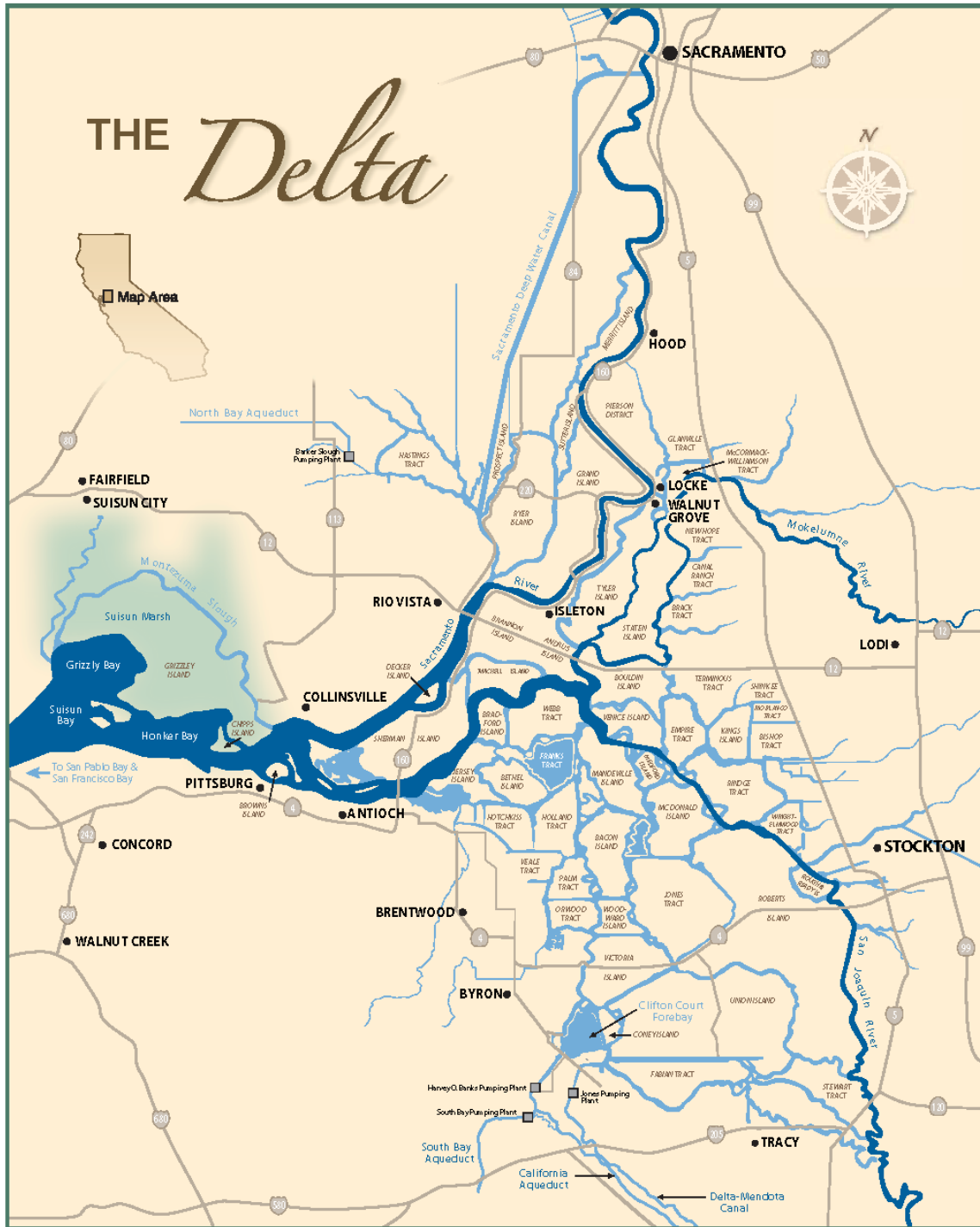


Figure 4-1 Sacramento-San Joaquin River Delta

Potential Benefits of Delta Conveyance

Generally, regional and interregional conveyance facilities provide a variety of benefits, including flood management, consumptive and non-consumptive environmental uses, water quality improvement, recreation, operational flexibility, and urban and agricultural water management.

The main benefits of Delta conveyance are in maintaining or increasing water supply reliability, protecting water quality, and providing water system operational flexibility. For the environmental sector, benefits include in-stream flows, appropriate water temperatures, and water quality for aquatic and riparian habitat. It is important to recognize that, in some cases, improving water supply reliability through operational flexibility or improving water quality is just as valuable as increasing overall supply.

Other specific benefits include:

- Optimal water supply conveyance through the Delta enables the success of the other resource management strategies.
- Water transfers are facilitated between sellers and buyers. In order for water to be developed by new groundwater or offstream surface storage, diversion facilities must be capable of filling available storage. Also, facilities must then be in place to convey the storage releases to the users at the right times and flow rates.
- Conveyance can improve water quality by moving more water when water quality conditions are better or less impacted by the movement of water, or by supplementing natural river flows and preventing excessive saltwater intrusion that can impair established beneficial uses and harm legal users of water in the Delta.
- Given the high-intensity, short duration characteristics of California's hydrology, improved conveyance capacities combined with adequate surface water or groundwater storage can enable diversions of more water during high flow, less competitive periods, and consequently reduce the pressure to divert water during low flow, highly competitive periods. This strategy could have additional benefits as an adaptation to future climate change.
- Conveyance improvements can provide the operational flexibility to divert and move water at times and from places that are less harmful to fisheries or to reliably transport environmental water supplies to locations where or at times when it can benefit fish and water quality.
- Water quality in the Delta may be enhanced through sophisticated management projects controlling source water mixing and reducing salinity intrusion from seawater, for example with the Franks Tract Project.

Other benefits of conveyance improvements, which can vary by specific location and hydrology, generally include:

- Enlarged and enhanced conveyance systems may increase flood control capability with higher and more controlled flow through the Delta.
- Increases in water use efficiency decrease the water demand for a given region and reduce demand for conveyance through the Delta. As a result, system-wide reliability improves by reducing the burden on the Delta.
- Redundancy in the Delta conveyance system will provide increases in resiliency and may, therefore, ensure some continuation of services during extreme events such as a long-term drought or following a catastrophic seismic event in the Delta.
- A larger conveyance will allow more pumping of water at optimal times, when energy costs are lower, and decrease pumping at peak energy demand periods, when energy costs are higher. Energy costs for pumping at night, for example, are less than costs during daytime when California's energy demand peaks for industrial and air conditioning uses. Project analyses will need to consider that some benefits may be offset by costs to enhance or increase conveyance capacity.

- Conveyance improvements may allow for better matching of water quality for different beneficial uses. For example, conveyance of fresher river water at times of abundant supplies for municipal, industrial and agricultural purposes could allow for greater salinity fluctuation at times of reduced supplies for ecosystem benefits in some parts of the Delta.
- Streams and channels enlarged for conveyance and flood passage may incorporate riparian habitat improvements that are designed for varying hydrology (including climate change) and operations.

Potential Costs of Conveyance

Potential costs for conveyance can include both facility construction and operating maintenance costs that can be a significant portion of the costs in a water management system. These costs depend on the local circumstances, how far and when the water needs to be conveyed, and topography (for example, pumping vs. gravity flow). Direct project costs also may include financing the capital investment. Other costs incurred by a project may include external costs, such as environmental stresses caused by construction and increased operation and maintenance costs of the project. However, the benefits of Delta conveyance improvements that improve environmental management, water supply reliability, and operational flexibility may outweigh project costs.

DWR prepared “An Initial Assessment of Dual Delta Water Conveyance” for the Delta Vision Blue Ribbon Task Force. This report identified a range of costs for through-Delta improvements from \$1.2 billion to \$8.6 billion. The estimated costs for an isolated facility with a capacity up to 15,000 cubic feet per second (cfs) ranged from \$4.2 billion to \$7.4 billion for an eastern or western alignment, respectively. The eastern alignment cost includes a canal, intake, fish screen, pumping plant, control structure, siphons, bridges, culverts, utility relocation, railway impacts, forebay, land, some mitigation, no operation and maintenance, and no planning. The western alignment cost includes a canal, pipeline, pumping plant, pipeline, tunnel, forebay, no mitigation, no operation and maintenance, and no planning. A combination of an isolated facility with through-Delta improvements ranged from \$5.4 billion to \$17.2 billion depending on alignment and degree of levee improvements selected for the through-Delta. The more expensive through-Delta improvement alternative would include levee earthwork, setback levees, channel dredging as well as intake, siphon, and operable gate components.

Major Issues and Considerations Facing Conveyance

Managing California's water conveyance necessitates persistent efforts to address chronic issues, such as maintenance of an aging infrastructure, while simultaneously addressing new issues, such as decreased Delta smelt population. Current Bay-Delta planning efforts to address Delta Conveyance issues such as Delta Vision, the CALFED Science Program, and the Bay-Delta Conservation Plan include plans to meet the needs of water supply for consumptive use as well as the needs of the Delta ecosystems. Additional efforts to protect the Delta conveyance system also involve emergency planning for flood events, levee maintenance to increase levee integrity, and climate change impact assessment to better predict future conveyance infrastructure needs.

Maintaining optimal water quality within the Delta for both drinking water and for native species habitat will be a challenge. Control of water quality in a tidal estuary with fluctuating hydrology from season to season and year to year will require well understood and fully inclusive strategies.

Maintenance

It is essential, at a minimum, to maintain the current level of conveyance capacity for both natural channels and constructed facilities. Substantial reinvestment will be required just to maintain the current level of benefits due to aging infrastructure as well as diminishing conveyance capacity in natural watercourses. This is critical from both a water supply and flood passage standpoint for channels in the Delta. Diminishing conveyance capacity is also a problem for flood management facilities such as bypasses that over time fill with silt, debris and plant growth that reduce the effectiveness for passing flood waters. In addition, rivers and streams depend upon a watershed that is in good condition. This is likely to take on very significant importance over time due to the increasingly higher costs of maintenance and the increasing demands of a growing population.

Science and Planning

Various programs have been studying Delta issues and expect to develop plans to improve the operation of the state's conveyance systems with a balanced approach to meet the needs of its people and the environment. These studies in the Delta are particularly challenging because of potentially competitive demands on conveyance, such as needs for flood control improvements, for water quality improvements, for adequate water supply, and for Delta fisheries and habitat provisions.

The purpose of the Bay-Delta Conservation Plan (BDCP) is to create a stable regulatory framework to conserve and recover at-risk native species and natural communities in the Delta and provide water supply reliability. A joint Habitat Conservation Plan/Natural Community Conservation Plan is being developed through a collaborative process with water users, State and federal agencies, and non-governmental organizations. The BDCP will examine how to improve the design and operation of the State and federal water projects over both the short term and the long term and implement a major program for restoring and managing habitats within the Delta.

The CALFED Surface Storage Program is studying increases in upstream-of-Delta reservoir storage to increase management and statewide system flexibility. This system flexibility is expected to contribute to increased survival of anadromous fish and improve Delta water quality, ecosystem restoration, and water supply reliability. To ensure the increased water to be stored in these or other proposed storage projects can be delivered to meet these needs, a reliable conveyance system will be needed.

The projects within the CALFED Conveyance Program are based upon a through-Delta conveyance approach and include the evaluation of a through-Delta facility, Delta Cross Channel

Reoperation, Franks Tract Project, permanent operable gates in the South Delta, south of Delta SWP/CVP aqueduct intertie, and CCWD Alternative Intake Project.

Characterization of dredged sediment contamination is being evaluated by the US Army Corps of Engineer's Long-term Management Strategy as part of ongoing Delta channel and levee maintenance work. DWR's Delta Risk Management Strategy (DRMS) will evaluate and recommend levee standards for the Delta to increase through-Delta water supply reliability. A more thorough discussion of the DRMS is presented in Volume 1 Chapter 4.

Area of Origin Interest

Interregional movement of water is sometimes opposed by the water users or agencies located in the watershed where the water supply originates. In addition to struggling to augment local water supplies to meet growing demands, area of origin interests often feel that downstream water users could or should be more committed to assisting in managing the environment, such as the watersheds from which their imported water supply originates. Delta conveyance planning considerations will need to ensure water supplies in the areas of origin are protected consistent with applicable legal and regulatory requirements.

Climate Change

Addressing climate change will be a challenge as precipitation patterns may change as well as future water needs. Predicted effects of climate change include warmer air temperatures, diminishing snowpack, increased evaporation, and seasonal changes in water availability. Warmer temperatures will reduce dissolved oxygen levels, hindering the health of sensitive species such as salmon. This will also adversely promote algal blooms and microbial growth, negatively affecting drinking water quality. Less precipitation is estimated to fall in the colder winter season reducing contributions to the snowpack, and more precipitation is estimated to fall later into a warmer spring season resulting in increased frequency and intensity of rainfall. This climate change scenario may require larger conveyance capacity and reservoir storage to successfully manage water for flood prevention and long-term water use. Further demands upon conveyance operations would also arise from a prediction of a wider range of extremes of water year types.

Studies indicate wetter years will be wetter and drier years will be drier than those in recent record. In the Delta, a combination of higher outflow in wet years with projected sea level rise would increase the burden on levees. In drier years a sea level rise would increase salinity intrusion into the Delta and thus impact in-Delta water quality and water supply reliability.

Water Supply Reliability

Over the past several decades, increasing demand for the Delta's resources have increased the conflict between the needs of water users and efforts to sustain the estuary's aquatic ecosystem and support recovery of State and federally listed fish. These conflicts have led to a crisis regarding the ability to protect Delta fisheries, maintain water quality, and meet the needs of both in-Delta and export area agricultural and municipal water users. This situation has resulted in the need to address these competing beneficial uses and sustainability concerns.

Delta export reliability hinges on first satisfying water quality requirements for native Delta fish and the criteria for in-Delta flow and water quality standards. The in-Delta water quality conditions will fluctuate with seawater intrusion, the quality and quantity of river and small

stream inflows, in-Delta water management operations, and export pumping operations. Required inflows to the in-Delta ecosystem will also depend on the health of indigenous species and invasive species management actions.

Existing Delta conveyance does not provide long-term reliability to meet current and projected needs. Conveyance through the Delta in times of drought is especially challenging considering the various demands from agriculture, municipalities, and environmental needs. To improve through-Delta conveyance water supply reliability and provide greater operational flexibility, improvements to existing facilities in the form of updating aging infrastructure, upgrading existing capacities, adding redundancy to the system and constructing additional facilities may be needed.

The major issues pertaining to reliability of water supply transferred through the Delta include the following items.

- The health of the Delta ecosystem is paramount in consideration of water-related activities within the Delta. Continuing declines in some native species populations migrating through or living in the Delta, such as salmon and delta smelt, highlight the increasing influence of the Delta ecosystem on water supply reliability. Any activity proposed for Delta conveyance will need to consider the restoration and preservation of native habitat to benefit pelagic organisms and other native species.
- The integrity of more than 385 miles of Project levees and over 730 miles of non-Project levees throughout the Delta is continually undermined by such elements as storm events creating floods and seawater surges, island subsidence, natural levee erosion, poor quality peat soils used to build the original levees, seismic activity, burrowing animals, and sea level rise. These vulnerabilities call into question the long-term sustainability of using the Delta as a conveyance corridor. DWR's Delta Risk Management Strategy Phase II report will recommend levee standards for the Delta to increase through-Delta water supply reliability and reduce risks to water conveyance and other values in the Delta overall. In addition, DWR has developed an emergency response plan that has put in place tools to protect the Delta.
- Maintaining optimal water quality within the Delta for both drinking water and for native species habitat will be a challenge. Some of the major concerns are salinity, organic carbon, nutrients, dissolved oxygen, temperature, and turbidity. Control of water quality in a tidal estuary with seasonal and yearly fluctuating hydrology will require well understood and fully inclusive strategies. As water quality requirements can vary and at times conflict among users, the challenge will be to agree upon the implementation strategy.
- Maintenance of in-Delta projects for beneficial uses such as recreational boating and swimming, sport fishing, shipping, agriculture, industrial, and drinking water supply will be an ongoing management challenge as political and fiscal climates evolve and resources for competing priorities become scarcer.
- Implementation of major conveyance facilities and improvements within the Delta will be financially costly. The federal, State, and local water agencies will need to combine their efforts to agree on project goals, plans, benefit/cost analysis, as well as financing mechanisms such as bonds and user fees.

Box 4-1 Flexible Operations Enhances Water Supply Reliability

Conveyance improvements can enhance water supply reliability by increasing operational flexibility without augmenting supplies. As more constraints have been put upon conveyance system operators, opportunities for moving water across the Delta and the reliability of those supplies is reduced. Increasing conveyance capacity would allow for greater exports when water is available to compensate for larger reductions in exports during fish-sensitive periods, thus maintaining overall exported water supply. Adding a pumping facility at a location that could be used when existing facilities have an unacceptable effect on Delta fish can be used to maintain overall water supply while simultaneously providing protection during fish sensitive periods.

Recommendations to Improve and Protect Delta Conveyance

The following recommendations apply to federal, State, and local water agencies:

- 1) DWR should use the Improvement Strategies from Phase II of the Delta Risk Management Strategy to guide their actions to improve the aging Delta infrastructure to reduce risks and consequences of levee failures.
- 2) DWR should use the recommendations from the Delta Vision Task Force and Bay-Delta Conservation Plan to guide their actions to increase operational flexibility and conveyance reliability through the Delta to benefit water supply as well as aquatic ecosystems.
- 3) DWR should take the lead to reduce energy needs through improved operational efficiency. Power consumption can be reduced through facilities maintenance and upgrades such as upgrades to export pumps. Water treatment plant power consumption and chemical usage could also be reduced by improving Delta water quality with structures such as operational barriers reducing seawater intrusion.
- 4) Establish performance metrics relating quantitative measurements (such as the quantity of deliveries for agricultural and urban users or miles of rehabilitated conveyance facilities) to qualitative indicators (such as resiliency of conveyance to earthquakes or fewer regulatory conflicts).
- 5) Ensure adequate resources to maintain the existing capacity and condition of natural channels and constructed conveyance facilities. This may include development of a strategy to maintain channel capacity in the Delta and existing floodways as well as financial support for regional, interregional, and Delta conveyance improvements.
- 6) Provide requested resources to support Delta Vision Blue Ribbon Task Force recommendations and address flagged issues.

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