Subject:	**South Delta Conveyance Facilities System Configuration (Final Draft)**
Project feature:	South Delta Conveyance Facilities
Prepared for:	California Department of Water Resources (DWR) / Delta Conveyance Office (DCO)
Prepared by:	Delta Conveyance Design and Construction Authority (DCA)
Copies to:	File
Date/Version:	December 23, 2021 / Version 2
Reference no.:	EDM_SC_CE_TMO_SDCF-System-Config_000963_V02_FD_20211223

1. Purpose

The purpose of the technical memorandum (TM) is to summarize the facility configuration, including basic siting considerations and functional characteristics, for features included in the South Delta Conveyance Facilities (SDCF). The SDCF would convey flow from the Southern Forebay to the California Aqueduct, upstream of the State Water Project's (SWP's) Harvey O. Banks Pumping Plant (Banks Pumping Plant). Provisions have also been made for a possible extension of this system that would convey flow to the Central Valley Project's (CVP's) Delta-Mendota Canal upstream of the C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant). Detailed operations and equipment information would be developed during final design.

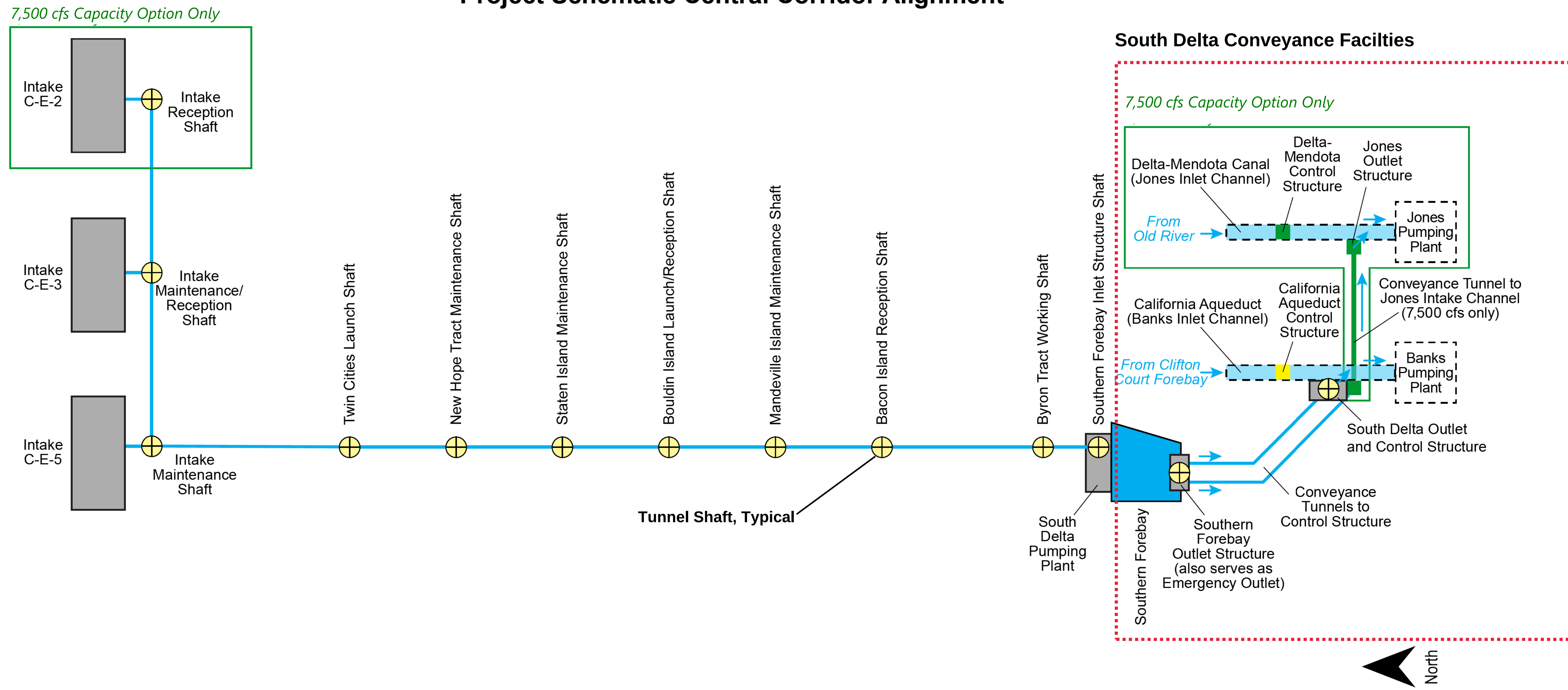
1.1 Background

The overall Delta Conveyance System would receive water from the Sacramento River and deliver it downstream of Banks Pumping Plant, with provisions to potentially supply Jones Pumping Plant. The project would include up to three Sacramento River intakes, a main tunnel connecting the river intakes to a new pumping plant located at a new Southern Forebay, and the SDCF that would deliver water from the Southern Forebay to the channels upstream of the two existing pumping plants. Figure 1 is a flow schematic of the entire Delta Conveyance System. The portion identified as the SDCF is identified on Figure 2.

The Delta Conveyance System's maximum design diversion capacity from the Sacramento River to the Southern Forebay has not been selected. However, a range of conveyance capacities from 3,000 to 7,500 cubic feet per second (cfs) has been established by the DCO. The DCA has performed a systemwide hydraulic and capacity analysis for design flow capacities of this capacity range, which is described in the Systemwide Hydraulic and Capacity Analysis for Tunnel Diameter Selection TM (Final Draft, DCA, 2021c).

As described in the Southern Forebay Siting Analysis (Final Draft, DCA, 2021b) and the South Delta Conveyance Facilities Hydraulic Analysis Criteria and Analyses (Final Draft, DCA, 2021d), the Southern Forebay was sized to store Banks Pumping Plant's maximum daily pumping volume. Although sized to a maximum flow capacity of 10,670 cfs, Banks Pumping Plant typically operates at 9,000 cfs, resulting in a maximum daily export pumping volume of 9,000 acre-feet (AF), which is equal to the size of the proposed Southern Forebay.

Project Schematic Central Corridor Alignment



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DCA DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

ENGINEERING PROJECT REPORT
DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

PROJECT SCHEMATIC

PROJECT NO. W8X97000

Figure 1

The SDCF design conveyance capacity would be somewhat independent of the overall Delta Conveyance System capacity. The SDCF conveyance capacity would be equal to the Banks Pumping Plant capacity of 10,670 cfs, for overall Delta Conveyance System capacities up to 6,000 cfs. If the CVP extension is included, the SDCF capacity that serves both the SWP and CVP facilities would increase by 1,500 cfs to 12,170 cfs. SWP and CVP flows would be split at the South Delta Outlet and Control Structure, with a capacity of 1,500 cfs used for facilities extending to the CVP and 10,670 cfs used for facilities that control flows into the California Aqueduct. The California Aqueduct and the Delta-Mendota Canal control structures' conveyance capacities would total 10,670 cfs and 4,600 cfs, respectively.

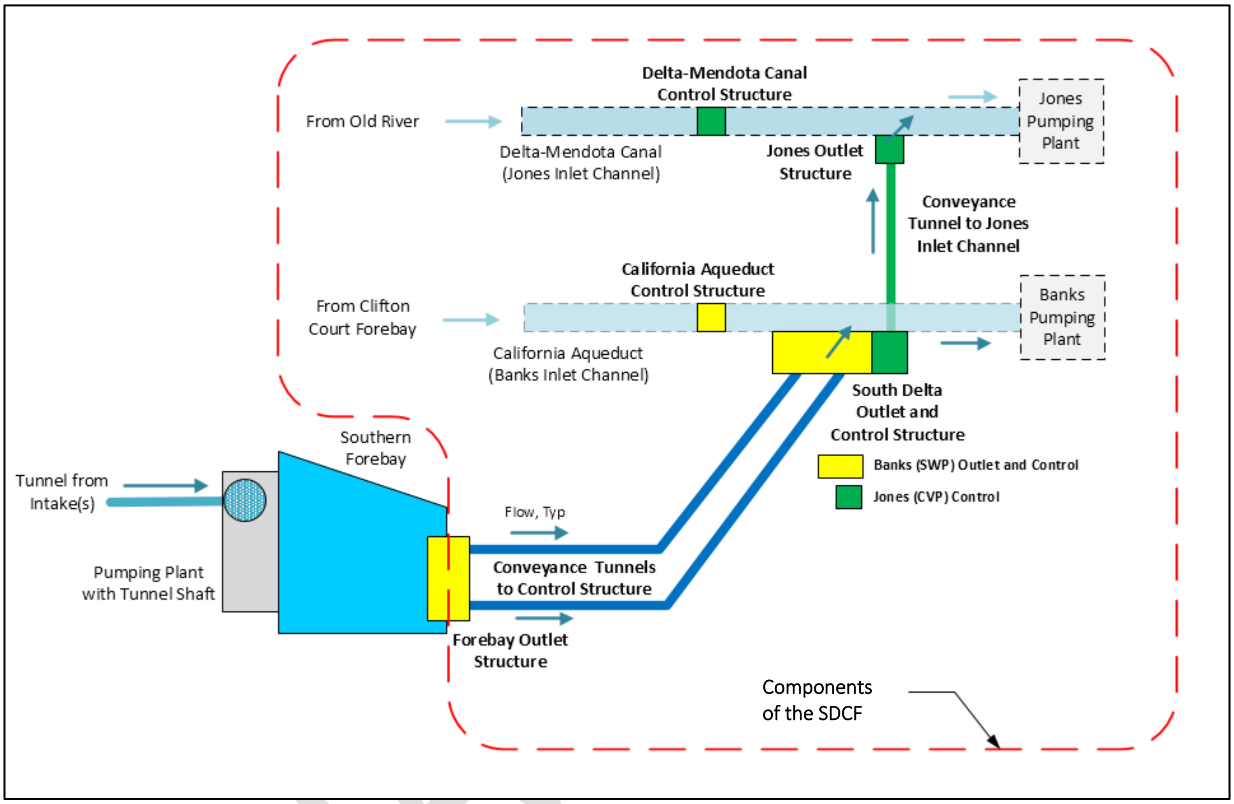

Figure 2. Southern System Schematic

1.2 Summary

The purpose of the Delta Conveyance System would be to convey water from the Southern Forebay to the California Aqueduct, just upstream of Banks Pumping Plant. The major facilites are:

- Southern Forebay Outlet
- Dual Conveyance Tunnels
- South Delta Outlet and Control Structure
- California Aqueduct Control Structure

Optional major facilities include:

- Jones Control Structure
- Jones Tunnel
- Jones Outlet Structure
- Delta-Mendota Canal Control Structure

The two facilites that would control the flow to Banks Pumping Plant are the South Delta Outlet and Control Structure, which would control flow from the Southern Forebay; and the California Aqueduct Control Structure, which would control flow from the existing Clifton Court Forebay (CCF). Flow would be able to come soley from one source or the other, or a combination of both.

Provisions made for conveying flow to Jones Pumping Plant by constructing a Jones Control Structure on the side of the South Delta Outlet and Control Structure would also be considered as options. Gates in this smaller structure would control flow that feeds a single tunnel and an outlet into the Jones Canal (aka Delte-Mendota Canal). A control structure would also be constructed in the Delta-Mendota Canal (DMC). These two structures would allow delivery solely from the Delta Conveyance System, the CVP Delta-Mendota Canal (via the Tracy Fish Handling Facility), or a combination of both.

All other structures discussed in this TM are considered flow-through structures with no day-to-day control function.

1.3 System Configuration

As shown on the Figure 2 system schmetatic, the Delta Conveyance System capacity would comprise the following components, generally listed in direction of flow.

SWP Facilities

- Southern Forebay Outlet
- Dual Conveyance Tunnels (Reach 5)
- South Delta Outlet and Control Structure
- California Aqueduct Control Structure

Optional Extension to CVP Facilities

- Jones Control Structure
- Jones Tunnel
- Jones Outlet Structure
- Delta-Mendota Canal Control Structure

Each of these facilites is further described in the following subsections.

1.3.1 Southern Forebay Outlet Structure

The Southern Forebay Outlet Structure would be located on the southern end of the Southern Forebay (Figure 3). The site was selected to minimize the length of the dual tunnels that would extend between this structure and the South Delta Outlet and Control Structure. It would also be located at the opposite end of the forebay from the inlet (proposed South Delta Pumping Plant), allowing water to flow through the forebay, which would help reduce stagnation. Figure 4 shows the general layout of the Southern Forebay Outlet Structure and its components.

The structure entrance has a large apron extending into the forebay. This apron slightly accelerates flow, protects against erosion at the entrance, and provides a hard surface to dredge to if needed in the future.

SOUTH DELTA CONVEYANCE

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DESIGNED: L. ALLIGER
DRAWN: T. PATTISON
CHECKED
APPROVAL RECOMMENDED
APPROVAL BY

DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

ENGINEERING PROJECT REPORT
DELTA CONVEYANCE PROJECT
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SOUTH DELTA CONVEYANCE FACILITIES
PROJECT OVERVIEW

PROJECT NO. W8X97000

Figure 3

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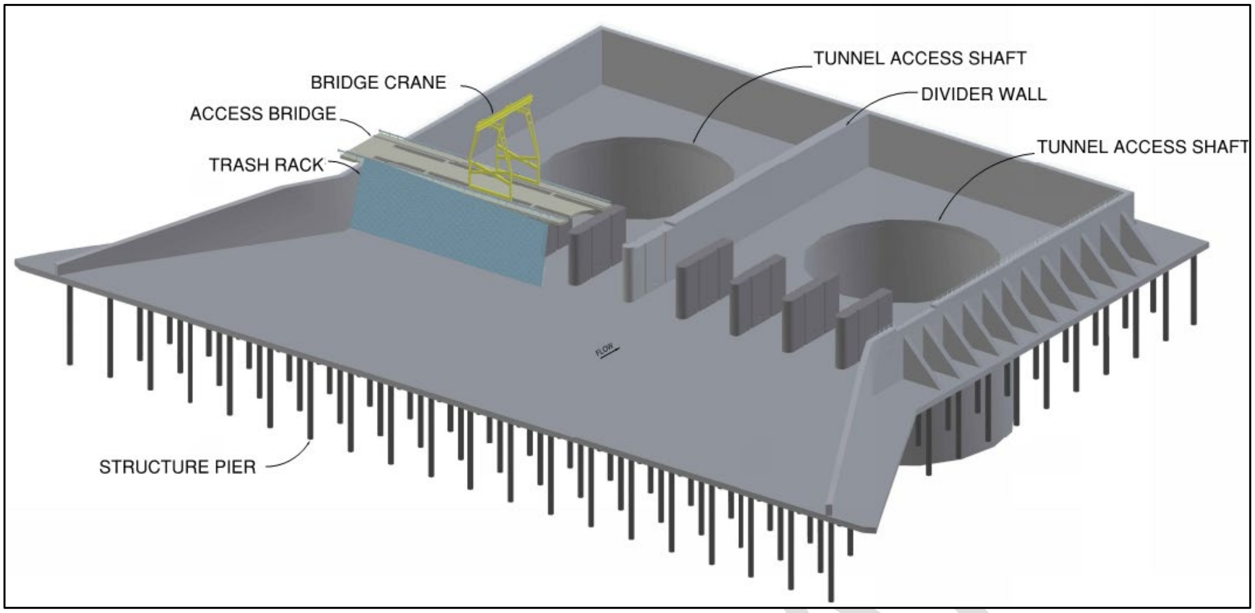

Figure 4. Southern Forebay Outlet Structure

The next downstream feature is a trash rack placed to catch debris prior to water entering the shafts and tunnels. Generally, water should be clean and debris-free flowing into the forebay. However, there is potential for aquatic weed growth in the forebay and for debris to get into the forebay from severe wind events. Such weeds and debris would need to be screened before flow enters the tunnel shafts. If desired, the structure footprint would be suitable to support an automatic rake system, though this is not currently shown.

Downstream of the screen would be piers placed perpendicular to the flow path. These piers serve as support for the access bridge and provide a location where large bulkead gates could be inserted to terminate flow into one or both of the tunnel shafts for isolation. Each pier has a dual set of slots to provide double isolation for the safety of personnel who could be working downstream. To allow a quicker response if isolation was needed, it was assumed that the gates would be left in place in one row across the entire structure and secured in the open position. A gantry crane would be provided to allow lifting and lowering of the gates when needed.

The structure would be divided into two chambers, each chamber serving one of the dual tunnels. This allows isolation and dewatering of one tunnel for maintenance and repair, while allowing uninterrupted flow through the other tunnel. Under normal conditions, this structure would be free-flowing with no day-to-day operational requirements except debris management.

1.3.2 Dual Conveyance Tunnels (Reach 5)

As shown on Figure 4, the Southern Forebay Outlet would have two drop shafts, each feeding one of the dual tunnels that extend to the California Aqueduct (Figure 3). The tunnels are considered Reach 5 of the Delta Conveyance Tunnel System. A tunneling configuration was selected over a canal delivery system for reasons described in South Delta Conveyance Facilities Canal and Tunnel Options Summary Comparison TM (Final Draft, DCA, 2021a).

The tunnel alignments would generally take the most direct route between the Southern Forebay Outlet Structure and the South Delta Outlet and Control Structure. There would be some deviation from a straight line along the route to comply with Western Area Power Administration and Pacific Gas and Electric Company (PG&E) requirements that the tunnels not traverse under powerline towers.

The tunnels would have no intermediate structures, and no day-to-day operator input is required. Dewatering would be accomplished by pumping the tunnels out on the downstream end and discharging the flow into the California Aqueduct.

1.3.3 South Delta Outlet and Control Structure

As shown on Figure 3, the dual tunnels would terminate at the South Delta Outlet and Control Structure. This structure would be located on the western bank of the California Aqueduct, between the John E. Skinner Fish Protective Facililty (Skinner Fish Facility) and the Banks Pumping Plant, just southwest of Byron Highway. To maintain the the flow to support fish screening, it would be necessary to introduce the Delta Conveyance System flow downstream of the Skinner Fish Facility. To limit the length of the tunnels, the South Delta Outlet and Control Facility would be placed as far north as practical along the California Aqueduct while allowing space to construct the California Aqueduct Control Structure and avoid conflicts with the Byron Highway Bridge and the PG&E power transmission easment that crosses the aqueduct just south of Byron Highway.

Figure 5 shows the South Delta Outlet and Control Structure's general configuration. The tunnel's termination shafts would extend vertically into a collection basin, where the flow transitions to an open channel system. The basin would have two separate tunnel transition compartments, each associated with one of the shafts. This configuration would allow isolation of one of the tunnels for dewatering and maintenance while maintaining the other tunnel in full operation.

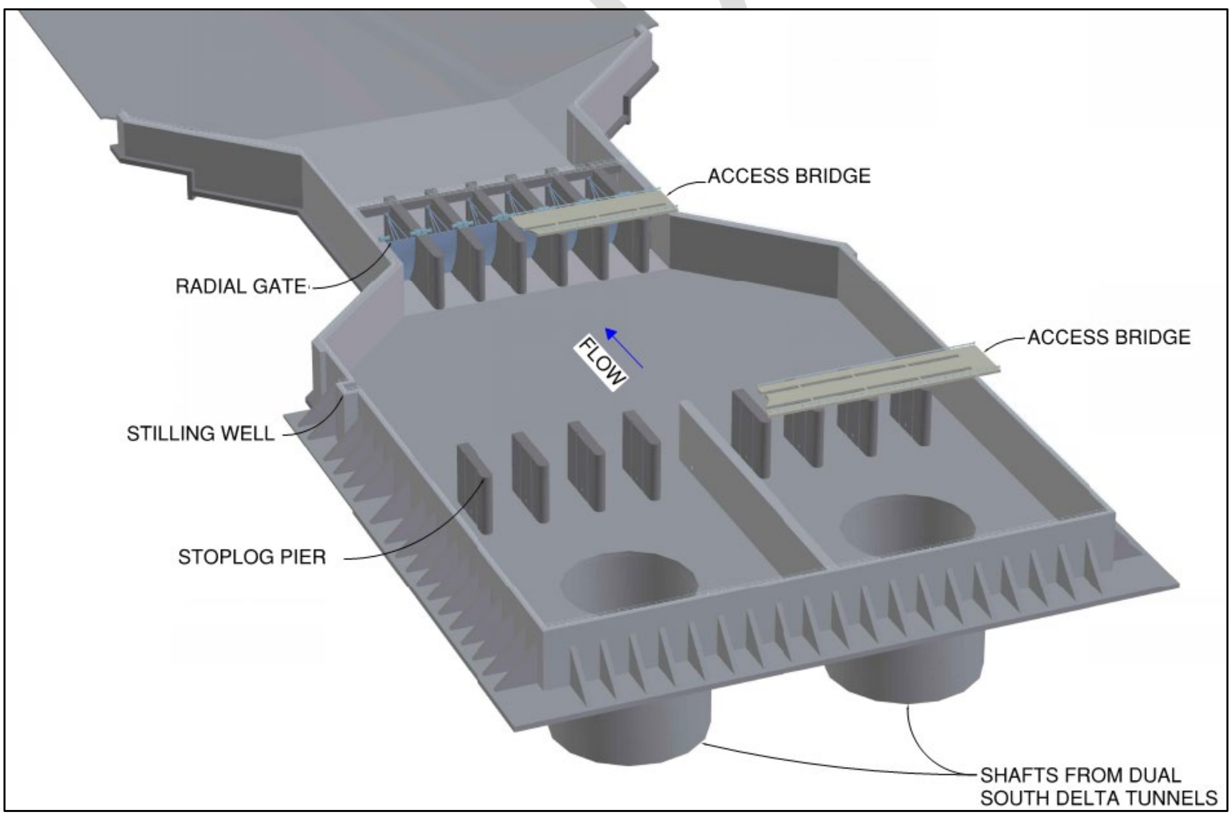

Figure 5. South Delta Outlet and Control Structure

A series of piers would be installed across the basin and oriented transverse to the flow. Each pier would have two vertical slots to accept two sets of bulkhead gates for isolation. The gates would provide double isolation for worker safety during maintenance activities in the tunnel. A bridge with slot openings for the gates would cross over the structure on top of the piers to provide access and facilitate bulkhead installation. Bulkheads would be stored on the site and installed with a mobile crane from the bridge deck.

Flow would proceed from the basin into a section of the facility containing radial gates. These gates would provide singular flow control for water withdrawn from the Southern Forebay and conveyed into the California Aqueduct. Vertical slots would be provided in the piers between the gates, both upstream and downstream. Bulkhead gates, inserted into these slots, would allow isolation and dewatering of each gate bay as needed for gate maintenance and repair. The height of the gates would be set to match the maximum water surface elevation in the Southern Forebay to allow complete isolation of the downstream system if needed. Six large gates, as shown on the engineering concept drawings, would be operated to deliver the bulk flow rates. One or more smaller gates would be provided to manage low flows and to trim flows through the structure to specific flowrates. The engineering concept drawings show a single smaller radial gate for this purpose. However, this function of this gate could also be accomplished using one or more sluice gates.

The specific number and size of the both the larger and smaller gates is subject to verification during final design. Such decisions will include additional detail regarding low flows and flow capacity requirements when one gate is out of service. In any case, it is not expected that final gate number and sizing would have more than a de minimis affect the footprint or the construction requirements for this facility.

Final gate size and quantity to be determined during final design.

Stilling wells would be provided both upstream and downstream of the gates to monitor water surface levels. These levels would be used with the gate rating curves to establish the required gate setting to maintain the desired flow. The gates would be controlled with electric hoist operators.

Because this is the critical control facility for delivering water from the Southern Forebay, a backup generator would be located onsite to allow operation during a power failure. This generator would also be used to provide backup power to the California Aqueduct Control Structure and the optional Jones Control Structure.

A short concrete-lined channel section would convey the flow from the gate section into the California Aqueduct. The structure and outlet channel have been rotated approximately 40 degrees from the California Aqueduct to facilitate a smoother transition of flow into the aqueduct.

Depending on gate opening, flow through the gates could be supercritical, which could result in erosive velocities entering the earthern-lined California Aqueduct. To control the energy from the gates, the invert of the structure would be set at an elevation suitable to cause a hydraulic jump within the concrete-lined section. This woud limit flow velocities entering the California Aqueduct to about 5 feet per second (fps) under maximum flow. Additionally, articulated concrete mats would be placed to reduce erosion in the unlined California Aqueduct in the area near the confluence with the new project, which is an area of possible turbulence. The need for additional energy dissipation would be further reviewed during final design and would not be expected to change the footprint of the facility.

1.3.4 California Aqueduct Control Structure

The California Aqueduct Control Structure would be located on the California Aqueduct, just upstream of the South Delta Outlet and Control Structure confluence. The purpose of this structure would be to control flows entering Banks Pumping Plant from the CCF via the Skinner Fish Facility. The California Aqueduct Control Structure and the South Delta Outlet and Control Structure would work in tandem to deliver water to the Banks Pumping Plant. By using different control logic for the control gates of both structures, flows could be taken from the proposed Delta Conveyance System, from the exisitng CCF system, or from a combination of both. Figure 6 shows the general relationship of these two facilities. Figure 7 shows the general configuration of California Aqueduct Control Facility.

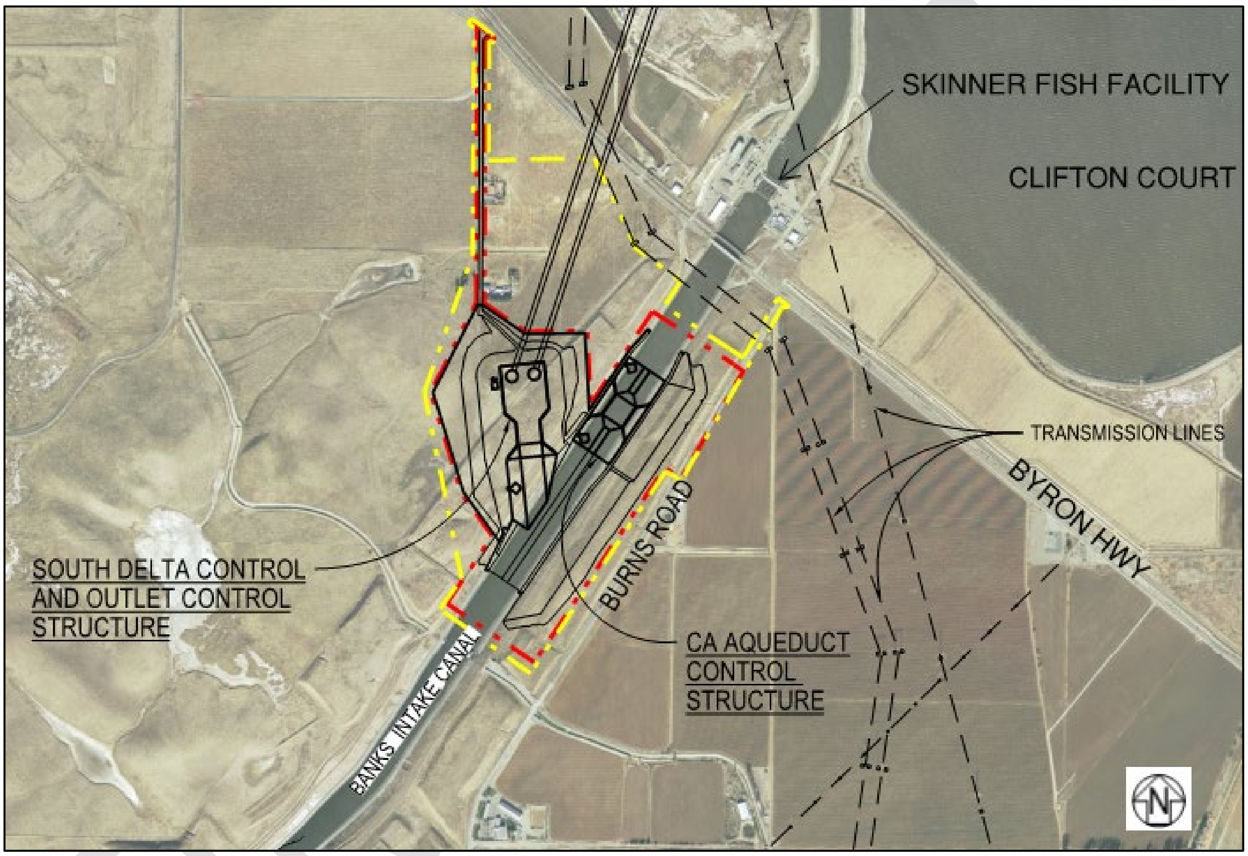

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Figure 6. Vicinity Plan for South Delta Outlet and Control Structure and California Aqueduct Control Structure

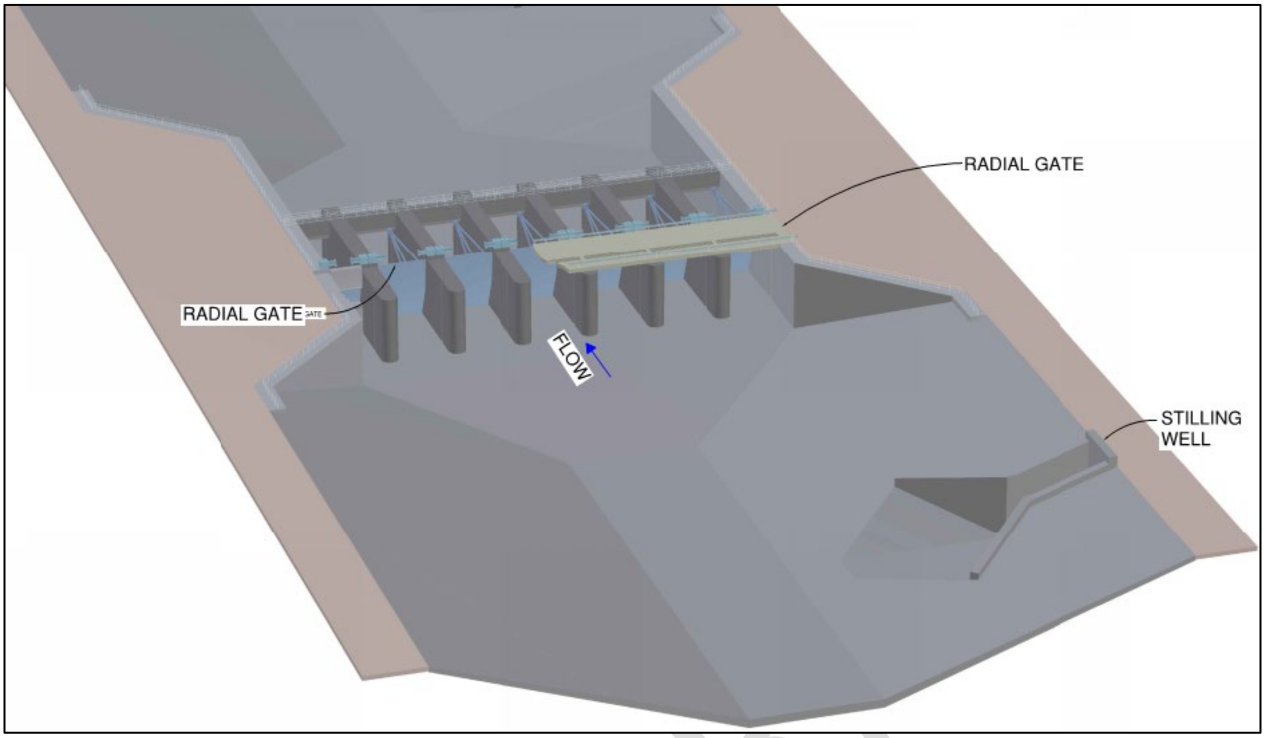

Figure 7. California Aqueduct Control Structure

The main component of the California Aqueduct Control Structure would be a set of six large radial gates that control flow from the CCF into the existing California Aqueduct. One or more smaller gates would be provided to manage low flows and to trim flows through the structure to specific flowrates. The engineering concept drawings show a single smaller radial gate for this purpose. However, this function of this gate could also be accomplished using one or more sluice gates.

The specific number and size of the both the larger and smaller gates is subject to verification during final design. Such decisions will include additional detail regarding low flows and flow capacity requirements when one gate is out of service. In any case, it is not expected that final gate number and sizing would have more than a de minimis affect the footprint or the construction requirements for this facility.

Final gate size and quantity to be determined during final design.

The gate elevations would be established to protect the California Aquduct downstream of the structure against the 200-year project flood event (plus estimated sea-level rise) in the vicinity of the CCF, plus 3 feet of freeboard. This results in a minimum protective control elevation of 23.8 feet (flood level of 20.8 feet plus freeboard). Given the confined nature of the site, wave runup is considered negligible at this structure. Due to the critical control nature of this facility, backup power would be provided by the generator at the nearby South Delta Outlet and Control Facility.

Vertical slots in the piers, upstream and dowstream of the gates, would be provided for isolation of individual gate bays. A bridge with slot openings would cross over the structure on top of the piers for access and bulkhead gate installation. Bulkheads would be stored on the site and installed with a mobile crane from the bridge deck.

Stilling wells would be located upstream and downstream of the gate structure for monitoring flow levels and setting gate openings. The entrance and exit of the structure would transition to the existing California

Aqueduct trapezoidal section to the vertical section through the gates. The transitions would be concrete-lined to prevent channel erosion. Articluated concrete mats would be placed downstream of the structure and through the confluence area with the South Delta Outlet and Control Structure to limit erosion in an area of possible turbulence.

This structure concludes the SDCF dedicated to serving the SWP. The additional components required for optional delivery to the CVP are described in the following sections.

1.3.5 Jones Control Structure

As shown on Figure 8, the Jones Control Structure would be appended to the side of the Southern Delta Outlet and Control Structure. There would be two large gates for controlling up to 1,500 cfs of flow into the CVP system. One or more smaller gates would be provided to manage low flows and to trim flows through the structure to specific flowrates. The engineering concept drawings show a single smaller radial gate for this purpose. However, this function of this gate could also be accomplished using one or more sluice gates.

The specific number and size of the both the larger and smaller gates is subject to verification during final design. Such decisions will include additional detail regarding low flows and flow capacity requirements when one gate is out of service. In any case, it is not expected that final gate number and sizing would have more than a de minimis affect the footprint or the construction requirements for this facility.

Final gate size and quantity to be determined during final design.

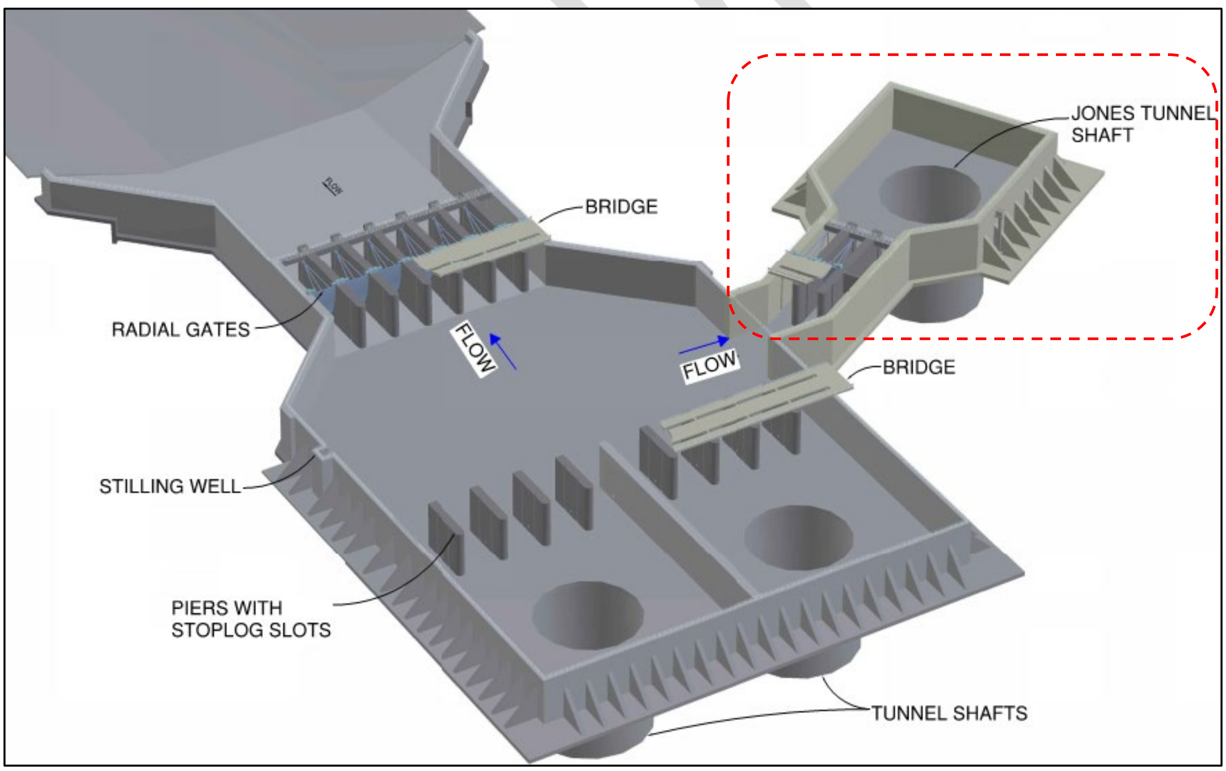

Figure 8. Jones Control Structure

Stilling wells would be provided to monitor the water level on each side of the gates and used with the gate rating curves to adjust gate opening for desired flow rates. Pipe stilling wells would be mounted directly to the vertical walls of the structures upstream and downstream of the gates. Due to the critical control nature of this facility, backup power would be provided by the generator at the nearby South Delta Outlet and Control Facility. The top elevation of these gates would also match the maximum water surface elevation in the Southern Forebay, including freeboard.

Pier supports would be provided on each side of the individual gates and have vertical slots to allow access and installation of bulkead gates. A double row of bulkhead gates would allow isolation and dewatering of individual gate bays for maintenance and repair. The installed bulkhead gates would also provide double isolation for worker safety when isolating and dewatering the Jones Tunnel for maintenance and repair. A bridge with slot openings would cross over the structure on top of the piers for access and bulkhead installation. Bulkhead gates would be stored on the site and installed with a mobile crane from the bridge deck.

1.3.6 Jones Tunnel

Figure 9 shows the Jones Tunnel alignment.The tunnel generally takes the most direct route to tie into the Delta-Mendota Canal southeast of the Jones Control Structure. The Jones Outlet Structure and Delta-Mendota Canal Control Structure are located as close as pratical to the Byron Highway crossing of the Delta-Mendota Canal. The alignment would extend centrally between two main powerline towers to comply with power company requirements.

SOUTH DELTA CONVEYANCE

REV	DATE	DESCRIPTION	SUB.	APPD

DESIGNED L. ALLIGER

DRAWN T. PATTISON

CHECKED

APPROVAL RECOMMENDED

APPROVAL BY

DCA
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

ENGINEERING PROJECT REPORT
DELTA CONVEYANCE PROJECT
SINGLE TUNNEL - CENTRAL CORRIDOR

SOUTH DELTA CONVEYANCE FACILITIES PROJECT OVERVIEW WITH JONES EXTENSION

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Figure 9

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1.3.7 Jones Outlet Structure

The downstream shaft from the Jones Tunnel would enter into the bottom of the Jones Outlet Structure, as shown on Figure 10. The main purpose of this facility would be to transition the flow from the tunnel to an open channel disharge into the Delta-Mendota Canal. The flare on the end of the outlet basin would spread the flow into a large cross-sectional area, which would reduce the flow velocity into the Delta-Mendota Canal. Articulated concrete mats would be placed to line the Delta-Mendota Canal in the confluence area to reduce potential erosion.

The structure would be a flow-through facility with no operational control and would have no electrical systems. Intermediate piers with two rows of vertical slots would be placed perpendular to the flow to allow installation of bulkhead gates, which would isolate the tunnel and allow dewatering for inspection, maintenance, or repair. The two rows of slots would allow installation of double bulkhead gates for safety of personnel working in the tunnel. The bulkhead gates would be stored onsite and installed with a mobile crane. A bridge deck with slots for the bulkhead gates extends across the piers for access and gate installation.

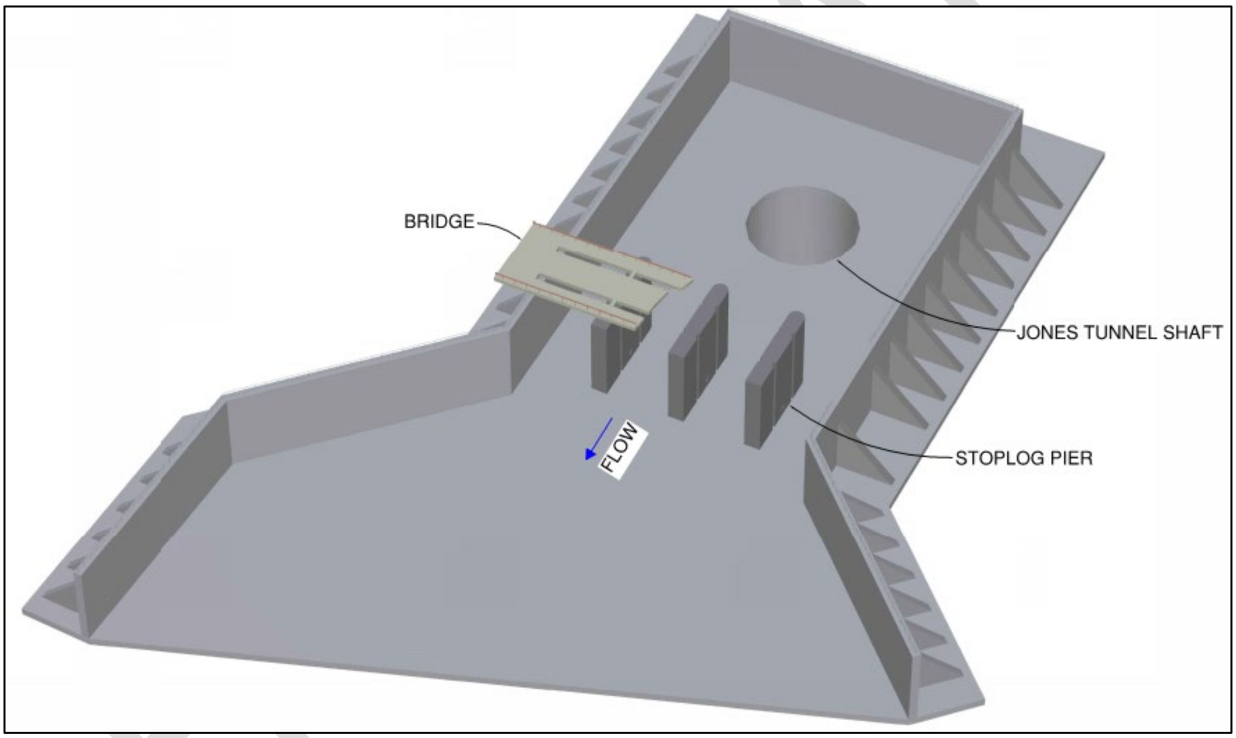

Figure 10. Jones Outlet Structure

1.3.8 Delta-Mendota Canal Control Structure

The Delta-Mendota Canal Control Structure would be located on the Delta-Mendota Canal just upstream of the Jones Outlet Structure (Figure 9). The purpose of the structure would be to work in tandem with the Jones Control Structure to deliver water to the Jones Pumping Plant. The flow scenarios would include delivery only from the Delta Conveyance System, delivery only through the existing CVP facilities, or a combination of both. Figure 11 shows the structure's general configuation.

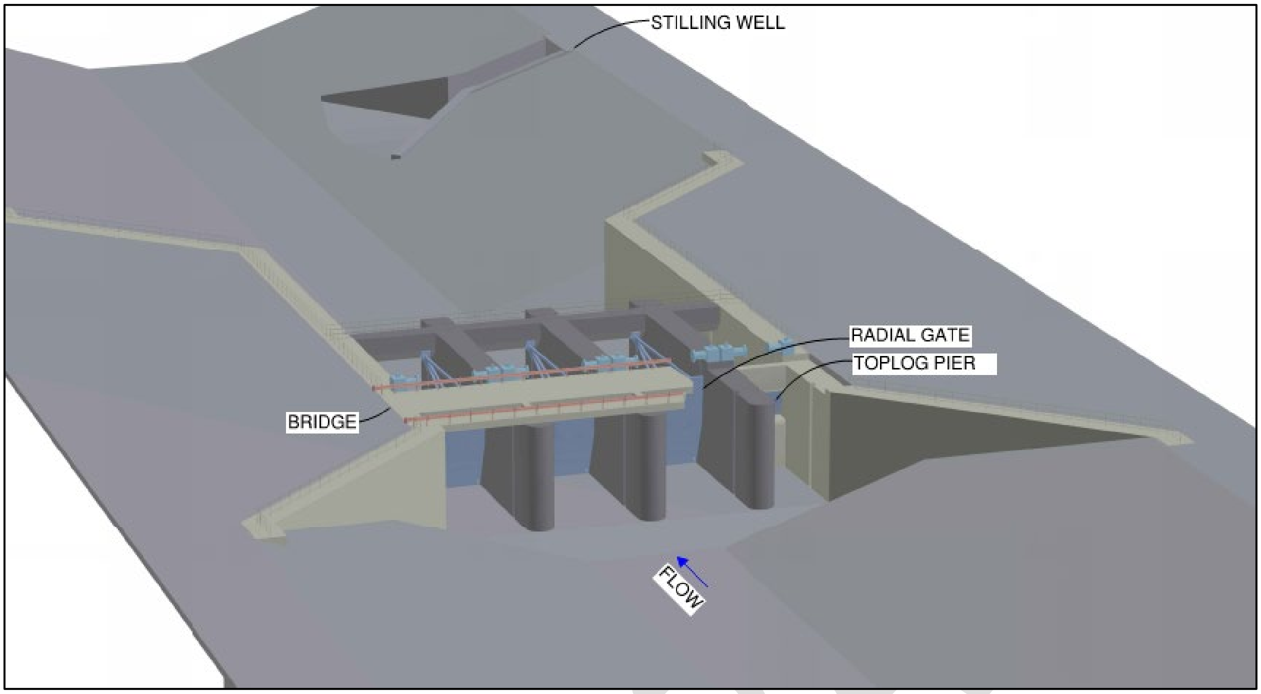

Figure 11. Delta-Mendota Canal Control Structure

The main component of the Delta-Mendota Canal Control Structure would be a series of radial gates that would control upstream flow. Three large gates, as shown in the enginering concept drawings, would control the bulk of the flow in the canal. One or more smaller gates would be provided to manage low flows and to trim flows through the structure to specific flowrates. The engineering concept drawings show a single smaller radial gate for this purpose. However, this function of this gate could also be accomplished using one or more sluice gates.

The specific number and size of the both the larger and smaller gates is subject to verification during final design. Such decisions will include additional detail regarding low flows and flow capacity requirements when one gate is out of service. In any case, it is not expected that final gate number and sizing would have more than a de minimis affect the footprint or the construction requirements for this facility.

Final gate size and quantity to be determined during final design.

Due to the critical control nature of this facility, a generator would be provided for backup power in case of a power outage.

Vertical slots in the piers, upstream and dowstream of the gates, would be provided for isolation of individual gate bays. A bridge with slot openings would cross over the structure on top of the piers for access and bulkhead gate installation. Bulkhead gates would be stored on the site and installed with a mobile crane from the bridge deck.

Stilling wells would be located upstream and downstream of the gate structure for monitoring flow levels and setting gate openings. The entrance and exit of the structure transitions from the exisiting canal trapezoidal section to the vertical section through the gates. The transitions would be concrete-lined to prevent channel erosion. Articluated concrete mats would be placed in the Delta-Mendota Canal downstream of the structure and through the confluence area with the Jones Outlet Structure to limit erosion in an area of possible turbulence.

2. References

Delta Conveyance Design and Construction Authority (DCA). 2021a. South Delta Conveyance Facilities Canal and Tunnel Options Summary Comparison TM. Final Draft.

Delta Conveyance Design and Construction Authority (DCA). 2021b. Southern Forebay Siting Analysis. Final Draft.

Delta Conveyance Design and Construction Authority (DCA). 2021c. Systemwide Hydraulic and Capacity Analysis for Tunnel Diameter Selection TM. Final Draft.

Delta Conveyance Design and Construction Authority (DCA). 2021d. South Delta Conveyance Facilities Hydraulic Analysis Criteria and Analyses TM. Final Draft.

3. Document History and Quality Assurance

Reviewers listed have completed an internal quality review check and approval process for deliverable documents that is consistent with procedures and directives identified by the Engineering Design Manager (EDM) and the DCA.

Approval Names and Roles			
Prepared by	**Internal Quality Control Review by**	**Consistency review by**	**Approved for submission by**
Ted Davis / EDM South Delta Conveyance Facilities Lead	Phil Ryan / EDM Design Manager	Gwen Buchholz / DCA Environmental Consultant	Terry Krause / EDM Project Manager

This interim document is considered preliminary and was prepared under the responsible charge of Philip K. Ryan, California Professional Engineering License C41087.

Note to Reader

This is an early foundational technical document. Contents therefore reflect the timeframe associated with submission of the initial and final drafts. Only minor editorial and document date revisions have been made to the current Conformed Final Draft for Administrative Draft Engineering Project Report version.