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Final Draft Engineering Project Report - Part 1 of 2

CENTRAL & EASTERN OPTIONS

May 2022

Delta Conveyance Final Draft Engineering Project Report – Central and Eastern Options

Project Feature: Project-wide

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Prepared by: Delta Conveyance Design and Construction Authority (DCA)

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The DWR requested the DCA develop conceptual engineering information for key features of the Central and Eastern corridors for consideration by DWR to prepare an Environmental Impact Report (EIR). The evaluation of the Central Corridor and Eastern Corridor options in the DWR EIR would include four project design capacity alternatives (6,000, 7,500, 3,000, and 4,500 cubic feet per second [cfs]) for each corridor option. DWR uses different nomenclature than DCA to describe the various alternatives. This nomenclature is described as follows:

DWR EIR Alternative	EPR Nomenclature
• Alternative 1: Central Corridor with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Central Corridor using Intakes C-E-3 and C-E-5
• Alternative 2a: Central Corridor with a project design capacity of 7,500 cfs and Intakes A, B, and C	• 7,500 cfs project design capacity for the Central Corridor using Intakes C-E-2, C-E-3, and C-E-5
• Alternative 2b: Central Corridor with a project design capacity of 3,000 cfs and Intake C	• 3,000 cfs project design capacity for the Central Corridor using Intake C-E-5
• Alternative 2c: Central Corridor with a project design capacity of 4,500 cfs and Intakes B and C	• 4,500 cfs project design capacity for the Central Corridor using Intakes C-E-3 and C-E-5
• Alternative 3: Eastern Corridor with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Eastern Corridor using Intakes C-E-3 and C-E-5
• Alternative 4a: Eastern Corridor with a project design capacity of 7,500 cfs and Intakes A, B, and C	• 7,500 cfs project design capacity for the Eastern Corridor using Intakes C-E-2, C-E-3, and C-E-5
• Alternative 4b: Eastern Corridor with a project design capacity of 3,000 cfs and Intake C	• 3,000 cfs project design capacity for the Eastern Corridor using Intake C-E-5
• Alternative 4c: Eastern Corridor with a project design capacity of 4,500 cfs and Intakes B and C	• 4,500 cfs project design capacity for the Eastern Corridor using Intakes C-E-3 and C-E-5

Additionally, the DWR EIR only considers information related to intakes using cylindrical tee fish screens. During the preparation of the EPR, a second fish screen option was developed based upon vertical flat plate fish screens. Information on the vertical flat plate fish screens is included in the DCA documentation.

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.

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1. Introduction and Background

This Engineering Project Report (EPR) provides descriptions of facilities provided for consideration by the California Department of Water Resources (DWR) during preparation of an environmental assessment of the proposed Delta Conveyance Project (DCP). The EPR includes a summary report and the associated technical memoranda (TMs), engineering concept drawings, and Geographic Information System (GIS) files attached to this report.

DWR will be completing an environmental assessment of the projects effects consistent with the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA). The DCP, as presented in the Notice of Preparation (NOP) issued by DWR on January 15, 2020 and published in CEQAnet on January 16, 2020 (DWR, 2020a), includes two conveyance corridors: the Central Corridor and Eastern Corridor, as described below in Section 1.2, Description of the Central and Eastern Corridor Options. DWR requested the Delta Conveyance Design and Construction Authority (DCA) to develop conceptual engineering information for key features of the Central and Eastern corridors described in the NOP for consideration by DWR to prepare an Environmental Impact Report (EIR).

The conveyance facility locations and tunnel alignments described in this document and presented in the attached engineering concept drawings represent the information available as of the date of publication of this EPR. The engineering concept drawings include final site plans, construction phase site plans where locations of features would be substantially different than final site plans, site ingress and egress layouts, and major cross sections through the structures of key facilities (e.g., South Delta Pumping Plant).

This document only addresses locations, configurations, construction methods, and long-term maintenance methods for potential physical facilities. This document does not address operational criteria, including, but not limited to, the patterns of diversions of water from the Sacramento River at the intakes and water deliveries from existing facilities used for the California State Water Project (SWP) and Federal Central Valley Project (CVP) water users. The long-term maintenance methods include annual activities as well as periodic equipment replacement over an assumed 100 year lifespan.

1.1 Project Background

As described in the NOP, the existing Delta conveyance facilities form the lynchpin of the SWP delivery system and needs to be modernized due to changing California climate, seismic risks, and hydrologic conditions. Currently, the SWP and CVP divert waters from dead-end sloughs in the southern Sacramento-San Joaquin Delta for use by cities and farms in the Central Valley, San Francisco Bay Area, and Southern California.

The SWP and CVP facilities include reservoirs on the Sacramento and the San Joaquin River systems. Water is conveyed along the river systems to the Sacramento-San Joaquin rivers Delta

(Delta), and the water continues to flow through internal Delta channels to the SWP and CVP South Delta pumping facilities with fish screening/collection facilities in the South Delta near the community of Mountain House. Maximum installed pumping capacity of the current SWP and CVP facilities are 10,670 cubic feet per second (cfs) capacity and 4,600 cfs, respectively. However, actual water flow through the pumping facilities is regulated by requirements of the Federal and State resource agencies, including the State Water Resources Control Board (SWRCB), California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and National Marine Fisheries Service.

For the DCP, DWR's underlying purpose is to prepare the SWP for the future. New intakes in the northern Delta will reduce risks to SWP water supplies from sea level rise and Delta levee failures. Multiple intake locations would help minimize conflicts with migrating fisheries resources. Water conveyance from the northern Delta intakes to existing SWP facilities in the southern Delta through a tunnel would protect water supply reliability and minimize land disturbances especially within sensitive Delta communities and ecosystems. To address these and other issues, DWR initiated studies to develop new diversion and conveyance facilities concepts in the Delta to restore and protect the reliability of water deliveries in a cost-effective manner, consistent with the State's Water Resilience Portfolio.

The current configuration of the DCP, as presented in this EPR, builds on previous efforts that have taken place over the past 15 years. A brief summary of the major historical efforts follows:

- The initial conveyance configuration, the Bay Delta Conveyance Project Pipeline/Tunnel Option (PTO), was documented in the March 10, 2010 Conceptual Engineering Report (CER) (DWR, 2010a) and the subsequent October 2010 Addendum. The original PTO included a 15,000 cfs conveyance facility that consisted of five intakes located along the Sacramento River between Freeport and Walnut Grove, pumping plants at each intake, an intermediate Pumping Plant and intermediate forebay (surface water impoundment) near the intakes, a new forebay near the existing SWP Clifton Court Forebay, and other appurtenant facilities.
- The PTO was later modified to the WaterFix Modified Pipeline Tunnel Option (MPTO) in the 2015 CER when the maximum design flow of the program was reduced from 15,000 cfs to 9,000 cfs (DWR, 2015). Other changes to the PTO at that time included the reduction in the number of screened intakes from five to three, the elimination of the pumping plants at the intakes and the Intermediate Pumping Plant, increasing the size of the north and main tunnels to provide for gravity flow of the water from the intakes to a new Clifton Court Forebay pumping plant, and placement of the new forebay within the existing footprint of the Clifton Court Forebay. The 2015 CER documented the proposed MPTO facility configuration that was included in the 2016 Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the program (DWR, 2016). DWR issued a Notice of Determination (NOD) in 2017, in accordance with CEQA, to officially adopt the MPTO as the adopted WaterFix project (DWR, 2017).
- The WaterFix proposed project concept was a further modified in 2018 to become the Byron Tract Option (BTO) (DWR, 2018a). The main differences between the 2015 WaterFix MPTO and the 2018 WaterFix BTO included moving the new forebay to Byron Tract to become the Byron Tract Forebay (BTF) and eliminating modifications to the Clifton Court Forebay. Certain

facility locations at the tunnel shafts were relocated to minimize disturbances to wetlands and sensitive biological resource habitat. DWR issued a Draft Supplemental EIR in July 2018 to present the results of the impact analysis of the BTO.

- In February 2019, California Governor Newsom announced in his State of the State address that he did not "support WaterFix as currently configured" but does "support a single tunnel." On April 29, 2019, Governor Newsom issued Executive Order N-10-19, directing several agencies, including DWR, to (among other things), "inventory and assess… [c]urrent planning to modernize conveyance through the Bay Delta with a new single tunnel project."
- The Governor's announcement and Executive Order led to DWR's withdrawal of all approvals and environmental compliance documentation associated with California WaterFix. In May of 2019, the WaterFix project approval by DWR was withdrawn and the associated NOD for the WaterFix adopted project was rescinded.

The CEQA process for the proposed DCP will, as appropriate, utilize relevant information from the past environmental planning process for California WaterFix, but the proposed project will undergo a new stand-alone environmental analysis leading to issuance of a new EIR.

In January 2020, DWR launched a new planning effort with the publication of the NOP (DWR, 2020a). The new DCP project included a fresh look at the historical planning information, building on areas of agreement and deviating where new concepts or configurations were identified. This EPR presents the conceptual level engineering description of the proposed DCP, as presented in the 2020 DWR NOP, including the Central Corridor and Eastern Corridor options. It includes information related to the Central Corridor and Eastern Corridor conveyance facilities and other facilities to support construction and operations of these facilities.

The EIR will include a Compensatory Mitigation Plan (CMP) and Community Benefits Program. The CMP will identify potential compensatory mitigation options to programmatically address impacts to habitat for special status species, as well as to jurisdictional wetlands and other waters that may result from the conveyance facilities. The compensatory mitigation approach will be based on anticipated mitigation needs for EIR alternatives and will be finalized through regulatory permits and approvals. At this time, the actual design and monitoring methods for the CMP are not known in sufficient detail to allow for detailed layouts. The programmatic plans will be developed by DWR for inclusion in the EIR. Because the Delta Conveyance Design and Construction Authority (DCA) did not assist with development of the CMP, the EPR does not include discussions of this plan.

The EIR will also include a programmatic description of a Community Benefits Program to be developed by DWR in collaboration with the Delta communities. Some of the information provided to DWR includes comments received during the DCA Stakeholder Involvement Program. At this time, the Community Benefits Program is being developed and site-specific items have not been identified in a manner that could be considered by the DCA. Therefore, the EPR does not include discussions of this plan.

See TM – Efforts to Minimize Delta Community Effects (Attachment H) for detailed information

The evaluation of the Central Corridor and Eastern Corridor options in the DWR EIR will include four project design capacity alternatives. These project design capacities include 6,000 cfs, 7,500 cfs, 3,000 cfs, and 4,500 cfs for each corridor option. This EPR presents the 6,000 cfs project design capacity facilities for the Central and Eastern corridors in Sections 2 through 6. The 7,500 cfs, 3,000 cfs, and 4,500 cfs project design capacity options are discussed in Section 7. DWR uses different nomenclature than this EPR to describe the various alternatives. The equivalent nomenclature and relevant sections of this EPR are summarized below:

DWR EIR Alternative	EPR Nomenclature and EPR Section
• Alternative 1: Central Corridor with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Central Corridor using Intakes C-E-3 and C-E-5 (Sections 2-6)
• Alternative 2a: Central Corridor with a project design capacity of 7,500 cfs and Intakes A, B, and C	• 7,500 cfs project design capacity for the Central Corridor using Intakes C-E-2, C-E-3, and C-E-5 (Section 7.1)
• Alternative 2b: Central Corridor with a project design capacity of 3,000 cfs and Intake C	• 3,000 cfs project design capacity for the Central Corridor using Intake C-E-5 (Section 7.2)
• Alternative 2c: Central Corridor with a project design capacity of 4,500 cfs and Intakes B and C	• 4,500 cfs project design capacity for the Central Corridor using Intakes C-E-3 and C-E-5 (Section 7.3)
• Alternative 3: Eastern Corridor with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Eastern Corridor using Intakes C-E-3 and C-E-5 (Sections 2-6)
• Alternative 4a: Eastern Corridor with a project design capacity of 7,500 cfs and Intakes A, B, and C	• 7,500 cfs project design capacity for the Eastern Corridor using Intakes C-E-2, C-E-3, and C-E-5 (Section 7.1)
• Alternative 4b: Eastern Corridor with a project design capacity of 3,000 cfs and Intake C	• 3,000 cfs project design capacity for the Eastern Corridor using Intake C-E-5 (Section 7.2)
• Alternative 4c: Eastern Corridor with a project design capacity of 4,500 cfs and Intakes B and C	• 4,500 cfs project design capacity for the Eastern Corridor using Intakes C-E-3 and C-E-5 (Section 7.3)

Sections 2 through 7 of this EPR include information related to intakes using cylindrical tee fish screens. During the preparation of the EPR, a second fish screen option was developed based upon vertical flat plate fish screens, which is described in Section 8 of this EPR. All of the DWR EIR alternatives only include intakes with cylindrical tee fish screens.

1.2 Description of the Central Corridor and Eastern Corridor Options

The existing SWP Delta water conveyance facilities, which include Clifton Court Forebay, Skinner Fish Facility, and the Harvey O. Banks (Banks) Pumping Plant in the south Delta, enable DWR to divert water from the south Delta and lift it into the California Aqueduct for delivery to users located to the south of the Delta. The proposed DCP would construct and operate new conveyance facilities in the Delta that would add to the existing SWP infrastructure.

New intake facilities as additional points of diversion would be located in the north Delta along the Sacramento River near the community of Hood; and a tunnel would convey water from the new intakes to facilities in the south Delta adjacent to the Clifton Court Forebay and ultimately to the SWP Banks Pumping Plant. The new intake facilities would provide an alternate location for diversion of water from the Delta. The new intake facilities would be operated in coordination with the existing south Delta pumping facilities, resulting in a system also known as "dual conveyance" because there would be two complementary methods to divert and convey water.

The NOP identified the DCP design capacity of 6,000 cfs. The NOP also identified the Central Corridor and Eastern Corridor facilities for the 6,000 cfs project design capacity including the following facilities:

- Two intake facilities (Intakes C-E-3 and C-E-5) along the Sacramento River in the north Delta near the community of Hood with on-bank intake structures that would include fish screens.
- A concrete-lined tunnel, and associated vertical tunnel shafts, to convey flow from the intakes about 40 miles to the southwest of the existing SWP Clifton Court Forebay.
- A South Delta Pumping Plant located to the west of the existing SWP Clifton Court Forebay to lift the water in the tunnel from below ground and into a new surface water impoundment (Southern Forebay).
- A Southern Forebay capable of receiving flows by gravity directly from the tunnel or from the South Delta Pumping Plant depending on hydraulic conditions in the Sacramento River and in the forebay.
- South Delta Conveyance Facilities located at the outlet of the Southern Forebay including: an outlet structure, and dual tunnels to convey water to the approach channel of the Banks Pumping Plant. Two flow control structures would be used to regulate flows from the DCP and to regulate flows from the existing Clifton Court Forebay to facilitate the dual conveyance aspects of the project.
- Other ancillary facilities to support construction of the conveyance facilities including, but not limited to, access roads, concrete batch plants, fuel stations, and power transmission and/or distribution lines.

1.2.1 Development of Facilities Plans in the Central and Eastern Corridors

The key facilities along the Central Corridor and the Eastern Corridor are presented in Figure 1. Consistent with DWR's process to develop potential conveyance options, the DCA initially considered multiple conveyance alignments and tunnel shaft locations, intake site layouts and locations, and southern Delta facility site layouts near the existing SWP facilities to meet the objectives of the project. This initial analysis included a review of previously identified conveyance options, as summarized in Section 1.1, including a range of canal and tunnel alignments and use of existing stream channels. This range of options, and results of preliminary evaluations of potential facilities were used to identify a preliminary range of feasible facility locations. Under the direction of DWR, the DCA conducted a series of siting analyses to evaluate a range of facility locations to minimize effects of the project on Delta communities, habitat, recreational users, and other features. The siting analyses for the Central and Eastern Corridors considered siting analyses, as schematically presented in Figure 2, for intakes; tunnel launch, maintenance, and reception shafts; Southern Forebay and South Delta Conveyance facilities; and an optional southern Delta conveyance alignment (also known as the Bethany Reservoir Alternative which is evaluated in the separate Final Draft Engineering Project

Report – Bethany Reservoir Alternative). The results of the siting analysis were used to modify facility locations, change construction traffic routes, and reduce the number and size of construction boundaries.

The siting analyses were developed to minimize the following effects:

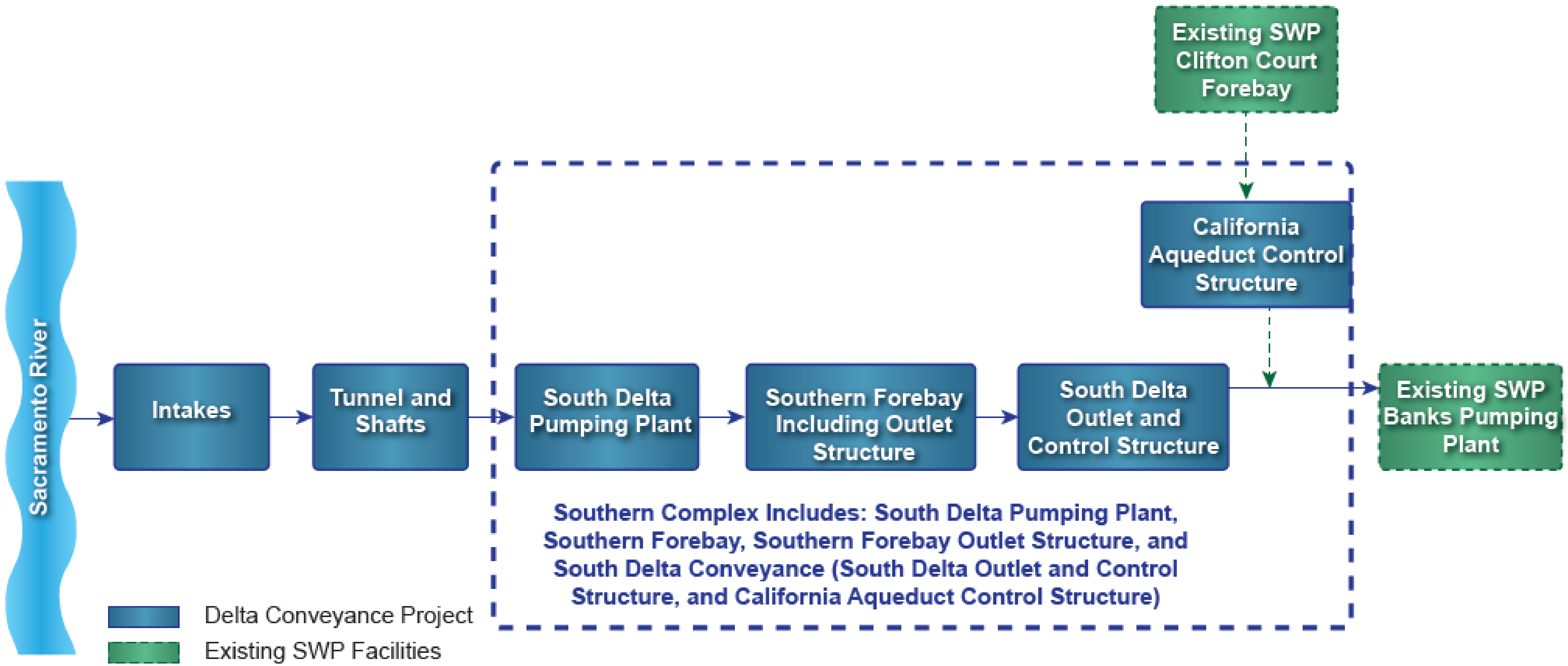
- Minimize construction areas and activities that could produce noise, dust, greenhouse gas (GHG) emissions, traffic, and land use disturbances.
- Minimize construction traffic and associated effects to residents, recreationists, wildlife habitat, and agricultural operations.
- Minimize disturbance to sensitive wildlife and terrestrial and/or aquatic habitat areas.
- Minimize disturbance to existing land uses, including agricultural and residential lands.
- Minimize effects on Delta water-based recreation and navigation.
- Minimize construction effects to existing infrastructure or other community resources, including powerlines, and groundwater and surface water resources.
- Manage flood risks to the project facilities and existing land uses.
- Manage seismic risks to people and property due to construction and operation of the project by avoiding placement of facilities, or including specialized design criteria, in the vicinity of known fault lines.
- Avoid increasing demand for existing emergency services in the Delta due to construction and operation of the project.
- Minimize effects on environmental justice communities, as defined by DWR.
- Minimize effects to sensitive areas identified by Tribal representatives, as defined by DWR.

The results of the siting analyses are summarized in Sections 2.1.3, 2.2.2.1, 2.3.2.1, 2.3.2.2, 2.3.3.1, and 4.1 of this EPR and presented in the following TMs attached to this EPR.

- **Intakes Siting Analyses:** Intake Site Identification and Evaluation TM (Attachment A).
- **Tunnel Shaft Siting Analyses:** Shaft Siting Study TM (Attachment B).
- **Southern Forebay Siting Analyses:** Southern Forebay Siting Analysis TM and Southern Forebay Emergency Spillway Siting Analysis (Attachment D).
- **South Delta Conveyance Siting Analyses:** South Delta Conveyance Facilities Canal and Tunnel Options Summary Comparison (Attachment E).
- **Construction Transportation Route Siting Analyses:** Potential Road Access Routes, Logistics Strategy, and Traffic Impact Analysis (Attachment F).
- **Overall Siting Analyses:** Efforts to Minimize Delta Community Effects – Central and Eastern Corridor Options (Attachment H).

Overall results of the siting analyses for the Central and Eastern Corridors are presented in Figures 3A and 3B, respectively, reflecting the general relationship of the facilities to the Delta geographic boundaries. Specific details related to these key facilities, including preliminary locations, are presented in the engineering concept drawings included with this EPR.

FIGURE 1. SCHEMATIC OF CENTRAL AND EASTERN CORRIDOR OPTIONS FACILITIES TO CONVEY WATER FROM INTAKES TO SWP BANKS PUMPING PLANT FOR PROJECT DESIGN CAPACITY OF 6,000 CFS



- Two intakes located along the Sacramento River near Hood
- Water would flow from the intakes into one tunnel and then into the Southern Forebay (either by gravity or pumped through the South Delta Pumping Plant facilities)
- Water would flow from Southern Forebay through the South Delta Conveyance Facilities dual tunnels to an outlet structure along the existing Banks Pumping Plant approach channel. South Delta Conveyance Facilities also would include a flow control structure to provide “Dual Conveyance”
- Existing SWP south Delta diversion facilities and Clifton Court Forebay would continue to operate as part of “Dual Conveyance”

FIGURE 2. SUMMARY OF DELTA CONVEYANCE PROJECT SITING ANALYSES FOR INTAKES, TUNNEL SHAFTS AND ALIGNMENTS, SOUTHERN FOREBAY, SOUTH DELTA CONVEYANCE, AND BETHANY COMPLEX

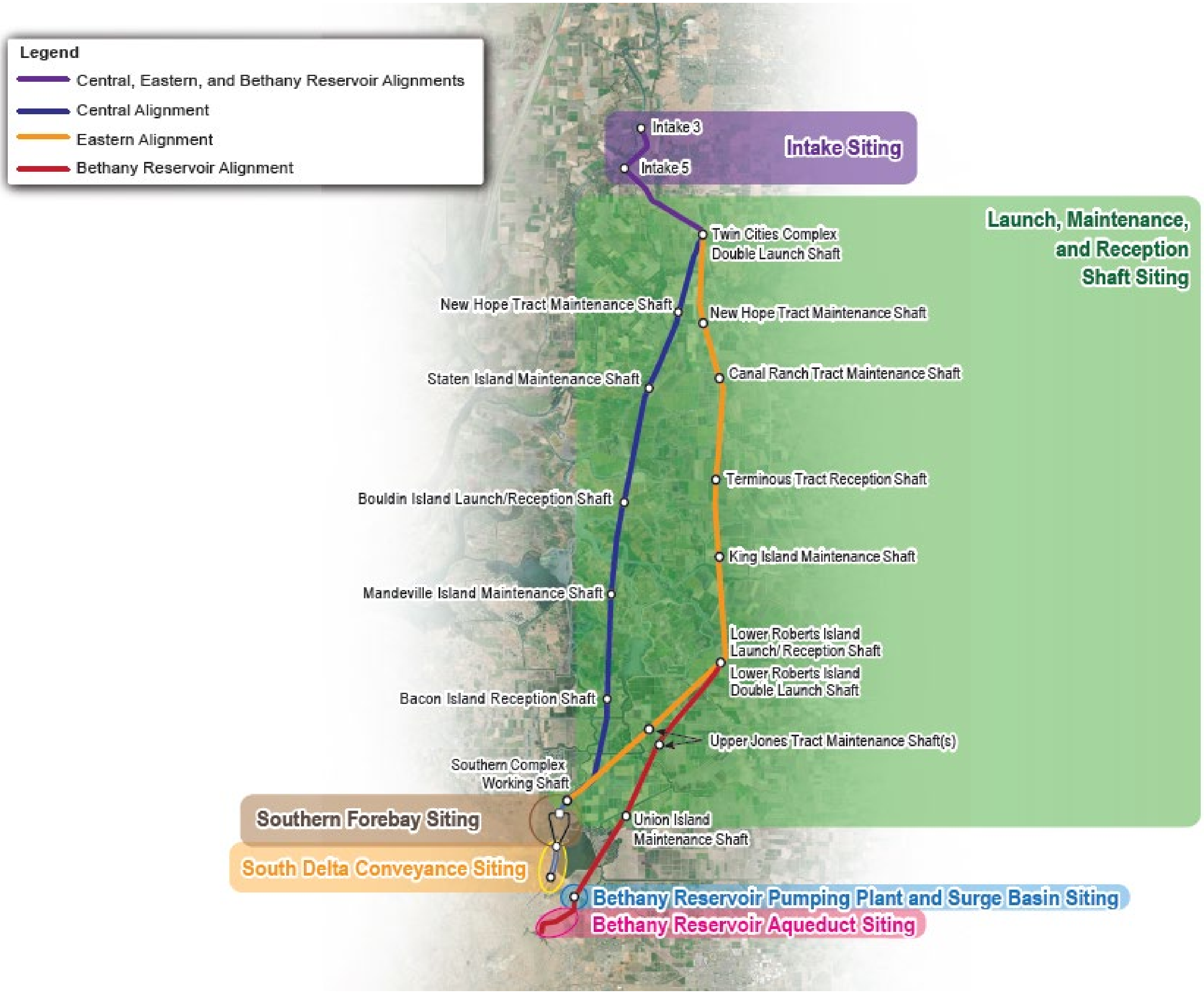
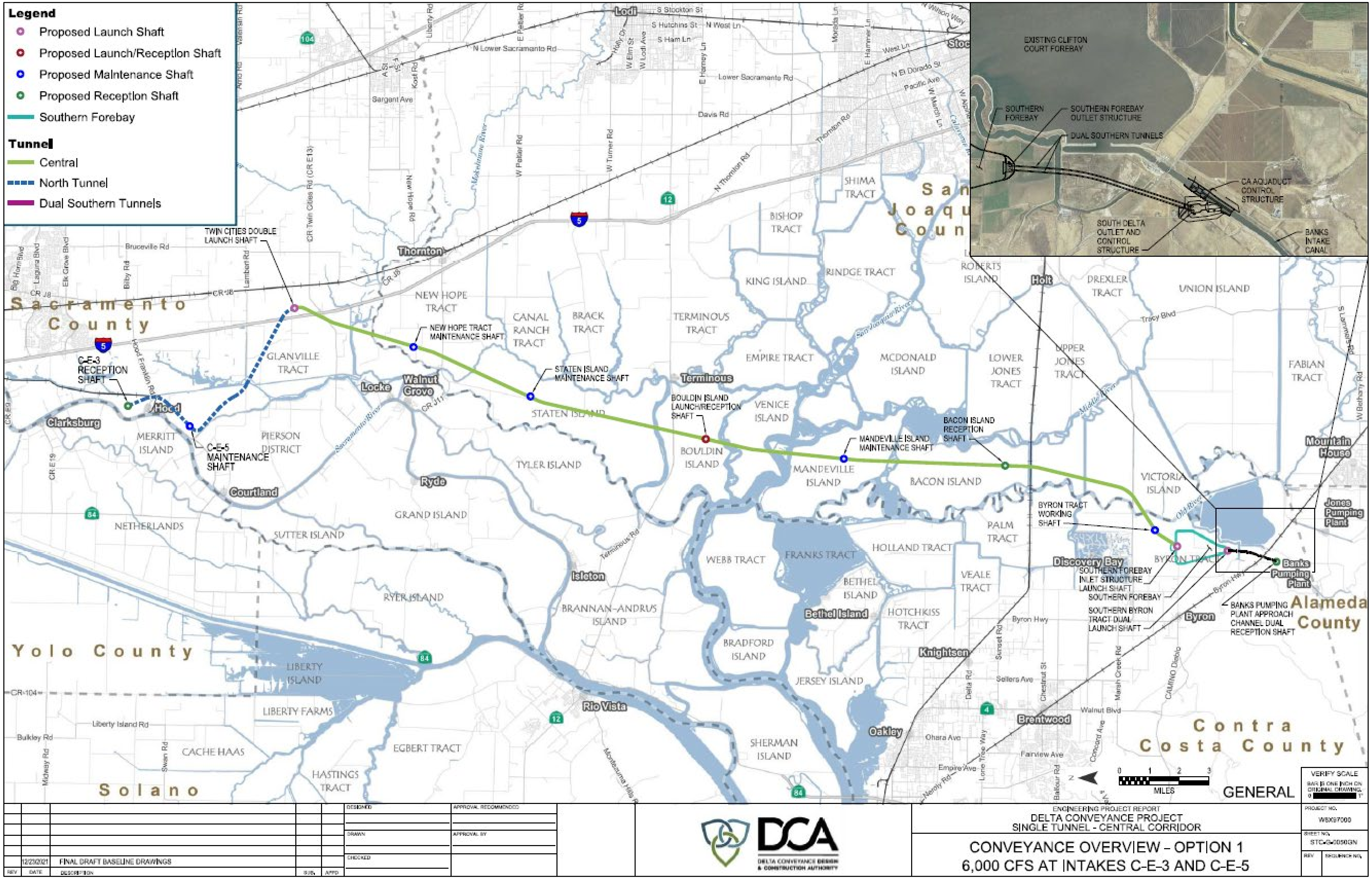
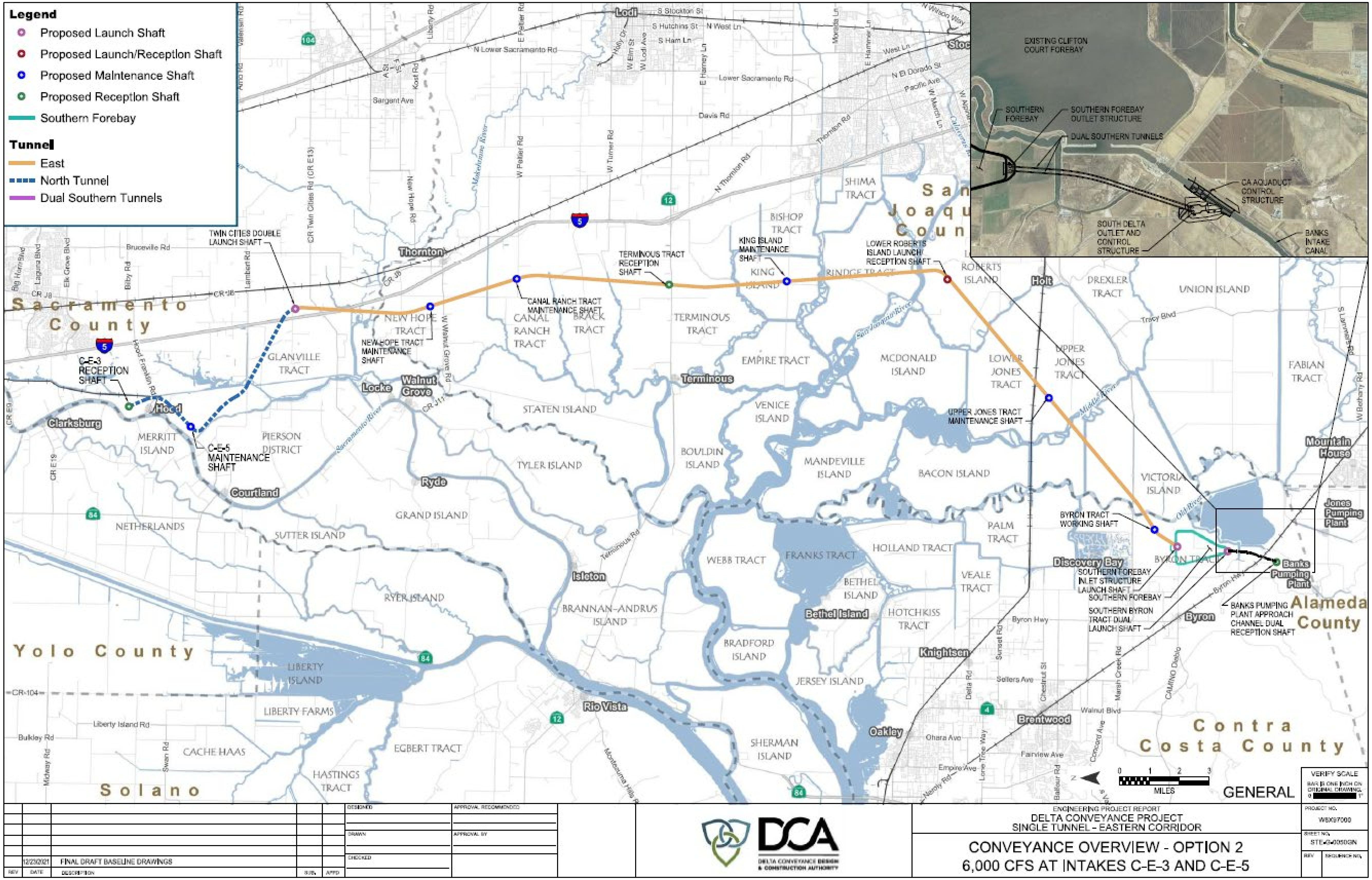


FIGURE 3A. CENTRAL CORRIDOR FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO SOUTHERN COMPLEX FOR PROJECT DESIGN CAPACITY OF 6,000 CFS



(From Engineering Concept Drawings, Volume 2, 01-GN)

FIGURE 3B. EASTERN CORRIDOR FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO SOUTHERN COMPLEX FOR PROJECT DESIGN CAPACITY OF 6,000 CFS



(From Engineering Concept Drawings, Volume 2, 01-GN)

Both alignments share common facilities in the northern and southern areas of the DCP system, as summarized below. The two corridors are defined by different alignments between the Twin Cities Complex (located to the northeast of the intersection of Twin Cities Road and Interstate 5) and the Southern Complex (including the South Delta Pumping Plant, Southern Forebay, and South Delta Conveyance Facilities located to the west of the existing Clifton Court Forebay).

- Two intakes along the Sacramento River near the community of Hood would be shared by both the Central and Eastern corridors.
- The Twin Cities Complex would be shared by both the Central and Eastern corridors.
  - The Twin Cities Complex would include a tunnel launch shaft to construct the tunnel to the intakes (Tunnel Reach 1).
  - The Twin Cities Complex would also include a tunnel launch shaft to construct the first part of the tunnel alignment towards the Southern Complex (Tunnel Reach 2), as described below for the Central and Eastern corridors
- The Central Corridor would extend from the tunnel launch shaft at the Twin Cities Complex towards the Southern Complex in the following manner:
  - The Central Corridor tunnel would start from the tunnel launch shaft on Twin Cities Complex to a tunnel shaft on Bouldin Island (Central Corridor - Tunnel Reach 2). The Bouldin Island tunnel shaft would be used as a tunnel reception shaft and tunnel launch shaft.
  - The next reach of the Central Corridor tunnel would be constructed from the tunnel launch shaft on Bouldin Island to a tunnel reception shaft on Bacon Island (Central Corridor - Tunnel Reach 3).
  - The last reach of the Central Corridor tunnel would be constructed from a tunnel launch shaft near the northern Southern Forebay embankment to the tunnel reception shaft on Bacon Island (Central Corridor - Tunnel Reach 4).
- The Eastern Corridor would extend from the tunnel launch shaft at the Twin Cities Complex towards the Southern Complex in the following manner:
  - The Eastern Corridor would start from the tunnel launch shaft site on Twin Cities Complex to a tunnel reception shaft on Terminous Tract (Eastern Corridor – Reach 2).
  - The next reach of the Eastern Corridor would be constructed from a tunnel launch shaft on Lower Roberts Island to the tunnel reception shaft on Terminous Tract (Eastern Corridor – Reach 3).
  - The final reach of the Eastern Corridor would be constructed from a tunnel launch shaft near the northern Southern Forebay embankment to the tunnel shaft on Lower Roberts Island (Eastern Corridor – Reach 4). The Lower Roberts Island tunnel shaft would be used as a tunnel reception shaft and tunnel launch shaft.
- The Southern Complex (including the tunnel launch shaft sites near the northern Southern Forebay embankment, South Delta Pumping Plant, Southern Forebay, and South Delta Conveyance Facilities) would be shared by both the Central and Eastern corridors. The Southern Complex is further defined with facilities located to the east and west of the Byron Highway in the following manner:

- Southern Complex facilities located to the east of Byron Highway would all be located on Byron Tract. These facilities would include:
  - Byron Tract Working Shaft
  - Southern Forebay Inlet Structure Launch Shaft
  - South Delta Pumping Plant located adjacent to the Southern Forebay Inlet Structure Launch Shaft
  - Southern Tunnel Dual Launch Shafts at the Southern Forebay Outlet Structure. Two tunnels would extend from the dual tunnel launch shafts to the Banks Pumping Plant Approach Channel Dual Reception Shaft (located to the west of the Byron Highway (Tunnel Reaches 5 East and 5 West, or 5E and 5W). The Southern Tunnel Dual Launch Shafts, Southern Forebay Outlet Structure, and dual tunnels are also part of the South Delta Conveyance Facilities.
- Southern Complex facilities located to the west of Byron Highway would include:
  - Extension of Tunnel Reaches 5E and 5W
  - Banks Pumping Plant Approach Channel Dual Reception Shaft located at the South Delta Outlet and Control Structure
  - South Delta Outlet and Control Structure located at the end of the Southern Tunnel adjacent to the California Aqueduct (aka Banks Pumping Plant Approach Channel)
  - California Aqueduct Control Structure located within the existing California Aqueduct between the existing Clifton Court Forebay and South Delta Outlet and Control Structure

Summary of the physical characteristics are presented in Table 1. More detailed information about these facilities are presented in Sections 2 through 6, engineering concept drawings, technical memoranda, and Appendix A of this EPR. Please note that all elevations presented in this EPR are relative to North American Vertical Datum of 1988 (NAVD88).

TABLE 1. SUMMARY OF THE PHYSICAL CHARACTERISTICS FOR THE 6,000 CFS PROJECT DESIGN CAPACITY

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Project Design Capacity		• 6,000 cfs	
Intake Facilities			
Intakes with Fish Screens		• 2 intakes with cylindrical tee fish screens • Temporary re-location of the existing levee (including State Route 160) • Intake structure with gates, piping, and flow meters • Sedimentation basin • Sediment drying lagoons • Flow control structure with radial gates • Intake outlet shaft	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Design Flow Capacity of Each Intake		• One Intake at 3,000 cfs (with Reception Shaft) (Intake C-E-3) • One Intake at 3,000 cfs (with Maintenance Shaft) (Intake C-E-5)	
Tunnel and Tunnel Shafts			
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)		• Maximum Capacity – 3,000 cfs between Intake C-E-3 and Intake C-E-5 – 6,000 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 36 feet • Tunnel Outside Diameter: 39 feet • Tunnel Length: 43,081 feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex Dual Launch Shaft) • Number of Reception Shafts: 1 • Number of Maintenance Shafts: 1 • Launch Shaft Inside Diameter (feet): 115 • Maintenance and Reception Shafts Inside Diameter (feet): 83 (aka Intake Outlet Shafts)	
Tunnel Reaches between Twin Cities Complex and Southern Complex	• Reach 2: Between Twin Cities Complex and Bouldin Island • Reach 3: Between Bouldin Island and Bacon Island • Reach 4: Between Bacon Island and Southern Forebay • Maximum Capacity: 6,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 36 feet • Tunnel Outside Diameter: 39 feet • Tunnel Length: 165,078 feet • Number of Tunnel Launch Shafts: 3 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 3 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 115 • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 115		• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Southern Forebay • Maximum Capacity: 6,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 36 feet • Tunnel Outside Diameter: 39 feet • Tunnel Length: 179,331 feet • Number of Tunnel Launch Shafts: 3 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 4 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 115 • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 115

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
	• Maintenance and Reception Shafts Inside Diameter (feet): 70		• Maintenance and Reception Shafts Inside Diameter (feet): 70
South Delta Pumping Plant at the Northern Southern Forebay Embankment		• Seven pumps at 960 cfs, each, including two standby pumps (Up to five pumps would operate at any one time for a total of 4,800 cfs capacity) • Three pumps at 600 cfs, each, including one standby pump (Up to two pumps would operate at any one time for a total of 1,200 cfs capacity) • Two Portable Pumps to dewater tunnel • Maximum Total Dynamic Head of Pumping Plant: 80 feet (in unprimed operation)	
Southern Forebay		• Normal Operating Capacity: 9,000 acre-feet with a surface area of approximately 750 acres • Average Surface Water Surface Elevation: 11.5 feet, or approximately the half-way point within the range of normal operating elevation 5.5 to 17.5 feet. – Minimum elevation of 5.5 feet would provide gravity flow up to 10,670 cfs to Banks Pumping Plant – Maximum elevation of 17.5 feet would provide a 12-foot operational range within the forebay • Southern Forebay Floor Elevation: Range from 0 to – 7 feet • Southern Forebay Area (including exterior embankment slopes, toe drains, and exterior circumference access roads): approximately 1,000 acres	
Tunnel Reaches 5E and 5W between Southern Forebay Outlet Structure and South Delta Outlet and Control Structure		• Maximum Combined Flow of Tunnels 5E and 5W: 10,670 cfs (per DWR) • Number of Tunnels: 2 • Tunnel Inside Diameter: 38 feet (to maintain gravity flow) • Tunnel Outside Diameter: 41 feet • Tunnel Length: 8,816 feet for each tunnel • Number of Tunnel Launch Shafts: 2 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 0 • Launch Shafts: Inside Diameter (feet): 115 • Reception Shafts Inside Diameter (feet): 90	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
South Delta Outlet and Control Structure		• Maximum Capacity: 10,670 cfs • Operable gates for flow control and stop logs for isolation	
California Aqueduct Control Structure		• Maximum Capacity: 10,670 cfs • Operable gates for flow control and stop logs for isolation	

1.2.2 Organization of this Report

The EPR is comprised of the following components:

- **Volume 1 - Summary Report and Technical Memoranda.** The engineering work that describes the design criteria, design assumptions, alternatives analyses, and planned siting and configurations are found in a series of Technical Memoranda (TMs) in Attachments A through H. This summary report is intended to highlight the key findings and conclusions of the TMs and focuses primarily on describing the proposed facilities and the key drivers to their configuration and siting where applicable.
  - Section 1: Introduction and Background
  - Section 2: Major Facility Descriptions for 6,000 cfs Project Design Capacity
    - Intakes, Tunnels and Tunnel Shafts, Southern Complex including South Delta Pumping Plant, Southern Forebay, and South Delta Conveyance Facilities
  - Section 3: Flood Management
  - Section 4: Site Development, Site Access, and Logistics
  - Section 5: Utilities
  - Section 6: Other Systemwide Considerations
  - Section 7: Project Design Capacity Options
  - Section 8: Vertical Flat Plate Fish Screen-Type Option

Volume 1 also includes Appendices with quantitative summaries of information from technical memoranda and engineering concept drawings. Appendices A through D provide summaries of quantitative information for the Central and Eastern Corridors with cylindrical tee fish screens for the project design capacities of 6,000 cfs, 7,500 cfs, 3,000 cfs, and 4,500 cfs, respectively. Appendix E provides a summary of information for intakes with vertical flat plate fish screens. Appendices F through I provide preliminary construction and operations and maintenance information needed to develop the EIR air quality and traffic analyses.

- **Volume 2 - Engineering Concept Drawings.** The engineering concept drawings provide a visual representation of the construction site plans, permanent site plans, as well as major plan and section views of the structures and equipment of individual component facilities of the DCP.
- **Volume 3 - GIS Mapbook.** The mapbook utilizes GIS information to display the proposed facility sites and features included in the Engineering Concept Drawings in the context of the existing land use.

2. Major Facility Descriptions for 6,000 cfs Project Design Capacity

The facilities described in this section represent the facilities in the DWR EIR Alternative 1 (Central Corridor) and Alternative 3 (Eastern Corridor), as schematically presented in Figures 3A and 3B, respectively. The major component features of the DCP include the following facilities which are described in the following sections of this report.

- Intakes at locations Intake C-E-3 and Intake C-E-5 (DWR EIR Intakes B and C, respectively)
- Tunnel and Tunnel Shafts (Central and Eastern Corridors)
- Southern Complex: South Delta Pumping Plant
- Southern Complex: Southern Forebay
- Southern Complex: South Delta Conveyance Facilities

These facilities are shown in the engineering concept drawings and include both the temporary construction impact boundaries and permanent impact boundaries. The construction boundaries are shown with a yellow line and the permanent boundaries are shown with red line.

The TMs provide the basis of design criteria, design assumptions, siting analyses, and planned siting and configurations based upon existing physical information. Future investigations would be conducted during pre-construction and construction phases to more specifically identify appropriate construction methods to be addressed in the final design documents.

2.1 Intakes

2.1.1 Purpose of Intakes

Intake structures allow the diversion of water from the Sacramento River and represent the most upstream facilities of the DCP. A summary of key intake functionality includes:

- Flow diversion— to divert flows from the Sacramento River under appropriate river flow based upon to-be-determined operational conditions. DWR will develop the operational conditions.
- Aquatic species protection— to protect aquatic species and prevent them from impingement and from being diverted with the river water through the use of fish screens.
- Sediment management— to manage the suspended sediment in the diverted water to minimize the settleable sediment in the tunnel system.
- Flow control— to control the hydraulics to manage flows at the proper flow rates in accordance with adopted regulatory criteria and downstream pumping controls.
- Flow transition— to direct flows into the downstream tunnel conveyance system.

- Flood management— to continuously maintain function of flood protection features per regulatory requirements.

2.1.2 Facility Description

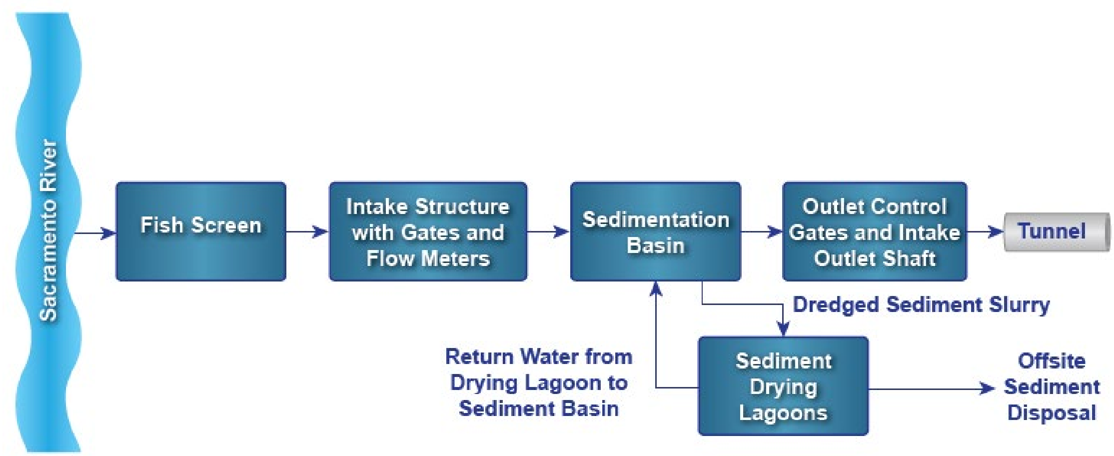
Each intake facility would be sized to divert up to 3,000 cfs of Sacramento River water. Operational diversion patterns will be developed by DWR for the EIR alternatives and presented in the EIR. The facilities described in this section would be able to be used for the DWR Alternatives 1 and 3 (Central and Eastern corridors, respectively) for a wide range of diversion criteria from 0 to 3,000 cfs and related operational criteria.

See TM – Intake Structural Configuration and Fish Screen Type Analysis (Attachment A) for detailed information

See TM – Intake Screen Sizing – North Delta Intakes (Attachment A) for detailed information

For the DCP, the intakes would be comprised of an on-bank structure with cylindrical tee fish screens to protect, among others, species listed under the Federal Endangered Species Act and California Endangered Species Act from entering the DCP system. Flow isolation and flow control equipment would be used to maintain an even flow rate through the face of the screens. Settleable solids in the diverted flow would be captured by gravity in a sedimentation basin. These settled solids would be periodically removed for drying and ultimately off-site disposal. Key features at intakes are schematically shown in Figures 4 and 5.

FIGURE 4. SCHEMATIC OF INTAKE FACILITIES TO CONVEY WATER FROM SACRAMENTO RIVER TO THE TUNNEL



See TM – Intake Flood Management (Attachment A) for detailed information

Construction of the intake would require an integrated re-location of the existing levee (including State Route 160) to a temporary position to provide land and river side construction sites for the intake, and a subsequent re-location of the levee to an alignment near the existing location of State Route 160.

The existing levee at the intake sites is located immediately adjacent to the river. State Route 160 is constructed on top of the levee. The levee was constructed as part of the Sacramento River Flood Control Project established by the U.S. Army Corps of Engineers (USACE) to provide flood management for surrounding lands. This type of levee is considered a jurisdictional levee (also known as the Sacramento River Flood Control “Project” levee) which requires approval by the USACE and Central Valley Flood Protection Board (CVFPB) prior to any modifications and requires that flood control criteria be maintained continuously during construction of any modifications and long-term operation of the intakes. The existing jurisdictional levees along the Sacramento River at the intake sites would be impacted by construction of the new intake facilities.

A temporary jurisdictional levee would be required at the intake site adjacent to but landward of the existing levee to allow the intake facilities to be constructed along the Sacramento River while maintaining continuous flood protection. State Route 160 would be relocated on top of the temporary levee. As excavation continues on the intake site, a new jurisdictional levee would be constructed around the perimeter of the sedimentation basin, and outlet shaft. The new jurisdictional levee would extend to the existing jurisdictional levee located to the north and south ends of the intake structure. The intake, sedimentation basin, and outlet channel would be designed to flood control standards that could accommodate the 200-year flood event with sea level rise. Following construction of the intake structure, State Route 160 would be re-located back to approximately its original location near the Sacramento River. However, the new intake structure would be between the river and State Route 160, so the sight distance to the water would be longer with minor obstructions at that location. The jurisdictional levee would remain at the perimeter of the sedimentation basin.

See TM – North Delta Intake Facilities Configuration, Construction, and Operations (Attachment A) for detailed information

Location of intake facilities on the site would be determined to minimize conflicts with existing surface water diversions on adjacent properties. As described in Section 5.4, Water Supplies to the DCP Sites, existing surface water diversions on the properties acquired for the intakes would be used to provide water supplies to the intake facilities.

See TM – Existing Surface Water Diversions (Attachment A) for detailed information

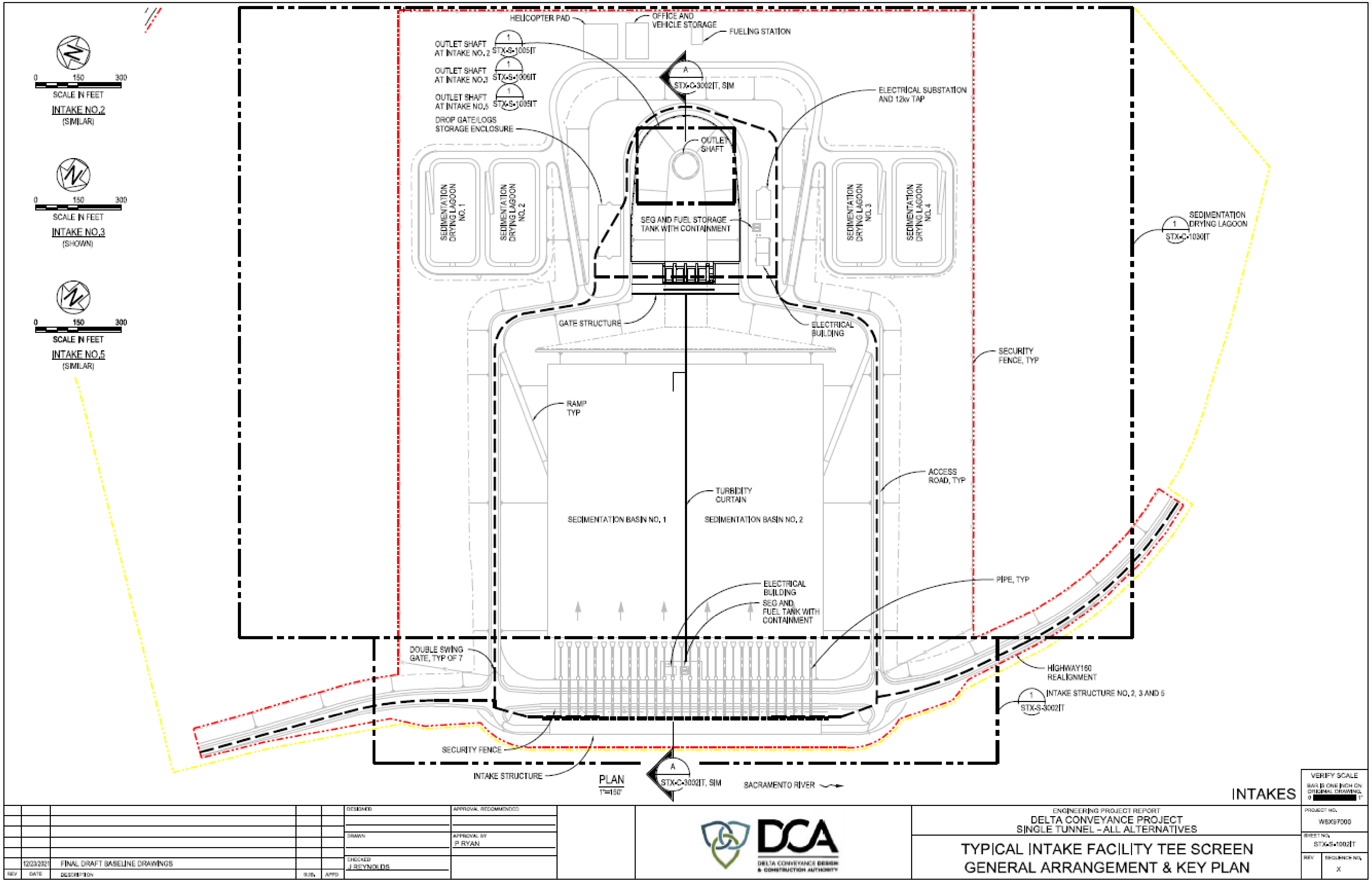
Below is a general description of the key system components of the proposed intakes. More details are summarized in Appendix A.

2.1.2.1 Intake Structure

There are a wide variety of water intake configurations used along rivers in the Western United States. For the DCP, a range of configurations were evaluated. Based upon the results of the evaluation, an on-bank concrete intake structure was determined to be the most appropriate configuration based on existing river conditions, regulatory restrictions, and project design capacity. The USACE typically limits the rise in the water surface to within the original design profile for the jurisdictional levee with minimal impacts. The finished footprint and configuration of the intake structure relative to the river channel would not cause a significant increase in the river water surface elevation during the design flood flow condition for the adjacent levees and associated flood control features. Similarly, the configuration of the intake structures would not cause a significant increase in the river water surface elevations estimated for existing and future conditions as part of the Central Valley Flood Protection Plan.

See TM – Intake Structural Configuration and Fish Screen Type Analysis (Attachment A) for detailed information

FIGURE 5. TYPICAL INTAKE FACILITIES: POST-CONSTRUCTION INTAKE SITE PLAN WITH CYLINDRICAL TEE FISH SCREENS



(From Engineering Concept Drawings, Volume 2, 02-IT)

The intakes would be designed to operate over a range from a low water level 1 percent of the time (99 percent exceedance) to a high water level consistent with the 200-year return period flood using climate change hydrology and sea-level rise for Year 2100 as defined by DWR (DWR, 2020b). Intakes would be best located along the outside of river bends and relatively "straight" riverbanks to allow space of the long structures and avoid accumulation of sediment that typical occur at inside bends of the riverbank.

The size of the intake would be based upon the surface area of the cylindrical tee fish screen along the intake. The intake structure lengths, including the training walls that connect to the existing levees, would be approximately 1,466 feet long at Intake C-E-3 and 1,426 feet at Intake C-E-5. The intake structures with the fish screens would be located partially on-land adjacent to State Route 160 and partially in the Sacramento River.

See TM – River Hydrologic Criteria for Intake Sizing (Attachment A) for detailed information

See TM – Sacramento River Flood Flow Hydraulic Modeling – HEC-RAS 2D (Attachment A) for detailed information

2.1.2.2 Fish Screens

To protect salmonids and juvenile Delta fish species at the locations of the proposed intakes, regulation requires fish screens with 1.75 millimeters (0.069 inch) or smaller openings and the screen area must be sized to provide a 0.2 feet per second (fps) approach velocity toward the screen surface. The actual approach velocity criteria will be determined by DWR as part of the development of the operational criteria and presented in the EIR.

Based upon an approach velocity design criteria of 0.2 fps and a 3,000 cfs design capacity, approximately 30 cylindrical tee-screens would be installed on the river-side of the intake structure for a project design capacity of 6,000 cfs.

See TM – Sacramento River Hydraulic Modeling – HEC-RAS 2D to Support Aquatic Effects Analysis (Attachment A) for detailed information

See TM – Intake Screen Sizing – North Delta Intakes (Attachment A) for detailed information

Water would flow from the Sacramento River through the cylindrical tee-style fish screens then through a piping system with flow meter and control gates to regulate the flow through each screen. The fish screens would have a perforated baffle system within each cylindrical screen unit to promote uniform approach velocity through the screen. A brush screen cleaner would be provided on both the outside and inside face of the screen units to remove debris and help avoid biofouling. Water would flow through the screens and into dedicated piping behind each screen. Control gates in structures along the discharge piping would use flow meter feedback to control the flow rate through each screen. The piping would extend beyond the permanent location of SR 160 and discharge the water into the sedimentation basin. A control structure at the back of the sedimentation basin would hold the water in the basin at a constant water level slightly lower than the river level and allow the diverted flow into the tunnel. The intake structure would include multiple tee screen units, each with dedicated 60-inch diameter piping and gate assemblies, each rated for a diversion capacity of 100 cfs. Each screen and piping assembly is an independent unit from other screen and piping assemblies and includes its own screen cleaning brushes, pipe, flow meter, and control gates, all leading to the common sedimentation basin. Subdividing the system into individual screen assembly units would facilitate better diversion flow control along the length of the intake structure. Consolidation of two or three screens into a common discharge pipe and flow control system could also achieve the desired control and would be considered during design.

See TM – Intake Structural Configuration and Fish Screen Type Analysis (Attachment A) for detailed information

A debris fender and log boom would be provided at each intake to help protect the fish screens from damage by floating and near surface debris.

The debris fender would be a series of timbers or steel cross beams installed horizontally across pipe piles and would be located just upstream from the most upstream fish screen. The fender would extend from the training wall out into the river at a shallow angle. The timbers on the piles would act as a debris fender and deflect near surface and floating material flowing along the edge of the structure away from the screen area.

A log boom with pipe piles to guide its position would be installed immediately in front of the entire length of fish screens along the face of the structure. On the upstream end, the log boom would tie into and extend off the end of the debris fender. The log boom would encourage near surface and floating material to flow downriver past the screen area.

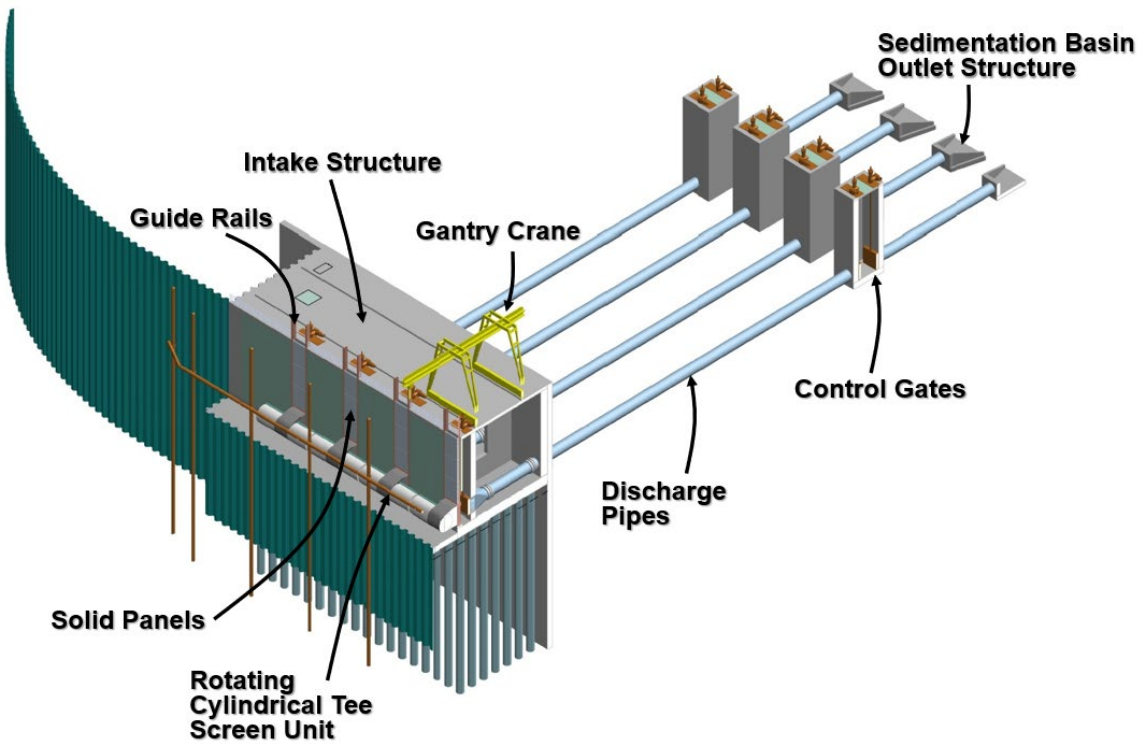
Cylindrical Tee Fish Screen Configuration

The screen units would consist of two fish screen cylinders installed on either side of a manifold feeding an outlet to form a "tee" configuration (Figure 6). The two sides of the tee would include fish screen cylinders that feed diverted flow into the branch outlet of the tee. The cylinders and outlet all would intersect at the manifold section. The screen cylinders would be comprised of fish screen material on the outside and include an interior cylindrical baffle assembly for porosity control. The end of the cylinders would be sealed with a solid plate. The upstream and downstream screen units would have a conical cover on the leading and trailing end, respectively. Slotted fish screen material would be fabricated from 1.75 millimeter wide wedge wire, similar to a well screen. The screen material would include 1.75 millimeter gaps between individual wedge wires to provide about 50 percent open area, which complies with regulatory requirements of a minimum 27 percent open area. The screen cylinders would be attached to the stationary screen manifold assembly and would rotate in both directions for cleaning, using a submersible motor driver. Stationary replaceable brushes would be installed on the exterior and the interior of the screen unit and apply cleaning action against the screen cylinders when they rotate. The stainless steel screen outlet manifold would be attached to a mounting panel constructed from heavy duty stainless steel tube framing. This panel would have a solid stainless steel covering outside of the screen outlet. The mounting panel would be used to slide the screen units up and down in guide rails installed flush with the face of the concrete intake structure. The mounting panel would include ultra-high molecular weight polyethylene (UHMWPE) runners along each side to facilitate installation in the guide rails as well as to allow custom fit adjustment in the field. The screen units and mounting panels would be fabricated to a high straightness and dimensional tolerances for the frame and the screen cylinders. Frame straightness would provide no gaps larger than 1/16 inch around the edges in the guide rails and at the interfaces with the bottom sill or solid panels above.

Screens would be installed by sliding the mounting panels into place along stainless steel guide rails that extend down flush with the face of the concrete structure at a spacing to allow the placement of the adjacent screen and to accept a 12 to 15-foot nominal width mounting panel. Guide rail fabrication tolerances would be compatible with the gap allowances stated above for fish screen openings. The UHMWPE runners would be planted in the field, if necessary, to achieve the desired fit. The actual tee screen portion of the overall unit would be balanced with the mounting panel using center of gravity hoisting cables. Once in place, the hoisting cables would either be removed or tied off to the concrete structure.

Solid panels, with dimensions similar to the screen mounting panels, would be installed in the guide rail above the screen mounting panels. The quantity of solid panels would be sufficient to extend slightly above the intake structure top deck. Since these panels would be solid, they would effectively force all diverted water to flow through the screen units below. The solid panels would be metal fabrications made using stainless steel or carbon steel with a coating. Solid panels would have the same straightness tolerances as screen mounting panels since they would also be excluding fish from the structure.

FIGURE 6. TYPICAL SCHEMATIC OF CYLINDRICAL TEE FISH SCREEN INTAKE FACILITY KEY FEATURES



(Modified From Engineering Concept Drawings, Volume 2, 02-IT)

2.1.2.3 Sedimentation Basin and Sediment Drying Lagoons

The sedimentation basin would remove most of the settleable solids before the flow enters the tunnel conveyance system where the solids would be more difficult to remove. Periodically, settled solids would be removed from the basin and diverted as a slurry to the sediment drying lagoons.

See TM – Intakes River Sediment Analysis – North Delta Intakes (Attachment A) for detailed information

As described in the introduction of Section 2.1.2, Facility Description, the permanent jurisdictional levee would be formed around the exterior of the sedimentation basin and the outlet shaft. The jurisdictional levee would be formed with a cutoff wall and low permeability core material constructed with materials hauled to the intake site. Soil excavated to from the sediment basin would be used to form the embankments over and around the cutoff wall and core material, as applicable.

Water would flow from the intakes through the sedimentation basin through a flow control structure with radial gates and into the outlet channel and shaft structure that would be connected to the tunnel system. The radial gates would function integrally with the jurisdictional levee and could also be used to isolate the tunnel system from high flood waters that could occur at the intake site. The tunnel shaft pad at each intake site would initially be constructed to approximately the height of the levee along State Route 160. Following construction of the jurisdictional levee embankment and the tunnel through the shaft at Intake C-E-5, and following the removal of the tunnel boring machine (TBM) at Intake C-E-3, the tunnel shaft pad and shaft at each respective site would be lowered to an elevation that would allow for gravity flow into the tunnel. At that time, the tunnel shaft would become the intake outlet structure to convey water into the tunnel.

The sedimentation basin would include a lining, such as an articulated concrete lining, for erosion control and to facilitate dredging.

It is expected that sediment would be removed from the basin once per year in the summer. Sediment would be dredged and conveyed as a slurry to the sediment drying lagoons on a rotating basis.

A turbidity curtain would be installed along the centerline of the sedimentation basin to allow for dredging of one portion while continuing operation of the other side of the basin. Dredging during periods when Delta smelt are not present (periods when possibly more water could be diverted at a single screen) would allow the intake to operate at about 2475 cfs (0.33 fps approach velocity) for the period of time when only half of the sedimentation basin was available. As dredging is completed in an area, more of the intake fish screen could be returned to service and restore the ability to divert at full capacity in a few weeks during most periods, depending upon hydrologic conditions. The sediment is anticipated to be composed of large silt and sand particles with minimal organic material. Therefore, no substantial odors are anticipated from the sediment drying lagoon operations.

2.1.2.4 Construction Method Considerations at the Intakes

Construction would be initiated concurrently at Intakes C-E-3 and C-E-5; however, the construction duration would be 10 years and 8 years, respectively. The differences in construction periods reflect different site layouts and riverbank conditions and removal of the TBM equipment from the tunnel at Intake C-E-3.

The site size and the amount of construction activity would be minimized at the intakes by not including tunnel launch shafts or concrete batch plants at the intake sites. Further, only a modest parking, area would be provided to support necessary construction traffic at the sites. A work force of up to about 200 employees for each intake would use offsite park and ride facilities to help minimize traffic and eliminate a large parking lot on each site. The tunnel launch shaft would be located at the Twin Cities Complex near Interstate 5 and the tunnel would be constructed towards the intakes. The concrete batch plants would be located near the intersection of Franklin Boulevard and Lambert Road. Lambert Road would be used as the construction traffic route to haul materials from Interstate 5 or the concrete batch plants to a new intake haul road. The new intake haul road would be constructed from Lambert Road to Intake C-E-3 along the ground surface located immediately to the west of the embankment constructed by the currently unused railroad and to the east of the intake sites to avoid construction traffic on State Route 160. A park and ride lot would be located near the intersection of Franklin Boulevard and Hood-Franklin Road and employee electric vans and buses and small vehicles would travel along Hood-Franklin Road to shuttle workers from parking to the intake sites. The traffic volume and site size requirements would be less than if tunnel launch shaft, concrete batch plant, and parking activities occurred at the intake sites.

The intake construction sequencing would also be established to minimize import or export of major soil volumes. Specialty soils, such as clay fines for levee core construction, cutoff walls, or special materials for other site needs, would be imported. However, based upon existing geotechnical information, most of the soils to form the levees and the basins would be excavated on the intake sites. There is limited geotechnical data available at the sites to accurately define the availability of suitable fine-grained levee embankment materials. However, available data suggest that there may be suitable material to construct the levee embankments, but the actual quantity and gradation cannot be defined at this time. Therefore, the approach described in this EPR includes a zoned fill for the embankments with a modest quantity of fine-grained core material to be imported and on-site material used for the remainder of the embankment. It is assumed that there would be suitable quantity of materials on site for that approach. Organic soils, highly-plastic soils, or oversized gradations would not be used.

Some of the structures at the intake site would require cofferdams and engineered foundations. To minimize disturbances that could occur during pile driving, vibratory pile driving and drilled piers would be used to the extent possible for these features and if supported by additional geotechnical information to be collected from the intake sites. During development of the EPR, a concept was developed to install a groundwater cutoff wall as part of the cofferdam using a deep mechanically mixed (DMM) cutoff wall reinforced with wide flange steel as part of the landside wall primarily supported by drilled and grouted tiebacks. The remaining three walls of the cofferdam would consist of interlocking steel sheetpiles without king piles. The sheetpile wall would be braced against the reinforced DMM wall with pipe struts. This would reduce the depth of the sheetpiles and eliminate the need for heavy wide-flange king piles that are typically driven. Instead, a vibrating pile head installer would possibly be used.

See TM – Conceptual Intake Cofferdam Construction (Attachment A) for detailed information

Ground improvement methods considered at the intake locations are described in Section 6.3.3, Ground Improvement Methods.

Quantifications of construction conditions for the intakes are summarized in Appendix A.

2.1.2.5 Operations Phase Methods for Intakes

The main operations and maintenance (O&M) activities at the intakes with cylindrical tee fish screens would include flow control operations, cleaning and inspection of the fish screen systems, maintenance of the sedimentation basin, including removal of sediment from the basins and the sediment drying lagoons. The disposal site for the sediment has not been defined at this time. However, the Florin Perkins Landfill in Sacramento is assumed to be the disposal site for planning purposes and the DWR EIR air quality and traffic analyses.

See TM – Intake Operations and Maintenance Equipment and Facility Needs (Attachment A) for detailed information

Flow Control Operations

Flow control operations would be conducted to operate the intakes in compliance with Project diversion requirements related to river conditions determined as part of the Project permitting process.

There are two main flow control features at the intakes. These include the radial gate flow control structure (FCS) at the back of the sedimentation basins and the flow control gates behind each fish screen.

- During diversions, the FCS would operate automatically to maintain the water level in the sedimentation basin at a predetermined differential level below the river level measured at the front of the intake structure.
- During diversions, the flow control gates behind the fish screens (screen gates) would modulate in response to flow meters on the discharge pipes to convey the currently allowed diversion flow from the river into the sedimentation basin.
- Both flow control features would be fully closed during periods of no diversion at each intake.

Fish Screen Related Maintenance

Cylindrical tee screen systems would be inspected and maintained on a regular basis to preserve functionality, including manual cleaning of screens and baffle assemblies; sediment buildup reduction; baffle plate adjustment; and screen unit adjustment.

Screen and panel cleaning would be required to remove algae growth, freshwater sponges, freshwater snails, and other biogrowth that are not cleaned by the automatic cleaning system or populate on the inside or back of the various panels and screens. This activity would be conducted from the top deck of the intake structure approximately every three to six months when the river depth is low enough to prevent flow into the structure as solid panels are moved to the center guide slot. The goal would be to conduct cleaning before substantial biofouling is present.

The cleaning procedure would generally include the following actions:

- The upper solid panel would be retrieved along the front guide rail to the top of the structure, inspected, secured in place, and cleaned with the high-pressure spray, front and back. The solid panel would be moved back and lowered into the (empty) rear guide slot.

- The process would be repeated for each solid panel. Since the solid panels are placed in the slot just behind the screens, they create a solid barrier preventing fish from being drawn into the structure. By conducting the work during low water level periods, or by using spare solid panels, the river level would never be higher than the panels in the front or rear guide slot, whichever is higher.
- After all the solid panels are cleaned and temporarily placed in the guide slot behind the screen, the fish screen unit would be pulled up, secured at the top, and the screens, baffle assembly and interior surfaces of the manifold and outlet would be thoroughly cleaned and inspected in a similar manner. The fish screen would be replaced into its original position and the solid panels would be returned to their original positions in reverse order.

In conjunction with screen and panel cleaning, the screen guide rail slots and bottom sill on the face of the intake structure would be cleared of sediment by using jetting nozzles. A jetting jig would be dropped in the guide slots when all panels were removed. The jig would jet the sides of the slots and the bottom sill to help ensure proper installation of the panels after cleaning.

Baffles inside the cylindrical tee screens would be initially set using lab testing, but would be adjusted in the field from the end of the screen units or by lifting the screen to the surface and adjusting from the inside. The details of baffle plate adjustments for both screen types would be further developed during design.

Approximately once or twice per year, a diver would inspect the screens and solid panels while installed in place and operating to look for damage, improper installation, improper cleaning, or sediment buildup. These inspections are often conducted in conjunction with manual screen cleaning activities.

The screen cleaner system would be inspected during panel dives and while being cleaned along with the screens. In accordance with the inspection results, the brushes could be replaced.

The screen rotation motors are sealed and do not require maintenance. However, the operation and performance of the screen rotation motor would be monitored, and the motors replaced, as needed.

Log Boom and Debris Fender Maintenance

The debris fender at the upstream end of the log boom and the log boom would require maintenance to prevent corrosion and related deterioration. Also, periodically debris may collect on the fender or boom, especially after or during storm runoff. Debris would be removed by personnel working from either the top deck of the structure or for work boats, both with hoists and, if needed, divers. Debris removal staff would use hand and power tools to facilitate removal.

Corrosion protection would be accomplished by removing portions of the boom from the water, either onto a floating work platform or onto land. Once removed, coatings would be repaired or reapplied and hardware would be changed if broken or in poor condition. Broken supports and guides would be repaired in a similar manner.

Sediment Management Facilities

The sedimentation basin would operate passively and sediment would settle to the bottom of the basin during flow diversions.

Once a year, during the warm summer months (assumed to be May through September), the sediment would be dredged from the sedimentation basin using a portable floating hydraulic suction dredge. The sediment basin dredge would discharge a sediment slurry into the sediment drying lagoons using a combination of portable (floating) piping in the basin and permanently installed piping leading to the lagoons. The sediment would be removed during the summer to maximize natural drying in the sediment drying lagoons.

Minor vegetation management would be conducted at least monthly along the side slopes of the basins to keep them free of unwanted vegetative growth. Minor debris collection would be conducted on a continuous basis.

Since the basin embankments would be the jurisdictional flood control levee, the levee side slopes and outside of the toe area would be inspected and maintained in full conformance with the CVFPB and USACE requirements. These requirements would include routine inspection and repair of all bulges, leaks, erosion, or other damage as soon as possible after detection.

Sediment dredged from the sedimentation basin would be separated from the dredged water and dried in the sediment drying lagoons for removal off site by trucks. The sediment is anticipated to be large silt and sand particles with minimal organic material. Therefore, no substantial odors are anticipated from the sediment drying lagoon operations.

Sediment dredged from the sedimentation basin would be conveyed from the dredge to the drying lagoons. The lagoons would be equipped with several inlet valves such that the dredged slurry would be distributed around the full lagoon area. The lagoons would include an outlet structure with an adjustable weir to decant water off the top of the sediment slurry and underdrains to transport water from beneath the dredged sediment.

The suction dredge would operate to fill each lagoon up to the level of the top of the adjustable weir in its full up position. Once the first lagoon is full, the dredge would begin to fill a second lagoon. It would be expected to take up to about 2 days to fill each lagoon. Therefore, it would take about 6 to 8 days to fill all four lagoons.

After the lagoon is filled, the weir gate would be used to decant the water off the top of the sediment. The decanting process would take about a day. After decanting the remaining water would be allowed to drain into the outlet structure through the underdrains. Decant and underdrain water would be pumped back into the sedimentation basin. Each time the lagoons are filled, about 0.5 to 1 foot of sediment would be expected to settle to the bottom of the lagoon. Once the sediment was collected and most of the water removed by decanting and underdrains, the basin would be allowed to dry for 2 to 3 days while being mixed with agricultural or municipal style mixing implements. Over the next two to three days, the basin would be cleaned using dozers and front end loaders and the sediment would be trucked off site for disposal at a permitted disposal site or used for beneficial uses off site.

Each lagoon would be filled and drained for about 3 days, then the sediment would be dried and removed in about 4-6 days. Therefore, the fill and drain/dry sequence would be about 7-9 days, which would approximately match the dredged material filling rate so continuous, or nearly continuous, operation would be possible.

2.1.3 Site Selection for Intakes

Potential Sacramento River intake sites were previously identified, considered, and evaluated in support of the Delta Habitat Conservation and Conveyance Program (DHCCP) and the associated California WaterFix Project, which has since been withdrawn from further consideration, as described in Section 1.1, Project Background. The previously identified intake sites were established through a multi-year process with a group comprised of agency, stakeholder, and consultant representatives that evaluated fisheries resources and water quality issues (DWR, 2011). The previously considered intake site locations and related characteristics identified and evaluated in the previous studies were re-evaluated for this analysis.

See TM – Intake Site Identification and Evaluation (Attachment A) for detailed information

In addition, DWR assessed alternative intake locations upstream and downstream from the siting limits described below as part of development of the upcoming Delta Conveyance Project EIR. The screening exercise found that these alternate locations did not meet the project objectives and did not have the potential to lessen potential significant environmental effects, which are the screening criteria for whether alternatives should move forward for further evaluation in the EIR.

Accordingly, the following siting criteria were used for selection of candiate intake sites.

- Sites downstream of the Town of Freeport are preferred because they will have less impact on total flow rate in the river and reverse flows affecting the Sacramento Regional Sanitation District's treated wastewater outfall at Freeport.
- Sites upstream of the confluence with Sutter Slough are preferred because greater bypass (or sweeping) flows are expected to be available in the river to help speed out-migration fish passage.
- Sites further upstream, but below the confluence with the American River, may help reduce the impact on Delta smelt.
- Sites upstream of the projected influence of brackish water in the Delta are essential to facilitate long-term operations with suitable water quality. Generally, intake sites along the river upstream of its confluence with Georgiana Slough are considered viable. The actual upstream limit of brackish water for the life of the Project is currently being evaluated and may shift upstream or downstream. This is not expected to change the intake siting process because the application of the Sutter Slough limit is likely to control the most downstream acceptable location.

During the development of this EPR, potential siting of intakes was conducted to determine viable intake sites. The candidate sites for the project were determined using the following methodology.

- Review previous studies and evaluations to verify the adequacy of previously considered intake sites against current siting criteria and bathymetric data.

- Review bathymetric information and select candidate intake site locations along the eastern riverbank that meet current siting criteria and are suitably deep and straight to site an intake structure.
- Conduct an evaluation of the candidate sites against the current siting criteria.
- Rank the remaining candidate sites according to relative suitability.

Potential intake sites on the west side of the Sacramento River also were not considered because the DWR proposed project presented in the NOP included conveyance alignments located to the east of the Sacramento River. Intakes located on the west side of the Sacramento River would require a major crossing or several crossings of the Sacramento River for both facilities and construction traffic.

Five candidate sites, labeled C-E-1 through 5, were identified (Figure 7).

These candidate sites are essentially the same as the five intake sites recommended in the Five-Agency Technical Recommendations for the Location of BDCP Intakes 1 through 7 (DWR, 2011). Re-examination of the bathymetry and physical setting of the Sacramento River between the community of Freeport and the southern confluence with Sutter Slough did not reveal any new or additional candidate sites conforming to the siting criteria. The five candidate sites shown in Figure 7 were analyzed and considered relative to each other according to the following evaluation categories:

- Bathymetry and river encroachment with straight riverbanks to accommodate long intake structures and prevent excessive accumulation of sediment in front of the screens
- Potential effects on adjacent parcels and parcels across the Sacramento River, including potential effects on existing development and habitat
- Geotechnical Concerns
- Roads and traffic impacts along access routes for construction material and employees
- Candidate Sites C-E-3 and C-E-5 were identified as the most preferable sites with Candidate Site C-E-2 identified as an alternate site if one of the primary sites is later determined to be unacceptable.
- Although Candidate Site C-E-2 had the poorest geotechnical conditions for intake facilities as compared to Candidate Sites C-E-3 and C-E-5, geological conditions at all three sites would be more favorable as compared to Candidate Site C-E-1. Therefore, Candidate Site C-E-1 was not considered in detail.
- Candidate Site C-E-4 was also not considered in detail due to the close proximity to the community of Hood.

FIGURE 7. FINAL CANDIDATE LOCATIONS CONSIDERED FOR THE INTAKE SITING ANALYSIS

Of the three remaining sites, Candidate Site C-E-2 had the shallowest and least straight riverbank, would affect the greatest number of adjacent parcels with existing land uses and/or habitat, and would be visible from the community of Clarksburg. Therefore, Candidate Site C-E-2 was only considered as an alternative for a project design capacity of 6,000 cfs in case future site specific studies identified potential adverse issues associated with Candidate Sites C-E-3 and C-E-5.

Candidate Sites C-E-3 and C-E-5 are referred to as Intakes C-E-3 and C-E-5 throughout the remaining EPR Narrative. Each of the intakes would be developed to divert up to 3,000 cfs, each.

2.2 Tunnels and Tunnel Shafts

2.2.1 Purpose of the Tunnels and Tunnel Shaft

Tunnels are a type of conveyance structure that can be used to move water when large volumes of water must be conveyed and/or where there would be significant benefits from underground construction that minimizes surface disturbances. The DCP includes a tunnel to convey Sacramento River flows diverted at the intake structures, southward to the Southern Complex. Tunnels would also be used to convey water from the Southern Forebay Outlet Structure to the South Delta Outlet and Control Structure which serves as the connection point of the DCP and the existing SWP system.

2.2.2 Facility Description

In the modern era, most large diameter water tunnels are constructed with TBMs that use large rotating cutter heads to drill through underground material. Pre-cast concrete segments that lock into place forming a continuous path of conjoining rings are used to line the inner walls of the bored hole. Construction activities within each TBM use an integrated system including automated tunnel liner installation equipment, tunnel spoils removal conveyors, a ventilation system for safety, and other necessary utility systems.

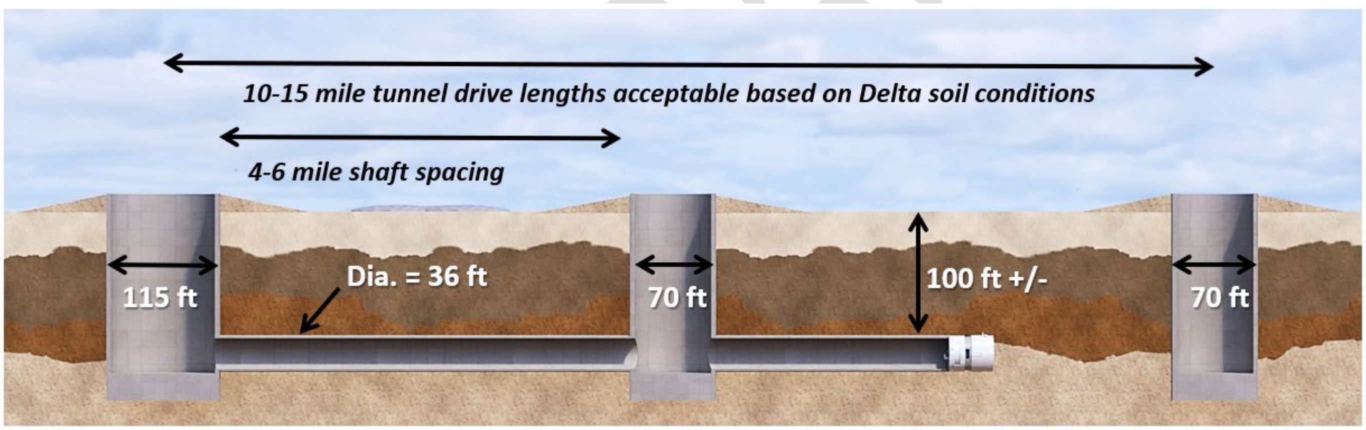
For the DCP, TBM would bore the tunnel from a tunnel launch shaft to a tunnel reception shaft. At each tunnel launch shaft, separate parts of the TBM would be lowered into the ground to the desired tunneling elevation and assembled to become the TBM near the bottom of the tunnel shaft. The tunnel launch shafts would be a significant focal point of tunneling construction activity where the workforce, TBM, and tunnel liner segments would enter the tunnel and where the excavated tunnel material would be transported out of the tunnel. For the purposes of this EPR, the excavated tunnel material is known as Reusable Tunnel Material (RTM) because this material would be used to construct some tunnel shaft pads and portions of the Southern Forebay embankment.

The TBM would bore along the tunnel alignment (also known as a “tunnel drive”) to a tunnel reception shaft. The TBM would be disassembled at the bottom of the tunnel reception shaft and the parts would be lifted to the ground surface for removal from the tunnel.

TBMs, like all rotating machinery, would require periodic maintenance to maintain acceptable performance. Some routine maintenance procedures on a TBM could be performed from within the tunnel. However, major maintenance events, such as inspection of the cutterhead, would be easier at tunnel maintenance shafts. The tunnel maintenance shaft would provide free air (non-pressurized atmosphere below the ground surface) access to the face of the machine. Tunnel maintenance shafts could also be used during tunnel construction to provide fresh air for ventilation in the tunnel and, in the case of an emergency, an exit to improve safety for the workers.

A schematic of the three types of tunnel shafts included in the DCP is presented in Figure 8.

FIGURE 8. KEY COMPONENTS WITH GENERAL DIMENSIONS OF A TUNNEL DRIVE WITH TUNNEL LAUNCH, MAINTENANCE, AND RECEPTION SHAFTS



Launch Shaft
Where the tunnel boring machine (TBM) is lowered into the tunnel. Where the concrete liners are transported into the tunnel. Where the excavated material (RTM) is removed.

Maintenance Shaft
Provides direct access to the TBM for routine maintenance work. Needed approximately every 4 to 6 miles.

Reception Shaft
Termination point of tunnel drive. Where TBM is disassembled and lifted out of the tunnel.

2.2.2.1 Tunnel Shafts for the Central and Eastern Corridors

See TM – Tunnel Excavation and Drive Assessment (Attachment B) for detailed information

See TM – Soil Abrasivity Testing Summary (Attachment B) for detailed information

During preparation of this EPR, a review of appropriate tunnel lengths between tunnel launch shaft and tunnel reception shafts was conducted based upon anticipated DCP tunnel diameter and tunnel depth, anticipated geological conditions, and experience of other tunnel projects. Based on available TBM and tunnel liner technology, tunnels lengths of up to 6 miles are achievable. In order to extend a single tunnel bore up to approximately 15 miles, tunnel maintenance shafts would be needed at intervals not to exceed 6 miles to allow the TBM to be inspected and refurbished, if necessary. Therefore, for the DCP, tunnel maintenance shafts would be located at least every 4 to 6 miles along the alignment.

For the DCP, the Central and Eastern Corridors would extend from along the same alignment between the intakes and the Twin Cities Complex; and then, along two separate corridors between Twin Cities Complex and the Southern Complex. The Twin Cities Complex would include a dual tunnel launch shaft for a tunnel bored to the intakes and for a tunnel bored to the Southern Complex near the northern embankment of the Southern Forebay. At the Southern Complex, two tunnel launch shafts would be located along the southern embankment of the Southern Forebay for two tunnels bored to the South Delta Outlet and Control Structure along the existing Banks Pumping Plant approach channel for both corridors.

On the Central Corridor, the tunnel would be bored from the Twin Cities Complex dual tunnel launch shaft site to the tunnel reception shaft on Bouldin Island. The tunnel shaft on Bouldin Island also would be a tunnel launch shaft for a TBM that would be bored to a tunnel reception shaft on Bacon Island. The Bacon Island tunnel reception shaft also would serve as tunnel reception shaft for a TBM that would be bored from the Southern Complex.

On the Eastern Corridor, the tunnel would be bored from the Twin Cities Complex dual tunnel launch shaft site to the tunnel reception shaft on Terminous Tract. The tunnel reception shaft on Terminous Tract also would be a tunnel reception shaft for a TBM that would be bored from a tunnel launch shaft site on Lower Roberts Island. The tunnel shaft on Lower Roberts Island would also serve as a tunnel reception shaft for a TBM that would be bored from the Southern Complex.

For both the Central and Eastern corridors at the Southern Complex, the tunnel launch shaft sites would be located near the northern embankment of the Southern Forebay. Initially, a tunnel launch shaft would be located at the site of the future inlet to the Southern Forebay and South Delta Pumping Plant. The TBM would bore from the initial tunnel launch shaft to a tunnel shaft site located approximately 1 mile to the north that would be called the “Working Shaft.” After the TBM would bore through the Working Shaft, the tunnel launch activities would be moved to the Working Shaft for continued boring towards the tunnel reception shaft on Bacon Island for the Central Corridor or the tunnel reception shaft on Lower Roberts Island for the Eastern Corridor. By relocating the tunnel launch shaft activities to the Working Shaft, the initial launch shaft would be used to facilitate construction of the South Delta Pumping Plant and avoid delays on the project schedule.

Tunnel Launch Shaft Sites

The tunnel alignments were determined based upon engineering criteria to identify appropriate locations for tunnel shafts, including geotechnical conditions, accessibility, and land uses. The tunnel lengths and the tunnel alignment would be based upon a number of variables such as separation from existing features, geological/groundwater conditions, as well as seismic conditions. Selection of the tunnel launch shaft sites was key to determining the overall tunnel alignments along the Central and Eastern corridors.

See TM – Shaft Conceptual Design (Attachment B) for detailed information

Tunnel launch shaft sites would need to include adequate acreage to accommodate construction of the tunnel shaft, operation of the TBM, and areas to receive and manage the RTM. The tunnel launch shaft site would also include areas for tunnel liner segment storage, slurry/grout mixing plants, electrical substation and electrical building, standby engine generator and fuel tank with spill prevention facilities, workshops and offices, water treatment tanks, access roads, conveyor cassettes storage, and RTM handling, drying, and storage areas.

Multiple sites were considered for tunnel launch shaft sites at Twin Cities Complex and Southern Complex for the Central and Eastern Corridors, Bouldin Island for the Central Corridor, and Lower Roberts Island for the Eastern Corridor. The key characteristics of these selected tunnel launch shaft sites are summarized below.

See TM – Shaft Siting Study (Attachment B) for detailed information

- Twin Cities Complex (Central and Eastern Corridors):
  - Within 15 miles of the intake sites; and therefore, would eliminate the need for another tunnel launch shaft near the intakes along the Sacramento River or in areas within or near Stone Lakes National Wildlife Refuge.
  - Transportation access along Interstate 5 at the Twin Cities Road interchange.
  - Adjacent to an existing Union Pacific Railroad (UPRR) to facilitate movement of tunnel liner segments and other construction materials to the tunnel launch shaft site, and to transport RTM to the Southern Complex for embankment construction.
  - Near existing power supplies.
  - Separated by Interstate 5 from sensitive environmental areas related to the Stone Lakes National Wildlife Refuge and by over 1 mile from ponds related to the Cosumnes River Preserve.
  - Near non-habitat land uses, including Interstate 5, UPRR, and Franklin Field Airport
- Southern Complex on near the northern embankment of the Southern Forebay (Central and Eastern Corridors):
  - Near the Southern Forebay embankments to allow transport of RTM from the launch shaft sites to form the embankments.
  - Near existing power supplies.
  - Transportation access along Byron Highway and UPRR which could be extended to the tunnel launch shaft site and Southern Forebay embankment areas.

- Southern Complex along the southern embankment of the Southern Forebay (Central and Eastern Corridors):
  - Near the downstream end of the Southern Forebay and located across the Byron Highway from the Banks Pumping Plant approach channel.
  - To the east of existing high voltage transmission lines.
  - Located north of the West Tracy Fault
  - To the north and east of lands with special status species habitat.
  - Near existing power supplies.
  - Adjacent to major transportation access along Byron Highway and UPRR which could be extended to the tunnel launch shaft site.
  - Adequate space for on-site transportation corridors to move RTM from tunnel launch sites at the Southern Complex and from the adjacent highway and railroads to construct the Southern Forebay embankments.
- Bouldin Island (Central Corridor):
  - Provided a central location between the Twin Cities Complex and Bacon Island reception shaft along the Central Corridor meeting the 15-mile-maximum threshold for distances between a launch and reception shaft established for the project.
  - Near existing power supplies.
  - Adjacent to major transportation access along State Route 12 which connects two major highways, Interstate 5 and Interstate 80.
  - Adequate space for RTM storage.
- Lower Roberts Island (Eastern Corridor):
  - Provided a central location between the Terminous Tract reception shaft and the Southern Complex along the Eastern Corridor meeting the 15-mile-maximum threshold for distances between a launch and reception shaft established for the project.
  - Located near existing power supplies.
  - Ability to extend major transportation infrastructure from the Port of Stockton roads and railroads (UPRR and Burlington Northern-Santa Fe Railroad [BNSF]) which could be used to deliver materials from ships moored at the Port of Stockton and other materials from major transportation corridors.
  - Adequate space for RTM storage.

Tunnel Maintenance Shaft and Tunnel Reception Shaft Sites

Tunnel reception and maintenance shaft sites would include areas for the tunnel shaft with adjacent areas for equipment to excavate the shaft, and cranes and appurtenant items to move equipment into and out of the tunnel shaft. Most tunnel reception and maintenance shafts would not be used to launch tunnel segments or remove RTM; therefore, no area would be required for RTM or tunnel segment handling. However, the tunnel shaft sites on Bouldin Island (Central Corridor) and Lower Roberts Island (Eastern Corridor) would be used for tunnel launch

See TM – Shaft Siting Study (Attachment B) for detailed information

and tunnel reception shaft activities; and the Working Shaft at the Southern Complex (Central and Eastern corridors) would be used for tunnel launch and tunnel maintenance shaft activities.

Due to the length of the tunnels and appropriate locations for tunnel reception shaft and tunnel maintenance shafts, the Central Corridor between Twin Cities Complex and Southern Complex would include three tunnel maintenance shafts (New Hope Tract, Staten Island, and Mandeville Island) and one tunnel reception shaft (Bacon Island). The Bouldin Island shaft site would also include a tunnel reception shaft to receive the TBM from the Twin Cities Complex. The Eastern Corridor between Twin Cities Complex and Southern Complex would include four tunnel maintenance shafts (New Hope Tract, Canal Ranch Tract, King Island, and Upper Jones Tract) and one tunnel reception shaft (Terminous Tract). The Lower Roberts Island shaft site would also include a tunnel reception shaft to receive the TBM from the Southern Complex.

The locations of the tunnel launch, reception, and maintenance shafts are shown in Figures 3A and 3B for the Central and Eastern corridors, respectively; and schematics of the tunnel shaft locations are provided in Figure 9 for the Central and Eastern corridors. The tunnel lengths between shafts for the DCP Central and Eastern corridors are summarized in Tables 2 through 4.

Quantifications of construction conditions for the tunnel shafts and tunnels are summarized in Appendix A.

FIGURE 9. ORDER OF TUNNEL SHAFTS AND TUNNELING DIRECTIONS FOR CENTRAL AND EASTERN CORRIDOR OPTIONS

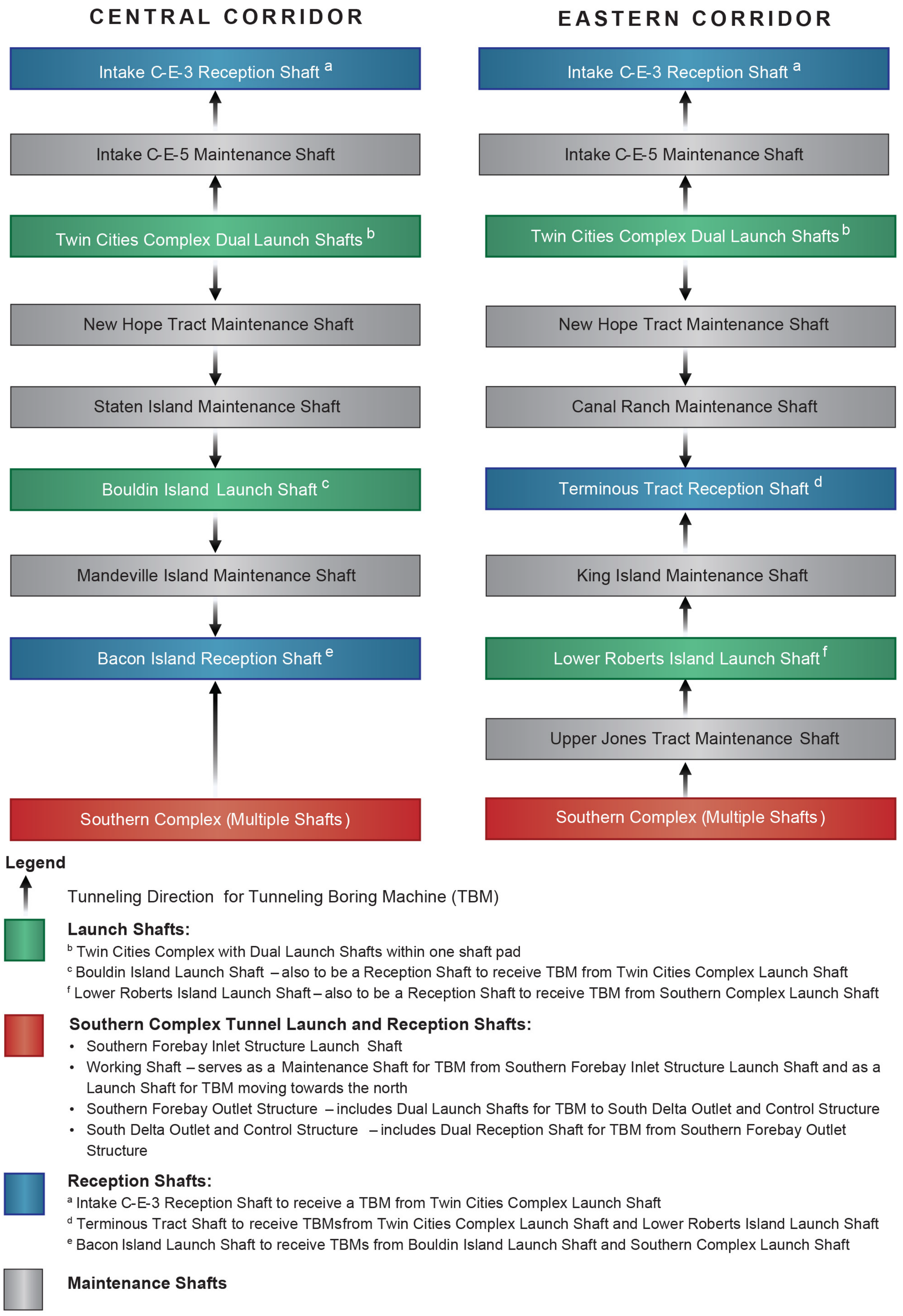


TABLE 2. TUNNEL ALIGNMENT LENGTHS BETWEEN LAUNCH AND RECEPTION SHAFTS ALONG CENTRAL CORRIDOR

Reach	Launch Shaft Site	Reception Shaft	Maintenance Shafts	Drive Length (miles)
1	Twin Cities Complex	Intake C-E-3	Intake C-E-5	8.2
2	Twin Cities Complex	Bouldin Island	New Hope Tract Staten Island	14.5
3	Bouldin Island	Bacon Island	Mandeville Island	10.1
4	Southern Complex on Byron Tract (includes Southern Forebay Inlet Structure Launch Shaft)	Bacon Island	Working Shaft	6.7

TABLE 3. TUNNEL ALIGNMENT LENGTHS BETWEEN LAUNCH AND RECEPTION SHAFTS ALONG EASTERN CORRIDOR

Reach	Launch Shaft Site	Reception Shaft	Maintenance Shafts	Drive Length (miles)
1	Twin Cities Complex	Intake C-E-3	Intake C-E-5	8.2
2	Twin Cities Complex	Terminous Tract	New Hope Tract Canal Ranch Tract	12.7
3	Lower Roberts Island	Terminous Tract	King Island	9.5
4	Southern Complex on Byron Tract (includes Southern Forebay Inlet Structure Launch Shaft)	Lower Roberts Island	Upper Jones Tract Working Shaft	11.8

TABLE 4. TUNNEL ALIGNMENT LENGTHS AT SOUTHERN COMPLEX TO PROVIDE WATER TO THE SWP BANKS PUMPING PLANT APPROACH CHANNEL

Reach	Launch Shaft Site	Reception Shaft	Maintenance Shafts	Drive Length (miles)
5E	Southern Forebay Outlet Structure	South Delta Outlet and Control Structure	None	1.7
5W	Southern Forebay Outlet Structure	South Delta Outlet and Control Structure	None	1.7

2.2.3 Considerations for Tunnel Features

The proposed main tunnel for DCP would convey 6,000 cfs. This subsection describes the basis for selection of the tunnel diameter and slopes, tunnel liner thickness, tunnel boring methods, and considerations for soil abrasivity during tunnel boring.

2.2.3.1 Tunnel Diameters and Depths under Ground Surface

During the preparation of the EPR, a range of tunnel diameter options were evaluated using a detailed hydraulic head loss analysis considering a range of water surface elevations (WSELs) within the tunnel, operational ranges for the South Delta Pumping Plant. The evaluation included a hydraulic transient-surge analyses especially for a scenario with the simultaneous shutdown of the pumps at the South Delta Pumping Plant (which could occur during a power failure) followed by closure of the flow control structure's radial gates at the sediment basin outlet of each intake. Based on the hydraulic analysis results, the tunnel inside diameter would be 36-feet (approximately 39-feet outside diameter) and the maximum design flow velocity would be 6 feet per second (fps).

See TM – Capacity Analyses for Preliminary Tunnel Diameter Selection (Attachment B) for detailed information

The hydraulic analysis was also used to identify the bottom elevations (invert) of the tunnels. The invert elevations of the tunnel between the intakes and Twin Cities Complex would range from -143 feet to -146 feet (North American Vertical Datum of 1988 [NAVD88]). Along both the Central and Eastern corridors, the invert elevations of the tunnel between Twin Cities Complex and the Southern Forebay Inlet Structure would range from -146 feet to -163 feet.

See TM – Hydraulic Analysis of Delta Conveyance Options – Main Tunnel System (Attachment H) for detailed information

The hydraulic analysis evaluated two basic flow conditions to convey water from the intakes to the Southern Forebay.

- During diversions, the water would flow by gravity to the South Delta Pumping Plant wet well to be located along the northern embankment of the Southern Forebay. The pumps at the South Delta Pumping Plant would lift the water from the tunnel into the Southern Forebay.
- When the Sacramento River elevation at the intakes would be sufficiently higher than the water surface elevations in the Southern Forebay, water could flow through the tunnel directly into the Southern Forebay through a bypass channel around the South Delta Pumping Plant. The flow rate achievable for this condition of full gravity flow would depend on the river and forebay levels and may not be sufficient to deliver the desired diversion rate through the system under many circumstances. Full gravity flow conditions would generally occur during periods when demand is below full capacity, flows in the Sacramento River were high, and water surface elevations in the Southern Forebay were low. The gravity flow would enter the Southern Forebay near the Southern Forebay Inlet Structure tunnel launch shaft site, as shown on the engineering concept drawings.

2.2.3.2 Tunnel Liner Considerations

The tunnel would be lined with precast concrete segmental liners. The tunnel liner thickness would be directly related to the inside diameter based on experience with similar diameter tunnel projects in similar ground conditions with a thickness of 18-inches for an inside diameter of 36 feet. The TBM cutterhead diameter would be 40.2 feet based upon the outside tunnel diameter (39 feet) and an overcut (annulus) of 7-inches (0.6 feet) to facilitate segment erection, steering tolerances and shield thickness. The magnitude of the settlement created by the overcut would be controlled by injecting grout into the annulus as soon as possible.

2.2.3.3 Tunnel Boring Methods

A TBM is capable of boring anywhere from a few feet per day to upwards of several hundred feet per day depending largely on tunnel diameter and underground geology. Based on the expected geologic conditions of the Delta at the proposed depth of the tunnel and the proposed boring operation plan, the TBM is expected to progress approximately 40 feet per day based upon similar tunneling operations. The TBM would operate up to 20 hours per day for five days per week with one additional day per week dedicated to routine maintenance.

See TM – Preliminary Construction Schedules for Central and Eastern Corridor Options (Attachment H) for detailed information

Two basic types of pressurized TBM machines could be utilized for the DCP: an earth pressure balance (EPB) machine or a slurry machine. Based upon anticipated geotechnical investigations along the tunnel alignments, the DCP assumed use of the EPB machines. This assumption represents a conservative assessment of the construction water demands of the project because EPB machine would use more water than slurry machines which recycle the slurry.

See TM - Tunnel Excavation and Drive Assessment (Attachment B) for detailed information

The tunnel liner would be installed behind the TBM cutterhead. The tunnel liner would provide support against static and dynamic external and internal pressures. External pressures would include TBM construction forces, earth weight, groundwater pressure and earthquake loads. Internal pressures would be related to water head pressures and surge pressures from the water flowing through the tunnel. Conceptual static design analyses were performed as part of the EPR preparation to identify the preliminary design requirements of the tunnel liner system. Based on the findings, a one-pass precast gasketed concrete segmental lining would be expected to be appropriate to resist all foreseen forces.

See TM – Conceptual Tunnel Lining Evaluation (Attachment B) for detailed information

Tunnel segmental liners for the DCP would be assumed to be fabricated at off-site pre-cast concrete facilities. The segmental liners would be delivered to launch shaft sites either by truck or rail depending on tunnel launch shaft site. Approximately 4 months of supply would be maintained at the launch shaft sites to reduce the risk of delays in tunnel operations caused by disruptions in liner manufacture or delivery.

See TM – Preliminary Precast Yard Study (Attachment F) for detailed information

Future geotechnical investigations would be conducted during the final design phase. The investigations would evaluate the ground load to determine the net tension in the liners, and to verify that the proposed lining system (including options, such as continuous hoop reinforcing and bolted connections) could meet all permanent loads. In addition, future geotechnical investigations would be used to confirm if groundwater pressures would result in artesian pressures that could yield higher hydrostatic pressures and that could reduce the net tension.

See TM - Tunneling Effects Assessment (Attachment B) for detailed information

During boring operations, water and chemical conditioners would be added at the cutter face of the TBM to alter the plasticity of the soil so that the RTM could flow more readily through the TBM cutter face and into the conveyor system for transport of the RTM out of the tunnel. A highly biodegradable conditioner made of all-natural materials would be specified for the DCP. Use of these soil conditioners in the tunneling process would not pose a risk to human health, wildlife or the environment provided standard procedures are followed.

See TM –Reusable Tunnel Material (Attachment B) for detailed information

2.2.3.4 Tunnel Launch Shafts

Tunnel launch shafts would be used as launch points for TBMs including worker access (elevator and emergency stairs), tunnel liner segment delivery and installation systems, RTM removal systems, grout pumping system (to seal space between exterior of liner and the tunneled earth), ventilation systems, compressed air, power, water supply and discharge, communications, and other facilities. During operations, the tunnel launch shafts would be used as an access point for inspection and maintenance, if needed.

See TM – Shaft Conceptual Design (Attachment B) for detailed information

The tunnel launch shafts would be 115 feet in inside diameter, as shown in the engineering concept drawings. Tunnel launch shafts that also serve as working and reception shafts also would be constructed with an inside diameter of 115 feet, including shafts on Bouldin Island (Central Corridor), Lower Roberts Island (Eastern Corridor), and the Byron Tract Working Shaft (Central and Eastern corridors).

A 5-foot thick slurry wall would be constructed around the outside diameter of the tunnel shaft and would extend from the top of the raised shaft pad to below the bottom of the tunnel shaft invert connected to a low permeability geologic unit to minimize connections to adjacent groundwater. The invert of the tunnel launch shaft would be about 130 to 150 feet below the ground surface to provide sufficient space for the TBM assembly and operation. Tunnel launch shafts would include the 5-foot thick slurry wall plus a 3-foot thick secondary lining which would act as the final lining, for a total of an 8-foot thick wall to resist external ground and groundwater loads. The tunnel shaft would be excavated after the placement of the slurry wall. An approximately 30-foot thick concrete base slab would be placed at the bottom of the shaft. Following installation of the concrete plug at the base of the tunnel shaft, the shaft would be dewatered. Then, the interior shaft concrete lining would be installed commencing from the shaft invert. The shaft walls and the 30-foot thick concrete base slab would resist uplift pressures from groundwater and separate the tunnel from the surrounding groundwater. The tunnel shaft would be constructed in saturated soil conditions due to high groundwater levels.

See TM – Shaft Conceptual Design for detailed information

During the initial construction phase at the tunnel launch shaft sites, the tunnel shaft pad would be constructed above the ground surface to an elevation approximately equal to the adjacent levee system, as described in Appendix A for each site. Following construction, the tunnel launch shaft liner would be raised above the shaft pad to an elevation determined by DWR to be above the maximum water surface in the tunnel for hydraulic surge events or the Sacramento River 200-year flood event with sea level rise and climate change hydrology for Year 2100 (DWR, 2020b), whichever is higher. The heights of the tunnel launch shaft pads and shaft liners are presented for each site in Appendix A and the engineering concept drawings.

See TM – Flood Risk Management (Attachment H) for detailed information

The tunnel launch shaft pads on Twin Cities Complex and the northern portion of Southern Complex for the Central and Eastern Corridors and on Lower Roberts Island for the Eastern Corridor would be developed from on-site soil excavations. The tunnel launch shaft pad at Bouldin Island would be constructed from soil excavated on Twin Cities Complex.

See TM – Soil Balance (Attachment H) for detailed information

Ground improvement would be required at all tunnel shaft sites except at the Twin Cities Complex, as shown in the engineering concept drawings, and as described in Section 6.3.3, Ground Improvement Methods.

The tunnel launch shaft construction sites would be different for each location based upon ground elevation, adjacent levee height, geological conditions, existing access corridors, and parcel boundaries. The tunnel launch shaft construction sites at Twin Cities Complex for the Central and Eastern corridors; Bouldin Island for the Central Corridor; and Lower Roberts Island for the Eastern Corridor would be sized to accommodate all functions necessary for tunneling operations, including RTM management. Construction and post construction site acreages for the tunnel launch shaft sites are provided in Section 6.8, Table 10. The construction area would include:

- Tunnel launch shaft and perimeter working platform
- RTM testing, drying and stockpiling areas
- Liner delivery, storage and transport systems
- Material supply yards, equipment storage, slurry/grout mixing plant, and laydown areas
- Utility services (power supply and fuel storage)
- Construction staff offices and other support space
- Water collection, treatment, and storage facilities
- Access roads
- Rail spurs and on-site rail lines at Twin Cities Complex and Southern Complex for Central and Eastern corridors and at Lower Roberts Island site for the Eastern Corridor, only

Following construction and removal of construction equipment and materials, the acreage of tunnel launch shaft sites would be substantially reduced and restored for future agricultural or habitat uses, as described in Section 6.8, Construction and Long-term Site Space Requirements.

2.2.3.5 Tunnel Reception Shafts

The TBM would bore from the tunnel launch shaft to the tunnel reception shaft where the TBM would be retrieved and removed from the tunnel. Reception shaft sites would be located no more than approximately 15 miles from the corresponding launch shaft sites, representing the maximum planned driving distance for the TBM, as summarized in Tables 2, 3, and 4. During operations, the tunnel reception shafts could be used as an access point for inspection and maintenance.

See TM – Tunnel Excavation and Drive Assessment (Attachment B) for detailed information

See TM – Tunnel Inspection and Maintenance Considerations (Attachment B) for detailed information

The tunnel reception shaft diameter would be based on results from hydraulic analyses as well as the space required to safely allow TBM breakthrough through the concrete walls of the shaft and dismantle the TBM for subsequent removal out of the shaft. Tunnel reception shafts on Bacon Island (Central Corridor) and Terminous Tract (Eastern Corridor) would be constructed with a 70-foot inside diameter. The tunnel reception shaft at Intake C-E-3 would be constructed with an inside diameter of 83-feet. The tunnel reception shafts at the South Delta Outlet and Control Structure would be constructed with an inside diameter of 90-feet. The tunnel shafts on Bouldin Island (Central Corridor) and Lower Roberts Island (Eastern Corridor) would be used as a tunnel reception shaft and a tunnel launch shaft; and therefore, the shaft inside diameter would be 115 feet to accommodate tunnel launch shaft activities.

See TM – Shaft Conceptual Design (Attachment B) for detailed information

Tunnel reception shafts would be constructed in the same manner as described in Section 2.2.3.4, Tunnel Launch Shafts.

Ground improvement would be required at the Bacon Island (Central Corridor) and Terminous Tract (Eastern Corridor) tunnel reception shafts, as shown in the engineering concept drawings and described in Section 6.3.3, Ground Improvement Methods.

Soil to construct the tunnel reception shaft pad at Intake C-E-3 would be provided from on-site excavations at the intake site, including soil excavated at the sedimentation basin. Soil to construct the tunnel reception shaft pad at Bacon Island (Central Corridor) would be provided from on-site excavations and soil materials, including RTM, from the Twin Cities Complex. Soil to construct the tunnel reception shaft on Terminous Tract (Eastern Corridor) would be provided from on-site excavations and soil from the Twin Cities Complex.

See TM – Soil Balance (Attachment H) for detailed information

The tunnel reception shaft construction sites would be different for each location based upon ground elevation, adjacent levee height, geological conditions, access roads, and parcel boundaries. The additional acreage at Bacon Island would be used for topsoil and peat storage and a concrete batch plant. Construction and post construction site acreages for the tunnel reception shaft sites are provided in Section 6.8, Table 10.

The tunnel reception shaft site would be sized to include adequate space to accommodate the following functions necessary for tunneling operations, including:

- Shaft and perimeter working pad
- Area for placement of TBM equipment removed from the tunnel
- Access roads
- Excavated material stockpiling
- Construction materials staging Staff offices and other support space
- Water collection, treatment, and storage facilities
- Utilities
- Access roads

Following construction, construction equipment and materials would be removed. However, the total acreage would not be modified and the land surrounding the reception shaft pad would not be reclaimed for agricultural or habitat uses. The disturbed areas would be seeded with grasses to minimize erosion.

2.2.3.6 Tunnel Maintenance Shafts

Tunnel maintenance shafts would be constructed along the tunnel every 4 to 6 miles between tunnel launch and reception shafts to provide for periodic inspection and maintenance of the TBM and cutterhead at atmospheric conditions. The maintenance activities for the TBM could require 4 weeks to complete minor repairs or up to 8 weeks to complete a major overhaul, such as replacement of the main bearing or cutterhead. During construction, the tunnel maintenance shafts would be used as an access point and an emergency egress, if needed.

See TM – Shaft Conceptual Design (Attachment B) for detailed information

The tunnel maintenance shaft diameter would be based on results from hydraulic analyses as well as the space required to safely allow TBM breakthrough through the concrete walls of the shaft and provide a safe area to work around the TBM. Tunnel maintenance shafts along the Central and Eastern corridors would be constructed with a 70-foot inside diameter except the tunnel maintenance shaft at Intake C-E-5 would be constructed with an inside diameter of 83-feet. The Working Tunnel Shaft at the Southern Complex would also be a tunnel launch shaft; and therefore, the shaft inside diameter would be 115 feet to accommodate tunnel launch shaft activities.

Tunnel maintenance shafts would be constructed in the same manner as described in Section 2.2.3.4, Tunnel Launch Shafts.

Ground improvement would be required at the tunnel maintenance shafts, as shown in the engineering concept drawings and described in Section 6.3.3, Ground Improvement Methods.

Soil to construct the tunnel maintenance shaft pad at Intake C-E-5 would be provided from on-site excavations at the intake site, including soil excavated at the sedimentation basin. Soil to construct the tunnel maintenance shaft pads on New Hope Tract and Staten Island along the Central Corridor would be provided from on-site excavations and soil from the Twin Cities Complex. The tunnel maintenance shaft pad on Mandeville Island along the Central Corridor would be provided from on-site excavations and RTM from the Twin Cities Complex.

See TM – Soil Balance (Attachment H) for detailed information

Soil to construct the tunnel maintenance shaft pads on New Hope Tract, Canal Ranch Tract, and King Island along the Eastern Corridor would be provided from on-site excavations and soil from the Twin Cities Complex. Soil to construct the tunnel maintenance shaft pad on the Upper Jones Tract on the Eastern Corridor would be provided from on-site excavations and soil from Lower Roberts Island.

The tunnel maintenance shaft construction sites would be different for each location based upon ground elevation, adjacent levee height, geological conditions, access roads, and parcel boundaries. The tunnel maintenance shaft sites would be slightly smaller than a tunnel reception site because the tunnel maintenance shaft site would not need an area to dismantle all of the TBM equipment. The tunnel maintenance shaft sites along the Central Corridor include New Hope Tract, Staten Island, and Mandeville Island. The tunnel maintenance shaft sites along the Eastern Corridor include New Hope Tract, Canal Ranch Tract, King Island, and Upper Jones Tract. Construction and post construction site acreages for the tunnel maintenance shaft sites are provided in Section 6.8. The tunnel maintenance shaft site at Intake C-E-5 would be part of the total intake site acreage, as summarized in Section 6.8 and Appendix A.

The tunnel maintenance shaft site would be sized to include adequate space to accommodate the following functions necessary for tunneling operations, including:

- Shaft and perimeter working pad
- Access roads
- Excavated material stockpiling
- Construction materials staging
- Staff offices and other support space
- Water collection, treatment, and storage facilities
- Utilities
- Access roads

Following construction, construction equipment and materials would be removed. However, the total acreage would not be modified and the land would not be reclaimed for agricultural or habitat uses. The disturbed areas would be seeded with grasses species to minimize erosion.

2.2.4 Reusable Tunnel Material Management

As noted in Section 2.2.3, Considerations for Tunnel Features, embankments and tunnel shaft pads at the intakes, tunnel shaft sites, and Southern Complex would be constructed with soil from on-site soil excavations. RTM would also be used for the Southern Forebay embankment (Central and Eastern corridors), Mandeville Island tunnel maintenance shaft pad (Central Corridor), and Bacon Island tunnel reception shaft pad (Central Corridor).

See TM – Soil Balance (Attachment H) for detailed information

Significant amounts of soil would be continuously excavated and removed from the tunnel during boring operations. Based on existing data, the soil properties are such that this material would be suitable for use as structural fill to meet a portion of the soil demand on the DCP – thus the label Reusable Tunnel Material, or RTM. It is recognized that under some conditions, small portions of this material may not be suitable for reuse due to physical or chemical characteristics. The unsuitable materials (assumed to be 5 percent of total volume) would be segregated and managed appropriately. For the purposes of this EPR, the term “RTM” will be used in this EPR for all material excavated during tunnel boring; however, it is assumed that only 95 percent of the total excavate volume would be suitable for reuse.

See TM – Reusable Tunnel Material (Attachment B) for detailed information

The TBM would excavate about 250,000 cubic yards of in-place RTM per mile. The wet in-place volume of RTM would expand by approximately 30 percent once the soil is removed by the TBM, mixed with conditioners, and conveyed to the ground surface. After drying and compaction, the RTM’s volume would be approximately 99 percent of the pre-excavated volume. Table 5 below provides a summary of the cubic yards of uncompacted material that would be expected to be generated at each of the tunnel launch shaft locations along the Central and Eastern Corridors.

TABLE 5. VOLUME OF WET UNCOMPACTED RTM GENERATED AT EACH LAUNCH SHAFT SITE FOR PROJECT DESIGN CAPACITY OF 6,000 CFS

Launch Shaft Site	Central Corridor (millions of cubic yards)	Eastern Corridor (millions of cubic yards)
Twin Cities Complex Dual Launch Shafts	7.19	6.61
Bouldin Island Launch Shaft	3.18	N/A
Lower Roberts Island Launch Shaft	N/A	3.00
Launch Shafts at Northern Southern Complex	2.13	3.74
Southern Complex Dual Launch Shafts at Southern Forebay Outlet Structure as part of South Delta Conveyance Facilities	1.19	1.19

The excavated material would be continuously conveyed from the face of the TBM, toward the tunnel launch shaft, and lifted vertically up the shaft to the ground surface. In general, RTM management at the tunnel launch shaft site would include the following major processes:

- **Testing for Hazardous Materials:** Excavated RTM would be tested in accordance with the requirements of the Central Valley Regional Water Quality Control Board and the Department of Toxic Substance Control for the presence of hazardous materials at concentrations above the regulatory threshold criteria. The RTM would be placed in temporary stockpile areas while it is tested for the potential presence of hazardous materials. It is anticipated that several stockpiles would be developed to allow for determination of the changes in geology as the TBM proceeds. Each temporary area would be generally sized to accommodate up to 1 week of RTM production and would be lined with impermeable lining material. At sites with mechanical drying, the RTM would be dried before being placed in a temporary stockpile. If portions of the RTM were identified as hazardous, that material would be transported in trucks licensed to handle hazardous materials to a disposal location licensed to receive those constituents. If the RTM meets the criteria for reuse, the material would be moved by conveyor to a long-term on-site storage site or transported off site for subsequent reuse.

See TM – Reusable Tunnel Material (Attachment B) for detailed information

- **RTM Drying:** RTM intended for reuse as structural fill would require drying. The naturally occurring moisture content of the ground in the tunnel zones is expected to average 31 percent. With the addition of conditioners and water used in the assumed EPB tunneling process, the excavated material could be expected to have a moisture content varying from 38 to 45 percent. For more clay-rich soils, structural fill material would require a moisture content between about 17 and 24 percent. Sandier soils could be used with a lower target moisture content and would be easier to dry than clay-rich soils.

  Both natural drying (evaporation) and mechanical drying were considered for the DCP tunnel launch shaft sites. At the Twin Cities Complex and Southern Complex, where the RTM would be reused on the project, mechanical dryers utilizing electric, natural gas, or propane heat sources would be considered. The mechanical dryers would minimize space requirements, provide for better moisture control, and avoid seasonal variation in evaporative drying rates as compared to natural drying process.

  Neither natural drying nor mechanical drying processes would be anticipated to create odors. It is recognized that odors typically occur due to the presence of organic or sulfide constituents. No information is available about these constituents at this time. However, organic material would not be expected at tunnel depths based on preliminary understanding of regional depositional processes and available subsurface information. If sulfides were present, these constituents would probably be oxidized during the tunneling excavation and RTM soil moving operations.

- **Stockpiling (Dry):** For the RTM slated for reuse, the dried RTM would be piled and moved by bulldozers and motor scrapers, and then deposited in the dry stockpile areas near the tunnel launch shaft sites at the Twin Cities Complex and Southern Complex. As the RTM is required either on-site or at other locations, the RTM would be removed by wheel loaders and conveyors onto trucks or rail cars for transport to the designated points of use. RTM not removed for reuse would be graded and planted with erosion-control seed mix to avoid need for future handling and avoid dust generation.
- **Stockpiling (Wet):** For the RTM not slated for reuse, the RTM would be spread over a broad area in relatively thin lifts (e.g. 18-inches) and allowed to dry and drain naturally over a period of up to 1 year. Continuous spreading in thin lifts would allow RTM that is not mechanically dried to be dried naturally without excessive earth moving requirements.

See TM – Post-Construction Land Reclamation (Attachment H) for detailed information

Reuse of RTM, storage of RTM, and acreage and heights of RTM storage stockpiles for each tunnel launch shaft site are presented in Soil Balance TM (Attachment H). Locations of RTM wet and dry storage areas are presented in engineering concept drawings and GIS files. The overall RTM management plan for each of the launch shaft sites are summarized below:

See TM – Soil Balance (Attachment H) for detailed information

- **Twin Cities Complex (Central and Eastern Corridors):** The Management Plan would be to move RTM to on-site storage areas, and as the RTM needs occurred during the construction period, provide RTM for soil materials at Twin Cities Complex and Southern Complex (Central and Eastern Corridors) and Mandeville and Bacon islands (Central Corridor). Mechanical drying of all RTM would occur within structures and would occur year-round. Approximately 1.3 to 1.8 million cubic yards of dry RTM would be moved to the Southern Complex for reuse. Approximately 400,000 to 1 million cubic yards would be used to fill excavated areas at Twin Cities Complex site and provide fill to Mandeville and Bacon islands. Long-term storage stockpiles of surplus dried RTM would be up to 15 feet high.
- **Bouldin Island (Central Corridor):** The Management Plan would be to naturally dry and store all RTM on-site. No mechanical drying would be provided. RTM would be placed in permanent stockpiles approximately 6 feet high on-site. Due to the soil conditions, it is anticipated that the RTM stockpiles would subside, and the long-term height would be less.
- **Lower Roberts Island (Eastern Corridor):** The Management Plan would be to naturally dry and store all RTM on-site. No mechanical drying would be provided. RTM would be placed in stockpiles up to approximately 7 feet high on-site during construction. Following tunnel construction, the RTM stockpile would be consolidated into a smaller area 15 feet high. Due to the soil conditions, it is anticipated that the RTM stockpiles would subside, and the long-term height would be less.
- **Southern Complex (Central and Eastern Corridors):** The Management Plan would be to maximize use of the RTM material for forebay embankment and forebay floor fill with year-round mechanical drying of RTM on-site. No long-term stockpiles of RTM would occur

for the Central Corridor. For the Eastern Corridor, long-term storage in stockpiles of surplus dried RTM would be 15 feet high and would be combined with the surplus topsoil and peat stockpiles. No long-term stockpile would exist for the Central Corridor.

Odors from construction materials are primarily generated from hydrogen sulfide gases through decomposition of organic materials in the soil particles (Reinhart et. al. 2004). The tunnel excavation would occur at least 120 feet below the ground surface. Testing shows that subsurface material does not contain substantial organic material and are predominately composed of silt, clay, and other inorganic materials (DWR 2010).

If hydrogen sulfide gas was present, these chemical compounds would generally be dissolved in the groundwater and not absorbed onto soil particles. For example, published literature indicates that hydrogen sulfides in surface soil are generally below the method detection limits and are thus unlikely to pose a nuisance impact on humans (Hansen et al. 2018; OEHHA 2008). However, if hydrogen sulfide or other gases (e.g., methane) are present in the tunnel, the gases would not remain in the RTM. A major ventilation system would be installed in the tunnel and at the tunnel launch shaft to control the excavation atmosphere to acceptable levels in accordance with the Cal/OSHA's Tunnel Safety Orders so that the tunnel can be excavated in a safe manner. The collected gas would be extracted through the ventilation system at the tunnel launch shaft. The collected gas would be monitored, and treated if necessary, prior to release into the air.

See TM - Tunnel Dewatering Pumping Facilities (Attachment B) for detailed information

Because the RTM would be excavated in deep soil strata with minimal or no organic material, it is anticipated that the RTM soil particles would not directly or indirectly include chemical compounds that would result in odors in the vicinity of the tunnel launch shaft sites, RTM handling and testing areas, or RTM storage areas.

2.2.5 Operations and Maintenance of Tunnels

See TM – Tunnel Inspection and Maintenance Considerations (Attachment B) for detailed information

The tunnels and shafts would be designed to be low-maintenance facilities, and therefore, inspections would be anticipated to be infrequent. An initial inspection could occur during the construction contract's warranty period, generally within about 1 year after the system is placed into operation. After the initial inspection, tunnel inspections could be completed once every 10 years for the first 50 years and every 5 years after 50 years from initial operation. The inspections could occur using autonomous underwater vehicles or remotely operated vehicles without the need to dewater the tunnel.

If the tunnel maintenance activities required dewatering, two portable dewatering pumps would be installed within the Southern Forebay Inlet Structure Launch Shaft. Each submersible pump would be equipped with a variable frequency drive with a flow meter and a flow control valve. The submersible pumps would discharge directly into the Southern Forebay. When not in use, the dewatering pumps would be stored in the Maintenance and Storage Building at the South Delta Pumping Plant.

2.3 Southern Complex

The Southern Complex would include facilities on Byron Tract (located to the east of Byron Highway) and on land located to the west of Byron Highway.

The Southern Complex facilities on Byron Tract would include the Southern Forebay Inlet Structure Launch Shaft, Working Shaft, South Delta Pumping Plant along the northern Southern Forebay embankment, Southern Forebay embankment, Southern Forebay emergency spillway into Italian Slough, Southern Forebay Outlet Structure along the southern portion of the Southern Forebay embankment.

The Southern Complex facilities on lands to the west of the Byron Highway would include the South Delta Outlet and Control Structure adjacent to the Banks Pumping Plant approach channel (also known as California Aqueduct) and the California Aqueduct Control Structure located between Clifton Court Forebay and South Delta Outlet and Control Structure.

The combination of the Southern Forebay Outlet Structure, South Delta Outlet and Control Structure, and California Aqueduct Control Structure are also referred to as the South Delta Conveyance Facilities in this EPR.

This section describes the South Delta Pumping Plant, Southern Forebay, and South Delta Conveyance Facilities.

2.3.1 South Delta Pumping Plant

As described previously, the Sacramento River water would be diverted at the intakes in the North Delta and flow approximately 40 miles through the main tunnel terminating at an inlet shaft located adjacent to the South Delta Pumping Plant. The purpose of the South Delta Pumping Plant would be to hydraulically lift the water from the conveyance tunnel system into the Southern Forebay. Under certain hydraulic conditions, the flow from the conveyance tunnel system would bypass the South Delta Pumping Plant and flow by gravity into the Southern Forebay.

See TM – South Delta Pumping Plant Basis of Conceptual Design Criteria (Attachment C) for detailed information

TM – South Delta Pumping Plant Facilities and Site Configuration (Attachment C) for detailed information

The South Delta Pumping Plant would be connected to the Southern Forebay Inlet Structure Launch Shaft and integrated into the northern embankment of the Southern Forebay, as shown in Figure 10. The South Delta Pumping Plant facilities would be located both below grade and above-ground on a raised site pad along the Southern Forebay embankment to protect the facilities from the 200-year flood event with anticipated sea level rise in Year 2100 and protection from surface water and wind wave run-up from the Southern Forebay. Additional details related to the Southern Forebay embankments are presented in Section 2.3.2, Southern Forebay.

The South Delta Pumping Plant would be connected to the tunnel system through an inlet channel that would be connected into the adjacent Southern Forebay Inlet Structure Launch Shaft. The pumps would lift water from a wet well hydraulically connected to the tunnel launch shaft. The pumps would be operated to maintain the flow rate supplied into the tunnel at the northern Sacramento River intakes.

During high Sacramento River surface water levels and low Southern Forebay water levels, water could flow by gravity from the tunnel through a bypass channel into the Southern Forebay.

Figure 10 shows the permanent infrastructure layout associated with the South Delta Pumping Plant facilities complex.

See TM – Main Raw Water Pump Selection, Adjustable Operating Speed Requirements and Redundancy (Attachment C) for detailed information

The desired flow of the pumping plant would range from a minimum of 600 cfs to a maximum of 6,000 cfs. However, a minimum flow of 300 cfs would be readily achievable during restricted diversion periods at the intakes. The firm capacity of 6,000 cfs would be achieved with five 960 cfs pumps (plus two standby pumps to operate when other pumps require repairs), and two 600 cfs pumps (plus one standby pump). The combination of larger and smaller pumps would be used to operate at incremental values. The maximum total dynamic head of the pumps would be 80 feet at design flow under unprimed conditions and 65 feet with operation of a vacuum priming system. The larger pumps would require 9,000 horsepower (hp) motors while the smaller pumps would require 6,000 hp motors.

Descriptions of the operations to move water from the tunnel into the Southern Forebay and major components of the pumping plant complex are presented in Appendix A and engineering concept drawings and summarized below.

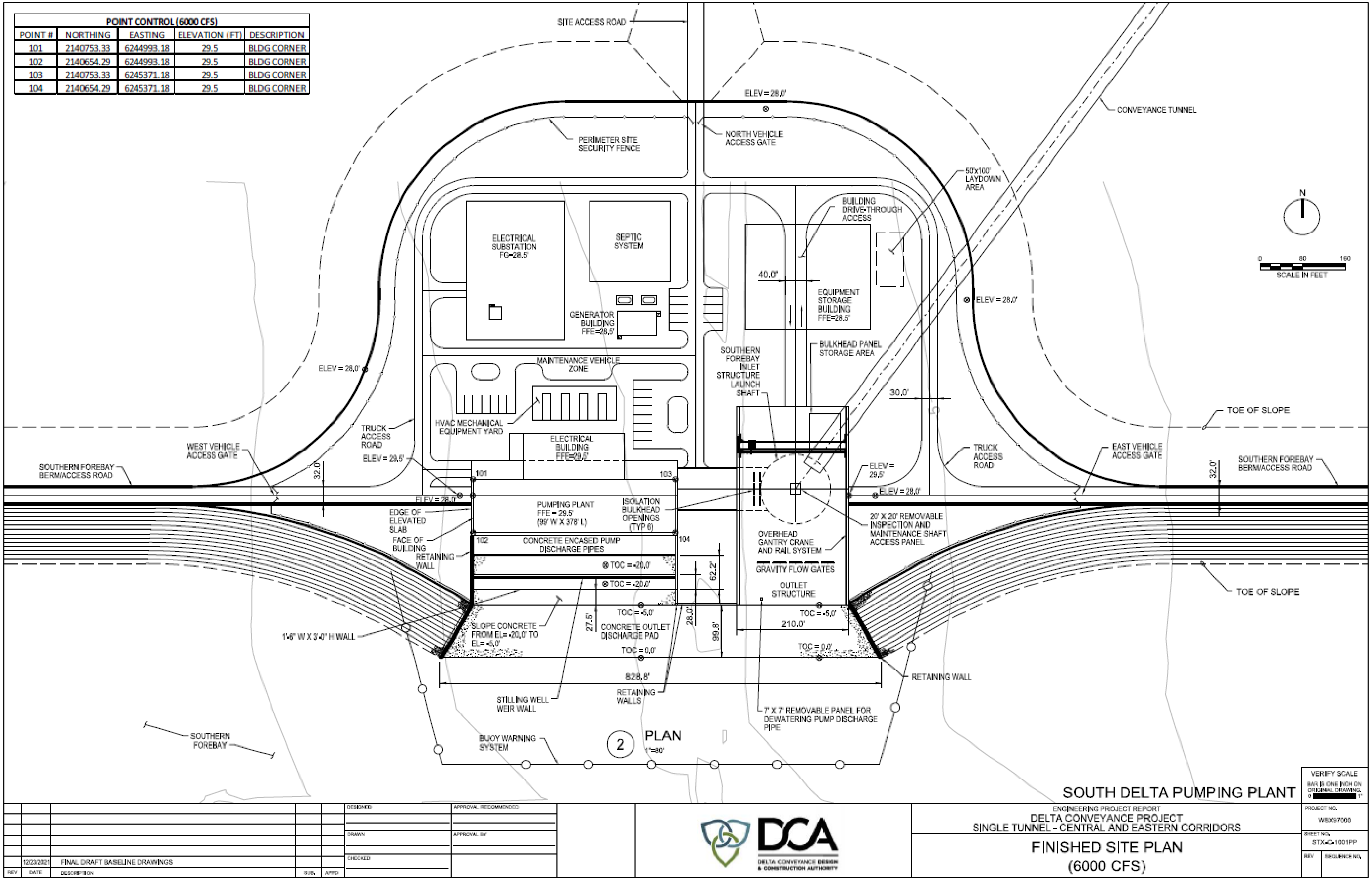
- **South Delta Pumping Plant**
  - The pumping plant would include a wet well, mechanical pumps, motors, associated piping and appurtenances, cooling equipment, an electrical room, and a control room. The pumping plant wet well would be located beneath the pumping plant building within the structural soil pad adjacent to the Southern Forebay. The depth and dimensions of the wet well structure would be set to ensure adequate depth of water above the pump suction bell under all conditions and to suppress vortex formation during pump operation.
  - The engineering concept drawings primarily show the overall footprint for the purpose of identifying above ground dimensions for analysis in the EIR. Selection of specific equipment within the pumping plant will occur during the design phase.

See TM – South Delta Pumping Plant Basis of Conceptual Design Criteria (Attachment C) for detailed information

FIGURE 10. SOUTH DELTA PUMPING PLANT FACILITIES: POST CONSTRUCTION SITE PLAN

POINT CONTROL (6000 CFS)

POINT #	NORTHING	EASTING	ELEVATION (FT)	DESCRIPTION
101	2140753.33	6244993.18	29.5	BLDG CORNER
102	2140654.29	6244993.18	29.5	BLDG CORNER
103	2140753.33	6245371.18	29.5	BLDG CORNER
104	2140654.29	6245371.18	29.5	BLDG CORNER



(From Engineering Concept Drawings, Volume 2, 04-PP)

- The pumping plant wet well and pump columns would extend below the water level in the Southern Forebay Inlet Structure Launch Shaft. Motors and pumps would be accessible from within the pumping plant building. Pump control valves, isolation valves, flow meters and gages would all be housed in a gallery type structure below the motor level floor. Flow meters would be used to monitor each pump discharge flow capacity, number of pumps operating, and pump operating speeds required to maintain the same flow rates into the Southern Forebay as the flow rates entering the tunnel through the intakes. An adjoining electrical room would house pumping plant switchgear and variable speed drives for the pumps. The pumping plant would be designed with provisions for cranes, air, oil, service water and fire suppression system meeting National Fire Protection Association design criteria. Dimensions of the pumping plant buildings are presented in Appendix A and on the engineering concept drawings.

See TM – South Delta Pumping Plant Facilities and Site Configuration (Attachment C) for detailed information

- Water would be discharged from the pumping plant into an energy dissipation structure with a stilling well and overflow into a Concrete Outlet Discharge Pad that would extend into the Southern Forebay. These facilities would be used to avoid turbulence as the water enters the Southern Forebay. The Concrete Outlet Discharge Pad would consist of a cast in place concrete submerged trench structure with a weir wall to maintain a minimum free-water surface and the internal operating pressure within each pump siphon discharge within acceptable limits. The bottom of the Concrete Outlet Discharge Pad would be constructed at an elevation of –20.0 feet with the top of the weir wall constructed at an elevation of 10.0 feet and surrounded by retaining walls to direct flow into the Southern Forebay and protect embankments. The Concrete Outlet Discharge Pad would be surrounded by a row of pump discharge piping outlets.

See TM – South Delta Pumping Plant Basis of Conceptual Design Criteria (Attachment C) for detailed information

- A buoy warning system would be installed on the water side of the Concrete Outlet Discharge Pad to reduce debris from entering the pumping plant.

- **Gravity Flow Pumping Plant Bypass and Surge Overflow Facilities**
  - As described in Section 2.2.3.1, Selection of Tunnel Diameter and Depth under Ground Surface, water would flow through a gravity flow control structure to be located on top of the Southern Forebay Inlet Structure Launch Shaft. The gravity flow control structure would include slide gates between the gravity flow outlet structure and the Southern Forebay to provide flow into the Southern Forebay at the same flow rate supplied into the tunnel by the Sacramento River intakes.
  - The Gravity Outlet Structure would consist of a concrete discharge pad to prevent scour within the Southern Forebay, as shown on the engineering concept drawings. The discharge pad would be set to an elevation of – 5.0 feet along the outer wall of the Gravity Outlet Structure and would slope upwards to the earthen bottom of the Southern Forebay. Retaining walls would be provided on either side of the Gravity Outlet Structure to direct flow into the Southern Forebay and protect embankments.

See TM – Hydraulic Analysis Criteria (Attachment H) for detailed information

See TM – Hydraulic Analysis of Delta Conveyance Alternatives – Main Tunnel System (Attachment H) for detailed information

- – The gravity flow control structure would incorporate fixed, emergency overflow, weir-type openings. These openings would function independent of the slide gates, permitting flow from the tunnel into the Southern Forebay and protecting the entire DCP and the communities surrounding the DCP in the event a hydraulic transient-surge condition occurs within the tunnel. This type of condition could occur if an electrical power failure event occurs at the pumping plant or if another emergency event would occur that would generate a transient-surge condition during operation. Suitable storage capacity within the Southern Forebay would be included to accommodate incoming flow capacities associated with transient-surge events.
- – The gravity flow control structure would be sized to achieve overflow capacities during a 200-year flood event and predicted sea level rise in Year 2100 at the Sacramento River intakes. The facilities would also provide surge relief of water during a hydraulic transient-surge event and to divert excess flow from the tunnel when the incoming tunnel flow exceeds the pumping capacity.
- – A buoy warning system would be installed on the water side of the Gravity Outlet Structure to reduce debris from entering the tunnel.

- **Electrical Building**
  - – The electrical building would be located adjacent to the pumping plant building. The electrical building would house the pumping plant switchgear and variable frequency drives for the main raw water pumps in the pumping plant, control room, portable tunnel dewatering pumps, and battery room.
  - – A substation would connect high voltage electrical feeders from nearby transmission lines. Initially, the substation would supply power for construction activities. Following construction, the substation would be repurposed to supply power to the permanent South Delta Pumping Plant facilities. Security fencing would be provided around the perimeter of the substation to restrict access.
  - – A standby engine generator would be located within the Generator Building adjacent to the electrical substation to supply emergency power for life-safety and critical control systems. An outside fenced area for the fuel tanks for the standby engine generator would be provided immediately adjacent to the Generator Building.
  - – A heating, ventilation, and air conditioning (HVAC) mechanical equipment yard would be provided adjacent to the electrical building for the purpose of providing the HVAC service for the electrical building. There would be up to four pad-mounted, direct expansion air handler units (AHUs) for pumps operated with air cooled variable frequency drives. A wall would be constructed around three sides of the HVAC mechanical equipment yard for visual screening and noise abatement. Adequate space would be provided within the screening wall and the HVAC equipment yard to allow for periodic access to perform maintenance on the AHUs.

See TM – South Delta Pumping Plant Facilities and Site Configuration (Attachment C) for detailed information

- **Additional Pumping Plant Complex Buildings**
  - An equipment storage building would be provided with a welding shop; machine shop; and storage for spare pumps and rotating assemblies, motors, and accessories. Storage space would also be included for large equipment such as wet well isolation gate panels, tunnel dewatering pumps, cable reels, and discharge piping assemblies.
  - Bridge and gantry cranes and rail systems plus other cranes would be located both inside and outside of the buildings to move equipment during maintenance procedures.
  - The site would be surrounded by security fences with three vehicle access gates.

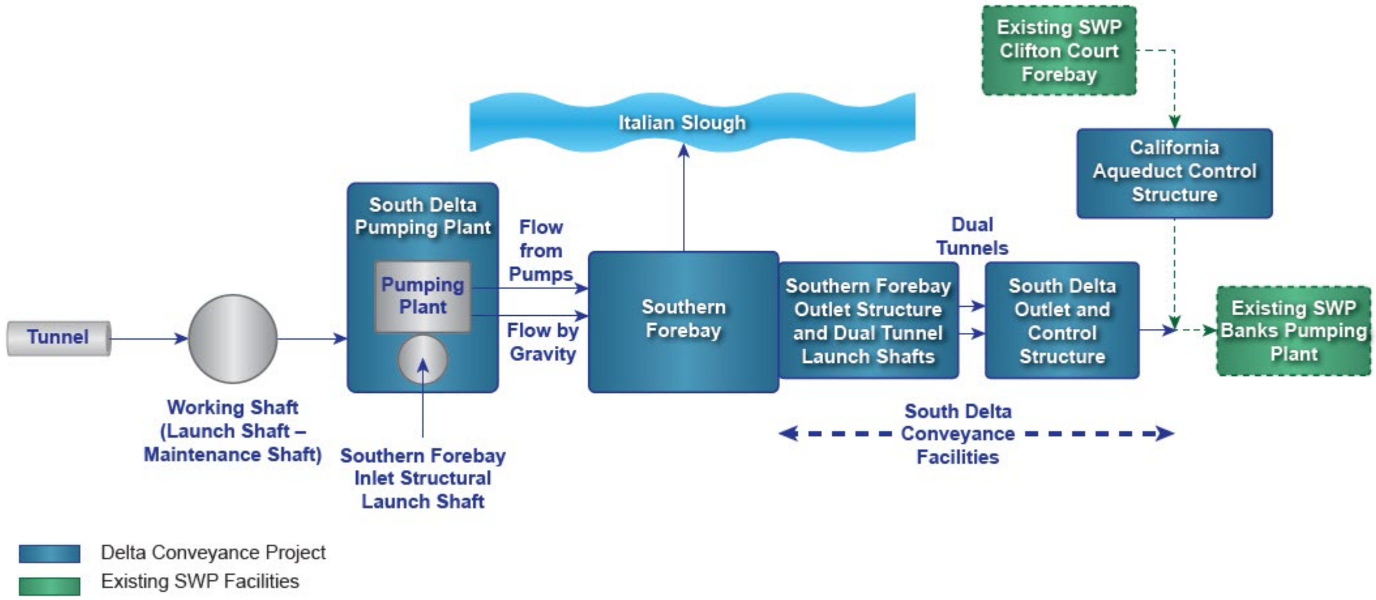
See TM – South Delta Pumping Plant Facilities and Site Configuration (Attachment C) for detailed information

Ground improvement methods considered at the intake locations are described in Section 6.3.3, Ground Improvement Methods.

2.3.2 Southern Forebay

The Southern Forebay would be located at the downstream end of the main tunnel system that would convey water from the intakes to the South Delta Pumping Plant and through the South Delta Conveyance Facilities to the existing Banks Pumping Plant, as shown in Figure 11. The primary purpose of the Southern Forebay would be to provide temporary equalization storage to balance flows for dual conveyance from DCP and the existing SWP facilities at Clifton Court Forebay (CCF) and convey the water to the Banks Pumping Plant. Water surface elevations (WSELs) in the Southern Forebay would be maintained at appropriate elevations to allow gravity flow from the Southern Forebay Outlet Structure to the South Delta Outlet and Control Structure along the Banks Pumping Plant approach channel.

FIGURE 11. SCHEMATIC OF SOUTHERN COMPLEX FACILITIES TO CONVEY WATER FROM TUNNEL TO EXISTING BANKS PUMPING PLANT



2.3.2.1 Site Selection for the Southern Forebay

See TM – Southern Forebay Siting Analysis (Attachment D) for detailed information

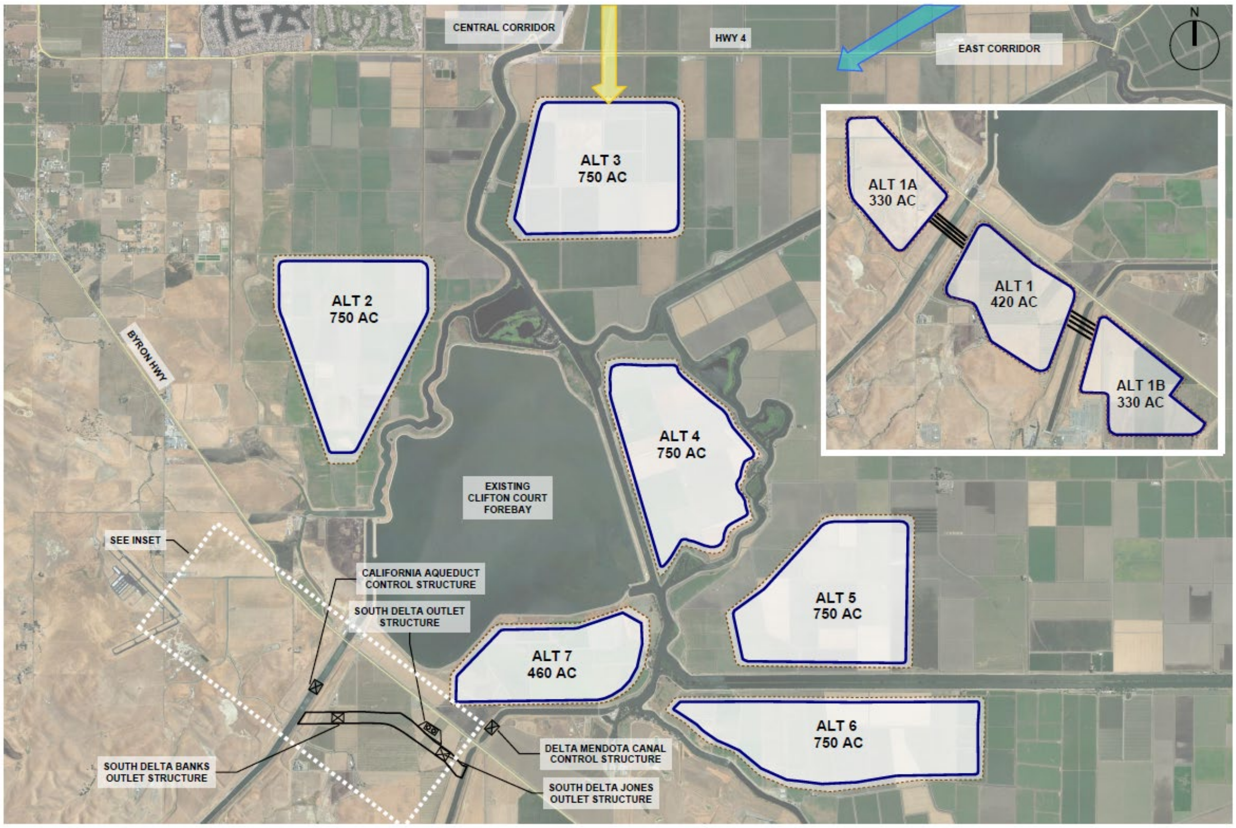
An initial desktop study and field reconnaissance was conducted during preparation of the EPR to identify alternative sites for the Southern Forebay. Seven potentially feasible sites located in proximity to the existing SWP and CVP pumping plant facilities were identified, as shown in Figure 12. Five of the sites were eliminated due to due to limited space availability, challenges with site access, or ease of connection into the existing SWP or CVP facilities.

Potential Sites 2 and 5 were further evaluated with respect to the following criteria:

- System configuration
- System operational compatibility
- Property and land use
- Existing infrastructure
- Geotechnical conditions
- Logistics
- Environmental and permitting conditions

Potential Sites 2 and 5 had similar and acceptable characteristics under the Geotechnical Conditions and Environmental and Permitting categories. Site 2 was determined to have more favorable characteristics in the remaining categories. Access to Site 2 was substantially better than access to Site 5 due to the proximity of Byron Highway and an existing rail line. Therefore, Site 2 was selected for the Southern Forebay.

FIGURE 12. CANDIDATE LOCATIONS CONSIDERED FOR THE SOUTHERN FOREBAY SITING ANALYSIS



2.3.2.2 Southern Forebay Facilities Configuration

The Southern Forebay would be an at-grade storage reservoir formed by an earthen embankment with a perimeter length of approximately 4.7 miles and a minimum crest elevation of +28.0 feet. The normal operating capacity of the Southern Forebay would be 9,000 acre-feet with a maximum surface area of approximately 750 acres. The Southern Forebay operating capacity was selected to provide the operational flexibility needed to support dual operation of both the DCP and the existing SWP facilities at CCF and the Banks Pumping Plant. The Southern Forebay would have an average surface water surface elevation of 11.5 feet, which would be approximately the half-point within the normal operating range of elevation 5.5 to 17.5 feet. The forebay floor would range from an elevation of 0 feet to -7 feet, so the average water depth would range from 11.5 feet to 18.5 feet at the average water surface elevation of 11.5 feet. A minimum surface water elevation of 5.5 feet would be required to provide gravity flow of up to 10,600 cfs to Banks Pumping Plant. The wide range in surface water elevations and placement of riprap on the interior slopes would discourage nesting and roosting of water birds in the Southern Forebay.

See TM – Forebay Conceptual Design Criteria (Attachment D) for detailed information

See TM - South Delta Conveyance Facilities Hydraulic Analysis Criteria and Analyses (Attachment E) for detailed information

Flows from the Southern Forebay would be controlled by gates at the South Delta Outlet and Control Structure. The California Aqueduct Control Structure would control flows from Clifton Court Forebay. The two structures would work in parallel for concurrent dual conveyance situations.

The DWR Division of Safety of Dams (DSOD) is the state agency with jurisdiction over the design, construction, and safe operation of the planned Southern Forebay. As mandated by DSOD, an emergency spillway would be required to safely convey reservoir inflows and prevent the perimeter earthen embankment from being overtopped from potential excess water supplied to the Southern Forebay from the tunnel system. Emergency Outlet Works would also be required to allow expedited drawdown of the Southern Forebay volume to mitigate a potential emergency and allow for inspection, maintenance and repair.

General project performance requirements for the Southern Forebay are summarized below:

- The embankment, outlet works, emergency spillway, and their appurtenances would be designed to prevent uncontrolled releases.
- The embankment, outlet works, emergency spillway, and their appurtenances would be designed to have a useful service life of at least 100 years without requiring major repairs, other than maintenance and refurbishment of the operable gates at the inlet and outlet structures once every 25 to 30 years.
- The embankment, outlet works, emergency spillway, and the appurtenant equipment would be operable in accordance with flood management criteria developed specifically for this facility.
- The embankment, outlet works, emergency spillway, and their appurtenances would be designed to protect the forebay from the 200-year flood event with sea level rise and climate change hydrology for year 2100 as defined by DWR, wave run-up, plus any anticipated and ground subsidence under the embankments. Riprap would be placed along the inside embankment slopes and native grasses would be placed along the outside embankment slopes for erosion protection.

Descriptions of the major features of the Southern Forebay are presented in Appendix A and engineering concept drawings and summarized below.

- **Southern Forebay Embankment**
  - The Southern Forebay embankments and spillway crest elevations would be established based on interior freeboard considerations mandated by DSOD and exterior sea level rise and flood condition data provided by DWR. The embankment height of elevation 28.0 feet would provide adequate protection from internal and external maximum surface water levels, including:
    - External surface water levels based on the 200-year flood event and sea level rise in Year 2100, including wave run-up and appropriate freeboard to reduce risk of overtopping of the embankment from external flooding.
    - Internal surface water levels could be higher than external water levels; therefore, the embankments would need to be of adequate height for maximum overflow water elevation, wave run-up, and freeboard on the interior side of the embankment.

See TM – Southern Forebay Conceptual Configuration (Attachment D) for detailed information

- The Southern Forebay embankments and other facilities would be designed in accordance with geotechnical and seismic considerations for the Byron Tract area, including consideration for proximity to the West Tracy Fault.
- The embankments would be constructed using materials from onsite excavations and dried RTM to the maximum extent possible. Based upon existing geotechnical information, embankment slopes are anticipated to be 4H:1V (horizontal to vertical), and could range from 3H:1V to 6H:1V depending on subsurface conditions.
- Embankment foundation improvements would be implemented where needed (i.e., cutoff walls for seepage, or ground improvement for embankment stability) due to potentially poorly consolidated or weak foundations and seismic conditions. Seepage collectors and drainage layers would be installed within the outboard toe of the embankment. A 15-foot wide access road and groundwater monitoring network would be installed along the perimeter of the outboard toe of the embankment (exterior slope).
- Ground improvement efforts would be implemented under portions of the embankment to minimize risk of ground subsidence, seepage-related issues, and seismic deformation. The ground improvement would include various combinations of removal of peat soils, installation of vertical wick drains, pre-loading of soils to promote ground settlement prior to construction of the embankment, in-situ soil treatments for improving foundation strength, and installation of seepage cutoff walls.
- Following construction and removal of construction equipment and materials, portions of the Southern Complex on Byron Tract around the Southern Forebay would be restored with native soil for agriculture or habitat. The acreage that would be restored is provided in Section 6.8.

See TM – Southern Forebay Seismic Sensitivity Evaluation (Attachment D) for detailed information

See TM – Conceptual-Level Seismic Design and Geohazard Evaluation Criteria (Attachment H) for detailed information

See TM - West Tracy Fault Preliminary Displacement Hazard Analysis (Attachment H) for detailed information

- **Southern Forebay Operations**
  - Significant sediment accumulation would not be expected within the Southern Forebay due to the sedimentation basins at the intakes. Also, sediment accumulation in the dead pool areas would not be operationally detrimental. Therefore, only periodic sediment removal and regrading of the interior and exterior embankments would be required to maintain erosion control provisions.
  - Paved access routes would be included at several points along the embankment (as shown on the engineering concept drawings) which could also be used to launch a maintenance boat.
- **Southern Forebay Emergency Spillway**

- As required by DSOD, an emergency spillway would be required to safely convey excess inflows from the tunnel system and rainfall on the forebay and to prevent the perimeter embankment from being overtopped; or infrequent emergency events such as mis-operation of the system (e.g., pumps on, downstream gates closed) and uncontrolled flood flow through the conveyance system (e.g., system intake gates open accompanied by power outage during high river stage leading to uncontrolled gravity flow into the Southern Forebay). Based on preliminary hydraulic analyses, the controlling discharge rate through the spillway would be based on running the pumping plant at full capacity (i.e. 6,000 cfs) while the gates at the forebay outlet were closed. Uncontrolled gravity flow through the system with the intake gates open would potentially result in a longer duration event but at lesser flow due to frictional head losses through the system.

See TM – Southern Forebay Emergency Spillway Siting Analysis (Attachment D) for detailed information

- Three spillway locations were considered, including a location that would discharge to Italian Slough close to the middle of the Southern Forebay, a location to that would discharge water to surrounding lands on Byron Tract with eventual discharge to Italian Slough, and a location that would discharge to Italian Slough near the southern portion of the Southern Forebay. The sites were evaluated and ranked based on subsurface soil conditions, existing topography, existing infrastructure and spillway discharge flow path. The potential for discharging water to surrounding lands was not considered appropriate due to the potential for flooding adjacent highways, farmlands, houses, and wastewater treatment facilities. The spillway location into Italian Slough between the Southern Forebay and Clifton Court Forebay was selected based upon the proximity to Italian Slough, hydraulic conditions at this location in Italian Slough, no potential land use impacts on Byron Tract, and geotechnical conditions.
- The Emergency Spillway would discharge flow into Italian Slough which flows into Old River. Italian Slough and Old River appear to have adequate capacity to convey expected spillway flows, as discussed in the Southern Forebay Emergency Spillway Siting Analysis. During the design phase, more detailed flood flow analyses would be conducted.
- The crest of the Southern Forebay embankment would be at elevation 28.0 feet and the spillway crest elevation would be 21.0 feet designed to pass the maximum system flow with 2.5 feet of water height over the spillway crest when the maximum water surface of elevation in the Southern Forebay would be 23.5 feet. The emergency spillway would be approximately 500 feet wide along the weir. The width could be reduced to approximately 300 feet using a labyrinth-type spillway weir to minimize the likely required foundation improvements. The emergency spillway would be approximately 200 feet long (measured from the inboard edge to the outboard edge of the spillway).
- Water from the emergency spillway would flow into a spillway discharge channel that would consist of riprap lined channel with earthen embankments that would extend from the outboard edge of the spillway into Italian Slough. The discharge

channel length would be approximately 600 to 700 feet with a total width of approximately 600 feet (measured from the outboard toes of the north and south embankments). Each of the earthen embankments would have a crest elevation of 14.0 feet, a crest width of 20 feet, and 3H:1V interior and exterior slopes. The floor elevation of the discharge channel would be at elevation -8.5 feet at Italian Slough with a 0.5 percent grade towards Italian Slough from the base of the emergency spillway structure. At the proposed location of the emergency spillway facilities, the bottom elevation of Italian Slough is approximately elevation -12.0 feet. The construction of the discharge channel would require the partial removal of approximately 500 feet of the existing levee along Italian Slough.

  – The construction work for the emergency spillway would occur from the landside, and no barges would be placed in Italian Slough. Boating speeds in Italian Slough may be limited for several months during excavation and riprap placement.

- **Southern Forebay Emergency Outlet System**
  – The DSOD criteria would require an emergency outlet system to be capable of lowering the maximum storage depth by 10-percent within 7 to 10 days and fully draining the Southern Forebay within 90 or 120 days depending on site-specific conditions.
  – If emergency drawdown of the Southern Forebay were required, water would be released by gravity through the Southern Forebay Outlet Structure into the South Delta Outlet and Control Structure into the Banks Pumping Plant approach channel. Operation of these features would be capable of lowering the Southern Forebay surface water elevation from a maximum operating level of elevation 17.5 feet to 5.5 feet in a single day. The surface water elevation would continue to decline from 5.5 feet to a low level between 1.0 and -1.0 feet by gravity over the next few days depending upon water levels in the Banks Pumping Plant approach channel.
  – Gravity drawdown of the Southern Forebay water levels through the Southern Forebay Outlet Structure would leave a remnant storage of up to 7 feet above the lowest outboard toe elevation (elevation -6.0 feet), which would be considered as a "dead pool." If the water levels in the Southern Forebay needed to be completely drained either due to maintenance activities or DSOD requirements, portable pumps with portable power supplies would be used to fully drawdown the dead pool water levels. The portable pumps and power supplies could be the same equipment that would be stored at the South Delta Pumping Plant to dewater the tunnel if necessary.
  – Operation of the emergency outlet system would be controlled by manipulating the water level in Banks Pumping Plant approach channel to induce the required flow. This system would operate independently of the emergency spillway into the Italian Slough.

See TM – Southern Forebay Emergency Outlet Evaluation (Attachment D) for detailed information

Quantifications of construction conditions for the Southern Forebay are summarized in Appendix A and the engineering concept drawings.

2.3.3 South Delta Conveyance Facilities

The purpose of the South Delta Conveyance Facility would be to convey and control the rate of flow delivered from the Southern Forebay to the existing Banks Pumping Plant approach channel. The South Delta Conveyance facilities include the Southern Forebay Outlet Structure with dual tunnel launch shafts, dual tunnels to the South Delta Outlet and Control Structure along the Banks Pumping Plant approach channel, and the California Aqueduct Control Structure within the channel between Clifton Court Forebay and South Delta Outlet and Control Structure. These facilities would control flows from the new DCP facilities and the existing SWP facilities to provide full flexibility in dual operations. Structures would be sized for peak flow at most critical hydraulic conditions. It should be noted that the DCP would not include any physical changes to the existing SWP Clifton Court Forebay facilities or existing Banks Pumping Plant. However, the interconnection of the DCP to the existing SWP South Delta facilities would involve minor operational changes that would depend on the dual conveyance operational parameters ultimately developed to operate both systems.

2.3.3.1 Type of Conveyance Facility

During preparation of the EPR, a siting analysis was conducted to evaluate the use of tunnels or a canal between the Southern Forebay Outlet Structure and the South Delta Outlet and Control Structure. The tunnel configuration was selected due to potential conflicts with canal construction related to multiple existing high voltage transmission lines, multiple special status species habitats, and crossings of the Byron Highway and UPRR. The tunnels would generally be constructed along the most direct alignment 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 alignment to comply with requirements that the tunnels not be constructed above ground and beneath high voltage transmission line towers. There were also concerns about the crossing of the West Tracy Fault located to the east of Byron Highway. There could be higher risk of damage for a canal crossing of the West Tracy Fault as compared to a tunnel crossing.

See TM – South Delta Conveyance Facilities Canal and Tunnel Options Summary Comparison (Attachment E) for detailed information

2.3.3.2 Description of Facilities

The South Delta Conveyance facilities would consist of major structures to deliver water to the Banks Pumping Plant, as shown in Figure 11. The South Delta Conveyance facilities would be designed to allow all flows to Banks Pumping Plant to be from either DCP or Clifton Court Forebay, or from both the DCP and Clifton Court Forebay.

Additional details for these facilities are summarized in Appendix A and the engineering concept drawings.

These facilities include:

- **Southern Forebay Outlet Structure** would include two launch shafts within a gated outlet structure connected to two parallel gravity flow tunnels that would extend to the South Delta Outlet and Control Structure.
- **South Delta Outlet and Control Structure** would be located along the Banks Pumping Plant approach channel and include dual reception shafts for the tunnels from the Southern Forebay Outlet Structure. The South Delta Outlet and Control Structure would include gates to control the rate of flow released from the Southern Forebay into the existing SWP system.
- **California Aqueduct Control Structure** would be located in the California Aqueduct between Clifton Court Forebay and the South Delta Outlet and Control Structure. This control structure would provide flow control to the Banks Pumping Plant from the existing Clifton Court Forebay, allowing flow from the existing SWP Clifton Court Forebay, the new DCP, or from both water conveyance systems.

See TM – South Delta Conveyance Facilities System Configuration (Attachment E) for detailed information

2.3.3.3 Southern Forebay Outlet Structure and Dual Tunnels

The Southern Forebay Outlet Structure would be located on Byron Tract at the southern end of the Southern Forebay embankment system. A trash rack would be placed on the inlet to the structure in the Southern Forebay to catch large debris prior to water entering the Southern Forebay Outlet Structure. A double row of bulkhead slots would provide isolation for the safety of personnel who could be working downstream. Permanently installed drop gates would be provided to allow rapid closure in the event of a hydraulic emergency within the interconnected new DCP and existing SWP systems.

See TM – South Delta Conveyance Facilities System Configuration (Attachment E) for detailed information

The Southern Forebay Outlet Structure would include two launch shafts, one for each of the dual 38-foot inside diameter (approximately 41-foot outside diameter) tunnels that would extend 1.7 mile. Use of dual tunnels would allow conveyance of the full design capacity of the Banks Pumping Plant as well as allow isolation and dewatering of one tunnel for maintenance and repair, while allowing uninterrupted flow of about half of the design capacity through the other tunnel.

The tunnel shafts would be constructed in a similar manner as described in Section 2.2.3.4, Tunnel Launch Shafts. The tunnel launch shafts would be 115 feet in inside diameter, as shown in the engineering concept drawings. The tunnels would be designated as Reach 5 East (5E) and 5 West (5W).

2.3.3.4 South Delta Outlet and Control Structure

The dual tunnels would terminate at dual reception shafts within the South Delta Outlet and Control Structure located to the west of Byron Highway This structure would be located along the western bank of the California Aqueduct downstream of the Clifton Court Forebay and approximately 1.4 miles upstream of the Banks Pumping Plant. 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, UPRR, and, and the high-voltage transmission line easement that crosses the California Aqueduct immediately to the southwest of Byron Highway.

The two 90-foot inside diameter reception shafts would extend vertically into two separate horizontal channels. Each channel would contain two sets of bulkhead gates for isolation of one or both tunnel flows. Double bulkheads would be used for worker safety during maintenance activities in the tunnel.

See TM – South Delta Conveyance Hydraulic Analysis Criteria and Analyses (Attachment E) for detailed information

Flow would continue from the dual horizontal channels into a section of the South Delta Outlet and Control Structure that would employ radial gates to control the rate of flow from the DCP into the California Aqueduct. Vertical slots would be provided in the piers on the upstream and downstream sides of the gates for installation of temporary steel bulkhead gates. The bulkhead gates, inserted into these slots, would allow isolation and dewatering of each gate bay for gate maintenance and repair.

See TM - South Delta Conveyance Facilities Operations and Maintenance Equipment and Facility Needs (Attachment E) for detailed information

Six large motorized radial gates would be operated to control the flow rates from the DCP into the Banks Pumping Plant. A smaller gate would be used to allow more specific flow control to match pumping needs at the Banks Pumping Plant. The gate heights would be designed to match the highest anticipated water level in the Southern Forebay, including freeboard. Stilling wells would be provided upstream and downstream of the gates to measure water surface elevations. The difference in elevation between these wells would be used with rating curves for the gates to determine the flowrate through each gate. This critical control facility would serve as an emergency outlet from the Southern Forebay, a backup generator would be located onsite to allow gate operation during a power failure.

A short concrete-lined channel section would convey the flow from the gate section into the California Aqueduct. The structure and outlet channel would be angled approximately 40 degrees from the California Aqueduct to facilitate a smoother transition of flow into the California Aqueduct. Flow velocities entering the California Aqueduct would be limited to about 3 feet per second under maximum flow and low tailwater conditions to limit scour and erosion. Additionally, articulated concrete mats would be placed to reduce erosion in the unlined California Aqueduct in the area near the confluence with the new facilities which is an area of possible turbulence. The need for additional energy dissipation within the existing California Aqueduct would be further reviewed during final design.

2.3.3.5 California Aqueduct Control Structure

The California Aqueduct Control Structure would be located on the California Aqueduct upstream of the South Delta Outlet and Control Structure. The purpose of this structure would be to control flows entering Banks Pumping Plant approach channel from the Clifton Court Forebay. 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 conveyed from the DCP, from the existing Clifton Court Forebay, or from a combination of both.

The main component of the California Aqueduct Control Structure would be a set of radial gates that control flow from the Clifton Court Forebay into the existing California Aqueduct. These electrically controlled gates would be designed as described in the TMs and would be similar to the design concept described above for the South Delta Outlet and Control Structure. A smaller gate would be provided for smaller flow controls. Stilling wells and rating curves would also be used to determine flowrates through this facility.

The gate elevations would be established to protect the California Aqueduct downstream of the structure against the 200-year project flood event with sea level rise for Year 2100 in the vicinity of the Clifton Court Forebay plus 3 feet of freeboard. This would result in a minimum protective control elevation of 23.8 feet (with a 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 a standby engine generator.

A double row of bulkhead gates would be used to isolate each individual gate bay. Bulkheads would be stored on the site and installed with a mobile crane from the bridge deck. The entrance and exit of the structure would transition to the existing California Aqueduct trapezoidal section from the vertical section through the gates.

See TM – South Delta Conveyance Hydraulic Analysis Criteria and Analyses (Attachment E) for detailed information

See TM - South Delta Conveyance Facilities Operations and Maintenance Equipment and Facility Needs (Attachment E) for detailed information

3. Flood Management

Flood risk management efforts for DCP would be focused on providing adequate flood protection at each site during and after construction.

3.1 Flood Risk Management Background

The Delta consists of land tracts and islands protected by approximately 1,100 miles of levees. Levees in the Delta were constructed over the past 170 years to reclaim marshland for cultivation; protect public infrastructure, such as highways, canals, and pipelines; and reduce flood risk to the residents and workers operating within the Delta. Approximately 35 percent of the Delta levees are jurisdictional Project levees constructed to standards based on the USACE guidelines. These levees are maintained by local agencies and periodically inspected by USACE. The remaining 65 percent are categorized as non-project levees and constructed and maintained by island landowners or local Reclamation Districts (generally referred to as Levee Maintenance Agencies). Non-project levees were generally built to an agricultural standards specific to the Delta (DWR, 1993).

See TM – Flood Risk Management (Attachment H) for detailed information

See TM – Levee Vulnerability Assessment (Attachment H) for detailed information

Major flood risks in the Delta were considered during preparation of this EPR to develop a flood risk reduction strategy for the project and determine improvements needed to protect the DCP sites both during construction and post construction.

The DCP facilities would be designed for long-term operations to be protected from the 200-year flood event with climate change induced hydrology, sea level rise for Year 2100, freeboard criteria, and wind fetch wave run-up. DWR provided the projected water elevations for the 200-year flood event and sea level rise for Year 2100 as documented in the *Preliminary Flood Water Surface Elevations (Not for Construction)* memorandum (DWR, 2020b). All flood elevations are referenced to the English unit, feet, with the North American Vertical Datum of 1988 (NAVD88).

Changes in surface water elevations due to sea level rise would vary throughout the Delta with the greatest change occurring near the western Delta and the least change occurring upstream along rivers and sloughs. Wind-fetch also would be greatest in the open flat areas of the western Delta and the least in the narrower river and slough channels. The WSEL assumptions for the Delta Conveyance Project facilities in Year 2100 with 200-year flood event and 10.2 feet of sea level rise at the Golden Gate (NAVD88) are provided below. The simulations used by DWR to develop these WSELs considered only in-channel flows into the model at the boundaries and assumed no levee overtopping to breaches within the system.

- Sacramento River near Clarksburg: 28.2 feet.
- Sacramento River upstream of Hood: 27.3 feet.
- Sacramento River upstream of Randall Island: 26.3 feet.
- South Fork Mokelumne River along Staten Island: 19.9 feet.
- Potato Slough along Bouldin Island: 19.5 feet.
- Stockton Deep Water Ship Channel along Lower Roberts Island: 19.7 feet.
- Old River along Byron Tract: 20.5 feet.

3.2 Levee Vulnerability Assessment

See TM –Levee Vulnerability Assessment (Attachment H) for detailed information

The levees in the Delta are exposed to many hazards that may damage or cause failure, resulting in flooding of the protected area. The most significant hazards are due to hydrologic, hydraulic, and seismic (earthquake) loading which can lead to seepage, stability, or overtopping related failures. A variety of site-specific conditions can also contribute to a levee's vulnerability for failure when subjected to loading including poor/weak embankment or foundation soils, insufficient levee geometry (height, width, and slope inclination), and various types of particularly damaging animal activity or vegetation growth.

A levee vulnerability assessment was developed during preparation of this EPR to evaluate indicators of levee condition that do not rely heavily on site-specific subsurface data while providing meaningful results to compare levee vulnerability. Existing levee geometry can provide an indication of how levee systems may perform during different loading conditions and can provide an even stronger indication of how levees might perform relative to one another. Broader levees with greater freeboard, wide crests and shallow slopes will inherently be less vulnerable compared to narrower levees with similar composition, loading and foundation conditions. Important geometric considerations related to levee vulnerability which can be extracted from topographic data include:

- Overall levee cross sectional geometry (levee height and slope inclinations) which inherently provide a metric of seepage and slope instability susceptibility;
- Freeboard which provides a direct measure of the maximum flood level a levee can protect against which translates to a risk of overtopping;
- Proximity of a toe ditch to the levee toe (if present) which may thin or penetrate subsurface fine-grained blanket layers and increase underseepage and slope instability susceptibility;
- Vulnerability to SLR which evaluates the current condition of levees under increasing future water levels; and
- Past changes in levee crest elevation provides an indication of potential future levee settlement and in turn reflect areas that may require future levee modifications to maintain flood protection.

Criterion specific to each of the above considerations was developed to evaluate levees within each corridor, including the following criteria:

- Criterion 1- Levees meeting levee geometry standards;
- Criterion 2- Freeboard against the 100-year flood elevation;
- Criterion 3- Ditches Proximity of toe ditch (if present) to landside toe of levee or berm;
- Criterion 4- Vulnerability to sea level rise; and
- Criterion 5- Change in Levee Crest Elevation between 2007 and 2017 LiDAR.

Each criterion was evaluated using a rating score that varied from 1 to 4 scale (1 being unfavorable, 4 being favorable) and was assigned an importance (weighting) factor ranging from 1 to 5 scale (1 being of little importance, 5 being very important). The rating scores and importance factors were multiplied together for each criterion and the cumulative sum of all criteria provides a levee vulnerability score. The vulnerability scores can then be grouped and compared to provide a relative levee vulnerability rating (Levee Vulnerability Rating).

See TM –Levee Vulnerability Assessment (Attachment H) for detailed information

The evaluation was performed using cross sections developed every 500 feet along the levee alignments using Light Detection and Ranging (LiDAR) data collected and provided by DWR. The geometric criteria developed for this study do not provide a comprehensive evaluation of a levee system or guarantee levee performance. This vulnerability assessment does not replace the need for site specific investigations, testing, and analyses.

A summary of key statistics that can be extracted from the vulnerability criteria when considering the entire data set used in this assessment includes:

- Criterion 1 – 72 percent of levee cross sections reviewed have geometry that meet or exceed the Public Law 84-99 (PL84-99) Delta-specific levee geometry.
- Criterion 2 – 86 percent of levee cross sections reviewed have at least 1.5-feet of freeboard above the 100-year flood elevation level.
- Criterion 3 – 44 percent of levee cross sections reviewed do not have a toe-ditch or if a toe-ditch is present, it is beyond 4 levee heights from the landside levee toe or beyond 2 levee height from the berm toe.
- Criterion 4 – 47 percent of levee cross sections reviewed have at least 1.5-feet of freeboard above an a 100-year flood elevation that considers potential sea level rise.
- Criterion 5 – 82 percent of levee cross sections reviewed have a 2017 crest elevation that is within 0.5 feet of the 2007 crest elevation.

3.3 Flood Risk Management Approach

The levee systems surrounding each Delta island provides the first line of defense against flooding. The Delta levees were typically constructed in phases over many decades. On many islands, the ground inside the levees has eroded or subsided several feet below sea level and the water elevation of the surrounding rivers and sloughs. Existing levees in the Delta generally comply with or are in the process of working towards compliance with Delta-specific geometric criteria which require 1.5 feet of freeboard above a 100-year WSEL (for Delta-specific Public Law 84-99 geometry) or 300-year WSEL (for DWR Bulletin 192-82 geometry [DWR, 1982a]). Existing roads within the Delta are commonly constructed along levee crests or adjacent to levee toes on the landside of the levees.

See TM – Flood Risk Management (Attachment H) for detailed information

Much of the interior Delta region lies below sea level, under constant threat of inundation and protected by a generally fragile levee system. The lower the interior island elevation, the greater the hydraulic pressure. Furthermore, the lower the island interior elevation, the greater the hydraulic differential available to generate rapid breach erosion and high breach inflows.

The levees are under greatest threat during major flood events, when huge flood inflows, high tides, wind waves, and rainfall put enormous strain on the levee system. High water increases the hydraulic pressure from the water side, strong currents cause erosion, high water and wave wash threaten levees with overtopping, and the high water combined with heavy rains saturate the levee sections and weaken them.

See TM – Flood Risk Management (Attachment H) for detailed information

In general, levee foundation conditions are better on the perimeter of the Delta, where the levees are founded on mineral soils, whereas in the central and western Delta regions levees are often founded on, or are adjacent to highly variable layers of deep peat, poorly consolidated sands, silts, and clays that are prone to seepage and structural weaknesses.

Some generalizations can be made about the geographic differences in the nature of the flood threats in various regions of the Delta, including:

- **North Delta:** Flood concerns in the North Delta are particularly acute. The combined flood flows of the Morrison Stream Group, Dry Creek, the Cosumnes River, and the Mokelumne River converge and accumulate because the downstream Delta channels lack the capacity to convey the combined flow to the Sacramento and San Joaquin Rivers. River stages rise until levees give way or are overtopped, such as occurred in February of 1986. In that flood event, the levees failed on McCormack-Williamson Tract, Glanville Tract, Dead Horse Island, and Tyler Island sequentially over a period of hours on the afternoon and evening of February 18, 1986 followed by a levee failure on New Hope Tract.
- **West Delta:** In the West Delta region, high water stages due to tides and total Delta inflow (especially from the Yolo Bypass) and high winds could result in extreme wave wash erosion, displacement of riprap, and waves overtopping the levees. Deep peat and weak foundations combined with island interiors well below sea level could contribute to the structural stresses on west Delta levees.
- **North and South Delta:** Extended periods of snowmelt, extending into June and July, are more likely to impact the northern and southern portion of the Delta in wet years, due to large accumulations of snow at high elevations in the Sierra Nevada. These conditions can increase the risk of levee failures due to scour, seepage, and slumping.

3.3.1 Flood Risk Management Measures

The DCP would include a combination of non-structural and structural flood risk management measures to reduce the risk of flooding during construction and operations, including at tunnel shafts. In this context, non-structural measures could involve temporary facilities or equipment, but such facilities or equipment would not significantly affect the construction footprint or on-site activities.

See TM – Flood Risk Management (Attachment H) for detailed information

The non-structural measures would involve fully integrating the DCP construction team with the existing Delta flood preparation, response, and recovery systems. This coordination would occur with the Reclamation Districts and the Levee Maintenance Agencies as well as State and Federal agencies with direct responsibilities, authorities, or emergency support roles over Delta levees, including the USACE, the Federal Emergency Management Agency (FEMA), the Bureau of Reclamation (Reclamation), the California Office of Emergency Services (CalOES), the Central Valley Flood Protection Board (CVFPB), and DWR. A multitude of other federal and State agencies, utilities, non-governmental entities, property owners, businesses, and residents also have roles and interests that affect Delta levee management. This would provide for the construction team members to understand the nature of flood risk in the Delta, be properly trained and equipped to deal with flood emergencies, be aware of real-time conditions, and participate in mitigating flood risks, if necessary. Non-structural solutions could include training of construction personnel in emergency notification protocols, provided with emergency contact information for the key emergency management personnel within the multi-layered flood risk management system, and be trained to have a basic understanding of Standardized Emergency Management System (SEMS) and the National Emergency Management System (NEMS). Each worker would be provided with a kit of emergency response gear to keep in their vehicles for the duration of the construction period. This could include a personal floatation device (PFD), all weather gear, a cell phone with good reception in the Delta, a first aid kit, a flashlight, flares, a shovel, a pack of sandbags, some stakes, twine, and a throw line.

Non-structural measures would also consider unanticipated events, such as seismic events or sunny-day levee failures (e.g. due to animal burrows). In the event that evacuation ahead of rising floodwaters is impractical because the flooding is occurring rapidly and without warning and/or roads and bridges to escape the floodwaters have become unsafe or impassable, there are a variety of options for allowing workers to escape floodwaters on site or in close proximity to the site to secure up to the 100-year flood level and not be dependent upon subsequent rescue efforts to assure worker safety. These measures include all-weather roads at elevations above levee crests, provisions for boats at construction sites, and elevated work sites.

Structural measures would also be developed for the construction period and the long-term operations and maintenance. The permanent facilities, such as the intake structures and surrounding levees, tunnel shafts, Southern Forebay, pumping plant, and South Delta facilities would be constructed above the 200-year flood elevation with sea level rise and climate change hydrology for Year 2100 at elevations determined by DWR (DWR 2020b). During construction, all tunnel shaft pads would be constructed to an elevation at, or slightly above, the adjacent levee height thus providing a high ground refuge above the local 100-year flood elevation. Several structural remediation measures to reduce risk during Project construction such as setback levees, ring levees and geometry repairs would be available to reduce the flood risk based on the hazard identified, including the structural measures discussed below.

3.3.1.1 Measures to Reduce Flood Risks along Existing Levee

Development of this EPR included considerations to minimize effects on existing levees, such as avoiding or minimizing the use of existing levees as construction haul routes for the DCP and avoiding placement of stockpiles or fills within a specified distances from the interior toe of existing levees. Actual project setbacks from existing levees will be determined during the design phase based on site-specific investigations and analyses.

See TM – Levee Vulnerability Assessment (Attachment H) for detailed information

3.3.1.2 Measures to Reduce Flood Risks at Intakes

As described in Section 2.1, Intakes, a temporary jurisdictional levee would be required at the intake site adjacent to but landward of the existing levee to allow the intake facilities to be constructed along the Sacramento River while maintaining continuous flood protection. State Route 160 would be relocated on top of the temporary levee. As excavation continues on the intake site, a new jurisdictional levee would be constructed around the perimeter of the sedimentation basin, and outlet shaft. The new jurisdictional levee would extend to the existing jurisdictional levee located to the north and south ends of the intake structure. The intake, sedimentation basin, flow control structure, and outlet channel would be designed to flood control standards that could accommodate the 200-year flood event with sea level rise. Following construction of the intake structure, State Route 160 would be re-located to approximately its original location to the east of the intake structure near the Sacramento River.

See TM – Intake Flood Management (Attachment A) for detailed information

As described in Section 2.1, Intakes, water would flow from the intakes through the sedimentation basin through a flow control structure with radial gates and into the outlet shaft that would be connected to the tunnel system. The radial gates would be operated integrally with the jurisdictional levee and would also be used to isolate the downstream portions of the DCP tunnel system from high flood waters that could occur at the intake site. The tunnel shaft pad at each intake site would initially be constructed to approximately the height of the levee along State Route 160. Following construction of the tunnel through the shaft and completion of the new perimeter levee around the sedimentation basin and outlet channel, the tunnel shaft pad would be lowered to an elevation that would allow for gravity flow into the tunnel. At that time, the tunnel shaft would become the intake outlet structure within the jurisdictional levee.

3.3.1.3 Measures to Reduce Flood Risks at Tunnel Shafts

As described in Section 2.2.2.1, Tunnel Shafts for the Central and Eastern Corridors, during the initial construction phase at the tunnel shaft sites, the tunnel shaft pad would be constructed above the ground surface to an elevation approximately equal to the adjacent levee system. Following construction, the tunnel shaft liner would be raised above the shaft pad to an elevation determined by DWR to be above the 200-year flood event with sea level rise and climate change hydrology for Year 2100 (DWR, 2020b), whichever is higher, and to provide height and freeboard for hydraulic surge events. The heights of the tunnel shaft pads and shaft liners are presented in Appendix A and engineering concept drawings for each site.

See TM – Flood Risk Management (Attachment H) for detailed information

The levee systems surrounding each Delta island along the Central and Eastern corridors provide the first line of defense against flooding. Their reliability was evaluated during preparation of this EPR in terms of their compliance with Public Law 84-99 criteria Public Law 84-99 criteria were considered an intermediate standard between the Delta Hazard Mitigation Plan and the DWR Bulletin 192-82 criteria.

See TM – Flood Risk Management (Attachment H) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H) for detailed information

Among the shaft locations along the Central and Eastern corridors, the tunnel launch sites justify a response proportional to the greater level of risk compared to the reception and maintenance shafts. The tunnel launch shaft sites would be active worksites for a seven to nine-year construction period and would require substantially more workers and equipment on site. Based on the flood risk evaluation performed in preparation of this EPR, Bouldin Island (Central Corridor) and Lower Roberts Island (Eastern Corridor) are considered to be in a higher risk category, due to the combined effects of levee geometric deficiencies, and potential inundation time and depth of flooding.

Twin Cities Complex (Central and Eastern corridors) located to the east of Interstate 5 on the eastern portion of Glanville Tract on an upland areas that would be vulnerable from overland flow, such as lands located between southern Elk Grove on the north and Twin Cities Road on the south, and State Route 160 on the west and the railroad embankment along Franklin Boulevard (also known as the “Franklin Pond”). This area is subject to flooding from the Sacramento, Cosumnes, and Mokelumne rivers, including during the floods of 1986 and 1997. Glanville Tract is not fully protected by perimeter levees. The UPRR embankment forms the eastern boundary of the Glanville Tract, but as demonstrated in the February 1986 flood, this embankment is porous and may fail when floodwaters pond on the east side of the embankment.

The two Southern Complex tunnel launch shaft sites near the northern embankment of the Southern Forebay (Southern Forebay Inlet Structure Launch Shaft and Working Shaft) are already protected by levees that substantially meet the Public Law 84-99 criteria primarily only on the east side of the Southern Complex (Central and Eastern corridors). The western side of the Southern Complex would be located on higher ground. In the area protected by levees, the time to flood in the event of a catastrophic failure has been conservatively estimated as being very short. However, the chance of levee failure is relatively low, and a sudden, catastrophic structural failure is unlikely at the Southern Complex due to portions of the levee system on mineral soil foundations compared to Bouldin and Lower Roberts islands. For these reasons further levee improvements on Byron Tract would not be warranted as part of the comprehensive flood risk management strategy for the tunnel construction corridor.

Provisions for flood management at these tunnel launch shafts are summarized below.

- **Bouldin Island (Central Corridor) -** Repairs are planned for portions of existing Bouldin Island levees to address areas that have insufficient freeboard and/or slopes that do not comply with Public Law 84-99 Delta-Specific levee design standard (considered by the Federal Emergency Management Agency) and historic performance issues that indicate potential existing vulnerabilities in the levee or foundation. The top elevation of tunnel shaft would be raised to heights to prevent inundation of the tunnel. However, the remaining portions of the site, including the buildings and RTM handling areas would be subject to flooding due to existing levee conditions. To reduce this risk, targeted repairs would be implemented to portions of existing Bouldin Island levees to address Public Law 84-99 geometry and historic performance issues during a potential high-water event. Multiple areas have been identified as not meeting the Public Law 84-99 design criteria standards. These areas would primarily require levee widening and crown raises to provide a levee prism and freeboard to meet this design criteria. The Delta-Specific Public Law 84-99 standard provides for minimum freeboard and levee geometry requirements based on levee height and the thickness of peat in the levee foundation. Following the Public Law 84-99 standard, the Bouldin Island would be designed with 1.5 feet of freeboard above the 100-year flood elevation, minimum 16-foot crest width, exterior slopes of 2H:1V exterior slopes, and interior slopes ranging between 3H:1V to 5H:1V depending on levee height and peat thickness. All of the modifications would occur on the landside of the levees using soil hauled from on-site excavations at the Twin Cities Complex. Levee modifications would occur at several areas for about 51,000 feet around Bouldin Island. The total size of the construction site and post-construction site for the Bouldin Island levee modifications would be approximately 251 acres, plus an additional 90 acres for temporary levee modification access roads. The levee improvements would remain following construction.

  A ring levee around the tunnel launch shaft site was not planned for Bouldin Island due to the extensive presence of peat and organic soft soils. To provide adequate foundations under a new ring levee, the initial levees would need to be 20 to 30 feet tall that would allow settlement of the levees. In comparison, construction to improve existing levees would occur on land that had already undergone some settlement and would provide a more stable foundation than a new ring levee.

See TM – Flood Risk Management (Attachment H) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H) for detailed information

- **Lower Roberts Island (Eastern Corridor) -** Repairs are planned for portions of existing Lower Roberts Island levees to address areas that have insufficient freeboard and/or slopes that do not comply with Public Law 84-99 Delta-Specific levee design standard (considered by the Federal Emergency Management Agency) and historic levee performance conditions that indicate potential existing vulnerabilities in the levee or foundation. These conditions could create a potentially unacceptable level of risk to the Project. These risks would be reduced through targeted repairs to existing levees to address Public Law 84-99 geometry and historic performance issues during a potential high-water event. Multiple areas have been identified as not meeting the Public Law 84-99 design criteria standards. These areas would primarily require levee widening and crown raises to provide a levee prism and freeboard to meet this design criteria. The Delta-Specific Public Law 84-99 standard provides minimum freeboard and levee geometry requirements based on levee height and the thickness of peat in the levee foundation. Following the Public Law 84-99 standard, the Lower Roberts Island levee would be designed with 1.5 feet of freeboard above the 100-year flood elevation, minimum 16-foot crest width, exterior slopes of 2H:1V exterior slopes, and interior slopes ranging between 3H:1V to 5H:1V depending on levee height and peat thickness. Levee modifications would occur along the Turner Cut eastern levee adjacent to West Neugerbauer Road. All of the modifications would occur on the land-side of the levees, as shown in the engineering drawings. Temporary levee modification access roads would be constructed along the landside toe of the existing levee at current grade level. The total size of the construction site and post-construction site for the Lower Roberts Island levee modifications would be approximately 30 acres, plus an additional 37 acres for temporary levee modification access roads. The levee improvements would remain following construction.

  A ring levee around the tunnel launch shaft site was not planned for Lower Roberts Island due to the extensive presence of peat and organic soft soils. To provide adequate foundations under a new ring levee, the initial levees would need to be 20 to 30 feet tall that would allow settlement of the levees. In comparison, construction to improve existing levees would occur on land that had already undergone some settlement and would provide a more stable foundation than a new ring levee.

See TM – Flood Risk Management (Attachment H) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H) for detailed information

- **Twin Cities Complex -** On the east side of the existing site, the UPRR embankment appears to form a flood barrier. The Twin Cities Complex geotechnical conditions are more stable than Bouldin Island and Lower Roberts Island, and the construction site can be protected from a 100-year flood event with a ring levee in accordance with the Delta-specific Public Law 84-99 equivalent standards (i.e. 1.5 feet of freeboard above the 100-year Federal Emergency Management Act flood elevation with 2:1 exterior slopes and 3:1 interior slopes). The ring levee would vary from about 3.5 feet to 11.5 feet tall. This configuration would be considered conservative since past inundation within this area in 1986 and 1997 resulted in relatively shallow flooding.

  To protect the other lands within the Twin Cities Complex, a ring levee would be constructed around the site. The site modifications would be implemented in a manner to avoid effects to water surface elevations on adjacent, upstream, or downstream lands during peak flood events.

See TM – Flood Risk Management (Attachment H) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H) for detailed information

An all-weather road would be constructed on-top of the ring levee, approximately 12 feet wide with shoulders of 2 feet on each side. All-weather 10-foot wide patrol roads would be constructed around the interior and exterior toes of the levee.

Following construction, the ring levee and equipment within the ring levee would be removed. Soil fill removed from degrade of the ring levee would be added to the permanent on-site RTM stockpile. In areas where the permanent RTM stockpile would be placed against the interior of the ring levee, the ring levee would be left in place.

The extent and types of planned levee repairs would be refined prior to construction and in coordination with the local Reclamation Districts.

See TM – Flood Risk Management (Attachment H) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H) for detailed information

3.3.1.4 Measures to Reduce Flood Risks at Southern Complex

As described in Section 2.3.2.2, the Southern Forebay embankments would be designed to provide adequate protection from internal and external maximum surface water levels, including:

- External surface water levels based on the 200-year flood event and sea level rise in Year 2100, including wave run-up and appropriate freeboard to reduce risk of overtopping of the embankment from external flooding.
- Internal surface water levels could be higher than external water levels; therefore, the embankments would need to be of adequate height for maximum overflow water elevation, wave run-up, and freeboard on the interior side of the embankment.

The South Delta Pumping Plant facilities would be located both below grade and above-ground on a raised site pad along the Southern Forebay embankment to protect the facilities from the 200-year flood event with anticipated sea level rise in Year 2100 and protection from surface water wind wave run-up from the Southern Forebay.

The Southern Forebay Inlet Structure Launch Shaft and the Southern Forebay Outlet Structure tunnel launch shafts would become part of the Southern Forebay embankment that would be designed to reduce flood risks, as described above. The Southern Forebay emergency spillway would also be designed to be protected from the 200-year flood event with sea level rise and climate change hydrology for Year 2100 (DWR, 2020b).

The western portion of the Southern Complex, South Delta Outlet and Control Structure would be located at elevations higher than the 200-year flood event with sea level rise and climate change hydrology for Year 2100 (DWR, 2020b).

The California Aqueduct Control Structure would be constructed to protect the downstream portions of the California Aqueduct from the 200-year flood event with sea level rise and climate change hydrology for Year 2100 (DWR, 2020b).

4. Site Development, Site Access, and Logistics

Site access/logistics items include efforts to develop individual sites to facilitate construction activities and reduce design complexity, identify access methods for each site, define methods to logistically integrate activities to minimize disruption to other land uses and traffic, and to provide for the flow of construction materials to each site in an efficient manner. Site access and logistics would be largely focused on identifying appropriate transportation modes and routes to ensure that manpower, goods and services would be transported in effective ways while minimizing impacts to the environment and residents of the Delta. The DCP would benefit from developments in logistics management including technological advances in the design of vehicles and equipment to curtail emissions, consideration for more centralized control of logistics flows (e.g., materials depots), and more centralized worker access plans, such as park and ride lots to reduce traffic loads and on-site parking requirements.

The extensive geographic footprint of the project, as well as the large volume of project materials of various commodity types, would require that all modes of transportation be examined for their relative ease of use, impact on the community, and cost-effectiveness. Three primary modes of transportation for the movement of goods and services exist in the Delta and each was considered for use on the DCP, including: truck, barge, and rail. All construction sites would require truck access. Barge and rail access were considered exclusively to service major construction sites to reduce on the local roads and highways.

Actions to improve site accessibility and reduce construction traffic on local roads would also include use of Materials Depots, park and ride lots, and offsite tunnel segment manufacturing sites, and emergency response plans.

4.1 Roads

Truck access would be required for all construction sites within the DCP. During the preparation of the EPR, analysis was conducted on potential truck routes, including State Routes 4, 12, and 160; Interstates 5 and 205; over 30 local roads with direct access to construction sites (many with only two 10-foot-wide lanes and minimal shoulders); nine bridges along the state routes (including seven bridges that are moveable to allow barge and boat traffic); and 40 bridges on local bridges (including 12 bridges that are moveable). Pavement conditions on the roads and traffic interruption times for the moveable bridges were considered.

See TM – Potential Road Access Routes (Attachment F) for detailed information

Traffic counts were compiled from published sources for these roads to establish a baseline level of traffic. Future traffic projections were developed for the construction period with the peak construction month. Linear annual growth rates were developed using regional travel demand models, including the Three County Model (2015 Base) prepared for the Merced County Association of Governments, San Joaquin Council of Governments, and Stanislaus Council of Governments (TJKM, 2018) and SACOG's SACSIM19 model (SACOG, 2019).

See TM – Traffic Impact Analysis (Attachment F) for detailed information

Monthly truck and employee traffic projections associated with the DCP construction were developed from the construction schedule which also included area of origins for each trip. This information was combined with the projected traffic for the construction period. The DCP traffic analysis was unusual because the construction traffic not only varied each month, construction at various locations in the Delta did not occur simultaneously.

See TM – Shaft Siting Study (Attachment B) for detailed information

See TM - Preliminary Construction Schedules for Central and Eastern Corridor Options (Attachment H) for detailed information

During the preparation of the EPR, preliminary traffic impact analysis results were used to identify sites for the tunnel shaft sites that would have fewer transportation challenges. As the construction site locations were modified, the traffic impact analysis also was modified.

Proposed truck routes, truck traffic histograms, and road improvements were identified for each construction site of the DCP. The results of the traffic impact analysis were used to identify needed road improvements where the forecasted construction traffic would create a Level of Service worse than the existing or target projections by the local counties, and if the project construction traffic would increase traffic volume by 10 percent or more over the forecasted traffic projections without the DCP. Service targets used in the analysis were:

- **For Local Roads:** Level of Service C as defined by the local county
- **For State Routes, Interstate Highways, and Byron Highway:** Level of Service D as defined by Caltrans or the local county
- **For new roads constructed as part of DCP:** Level of Service D as defined by the local county

Design standards for each state or local entity that operates roads and bridges would be followed for all proposed improvements on the existing respective roadways. For most construction traffic routes along public roads, the road would need to include two 12-foot wide lanes with two 4-foot wide shoulders, or with two 8-foot wide shoulders for roads with more traffic, such as along Franklin Boulevard. The intake haul road would not be a public road and would only include two 12-foot wide lanes with no shoulders to minimize land disturbance. The absolute minimum road width for public roads used for construction traffic would be two 10-foot wide lanes with two 1-foot wide shoulders in areas where further expansion would affect habitat, such as along Lambert Road.

See TM – Logistics Strategy (Attachment F) for detailed information

See TM - Potential Road Access Routes (Attachment F) for detailed information

See TM - Traffic Impact Analysis (Attachment F) for detailed information

Most new access roads would be paved to minimize noise, dust, and maintenance. Access roads to more remote locations would be improved as gravel roads, including access roads to tunnel shafts on New Hope Tract, Mandeville Island, and Bacon Island along the Central Corridor and New Hope Tract along the Eastern Corridor. Future roadway projects under consideration by local or state agencies were reviewed to potentially coordinate road improvements. For example, Contra Costa County and Caltrans are evaluating a new highway route near Byron Highway and the Southern Complex. Access roads in this area were aligned in a manner that could potentially be coordinated with this future project. Access roads to construction sites were also identified based upon the following assumptions which would be included in the design specifications for each key feature:

- No construction traffic would be allowed within Solano County except for Interstate 80 and State Route 12 in Solano County (between Interstate 80 and Sacramento River), or for individuals or vehicles traveling from homes or businesses in Solano County.
- No construction traffic would be allowed in Yolo County except for Interstate 80, or for individuals or vehicles traveling from homes or businesses in Yolo County.
- No construction traffic would be allowed on State Route 160 between State Route 12 and Cosumnes River Boulevard except for re-alignment of this highway at the intake locations, installation of SCADA cables, or for individuals or vehicles traveling from homes or businesses along the affected routes.
- No construction traffic, except the employee electric shuttle buses or vans and small vehicles, would be allowed on Hood-Franklin Road. This excludes construction vehicles crossing Hood-Franklin Road at the improved intersection with the new intake haul road between Intakes C-E-3 and C-E-5.
- No trucks with three or more axles would be allowed on State Route 4 across Victoria Island.
- Construction of the new South Holt Road Overpass over BNSF railroad tracks and East Bay Municipal Utility District (EBMUD) Mokelumne Aqueducts would be coordinated with BNSF railroad to avoid traffic issues. There would be a minimum of 23 feet 4 inches of clearance between the top of the BNSF tracks and the bottom of the bridge deck, in accordance with BNSF requirements. Approximately 20 feet of clearance would be provided from the top of the Mokelumne Aqueducts to the bottom of the bridge deck. This height would be subject to design development and coordination with EBMUD.

See TM – Logistics Strategy (Attachment F) for detailed information

See TM - Potential Road Access Routes (Attachment F) for detailed information

See TM - Traffic Impact Analysis (Attachment F) for detailed information

Major road improvements that will be needed to service construction of the DCP are summarized in Table 6 and included in Appendix A and the engineering concept drawings. Appendix A also includes the number of piles and piers required for new or modified bridges. These roadways would be maintained for transit throughout the construction period.

TABLE 6. MAJOR ROAD IMPROVEMENTS FOR THE CENTRAL AND EASTERN CORRIDORS

Construction Sites	Description of Major Improvements
Intake Haul Road (Central and Eastern Corridors)	• Widen 3.2 miles of Lambert Road between Interstate 5 and the new intake haul road. • New 3.8 mile paved intake haul road at ground level along the west side toe of the abandoned railroad embankment to the east of the intakes to avoid use of State Route 160 and access Intakes C-E-3 and C-E-5. Would include widening of approximately 180 feet of the existing bridge at Hood-Franklin Road over Snodgrass Slough.
Twin Cities Complex (Central and Eastern Corridors)	• Widening of 1.0 miles of Dierssen Road, re-alignment of 1 mile of Franklin Boulevard to accommodate the new rail sidings, and widening of 0.6 mile of Twin Cities Road east of Interstate 5.
New Hope Tract (Central Corridor)	• Widening of 0.8 miles of West Lauffer Road
Bouldin Island (Central Corridor)	• Widen 8 miles of State Route 12 between Interstate 5 and new Bouldin Island interchange, including widening of bridge over Farm Road and Little Potato Slough

Construction Sites	Description of Major Improvements
	• New interchange and bridge over State Route 12 to access Bouldin Island and new 2.1 miles of access roads on Bouldin Island
Bacon and Mandeville Islands (Central Corridor)	• New bridge at community of Holt over EBMUD Mokelumne Aqueducts and BNSF railroad • For access to tunnel shafts on both Bacon and Mandeville islands, upgraded roads and new roads for 15.5 miles of along West Lower Jones Road, Bacon Island Road, and farm roads on Bacon and Mandeville islands, including a new bridge over Connection Slough
New Hope Tract (Eastern Corridor)	• New 0.3 miles access road to the shaft site from Blossom Road
Terminous Tract (Eastern Corridor)	• New uncontrolled interchange with longer acceleration and deceleration lanes along State Route 12 and improved 2.3 miles of State Route 12 from Interstate 5 to the tunnel shaft site
Lower Roberts Island (Eastern Corridor)	• New 1.2 miles access road from West Fyffe Street to new bridge • New road and railroad bridges over Burns Cut from Port of Stockton • New 3.2 miles access road and rail lines along West House Road from new bridge • New 1.6 miles of new access road on Lower Roberts Island
Southern Complex on Byron Tract (Central and Eastern Corridors)	• New 0.8 miles of road to provide access from State Route 4 (extension of Discovery Bay Boulevard) • Relocation of 0.8 miles of Western Farms Ranch Road
Southern Complex West of Byron Highway (Central and Eastern Corridors)	• Extend Clifton Court Road by 0.1 miles; and widen 0.6 miles • Widen 0.7 miles of North Bruns Way • Two new bridges over re-aligned Byron Highway • Relocate Byron Highway with a new round-about to the east of existing Byron Highway

4.2 Water Access

The only water access to construction sites would be by barges to place riprap near the end of construction at the intakes, as described below. Navigation would not be substantially affected, however, during construction, boat speed limits would be in place in the Sacramento River near the intake cofferdams and in Italian Slough near the Southern Forebay Emergency Spillway. Barges would also be used to conduct overwater geotechnical investigations. Barges would only move through the Delta during weekday daylight hours.

See TM – Barge Transportation Study (Attachment F) for detailed information

Barge access was considered for sites requiring large volumes of material transport to help ease the load on the local roadways. These sites included the intakes, tunnel launch shafts at Bouldin Island and Lower Roberts Island and the Southern Facilities Complex. Barging to other DCP sites that would require substantially far less material deliveries or were not located near waterways was not considered.

Barging is a common method of moving large quantities of materials in the Delta. The Delta also contains two major ports, the Port of West Sacramento, and the Port of Stockton. The Port of Stockton is a major shipping hub in the region. These ports may be interim points of material delivery for the project and barging of these materials to sites in the Delta could be an effective transportation mode.

The Sacramento River and other watercourses are characterized by narrow widths, low bridges, and shallow areas that have not been dredged for many years and have known areas of shoaling. The Sacramento River Deep Water Ship Channel (SRDWSC) and the Stockton Deep Water Ship Channel (SDWSC) can accommodate larger barge configurations due to ample width and deep drafts. However, the barges would need to move through the smaller channels to access the DCP construction sites.

Outside of the major ship channels, barges in the Delta are generally limited. The typical towing configuration in the Delta is a single 200-foot by 50-foot barge with a draft of 10 feet and pushed by a 1,500-horsepower harbor tug.

A range of locations were considered and evaluated during preparation of this EPR with respect to water depths and experience by marine contractors in the Delta to access the tunnel launch shaft sites. However, except for the SRDWSC and SDWSC, use of the waterways would require a combination of using light-load barges, moving barges during high tides, or use of multiple tugs to move the barges around tight turns.

See TM – Barge Transportation Study (Attachment F) for detailed information

Access to the intake locations would be limited due to constraints along the Sacramento River including narrow channel widths and shallow depths along from approximately 2 miles north of Rio Vista to Walnut Grove. There are also several fixed restrictions including the Rio Vista Bridge and Isleton Bridge with wait times for opening of the bridge when transporting barge materials on the Sacramento River. The bridge openings also would affect road traffic over the bridge.

It is anticipated that barges would be used for a short period of time at the intakes to deliver riprap rock for placement and to remove dredged spoils following removal of the cofferdam at the end of the construction period. No barge landings would be required. The barges with a crane and the riprap rock would be anchored at the intake sites for several days while the rock would be placed in a manner similar to flood management repairs of existing levees. Barges would only move through the Delta during weekday daylight hours.

See TM – Potential Future Field Investigations – Central and Eastern Corridor Options (Attachment H) for detailed information

Limited barging would also be used to perform the pile installation method test program. Additionally, barges, ships, or boats may be used to conduct overwater borings and overwater CPTs. Barges would only move through the Delta during weekday daylight hours. These activities are discussed in the Potential Future Field Investigations Technical Memorandum.

A potential barge landing location on Bouldin Island was identified along Potato Slough. The barge route from the San Joaquin River would include navigation under two moveable bridges. The potential barge landing on Bouldin Island would be located in an area characterized by extensive peat soils and would require ground improvement to provide adequate foundations for the barge landing and related transport facilities. During preparation of the EPR, house boaters with long-term moorings along Potato Slough and recreational boaters that use Potato Slough raised concerns about a barge landing on Bouldin Island. Due to the ability to widen State Route 12 (as summarized in Table 6), it was determined that providing construction materials to the Bouldin Island site could be accommodated without the need for a new barge landing.

A potential barge landing location was identified on Lower Roberts Island along the adjacent SDWSC/San Joaquin River. There is a small existing barge landing near Windmill Cove. However, the DCP would require a larger site. Due to the ability to access Lower Roberts Island by road and rail from the Port of Stockton, it was determined that providing construction materials to the Lower Roberts Island site could be accommodated without the need for a new barge landing.

A potential barge landing location was identified near the Southern Complex near the confluence of Old River and Italian Slough. However, this reach of Old River includes the Contra Costa Water District Old River intake, the Town of Discovery Bay Community Services District wastewater treatment plant outfall, and a local irrigation district intake. avoid conflict with these utilities, barge landings were not considered for the Southern Complex.

4.3 Rail Access

Rail access was considered for tunnel launch shafts and the Southern Complex that would require large volumes of material transport to help ease the load on the local roadways. The rail network surrounding the DCP construction sites has been in existence for over one-hundred years. The two primary railroads adjacent to the DCP construction sites are the UPRR near the Twin Cities Complex and Southern Complex (Central and Eastern corridors) and Lower Roberts Island (Eastern Corridor) and the Burlington Northern-Santa Fe Railroad near Lower Roberts Island (Eastern Corridor).

See TM – Rail Potential Study (Attachment F) for detailed information

In general, large rail facilities are designed and constructed to handle either unit train service (full train loads at one time) or manifest service (less than a full train load at one time). For the DCP, the rail facilities would probably use small manifest train facilities. The major railroad would deliver the rail cars to a designated area at the construction site, and the DCP would move the rail cars along on-site railroads within the construction site to specific loading or unloading locations. The DCP would place the filled or unfilled rail cars back on tracks in the designated area and the major railroad would move the rail cars. Detailed discussions with the railroads would occur during the design phase. The rail infrastructure at the DCP sites is summarized in Table 7.

TABLE 7. RAIL ACCESS TO MAJOR CONSTRUCTION SITES

Site	Railroad Company	Description
Twin Cities Complex	Union Pacific Railroad	A rail spur would be constructed as a siding along the UPRR line that is located to the east of Franklin Boulevard. Franklin Boulevard would be re-aligned to accommodate the new rail siding. Two new rail lines, one for each tunnel drive, would be extended from the rail siding to the Twin Cities Complex site and would wrap around the construction site to deliver materials to tunnel segmental liner storage areas and to load rail cars with RTM for delivery to the Southern Complex.
Lower Roberts Island Launch Shaft	Union Pacific Railroad and Burlington Northern-	Both UPRR and BNSF have rail lines on the Port of Stockton near Burns Cut. Rail lines would be extended from one of the existing rail facilities in the Port of Stockton depending upon the results of discussions during the design phase.

Site	Railroad Company	Description
	Santa Fe Railroad	The DCP would construct a new rail bridge over Burns Cut and rail lines to the launch shaft area to deliver tunnel segments and other materials.
Southern Complex	Union Pacific Railroad	A rail spur would be constructed on the north side of UPRR line that is located adjacent to Byron Highway. The DCP rail line would extend to the concrete batch plants, RTM processing areas, and tunnel liner storage area for all four tunnel launch/working shafts.

4.3.1 Rail-Served Material Depots

Rail-Served Material Depots would allow materials and equipment to be transported to the construction work sites in bulk quantities (either by rail or truck) and then distributed to the nearby work sites by truck to meet demand. These depots at the Twin Cities Complex and Southern Complex (Central and Eastern corridors) and Lower Roberts Island (Eastern Corridor) could reduce traffic by targeting lower traffic periods to make equipment site deliveries, and consolidate smaller loads from several trucks to one truck. Delivery trucks servicing the Materials Depot could all be clean fuel vehicles to reduce air quality and greenhouse gas emissions to be determined during the design and construction phases.

4.4 Park and Ride Lots

In addition to parking facilities included within work sites, several separate potential park and ride lots would be established near the major commute corridors to consolidate worker vehicles and allow for conveying workers to some of the construction work sites on clean fuel buses or vans or in carpools. Trucks could also use these areas for waiting if the trucks arrive at night. The park and ride lots would include asphalt paved parking areas with striped parking spaces. The park and ride lots would include lights and electric vehicle charging stations with solar panels to provide a portion of the power supplies.

See TM – Logistics Strategy (Attachment F) for detailed information

Five new park and ride facilities were identified to support construction of the DCP:

- Hood-Franklin Park and Ride Lot: along the south side of Hood-Franklin Road immediately east of Interstate 5 to provide parking for employees for the intakes (Central and Eastern corridors)
- Rio Vista Park and Ride Lot: along the south side of State Route 12 immediately east of State Route 160 to provide parking for employees for the Bouldin Island Tunnel Shaft (Central Corridor)
- Charter Way Park and Ride Lot: along the south side of Charter Way at the southwest corner of the Interstate 5 overpass to provide parking for employees for the tunnel launch shaft on Bouldin Island (Central Corridor) or Lower Roberts Island (Eastern Corridor). There would be adequate parking space on tunnel reception and maintenance shaft sites; however, the Charter Way Park and Ride Lot could also be used by some employees for New Hope Tract, Staten Island, Mandeville Island, and Bacon Island (Central Corridor) or New Hope Tract, Canal Ranch Tract, Terminous Tract, and King Island (Eastern Corridor)

- Byron Park and Ride Lot: near the northwest corner of Camino Diablo Road and Byron Highway to provide parking for employees at Southern Complex (Central and Eastern corridors)
- Bethany Park and Ride Lot: near the intersection of Bethany Road and Henderson Road, adjacent to Byron Highway to provide parking for employees at Southern Complex (Central and Eastern corridors)

The park and ride lots would be removed following construction.

4.5 Pre-Cast Tunnel Segmental Liner Facility

The entire length of the tunnel would be lined with pre-cast concrete tunnel liner segments. These liner segments would be mass produced and transported in sufficient quantity to keep pace with tunneling progress. Local and regional pre-cast manufacturing capacity to serve the quantities needed for DCP were surveyed to assess local capacity during preparation of this EPR.

See TM – Preliminary Precast Yard Study (Attachment F) for detailed information

For the DCP, it is assumed that the tunnel liner segments would be manufactured at existing commercial facilities and hauled by road or rail to the tunnel launch shaft sites where the tunnel liner segments would be stored for several months. Existing pre-cast facilities near the DCP tunnel launch shaft sites include Confab in Lathrop, Traylor-Shea in Stockton, Kie-Con in Antioch, and Clark Pacific at the Port of West Sacramento.

4.6 Emergency Response Planning

The DCP would require sustained incident management operations and support activities throughout the construction period. The types of potential incidents could include vehicle accidents, falls, heat-related illness, electrocution, trauma, fire, and working over and under water. The greatest challenge would be to meet the tunneling rescue needs during construction. As stipulated by the Division of Occupational Safety and Health of California (Cal/OSHA), response time by a qualified rescue team to a tunneling incident must be within a half-hour travel time from the entry point. A secondary rescue team would be required to be available within 2 hours of the travel time from the tunnel entry point when the number people underground totals at least 25 in accordance with the Cal/OSHA requirements.

See TM – Project Emergency Response Plan (Attachment F) for detailed information

It is assumed that the incident scene could be at any one of the intake structures, tunnel shaft sites, Southern Forebay, or pump station locations. During preparation of the EPR, the current capability, capacity, and proximity of emergency services agencies in the Delta that could potentially be called upon to respond to an incident during construction of the project were evaluated. The results of this preliminary evaluation indicated that most of the tunnel shafts would be located within 30 minutes travel time (without consideration of traffic congestion) to an existing fire station.

Based on the unique nature of much of the construction activities under the DCP, it is suggested that in general the primary emergency response services be provided by the construction contractors. Therefore, temporary emergency response facilities, equipment and trained personnel have been included in the plans for the main DCP construction sites (the intakes, tunnel launch shaft sites, and the Southern Complex) summarized in this ERP, including helipads to evacuate injured persons at the tunnel launch shaft sites and intake sites. In addition to the primary response services provided by the contractor, it is planned that nearby local emergency response agencies would provide secondary backup emergency response services. Emergency response agencies that were considered near to the DCP construction sites were identified and contacted to understand the capacity and capabilities of each agency and potential access routes to construction sites. The analysis also considered medical facilities that operate 24 hours per day, seven days per week; and law enforcement agencies.

However, none of the fire departments are currently capable of responding to a tunneling incident with suitably trained and equipped resources to meet Cal/OSHA regulatory requirements for safe construction operations. Additional training and equipment would be required for the following:

- Tunnel and shaft rescue training
- Appropriate heavy rescue equipment and vehicles
- Confined space training
- Confined space rescue equipment

During the design phase, additional evaluations and discussions with local agencies would be required to determine the most appropriate method to coordinate between DCP-provided emergency response services at the construction sites and integration with local agencies.

5. Utilities

5.1 Purpose

The construction sites for the Central and Eastern corridors would require utility services during construction and permanent operations. Utility services would include power and water. SCADA (Supervisory Controls and Data Acquisition) would be provided by the project to intakes, tunnel launch shafts, South Delta Pumping Plant, South Delta Outlet and Control Structure, and the California Aqueduct Control Structure to remotely operate equipment, monitor equipment operations and performance (including video security camera footage), evaluate historical trending analyses, and provide real-time performance information.

5.2 Electric Power Facilities

Power supplies would be needed at construction sites for the intakes, tunnel shafts, Southern Complex including the South Delta Pumping Plant, concrete batch plants, and park and ride lots. Power supplies would also be needed during operations of the intakes, Southern Complex control structures, South Delta Pumping Plant, and lights and security at all locations.

See TM – Electrical Power Load and Routing Study (Attachment G) for detailed information

Electrical power is provided in the project area by Sacramento Municipal Utility District (SMUD) in Sacramento County and Pacific Gas & Electric Company (PG&E) throughout the project area. High-voltage transmission lines in the project area are owned and maintained by SMUD, PG&E, and Western Area Power Administration (WAPA).

To minimize construction of new power lines, the ability to use existing power lines was analyzed. Some of the DCP facilities would be located in areas not currently served by existing power lines with required voltage and capacity; therefore, several different methods were considered to extend power connections to the DCP facilities, including:

- Replacement or addition of new power lines within the existing distribution/transmission corridors on existing power poles or towers.
- Moving existing or addition of new above-ground power poles or towers.
- Installation of new underground power cables.
- It was assumed, that if new underground power cables would only be used for construction and not operations, the cables would be de-energized and abandoned-in-place.
- Widening of some access roads could result in the need to move existing poles used for overhead power lines. The new poles and overhead lines would be placed adjacent to the widened roadway. Along the new intake haul road, existing overhead power lines would be installed in underground cables because the existing power lines would conflict with construction activities.

See TM – Electrical Power Load and Routing Study (Attachment G) for detailed information

- Power demands were identified for both construction and operations phases. During construction, power demands would include support for large equipment, such as cranes and ground improvement machines, small tools, and construction-support facilities, including construction trailers, temporary lighting, and electric vehicle charging stations. Much of this equipment could be powered by on-site generators or internal combustion engines; however, use of electrical grid service to the sites, if available, would be more efficient, use less diesel fuels, and produce less emissions.
- Power demand during operations would include power for mechanical equipment (e.g., operable gates, screen cleaners, pumps), SCADA systems, and power for onsite buildings and lights.
- Helicopters would only be used to construct new transmission towers along a new transmission line to serve the Southern Complex.

Discussions with SMUD, WAPA, and PG&E are ongoing as this EPR is being prepared. The current concepts to provide interconnection service and power, either concurrently or eventually, to DCP facilities are presented in the Electrical Power Load and Routing Study TM and briefly summarized in Table 8.

TABLE 8. SUMMARY OF POWER SUPPLY CONNECTIONS FOR CENTRAL AND EASTERN CORRIDORS

Key Feature	Existing Facilities	Proposed Changes
Intakes (Central and Eastern Corridors)	Several overhead 12 kilovolt (kV) SMUD power lines within the intake construction sites	• Extension of SMUD power lines from the SMUD Franklin Substation to a location along Franklin Boulevard near Lambert Road which would be constructed using new power lines on existing power poles. The new power lines would be located at the same height as the existing power lines, but on a different side of the power pole. • Install new underground cable in a dedicated easement along Lambert Road between Franklin Boulevard and along the new intake haul road • Relocate the overhead power line that cross the intake sites with new underground cables in new easements around or through the sites.
Twin Cities Complex (Central and Eastern Corridors)	A 69 kV and a 12 kV SMUD overhead power line adjacent to the site	• Power would be provided from the extension of SMUD power lines from the SMUD Franklin Substation to a location along Franklin Boulevard near Lambert Road, as described under the above entry for Intakes. A new underground cable would be extended in a new dedicated easement from the end of the new overhead line near Lambert Road to a new substation near the intersection of Dierssen Road and Franklin Boulevard. A new substation would be installed as part of the Twin Cities Complex near the intersection of Dierssen Road and Franklin Boulevard. • Install underground cables on-site
New Hope Tract Shaft (Central Corridor)	An existing 11 kV PG&E overhead line is located	• Install a new underground cable along the new access road

Key Feature	Existing Facilities	Proposed Changes
	near the site along West Lauffer Road	
Staten Island Shaft (Central Corridor)	An existing 12 kV PG&E overhead line is located along Staten Island Road	• Install a new underground cable along the new access road
Bouldin Island Shaft (Central Corridor)	Two 230 kV WAPA transmission lines and a 230kV PG&E transmission line located near Interstate 5 approximately 7.4 miles to the northeast of Bouldin Island	• Install a new substation on Bouldin Island • Install a new substation adjacent to existing 230 kV transmission lines near the intersection of State Route 12 and Interstate 5 • Install a new underground cable in a new dedicated easement along the new access route and along the widening of State Route 12 • Install underground cables on-site
Mandeville Island Shaft (Central Corridor)	An existing 11 kV PG&E overhead line across the island	• Install a new underground cable from the existing power lines
Bacon Island Shaft (Central Corridor)	An existing 11 kV PG&E overhead line near Bacon Island Road	• Install a new underground cable along the new access road
New Hope Tract Shaft (Eastern Corridor)	An existing 11 kV PG&E overhead line along North Blossom Road and a 11 kV PG&E overhead line to the west of the shaft location	• Install a new underground cable along the new access road
Canal Ranch Tract Shaft (Eastern Corridor)	An existing 11 kV PG&E overhead line along West Peltier Road	• Install a new underground cable along the new access road
Terminous Tract Shaft (Eastern Corridor)	An existing 11 kV PG&E overhead line along State Route 12	• Install a new underground cable from power line adjacent to site along State Route 12
King Island Shaft (Eastern Corridor)	An existing 21 kV PG&E overhead line along West Eight Mile Road with a power pole on the construction site	• Install a new underground cable adjacent to site along Eight Mile Road
Lower Roberts Island Shaft (Eastern Corridor)	A 21 kV PG&E overhead line and a 11 kV PG&E overhead line across the site Two 230 kV WAPA overhead lines and a 230 kV PG&E overhead line to the east of the shaft site	• Install a new substation on Lower Roberts Island • Install new high voltage transmission line and new substation in new dedicated easements to connect to existing high voltage transmission lines • Install underground cables on Lower Roberts Island from onsite substation to construction sites
Upper Jones Tract Shaft (Eastern Corridor)	An existing 11 kV PG&E overhead line along West Bacon Road	• Install a new underground cable along the new access road
Southern Complex on Byron Tract, including Inlet Structure Launch Shaft, Working Shaft tunnel launch shaft and tunnel maintenance shaft, South Delta Pumping Plant, Southern Forebay, Southern Forebay Outlet Structure	Several high-voltage power lines, including a 69 kV WAPA line and two 500 kV PG&E lines	• Install a new power line in a dedicated easement to connect to the existing WAPA Tracy Substation. The new connection would include be primarily overhead power poles with a new switchyard adjacent to the Tracy Substation and short sections of underground cables for crossings.

Key Feature	Existing Facilities	Proposed Changes
(Central and Eastern Corridors)		• Install new substations for the South Delta Pumping Plant, Byron Tract Working Shaft, RTM mechanical drying area, and Southern Forebay Outlet Structure tunnel launch shaft. • Install underground cables to connect to all electric demand sites.
Southern Complex West of Byron Tract including South Delta Outlet and Control Structure and California Aqueduct Control Structure (Central and Eastern Corridors)	An existing 21 kV PG&E overhead line along North Bruns Road	• Install a new underground cable from the existing power lines adjacent to construction site
Lambert Road Concrete Batch Plant (Central and Eastern Corridors)	An existing 60 kV SMUD overhead line and new SMUD substation at the intersection of Lambert Road and Franklin Boulevard	• Power would be provided from the extension of SMUD power lines from the SMUD Franklin Substation to a location along Franklin Boulevard near Lambert Road, as described under the above entry for Intakes. A new underground cable would be extended from the end of the new overhead line along Lambert Road between Franklin Boulevard and the batch plant site • Connect to the end of the overhead power line modification extending to the intersection of Franklin and Lambert that would be installed to serve the Twin Cities Complex (see above)
Hood-Franklin Park and Ride Lot for lights and electric vehicle charging station (Central and Eastern Corridors)	An existing SMUD overhead line along Hood-Franklin Road	• Install a new underground cable from the existing power lines
Rio Vista Park and Ride Lot for lights and electric vehicle charging station (Central Corridor)	An existing PG&E overhead line adjacent to River Road	• Install a new underground cable from the existing power lines
Charter Way Park and Ride Lot for lights and electric vehicle charging station (Central and Eastern Corridors)	An existing PG&E overhead line adjacent to the site	• Connect to the existing power lines on-site
Bethany Park and Ride Lot for lights and electric vehicle charging station (Central and Eastern Corridors)	An existing PG&E overhead line adjacent to the site	• Install a new underground cable from the existing power lines
Byron Park and Ride Lot for lights and electric vehicle charging station (Central and Eastern Corridors)	An existing PG&E overhead line adjacent to the site	• Install a new underground cable from the existing power lines

5.3 Communications and Supervisory Control and Data Acquisition

The SCADA systems, and associated data communication systems, are common features of water infrastructure providing the ability to remotely monitor and control the performance and operation of the system. SCADA systems use data derived from instruments installed throughout the system and send signals using data communications systems for monitoring and control of equipment to perform desired functions such as flow set points.

The existing SWP facilities are largely monitored and controlled through an existing SCADA system and the DCP will need to be integrated into this system to allow for coordinated operations. The communications network for the DCP would connect three major data centers, two intakes and up to five remote data sites for the Central Corridor and six remote data sites for the Eastern Corridor. The network would require high speed, reliable data communications for proper function. The major data centers would be at the existing DWR Project Control Center, DWR Operations and Maintenance Area Control Center at the Delta Field Division, and the South Delta Pumping Plant. As shown in the engineering concept drawings, the system would include ring communication topology for redundancy purposes.

See TM – SCADA/ Communications Routing and Basic Design Approach (Attachment G) for detailed information

The SCADA system would be used for communications and to remotely operate equipment, monitor equipment operations and performance (including video security camera footage), evaluate historical trending analyses, and provide real-time performance information at:

- Intakes
- Tunnel Shafts (launch shafts and select maintenance or reception shafts, only)
- South Delta Pumping Plant and Southern Forebay
- South Delta Outlet and Control Structure
- California Aqueduct Control Structure

The SCADA system would consist of SCADA equipment and communications links based upon fiber-optic cables that would be installed within new structures. Whenever possible, the construction of fiber-optic based communications systems for the DCP would use existing telecommunications infrastructure, dedicated conduits within DCP road modifications (as shown in the GIS files), and termination panels installed inside or on the buildings or structures. Wherever possible, underground routes would be located along existing roads and DCP access routes. Overhead fiber installation would be limited to alignments with existing power pole corridors. The fiber cables would have a similar appearance as cable television cables.

The constructability of radio-based communications systems, whether satellite, cellular, or microwave, were also considered during preparation of the EPR. However, these options were considered to be less favorable than connections to existing fiber optic systems. Satellite and cellular leased systems would depend on the availability and power at existing radio transmitters to provide signal strength within the Central and Eastern corridors. Satellite signals were assumed to be available and could be costly for long-term operations. Cellular signals were determined to be generally unavailable within the Central and Eastern corridors. Microwave system would require construction of very high new towers with a large microwave dish antenna at a high elevation to allow for "line of sight" over the tops of trees to all locations.

5.4 Water Supplies to Construction Sites

Typical water demands at most of the construction sites would be used for dust control, mixing with cement-like material to stabilize soils during ground improvement efforts, moisture compaction to stabilize soils, mixing with slurry material or bentonite to form cutoff walls, and tire wash basins at each exit location around the site. Water would also be used for restroom facilities at the tunnel launch shaft sites (including tunnel shafts also used as a reception shaft and the Byron Tract Working Shaft), intake sites, South Delta Pumping Plant, and Southern Forebay. Portable restrooms would be used at other construction sites. Water would also be used for tunneling operations at the tunnel launch shaft sites and to make concrete at the concrete batch plants at Lambert Road facility, Bacon Island, and Southern Complex.

The water supply needed for construction will be satisfied through a combination of the following: import from local sources, exchanges, use of existing riparian diversions, new temporary appropriations, or existing State Water Project appropriations. Any use of diversions will be screened, as appropriate, and additional authorizations addressed following development of detailed engineering design.

At the intakes, tunnel shafts, and Southern Complex, all water from dewatering activities and stormwater runoff on the construction site would be collected, treated, and stored on-site to reduce the need for off-site water sources and to avoid increased peak runoff flow rates from the DCP construction sites. The dewatering flows and stormwater runoff flows would be treated in self-contained on-site trailers (similar to freight trailers used for tractor-trailer rigs). Similar trailers would be used for on-site storage of the treated dewatering flows and stormwater runoff for future use. Based upon the size of the site and types of on-site activities, 20 to 50 trailers would be located on the construction site. If portions of the dewatering flows and stormwater runoff are not needed on-site and storage units are full, the flows would b treated prior to discharge to adjacent water bodies.

5.5 Wastewater Facilities at Construction Sites

Wastewater facilities for most of the DCP construction sites would be provided with portable restrooms. Septic systems would be constructed at the intakes, Twin Cities Complex, Bouldin Island, Lower Roberts Island, and Southern Complex on Byron Tract (at the Byron Tract Working Shaft and the South Delta Pumping Plant). Due to high groundwater and/or low soil permeability at these sites, the leach fields would be sized larger than for locations with more favorable soil conditions in accordance with the applicable county regulations.

5.6 Potential Crossings with Local Wastewater Facilities at Construction Sites

Wastewater service for most of the structures near the DCP construction sites consist of individual septic systems with septic tanks and leach fields. Regional wastewater facilities are provided to the communities of Courtland and Walnut Grove by the Sacramento Area Sewer District. Interceptor pipelines extend between these communities and a regional pumping plant at the Rio Cosumnes Correctional Center (RCCC) (near the Franklin Field along Bruceville Road). The pumping plant lifts the wastewater into another interceptor that extends to the Sacramento Regional County Sanitation District wastewater treatment plant near the community of Elk Grove.

See TM – Summary of Utility Crossings (Attachment G) for detailed information

The interceptor between the community of Courtland and the regional pumping plant at the RCCC was constructed under Lambert Road. The DCP facilities would include widening of Lambert Road and installation of underground power cables along Lambert Road. These facilities would be designed to not affect the wastewater interceptor. The tunnel would be bored at a depth of almost 100 feet below the interceptor at Lambert Road.

The interceptor between the community of Walnut Grove and the regional pumping plant at the RCCC was constructed near West Lauffer Road. However, the New Hope Tract tunnel maintenance shaft along the Central Corridor would be located to the north of the interceptor alignment. The tunnel would be bored at a depth of almost 100 feet below the interceptor near West Lauffer Road.

5.7 Potential Crossings with Local Water Facilities at Construction Sites

Water service for structures near the DCP construction sites and along the tunnel alignment primarily consist of individual wells. During the design phase, individual well location and conditions would be identified along the tunnel alignment. Existing wells that would be in conflict with the tunnel alignment would be relocated to maintain water supply to the property or properties that rely upon the well.

See TM – Summary of Utility Crossings (Attachment G) for detailed information

The tunnel alignment or construction sites between the intakes and Southern Complex would cross several regional water facilities. These include the following:

- The City of Stockton Delta Water Supply Raw Water Pipeline located along West Eight Mile Road (Eastern Corridor)
- The Contra Costa Water District Middle River Pipeline and/or the Old River Pipeline located near Old River (Central and Eastern Corridors)
- The Contra Costa Water District raw water pipeline at the intersection of SR 4 and Western Farms Ranch Road (Central and Eastern Corridors)

- The Byron-Bethany Irrigation District raw water supply pipeline to Mountain House along Bruns Road and Byron Highway (Central and Eastern Corridors)
- Several crossings with the East Bay Municipal Utilities District (EBMUD) Mokelumne Aqueducts located along the north side of Woodward Island, on Upper Jones Tract, and on the southeast side of Lower Roberts Island (Central and Eastern Corridors)

5.8 Potential Crossings with Local Irrigation and Drainage Facilities at Construction Sites

Many construction sites are located on existing agricultural lands. Local irrigation and drainage facilities have been installed by existing and previous landowners at most of the construction sites. These facilities are owned by private landowners or potentially by reclamation districts. Many of these systems include facilities that either provide irrigation water or convey subsurface drainage between the parcels that would be acquired for the DCP and adjacent parcels. Most of these facilities are buried and cannot be identified from aerial photographs. During the design phase when access to specific parcels can be acquired, these buried facilities would be mapped on a site-specific basis. If the facilities located on a parcel to be used for a DCP feature extends to adjacent parcels, the water conveyance would be installed in underground pipes or canals through, or around, the construction site parcels to maintain service to the adjacent properties.

All DCP features would be designed to not increase peak runoff flows into adjacent storm drains, drainage ditches, or rivers and sloughs, as described in Section 5.4, Water Supplies to DCP Sites. Water runoff on the sites would be collected and tested in a location to determine if the runoff would require treatment prior to reuse on the site or discharge from the site. Water would initially be considered for reuse on the site, including dust control during construction. Storage or detention basins would be used to store water for reuse and to reduce the peak runoff rate from the site. Capacity analyses would be conducted for existing drainage features. On-site water storage would be used to reduce peak flows and allow discharge of the water during periods when adequate capacity would be available in the drainage features.

5.9 Potential Crossings with Existing Communication Facilities

Existing communications facilities in the DCP project area are primarily telephone lines co-located on the same poles as overhead electrical power lines. Communication lines co-located on power poles to be relocated would also be relocated on the new power poles. Communication lines on the existing power poles crossing the intake haul road would also be placed underground. Communications to the DCP facilities are described in Section 5.3, Supervisory Control and Data Acquisition and Other Communication Equipment.

5.10 Potential Crossings with Existing Natural Gas, Oil, and Fuel Transmission Pipelines

Transmission pipelines are located throughout the Delta to convey natural gas, oil, and fuel between major substations. These pipelines do not serve individual energy users, such as providing natural gas services to a house. Many of the transmission pipelines are located parallel to railroad and highway alignments that are crossed by the tunnel alignment. Above ground access roads, and power and SCADA facilities within the Southern Complex would also cross several transmission pipelines.

See TM – Summary of Utility Crossings (Attachment G) for detailed information

During the design phase, detailed surveying would occur to identify specific locations of the transmission pipelines. Design criteria and alignment locations would be coordinated with the owners of these transmission pipelines to avoid interference or interruption of service.

6. Other Systemwide Considerations

6.1 Purpose

Hydraulics and operational requirements, geotechnical and seismic considerations, balancing earthwork demands and supplies, tunneling considerations through areas with oil and gas well fields, avoidance of settlement during tunneling, construction methods to comply with environmental requirements, post-construction site reclamation, and considerations for development of the construction schedule were considered during development of this EPR on a systemwide basis. Other systemwide considerations conducted during preparation of this EPR included evaluation of existing levee vulnerability (see Section 3.2, Levee Vulnerability Assessment) and flood risk management (see Section 3, Flood Risk Management).

6.2 Hydraulics and Operational Requirements

Hydraulic modeling was used during preparation of this EPR to determine tunnel diameters and elevations, sizes of the pumps at the South Delta Pumping Plant, Southern Forebay embankment configuration, and control structure sizing at the Southern Complex.

See TM – Hydraulic Analysis Criteria and Hydraulic Analysis of Delta Conveyance Options – Main Tunnel System (Attachment H) for detailed information

The general approach to the hydraulic analyses divided the system into two separate subsystems:

- Hydraulic analysis between the Sacramento River and the Southern Forebay
- Hydraulic analysis between the Southern Forebay and the delivery point into the approach channel upstream of the Banks Pumping Plant

The Central and Eastern Corridor projects would have many individual hydraulic elements with associated hydraulic losses that form the hydraulic and energy grade lines throughout the entire system. To replicate the interaction of these system components from the Sacramento River to the discharge point at the South Delta Outlet and Control Structure into the California Aqueduct, the modeling software InfoWorks ICM was used. The model included a detailed hydraulic head loss analysis considering a range of WSELs within the tunnel, operational ranges for the South Delta Pumping Plant. The evaluation included a hydraulic transient-surge analyses especially for a scenario with the simultaneous shutdown of the pumps at the South Delta Pumping Plant (which could occur during a power failure) followed by closure of sediment basin outlet gates at each intake. The hydraulic analysis evaluated two basic flow conditions to convey water from the intakes to the Southern Forebay. Under most conditions, the water would flow by gravity to the South Delta Pumping Plant wet well to be located along the northern embankment of the Southern Forebay. The pumps at the South Delta Pumping Plant would lift the water into the Southern Forebay.

The system's major hydraulic elements include the following.

- Intake facilities, including flow control systems
- Tunnels and Shafts
- South Delta Pumping Plant
- Southern Forebay
- Southern Forebay Outlet Structure
- South Delta Outlet and Control Structure
- California Aqueduct Control Structure

See TM – Capacity Analysis for Preliminary Tunnel Analysis (Attachment B) for detailed information

The upstream system between the Sacramento River and the Southern Forebay would largely be driven by the upstream boundary conditions, including the WSELs in the Sacramento River at the intakes and the allowable hydraulic losses in the intakes, along the tunnels, and other appurtenances. The hydraulic analysis was used to size the facilities for different flow rates to meet the upstream and downstream boundary conditions.

See TM – South Delta Conveyance Facilities Hydraulic Analysis Criteria and Analyses (Attachment E) for detailed information

The downstream system between the Southern Forebay and the Banks Pumping Plant would be controlled by the lowest operational WSEL at the Banks Pumping Plant. This downstream system would control the Southern Forebay WSEL, which in turn would establish the downstream boundary conditions for the South Delta Pumping Plant or the gravity flow options into the Southern Forebay.

6.3 Geotechnical and Soil Considerations

Existing geotechnical information and data were reviewed during preparation of this EPR to perform preliminary evaluations of seismic, liquefaction, ground improvement, and dewatering considerations for the planning phase and EIR preparation. Geotechnical, soils, and additional field work investigation would be completed during the design phase prior to completion of the geotechnical and seismic design.

See TM – Potential Future Field Investigations – Central and Eastern Corridor Options (Attachment H) for detailed information

6.3.1 Seismic Considerations

Conceptual seismic design criteria were developed during preparation of this EPR regarding a seismicity evaluation, as well as the development of seismic design ground motions and potential ground rupture or local faulting for the various facilities of the DCP including:

- Intakes
- South Delta Pumping Plant
- Southern Forebay embankments
- South Delta Conveyance Facilities
- Appurtenant works and buildings
- Tunnel and tunnel shafts
- Temporary facilities
- Bridges and roads

See TM – Conceptual-Level Seismic Design and Geohazard Evaluation Criteria (Attachment H) for detailed information

The DCP facilities would be designed in general conformance with the DWR Seismic Loading Criteria Report (DWR, 2012) which presents minimum seismic loadings for the SWP and provides different levels of seismic loading criteria based on criticality of a facility. The guidelines allow flexibility based upon use of the facilities. The seismic loading and performance criteria selected for a facility would be based on:

- Consequences of failure
- Criticality of the structure for water delivery
- Downtime and cost for the repair of the facility

The loading criteria report (DWR 2012) states that consideration should be given to life-safety protection, post-earthquake emergency access, and difficulty or ease of repair work. For instance, canals could be repaired within a reasonable time frame compared to tunnels or the large pumps of a pumping plant. Therefore, the project facilities would be considered "critical." The human-occupied facilities (e.g., the South Delta Pumping Plant) would also be designed for collapse prevention (life safety), as described in current building codes (such as American Society of Civil Engineers [ASCE] 7 and California Building Code). These factors were considered in development of the conceptual design seismic criteria for the key features of the DCP.

The following steps were completed using existing information to identify criteria associated with seismicity and associated ground motions for project features:

- Reviewed existing data and information to identify and characterize seismogenic sources and the background seismicity
- Assessed site conditions to identify competent soil deposits for estimating reference ground motions
- Estimated appropriate reference ground motion hazards and prepared initial seismic hazard analyses for each construction site
- Developed acceleration, velocity, and displacement time histories, based upon available information, to evaluate the seismic performance of critical facilities
- Evaluated the effects of local soils on ground motions based upon available information

See TM – Conceptual-Level Seismic Design and Geohazard Evaluation Criteria (Attachment H) for detailed information

As soils and geotechnical investigations are completed in the future, these analyses would need to be reviewed and updated.

DWR previously collected preliminary geotechnical exploration data at locations along potential conveyance corridors, including results from soils investigations conducted from 2009 to 2012 and on Bouldin Island in 2018, while preparing the EIR/EIS for the California WaterFix Project. This effort included approximately soil borings and cone penetrometer tests (CPTs) (DWR, 2013; DWR, 2018b). Additional subsurface data were also obtained from various counties and agencies, including Caltrans and EBMUD.

Geotechnical data from these preliminary investigations indicate the Sacramento-San Joaquin Delta region is dominated by marsh and tidal estuary deposits, with interbedded alluvium, from the Sacramento and San Joaquin Rivers. The local geological setting is complex, and can be characterized by buried river channels, abundant sand lenses, and upper layers of organic-rich soil. The groundwater level is generally about 5 to 10 feet below ground surface within much of the Delta, except near the Sacramento River, where the groundwater may be no more than 2 feet below the ground surface (DWR, 2013; DWR, 2018b).

Facility-specific seismic criteria for both structural and geologic hazard evaluations were developed for individual sites. For example, DWR criteria developed for the SWP facilities (DWR, 2012) were combined with USACE criteria at the intakes and combined with DSOD criteria at the Southern Forebay. In general, the planned seismic loadings considered two-levels of design earthquakes:

See TM – Conceptual-Level Seismic Design and Geohazard Evaluation Criteria (Attachment H) for detailed information

- Operational Basis Earthquake (OBE) - defined as the probabilistic ground motion with a return period of 475 years (20 percent probability of being exceeded in 100 years)
- Maximum Design Earthquake (MDE) – facility-specific and represents the rare events that have low probability of occurrence during the life of the facility for which a facility is designed or evaluated. These may be probabilistic or deterministic ground motions, or an envelope of both, depending on the facility-specific criteria

During design phase, additional geotechnical and soils investigations would be completed and the data used to conduct final-design-level seismic hazard analyses for each feature using probabilistic and/or deterministic methods. The analyses would include characterization of local subsurface conditions, potential seismic sources, fault parameters, and geometry of the site. Probabilistic and deterministic seismic hazard analyses would be conducted to generate acceleration response spectra for a reference site condition (e.g., the surface of a competent subsurface soil layer at depth). Magnitude and distance de-aggregation analyses would be conducted to identify controlling earthquake magnitudes and distances. Site response analyses would be conducted using numerical modeling to estimate response spectra at or near the ground surface, especially if soft soils, peat soils, and/or liquefiable soils could be present in the subsurface.

The southern portions of the Southern Complex would be located near the West Tracy Fault, a fault currently thought to have potential for surface rupture along portions of its alignment. Several previous reports indicated that the West Tracy Fault near the Southern Complex may have experienced movement within the past 35,000 years and therefore could be potentially active (LCI, 2019). It is currently unknown whether the West Tracy Fault is capable of rupturing to the ground surface to the south of the Southern Forebay area in a large earthquake. Regardless of the potential for surface rupture, accurate characterization of the fault is important as the fault's proximity to project facilities affects design ground motions for use during facility design.

See West Tracy Fault Preliminary Displacement Hazard Analysis (Attachment H) for detailed information

During the design phase, test trenches (up to approximately 1000 feet long and 20 feet deep) would be excavated along a line running from the southeast of Byron to the southeast of Clifton Court Forebay to further investigate the nature and location of the West Tracy Fault between the town of Byron and the area southeast of Clifton Court Forebay (Latitude 37.8388 / Longitude -121.5934). Soil borings and cone penetration tests would be completed to a depth of 150 feet; and soil samples from test boring to age-dating laboratory testing.

See TM – Potential Future Field Investigations – Central and Eastern Corridor Options (Attachment H) for detailed information

6.3.2 Soil Liquefaction Potential

Screening-level liquefaction-triggering potential was evaluated during the preparation of this EPR phase based upon liquefaction events reported during past earthquakes and considering the presence of saturated materials classified as sandy soils, gravelly soils with sufficient fine contents, or silty and low plasticity clayey soils, measured Standard Penetration Test (SPT), measured shear wave velocity measurements, measurements from Cone Penetration Tests, and the potential for strength gains due to age of soil deposits.

See Liquefaction and Ground Improvements Analysis (Attachment H) for detailed information

Liquefaction triggering evaluations included determination of the Factors of Safety (FOS) against liquefaction under the design earthquakes as a function of depth. If the FOS against liquefaction values were less than 1, the potential would be evaluated for partial or total loss of soil shear strength with considerations for topography, subsurface soil heterogeneity, and horizontal and vertical extents of potentially liquefiable soils and the potential for foundation instability, embankment failure, lateral spreading and excessive ground deformations.

Preliminary results developed during preparation of this EPR identified that potential liquefaction could occur at several sites unless soil stabilization methods would be included in the construction methods. Liquefaction potential was identified at the intakes, most tunnel shaft sites, and at the Southern Complex on Byron Tract (including the South Delta Pumping Plant and the Southern Forebay) based on preliminary estimated ground motions, as described in the Liquefaction and Ground Improvements Analysis (Final Draft) and Conceptual Design Phase Seismic Site Response Analysis (Draft) attached to this EPR. Design-level analyses will be conducted using numerical modeling and the results of future subsurface exploration and testing.

See Conceptual Design Phase Seismic Site Response Analysis (Draft) (Attachment H) for detailed information

For the sites where liquefaction was identified, implementation of ground improvement would be considered to reduce the liquefaction susceptibility of the soils, by raising the factor of safety related to liquefaction. A deep mechanical mixing (DMM) method was identified as a suitable ground improvement technique. By enclosing potentially liquefiable soils in a DMM soil-cement grid, shear strain-induced cyclic loading (that is, earthquake loading) in the soils would be reduced. Most of the earthquake loads would be absorbed by a stiff soil-cement grid and the generation of excess pore pressure would be slowed. The grid would also form a boundary to restrain the soil lateral deformations.

Design criteria would be developed for each key feature during the design phase based upon additional geotechnical investigations, including the intakes, tunnel shafts, and Southern Complex facilities.

Future geotechnical and soil investigations related to soil liquefaction potential to be completed during the design phase, including data from soil borings, borehole soundings, downhole geophysical testing, dynamic peat testing, and cone penetration tests.

6.3.3 Ground Improvement Methods

Performance of large facilities at the intakes, tunnel shafts, and Southern Complex on Byron Tract would be difficult on sites with soils with high potential for liquefaction (e.g., loose sandy soils), soft and compressible soils, expansive soils that increase in volume when wet and shrink in volume when dry (generally based upon clay content), and peat soils. Facilities placed on these types of soils could settle or be damaged due to soil movement and changes in soil moisture content. Ground improvement methods would be implemented during the early construction phases to structurally strengthen these soils and to minimize or mitigate their compressibility or expansion potential. Ground improvement methods would likely consist of a combination of installation of a grid of DMM soil-cement shear walls with cement under the footprints of large structures, placement of soils prior to construction ("surcharging") to induce consolidation prior to final construction, installation of vertical wick drains, and excavation of unsuitable soils and replacement with compacted suitable fill material. Areas considered for DMM are shown on the engineering concept drawings.

See TM – Liquefaction and Ground Improvement Analysis (Attachment H) for detailed information

At locations with potential liquefaction and associated surface settling, a grid of soil-cement shear walls would be constructed using DMM to provide stability at the site. The DMM would mix the in-situ soils with a cement grout to increase the strength of the foundation. The grout would be prepared at an on-site batch plant and injected into the subsurface at the mixing depth. Subsurface mixing would be performed using overlapping paddle augers or rotating cutter heads. The contractor would develop a mix design based site-specific soil conditions, groundwater chemistry, and design specifications and performance requirements. Cement replacement alternatives such as fly ash or slag cement could also be used to achieve design specifications. The presence of highly organic soils or peats could affect the mix design typically requiring significantly more cement to achieve strength gain in the foundation.

See TM – Conceptual Intake Cofferdam Construction (Attachment A) for detailed information

Pre-loading (also known as "surcharging") would be used in areas to consolidate the foundation prior to final construction. Pre-loading involves creating a load on the foundation using incremental fill placement over time that allows internal pore pressures to dissipate and the soil structure to consolidate. Pre-loading would be suitable where soft, compressible clays and peats are encountered underlying the Southern Forebay embankment. The period of pre-loading would be assumed as 2 to 2.5 years but would need to be confirmed based on site-specific investigations, testing, analyses, and monitoring during construction. Pre-loading would at a minimum involve a load that equals the final structure in order to adequately pre-consolidate the foundation.

See TM – Liquefaction and Ground Improvement Analysis (Attachment H) for detailed information

Prefabricated vertical drains (also known as "wick drains") would be used to assist in the consolidation of low-permeability clays and silts by providing a pathway for pore pressure dissipation during consolidation. A 1-foot thick gravel blanket (or equivalent geosynthetic drain) would be placed at the ground surface to allow water transmitted through the wick drains to be released to the surface.

Peat soils are located at most tunnel shafts and Southern Forebay locations. Peat soils are subject to oxidation when exposed to oxygen, such as during excavation. The oxidation process releases sequestered carbon which contributes to greenhouse gas emissions. Wherever practical, excavation of peat would be avoided. Where necessary, excavated peat would be reburied on the construction site and covered with a suitable thickness of mineral soils or RTM to prevent potential peat flotation to the ground surface and reduce oxidation. The thickness of cover material would be determined during the design phase based on site-specific testing and analysis of potential cover materials, as well as, testing and characterization of organic soils or peat materials.

The need and extent of ground improvement and peat soil handling would be based upon local geotechnical conditions determined through geotechnical investigations during the design phase.

The following sections present ground improvement methods anticipated at the intakes, tunnel shaft sites and Southern Forebay.

6.3.3.1 Ground Improvement at Intake Sites

Due to the ground conditions beneath the intake sites, liquefaction and associated surface settling could occur during seismic events. Therefore, a grid of soil-cement shear walls would be constructed using DMM to provide stability for embankments at the site. At the intakes, cement would be mixed with existing in-situ soil in a wall panel configuration to strengthen the ground for supporting overlying structures and embankments, including the jurisdictional levee. This work would extend under all areas of embankments and some structures. Drilled pier foundations would be utilized under the major structures, including radial gate structure and intake structure, as shown on the engineering concept drawings. Following additional site-specific geotechnical analyses, further refinement of the depths and limits of the ground improvement may be necessary.

See TM – Liquefaction and Ground Improvement Analysis (Attachment H) for detailed information

A deep soil-cement-bentonite perimeter wall (cutoff wall) would serve to isolate the sediment basins from the local groundwater and the Sacramento River. The cutoff wall would be integrated with the DMM wall at the land side of the river cofferdam and the DMM ground improvement grid. The groundwater is relatively shallow near the intake site. Therefore, it would be unlikely that changes in the groundwater elevation would impact the liquefaction potential of the soils; however, this would be determined during the design phase based upon additional geotechnical and soil investigations. Groundwater would continue to move around these features similar to the area enclosed by the slurry cutoff walls. Final ground improvement criteria would be completed following additional site specific geotechnical and hydrogeologic analyses during the design phase.

6.3.3.2 Ground Improvement at Tunnel Shafts

Ground improvement at many of the tunnel shafts would be similar to the methods described above for the intakes including use of DMM. If the existing soils are subject to potential settlement or liquefaction issues, ground improvement would be implemented on soils under the shaft pad tops, as shown on the engineering concept drawings. Ground improvement methods would be used to strengthen the foundation soils and reduce settlement of the shaft pad and soils adjacent to the shaft pad walls. Groundwater migration into the shaft pad would be minimized through the slurry diaphragm walls constructed around the shaft pad liner and the concrete base pad at the bottom of the shaft.

See TM – Liquefaction and Ground Improvement Analysis (Attachment H) for detailed information

Existing soils outside of the areas with ground improvements would be allowed to settle. The settlement would be accelerated with the use of vertical wick drains and horizontal drainage blankets to reduce the time to achieve vertical settlement equilibrium.

It is not anticipated that ground improvement would be required at the Twin Cities complex, where existing information suggests the presence of older stiffer soils.

6.3.3.3 Ground Improvement at the Southern Forebay Embankments

Available information indicates the Southern Forebay foundation transitions from deltaic deposits to alluvial/fan deposits approximately midway across the Southern Forebay from east to west and that the groundwater table is somewhat deeper along the western side of the site compared to topographically lower areas closer to Italian Slough. Geotechnical conditions for the Southern Forebay site, and particularly along the eastern portion of the site, consist of peaty, organic soils within the upper foundation overlying high-plasticity clays and sand. Blow counts measured in the field indicate the shallow organics and clayey material are generally soft and the sandy material was loose to medium dense. Also of note is the close proximity of the forebay to a fault lineament immediately to the south of the forebay site, which is likely associated with the West Tracy Fault, as discussed in Section 6.3.1, Seismic Considerations.

Embankment deformations and cracking of the embankments under the Maximum Credible Earthquake (MCE) would be limited to safeguard the post-earthquake safety of the embankment and not inhibit the ability to maintain reservoir levels and operate the project in accordance with unrestricted conditions. This condition would apply to the deformations caused by earthquake shaking and to shearing and distortion due to offset of the foundation. Ground improvement or other appropriate means would be incorporated to limit seismically-induced settlements under the Southern Forebay embankments caused by liquefaction of the foundation soils. The design approach would be based on the pattern of deformations and the location of the potential sliding mass within the embankment in relation to embankment design features, such as filter and transition thicknesses and embankment freeboard. The design performance would be considered acceptable if repairs following occurrence of the MCE do not interrupt facility operations (i.e., are limited to re-grading of the embankment, repairing cracks, or other minor repairs that do not interrupt operations). The embankment would also be designed to resist the hazard of internal erosion (piping) caused by seismic deformation.

See TM – Forebay Conceptual Design Criteria (Attachment D) for detailed information

Significant extents of foundation improvement would likely be required to mitigate soft, compressible and potentially liquefiable foundation soils.

Ground improvement would include excavation and replacement of at least 6 feet of the upper Southern Forebay embankment foundation and would be performed for the entire perimeter. The excavation and replacement would create a consistent embankment foundation and remove shallow foundation discontinuities. Deeper excavation and replacement could be performed, if practical, to remove unsuitable foundation materials, such as peat, highly organic soils, or loose sands. However, shallow groundwater may limit the depth of excavation in some areas unless dewatering is also incorporated.

In addition to excavation and replacement of the upper foundation, three additional methods of ground improvement would be used at the Southern Forebay, including DMM, surcharging, and wick drains.

See TM – Southern Forebay Seismic Sensitivity Evaluation (Attachment D) for detailed information

As shown on the engineering concept drawings, the additional ground improvement methods are configured into four methods, or Types, based upon various combinations of pre-loading, DMM shear panels, soil excavation, and wick drains.

A cutoff wall would be installed through the centerline of the embankment around the entire perimeter of the Southern Forebay. The total length of the cutoff wall would be approximately 4.7 miles in length. The seepage cutoff wall would be installed through the embankment and into the foundation using a combination of bentonite, water, and excavated native soil to produce a low-permeability trench backfill to cutoff groundwater flow through and beneath the embankments, as shown in the engineering concept drawings.

The seepage cutoff wall would be installed as a slurry wall through the centerline of the forebay embankment from a temporary working platform at elevation 18.0 feet. This elevation would correspond to approximately 67 percent of the total embankment height. The cutoff wall would have a width of 3.0 feet and would have an estimated bottom depth of 50 feet below existing grade, resulting in a total height of approximately 68.0 feet (where existing grade is at elevation 0 feet). The actual bottom depth of the cutoff wall would be determined based on site-specific investigations along the cutoff wall alignment. The cutoff wall would be intended to penetrate at least 5 feet into a fine-grained confining unit to prevent seepage in pervious units from flowing beneath the cutoff wall.

Where necessary, excavated peat would be reburied on the construction site and covered with a suitable thickness of mineral soils or RTM to prevent potential peat flotation to the ground surface and reduce oxidation. The thickness of cover material will be determined during the design phase based on site-specific testing and analysis of potential cover materials, as well as, testing and characterization of organic soils or peat materials.

6.3.4 Dewatering at the Intakes and Southern Complex

Dewatering would occur at most construction sites. The most substantial dewatering activities would occur at the intakes and Southern Forebay Emergency Spillway. During preparation of the EPR, groundwater modeling was conducted to estimate dewatering rates and durations for dewatering at the intake facilities and Southern Forebay Emergency Spillway. These two locations were selected, as they likely represent typical dewatering scenarios for other elements of the project. For Intake C-E-5, modeling included the construction and maintenance scenarios for the sedimentation basins. For the Emergency Spillway, modeling only included dewatering during construction because dewatering is not anticipated during operations.

At all of the locations evaluated, site-specific lithologic data are limited, especially with respect to aquifer performance data, and even general groundwater condition. The modeling results are based on simplistic depictions of site lithology, and although attempts were made to provide boundaries for potential extraction rates and times-to-dewater, considerable uncertainty remains. Site-specific aquifer testing is planned during the design phase at any location needing dewatering. Such testing should focus on the hydraulic aquifer properties of areas within any proposed cutoff wall, with particular attention to connectivity of both fine- and coarse-grained units.

6.3.4.1 Intake Facilities

The Sacramento River at the Intake C-E-5 location is about 600 feet wide and 30 feet deep (DWR, 2020c). The riverbed is at about elevation -20 feet, and the tops of the existing levees are higher than elevation 20 feet. The surrounding land elevation is near 0-5 feet and generally near or below the Sacramento River water surface elevation.

See TM – Dewatering Estimates for Intake Facilities and Southern Forebay Emergency Spillway(Attachment H) for detailed information

Available soil boring logs between Hood and Intake C-E-5 were compiled into conceptual cross sections. The stratigraphy generally consists of interlayered alluvial deposits ranging from coarse sand to clay. Both sites have organic-rich, fine-grained deposits within the upper 20 feet. Immediately south of Hood, the fine-grained deposits are underlain by abundant sands with some interbedded silts and clays to about elevation -80 feet, followed by a thick sequence of silts and clays between about elevation -80 and -120 feet. At Intake C-E-5, the upper organic-rich zone is underlain by about 30 feet of sands, with about 30 feet of silts and clays separating this from more sands in the elevation -80 to -120 feet range. At both depths, the boring logs indicate fine and coarse intervals are not homogeneous; rather, they have discrete interbeds.

An aquifer test was performed between Hood and Intake C-E-5 in 1982 (DWR, 1982b). The pumping and observation wells were screened within the upper 40 feet and encountered a sandy deposit from about 15 to 30 feet below ground surface (bgs). The pumping well produced 245 gallons per minute (gpm) for 24 hours. The resulting hydraulic conductivity (K) value of the upper sand unit was about 250 feet per day.

As previously described, a deep cutoff wall would be constructed into the foundation of the sedimentation basin and outlet channel perimeter embankment, the temporary levee, and the back of the intake structure to isolate the internal subsurface from surrounding local groundwater for both construction and operations phases. The cutoff wall should substantially limit reduction of external groundwater levels during internal dewatering activities and limit mounding of water external to the walls during operations when basin levels are higher than the surrounding groundwater levels.

A series of groundwater recharge and extraction wells could also be installed around the external perimeter of each intake basin to allow for discharge of captured dewatering water back into the subsurface on the external side of the deep cutoff walls in the event that some local external effects due to dewatering are observed. Conversely, these wells could be used to extract mounded water for return to the sedimentation basins if needed to maintain local groundwater levels. Conditions would be monitored using a network of piezometers, and recharge or extraction could be managed to maintain local external groundwater levels within typical ranges under existing conditions. Methods to minimize changes to area groundwater elevations, such as spacing, depth, and location of recharge/extraction wells and piezometers, or other methods, as well as thresholds for target external groundwater levels, would be determined after further site-specific investigation, testing, and analysis during future design phases.

6.3.4.2 Southern Complex

Dewatering at the Southern Complex would occur at the Southern Forebay Emergency Spillway, Southern Forebay Outlet Structure, and the Outlet and Control Structures located to the West of Byron Highway. No dewatering would occur under the Southern Forebay embankments or along the bed of the Southern Forebay. Dewatering at the Emergency Spillway would be related to removal of groundwater and adjacent surface water flows for approximately six months. Due to the proximity of the Emergency Spillway to Italian Slough, modeling was conducted to define the extent of the groundwater dewatering needs. Dewatering of groundwater would occur at the Outlet and Control Structures to allow for placement of concrete for approximately one year at each site. The extent of these groundwater activities does not require additional modeling at this time.

The Southern Forebay Emergency Spillway would be located on low-relief land with a ground surface between elevation 0 and -10 feet. Several historical borings have been drilled near the proposed Southern Forebay, and generally extend 30 to 50 feet bgs. These logs indicate extensive organic-rich clay deposits in the upper 15 to 25 feet, with apparently continuous silty or clayey sands from about 25 to 40 feet bgs. The thickness of the sandy zone ranges from about 7 to 15 feet. Groundwater was generally encountered within the upper 10 feet of the subsurface, or around elevation -10 to -14 feet.

Groundwater elevation data from nearby monitoring wells were accessed through the Sustainable Groundwater Management Act (SGMA) Data Viewer. The log results indicated that along the Italian Slough, north of the site, groundwater elevations ranged from about elevation -5 to -15 feet over the period 2000 to 2015. While most of the wells along Italian Slough are shallow wells with a depth of 20 feet, two wells have screens from 90 to 100 feet depth with groundwater elevations very similar to nearby shallow wells. A well at Discovery Bay is screened from 200 to 210 feet deep with groundwater elevations in the range of about elevations -10 to -30 feet over the same time period (DWR, 2020d).

Water surface elevations at the Italian Slough Headwaters (Station ISH) located near the southern end of the Southern Forebay ranged from about elevation 1.5 to 7 feet during 2019.

Water surface elevations at the West Canal (Station WCI) on the western side of Clifton Court Forebay ranged from about elevation 1.75 to about 7.25 feet (CDEC, 2020).

6.4 Earthwork Balance

The DCP would require an extensive amount of soil materials for fill at intakes, tunnel shafts, South Delta Pumping Plant, Southern Forebay, and roadway modifications. Construction would also produce an extensive amount of excavated soil materials at most of these facilities and RTM from the project tunnels. It is anticipated that six inches of topsoil would be removed and stockpiled from construction work areas at the intakes, all tunnel shaft sites and the Southern Complex.

See TM – Soil Balance (Attachment H) for detailed information

See TM - Reusable Tunnel Material (Attachment B) for detailed information

See TM - Preliminary Construction Schedules for Central and Eastern Corridor Options (Attachment H) for detailed information

Construction of the DCP would occur over a period of years at most construction-sites would not start simultaneously at all sites. For example, at the tunnel launch shaft sites, soil fill material would be required several months before the start of tunneling operations that would produce the RTM in large volumes; and the RTM volume would be greater than the need for other fill material at the tunnel launch shaft sites. Optimizing the movement of fill material could reduce the need for import or disposal and minimize stockpiling of RTM at tunnel launch sites following construction.

A project-wide assessment and soil balance model (Earthwork Model) was prepared to understand and improve the balance of the total amount of soil fill material required and produced at the various project construction-sites. The Earthwork Model analyzed soil fill material including, structural and non-structural fill, topsoil, and peat. Specialty materials such as gravel or aggregate base were generally not included since they are unlikely to be derived on-site and would be imported. However, for structures such as the Southern Forebay embankment where the embankment cross section includes a combination of project-generated and imported fill, the imports were included in the soil balance for completeness. The Earthwork Model did not include other construction materials, such as concrete and asphalt. All soil materials not obtained from the DCP construction sites would be obtained from commercially-licensed sources.

An inventory was performed for each construction-site to compile fill requirements and soil generation rates and volumes associated with various earthwork activities. The schedule for each activity was applied to the need for and production of soil materials based on the overall project schedule and the duration of the various construction activities. The results of the Earthwork Model were used to identify the structural fill needs at each major construction site utilizing excavated material, including RTM, from the same site (on-site reuse) or imported from other sites with surplus material, summarized in Section 2.2.4 and Table 9.

See TM – Soil Mass Balance (Attachment H) for detailed information

TABLE 9. SUMMARY OF EARTHWORK MODEL RESULTS FOR SOIL BALANCE

Facility	Structural Fill Balance
Intakes	• On-site excavated soils would be used to balance the on-site soil needs; including no significant import or export of structural fill from site. • A relatively small quantity of imported fine-grained levee embankment core material would be required
Shaft Pads	• On-site soils would be used for a portion of backfill requirements at all tunnel shaft sites. • On-site excavated soil from the Twin Cities Complex would be used for constructing the on-site ring levee and tunnel shaft pad at the Twin Cities Complex; shaft pads on New Hope Tract, Staten Island, and Bouldin Island (Central Corridor); and shaft pads on New Hope Tract, Canal Ranch Tract, Terminous Tract, and King Island (Eastern Corridor) • RTM material from Twin Cities Complex would be used to develop the tunnel shaft pad at Mandeville and Bacon islands (Central Corridor) • RTM material from the on-site tunneling operations at Twin Cities Complex would be used to backfill on-site borrow areas • On-site excavated soil from the Lower Roberts Island site would be used for the tunnel shaft pads on Lower Roberts Island and Upper Jones Tract and for repair of existing levees on Lower Roberts Island • RTM material from the on-site tunneling operations at Lower Roberts Island would be used to backfill on-site borrow areas
South Delta Pumping Plant	• On-site soils and on-site generated RTM would be used to form the embankments around the South Delta Pumping Plant along the Southern Forebay embankment
Southern Forebay Embankments	• On-site soils from Southern Complex and re-use of RTM from Twin Cities Complex and Southern Complex would be used to construct the embankment
Southern Forebay Outlet Structure (South Delta Conveyance Facilities on Byron Tract)	• On-site soils would be used for at the Southern Forebay site on Byron Tract • Surplus excavated material from the southern tunnel reception shafts would be used at the Southern Forebay site
South Delta Outlet and Control Structure (South Delta Conveyance Facilities located to the West of Byron Highway)	• On-site soils would be used for backfill requirements • Surplus excavated material would be used at the Southern Forebay site
Roads and Bridges	• Soils would be imported from commercial sources

6.5 Tunneling Through Areas with Oil and Gas Well Fields

Both the Central Corridor and Eastern corridors would be located in areas with numerous active and abandoned oil and gas wells. During preparation of this EPR, potential locations of oil and gas wells were reviewed in the oil and gas database maintained and published by the California Department of Conservation, Geologic Energy Management Division (known as CalGem; and previously maintained and published by Division of Oil, Gas, and Geothermal Resources, or DOGGR [note that many records are still referred to as “DOGGR”]). The database information was used to modify several tunnel shaft locations to avoid identified well sites, including the tunnel maintenance shaft site on Staten Island.

See TM – Tunneling Effects Assessment (Attachment B) for detailed information

See TM - Shaft Siting Study (Attachment B) for detailed information

See TM - Emergency Response Plan (Attachment F) for detailed information

Tunneling activities in areas with flammable gasses and hydrocarbons are carefully controlled by the State of California Division of Safety and Health, Mining & Tunneling (M&T) Unit. All tunnels with diameters equal to or greater than 30-inches in diameter must be classified under California Labor Code, Section 7955 and Title 8 of the California Code of Regulations, Section 8422, Subchapter 20 (Tunnel Safety Orders) based upon diameter, length, proximity to other utilities, potential for contaminated soils, and geological and soil conditions related to the presence of flammable gases and hydrocarbons.

For the DCP, the tunnels would be classified as Non-Gassy, Potentially Gassy, Gassy, or Extra Hazardous. The M&T Unit and Classification outlines the rules and regulations for safety, air monitoring frequency for gas levels, and notification to Cal/OSHA procedures based upon the expected level of flammable gasses and/or hydrocarbons. Tunnel boring operations for the DCP in areas with a potential for flammable gasses would be required to include numerous and redundant safety features and practices. For example, TBMs could include continuous gas monitoring equipment linked to automatic shutdown switches, sealed electrical components to avoid sparks, and ventilation fans rated as “explosion proof.”

During the design phase, additional desktop surveys of documented wells would be conducted and would include research of historical topographic mapping that may document the presence of wells that were not identified in the CalGem system. The locations of identified wells within the tunnel alignment would be used to determine methods to abandon, relocate, or avoid the wells.

A field test program would be used to evaluate the suitability of various geophysical techniques to detect buried and abandoned wells. During the design phase, a comprehensive exploration program would be conducted using the suitable geophysical methods to identify and/or confirm the location of well casings along the alignment including wells that have not been identified in published data base. The methods could use wide-area airborne (drone, helicopter, or fixed-wing aircraft) magnetic surveys followed by more site-specific walk- or tow-over ground-based magnetic surveys.

6.6 Avoidance of Settlement During Tunneling

See TM – Tunneling Effects Assessment (Attachment B) for detailed information

Many of the DCP construction sites would be located near existing levees and both the Central and Eastern corridor tunnel alignments would cross under levees, railroads, highways, and the EBMUD Mokelumne Aqueducts. The top of the tunnel structure would cross under these surface features at depths of approximately 100 feet under the ground surface with some areas of approximately 80 feet under the ground surface (e.g., Bouldin Island for Central Corridor and near the Southern Forebay Outlet Structure).

During the design phase, geotechnical investigations would be conducted to determine the need for ground improvement methods to stabilize soil around the levees or along tunnel alignments and to establish performance thresholds and monitoring requirements. To minimize ground settlement in soft ground conditions with shallow groundwater, such as in the Delta, pressurized TBMs would prevent the uncontrolled entry of soil and groundwater into the tunnel during excavation. The TBM operator would be responsible for limiting ground settlement through-control of the tunneling rate through manipulation of the cased screw auger that balances the face pressure.

6.7 Compliance with Environmental Requirements

For all of the construction sites, there would be Spill Prevention and Control Plan (SPCP), Hazardous Materials Management Plan (HMMP), Stormwater Pollution Prevention Plans (SWPPP), and dust control plans.

6.7.1 Spill Prevention and Control and Hazardous Materials Management Plan

Bulk fuel, lubricants, paints, solvents, batteries, generator fuel, and other project-critical materials would be stored on-site. A SPCP and Hazardous Materials Management Plan HMMP would be developed and implemented to minimize effects from spills of hazardous or petroleum substances during construction and operation/maintenance of the project. The plans would include measures to avoid the accidental release of chemicals, fuels, lubricants, and non-stormwater into channels and account for all applicable federal, state, and local laws and regulations including the Spill Prevention, Control, and Countermeasure (SPCC) Regulation and the Resource Conservation and Recovery Act (RCRA), such as the following measures.

- Spill prevention kits in proximity to where hazardous materials would be used (e.g., crew trucks and other logical locations)
- Hazardous materials handling plan training to properly implement all reasonable means when working in or near any waterway

- For all fueling of stationary equipment at the construction sites, containments would be provided to the degree that any spill would not enter waterways or damage wetland or riparian vegetation

Best management practices (BMPs) would be designed to avoid spills from construction equipment as well as equipment used for the operation and maintenance of project facilities would also be implemented, including:

- Storage of hazardous materials in double containment
- Disposal of all hazardous and nonhazardous products in a proper manner
- Monitoring of onsite vehicles for fluid leaks and regular maintenance to reduce the chance of leakage
- Containment (a prefabricated temporary containment mat, a temporary earthen berm, or other measure can provide containment) of bulk storage tanks having a capacity of 55 gallons or more

If any unforeseen hazardous conditions are discovered during construction, existing federal, state and local worker safety and emergency response regulations require that the contractor coordinate with the appropriate agencies including the county agencies for the safe handling, sampling, transportation, and disposal of encountered materials. The contractor would be required to comply with Cal/OSHA worker health and safety standards that ensure safe workplaces and work practices.

6.7.2 Stormwater Pollution Prevention Plan

Under the regulatory oversight of the SWRCB and in compliance with the required Construction General Permit, a SWPPP would be required for each construction site to protect adjacent water bodies related to constituent discharge from stormwater runoff and dewatering flows. The SWPPP would be prepared prior to the initiation of construction and would identify applicable BMPs to prevent and minimize the introduction of contaminants into surface waters. The BMPs would be implemented before, during, and after construction and, for this project, would be anticipated to include site stormwater and non-stormwater management, erosion and sedimentation controls, and an inspection, monitoring, and maintenance program, such as the measures listed below.

- Preventing off-site runoff from entering the construction site by surrounding the construction site with ditches, berms, fiber rolls, silt fences, or other barriers with interior drainage ditches to divert flows towards the SWPPP sump and treatment facility, prevent runoff from flowing into adjacent water bodies, and retain sediment on the construction site. Site specific structural and operational BMPs to prevent and control impacts on runoff water quality, measures to be implemented before each storm event, inspecting and maintaining BMPs, and monitoring of runoff quality by visual and/or analytical means. On-site runoff would be collected and conveyed to treatment and storage facilities to also reduce the volume of amount of off-site water supplies.

- Temporary erosion control measures (e.g. silt fencing, straw bale barriers, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrances) for all disturbed areas. No disturbed surfaces would be left without erosion control measures in place.
- Implementing and monitoring post-construction erosion control measures (including silt fencing, straw bale barriers, fiber rolls, hydraulic mulch/seeding, and vegetative plantings) to reduce the potential for erosion and associated water quality effects.

6.7.3 Dust Control

Fugitive dust control would be addressed during design through preparation of a Fugitive Dust Control Plan that would be submitted to the local air quality management district. The Fugitive Dust Control Plan could include a monitoring program and procedures for the public to notify the agencies of dust complaints and air quality violations.

Typical dust sources on the construction site would include:

- Soil re-entrained in the air as vehicles pass along unpaved on-site roads and off-site access roads.
- Soil re-entrained in the air as part of excavation, building demolition, storage pile wind erosion, fill placement, material movement, concrete or grout batch plants activities and soil stockpiles at the work sites.
- Soil and debris tracked from the construction site onto paved surfaces where the dust would become re-entrained in the air by vehicle traffic or wind.

To reduce the dust potential at the construction sites, all roadways on the construction sites would be covered with gravel or pavement. Most of the dedicated haul roads would be paved between the construction sites and paved public roads. The dedicated haul roads on New Hope Tract, Bacon Island, and Mandeville Island would be covered with thick layers of gravel due to geotechnical conditions.

Trucks hauling soil materials would be required to install covers over the loads. To minimize soil and debris tracked from the construction site, truck tire washes with track-out plates, and/or gravel aprons would be located at all the entrances and exits of all construction sites to reduce inhalable particulate matter. Dust and debris blowers would not be used on the construction sites.

Excavation areas would be sufficiently stabilized prior to backfilling or construction completion to reduce dust re-entrainment in the air column with water application, geotextile fabric, or mulch. Water would be applied to the excavated areas to reduce potential fugitive dust. Water application would be provided by a combination of irrigation piping with spray nozzles and water trucks.

At the tunnel launch shaft sites, conveyors to move RTM between the tunnel shaft and the RTM handling locations would be covered. At the concrete batch plants, to the extent possible based upon commercially-available technology, material storage and transfer equipment would be covered.

6.8 Construction and Long-term Site Space Requirements

The engineering concept drawings and GIS files for this EPR include two boundaries for each construction site. The construction site boundary is shown in yellow. The post-construction boundary is shown in red, including the total final site area that would be needed for operation and maintenance of the permanent facilities. The post-construction boundary also includes land that would probably not easily be restored to other land uses due to compaction during construction. Following construction, temporary construction areas previously used for material and equipment laydown and staging, material stockpiles, retention ponds, parking areas, bus drop off and pick up, onsite access roads, contractor trailers, and other facilities would be reclaimed for either agriculture or habitat uses. Table 10 summarizes the construction and post-construction site requirements, and the area to be restored to agriculture or habitat for the major features for a project design capacity of 6,000 cfs.

For the intakes, tunnel launch shaft sites, and Southern Complex, the physical area required for construction activities would exceed the area needed for permanent post-construction operations. In these cases, the area within the red boundary would be smaller in size than the area within the yellow boundary, shown in the engineering concept drawings and summarized in Table 10.

TABLE 10. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 6,000 CFS

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E-3	Central and Eastern	242	123	119 (Agriculture or habitat)
Intake C-E-5	Central and Eastern	239	109	130 (Agriculture or habitat)
Lambert Road Concrete Batch Plant	Central and Eastern	15	14	N/A
Twin Cities Complex	Central	479	141	340 (Agriculture or habitat) 130 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Central	11	11	N/A
Staten Island Shaft Site	Central	12	12	N/A
Bouldin Island Shaft Site	Central	615	507	88 (Agriculture or habitat) 196 (RTM stockpile planted with native grasses)
Mandeville Island Shaft Site	Central	14	14	N/A
Bacon Island Shaft Site	Central	15	15	N/A
Twin Cities Complex	Eastern	479	170	311 (Agriculture or habitat)

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
				159 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Eastern	11	11	N/A
Canal Ranch Tract Shaft Site	Eastern	11	11	N/A
Terminous Tract Shaft Site	Eastern	13	13	N/A
King Island Shaft Site	Eastern	12	12	N/A
Lower Roberts Island Shaft Site	Eastern	407	176	211 (Agriculture or habitat) 71 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	Eastern	13	13	N/A
Southern Complex on Byron Tract (Southern Forebay Inlet Structure tunnel launch shaft, Working Shaft tunnel launch shaft and tunnel maintenance shaft, South Delta Pumping Plant, Southern Forebay, Southern Forebay Outlet Structure and dual tunnel launch shafts)	Central	1,457	1,189	229 (Agriculture or habitat) 60 (peat stockpile planted with native grasses)
Southern Complex on Byron Tract	Eastern	1,488	1,220	227 (Agriculture or habitat) 90 (RTM and peat stockpile planted with native grasses)
Southern Complex located to the West of Byron Highway (South Delta Outlet and Control Structure and California Aqueduct Control Structure)	Central and Eastern	164	112	53 (Agriculture or habitat)

Notes:

Acreage is approximate; exact area should be obtained from the GIS. Acreages include ring levees or other levee modifications, and generally exclude access roads, except for levee modification access roads.

Intake acreages are based on cylindrical tee screens. Acreages for intakes with vertical flat plate screens are included in Appendix E.

RTM and peat stockpiles planted with native grasses would be located within the post-construction boundary.

N/A = Not Applicable

6.8.1 Post-Construction Site Reclamation

As discussed above and summarized in Table 10, areas included in the construction boundary and not included in the post-construction boundary would undergo post-construction reclamation. These areas are located at the intakes, tunnel launch shaft sites, and Southern Complex. DWR would acquire the land for construction and would determine final restoration methods and potential transfer of the lands to other parties.

See TM – Post-Construction Land Reclamation (Attachment H) for detailed information

Several methods could be used to restore the land to agricultural or habitat land uses. To determine remedial efforts necessary to reclaim construction-impacted land, an assessment of the existing site conditions, a review of the type of construction activities that would take place on the land, and the desired end land use was evaluated during preparation of this EPR.

The near-surface native soils within the construction areas could be compacted from construction equipment activities, consolidated beneath material stockpiles, or have properties less suitable for agriculture or habitat restoration due to construction activities. The main goals of the land restoration efforts would be to restore the soil quality and condition, to the extent practical, in these construction areas.

Initial reclamation tasks in these areas would include removal of all construction equipment and materials, demolition of concrete slabs from temporary material storage areas, removal of temporary stockpiles/embankments, removal of temporary haul routes, and grading and leveling of the site to generally meet adjacent lands.

Initial soil treatments would depend on the actual disturbance, but for soils with more than minimal impact, the work would be expected to include ripping the soil and incorporating amendments (e.g., gypsum) to reduce compaction. This would be followed by spreading topsoil, cross disking, and fine grading/leveling to prepare the soil surface for future use. If the end user (e.g. farmer, conservation entity) would transition the site shortly after construction, no additional work could be necessary. However, if the land transition would not occur in a relatively short period of time, the areas would be drill seeded to provide erosion/dust control using a grass seed mix appropriate for the desired end use. Areas to be restored to natural/habitat would be seeded with a native grass mix, whereas, areas to be restored to agricultural use could be seeded with an erosion control seed mix.

Areas that were excavated to create borrow soil materials, would be refilled to existing grade with soil and/or RTM from existing stockpiles at the end of construction. Treatments for reclamation using RTM base soil would be similar to those planned for reclamation with native soils; however, additional treatments could be required to address soil conditions (for example, high or low pH). Lime and soil sulfur could be appropriate amendments for addressing soil pH; however, the actual amendments used would be based on soil tests performed at each of the sites post-construction. Amendments to address nutrient deficiencies would be handled by the end-user because the choice and quantity of amendments could be dependent on the crop type or specific habitat plan. Topsoil would be re-spread to a depth of 1 foot over the RTM base soil. For future agricultural uses, the top 1 foot is most important to the farmer and where they typically focus fertilizer application to address the specific needs of the crop.

Permanent RTM stockpiles would be expected at some tunnel launch sites. These stockpiles would be elevated above the surrounding grades and would be planted with native grasses primarily for erosion control, and to create a natural habitat area when the stockpile is not being accessed for a soil material source. Planned treatments for permanent RTM stockpiles would include spreading topsoil, cross discing, and planting native grasses. An access road would also be constructed from the existing paved road nearest to the stockpile to facilitate future use of the stockpile as a soil material source.

Ground improvement would be required to support concrete slabs at the tunnel launch shaft sites on Bouldin Island and Lower Roberts Island. Following construction, the concrete slabs would be removed prior to land restoration. Similar restoration would occur on areas within the permanent site boundaries, but are not planned for post-construction changes in land use.

6.9 Preliminary Construction Schedule Considerations

Construction scheduling was developed using scheduling software based upon the key features presented in the engineering concept drawings and an assumed number of construction packages. The preliminary construction schedules for the DCP (see Attachment H) only represents one possible sequence of work and are not meant to mandate contractor means and methods or possible phasing activities in a different manner.

The construction schedules include the following assumptions.

- **Early Works:** These work packages would include construction of access roads and utilities to each work site. Rail access, power supply and other utility provisions would also be completed as early works to support the main feature contracts.
- **Intakes:** Each intake structure was assumed to be constructed under a separate contract with a one year stagger between starts. The sequence of the intakes would be from south to north to reflect the direction of the northern tunnel drive so that the inlet shafts would be ready for the advancing tunnel drive.
- **Tunnels and Shafts:** Five tunnel contracts were assumed in the schedules. Tunnel drive contracts would include shaft construction, except at the intakes and Southern Complex. At Twin Cities Complex (Central and Eastern corridors), the first tunnel contract would include completion of a double launch shaft before using one of the cells for the second tunnel contract. At the Southern Complex, the drive to the north (Reach 4) would launch from the Southern Forebay Inlet Structure Tunnel Launch Shaft and then transfer tunnel operations to the separate Working Shaft, thereby releasing the Southern Forebay Inlet Structure Tunnel Launch Shaft to the South Delta Pumping Plant contractor.

  Tunnel reception and maintenance shafts would be included in the tunnel contracts with the construction sequenced to follow on from the tunnel launch shaft in the direction of tunnel drive. Tunnel receptions shafts that receive two tunnel drives would be included in the tunnel contract that would be planned to arrive first.

  Tunnel excavation rates were developed based on various tunnels of similar size and similar ground conditions utilizing the same type of equipment. The rates were determined using historical data for segmental ring erection time from published data; Colzani (2001) and Davies (2009). Using similar construction rates, the overall average for tunnel excavation for the 36-foot inside diameter tunnels using a segmental pre-cast concrete lining on a 20-hour workday estimated approximately 40 linear feet per day, including TBM start up and stoppages.
- **South Delta Pumping Plant:** The pumping plant contract would include the foundation/ground treatment works associated with the raised embankment surrounding the structure. On completion of the embankment area by the Southern Forebay contractor,

See TM – Preliminary Construction Schedule for Central and Eastern Corridor Options (Attachment H) for detailed information

the pumping plant construction would continue with construction of the box structure from the raised embankment level. Following use of the Southern Forebay Inlet Structure Tunnel Launch Shaft, the tunnel contract the wet well conduit and overflow structures would be completed by the pumping plant contractor.

- **Southern Forebay:** The Southern Forebay would include overall preparation of the Southern Complex site with site clearance, borrow activities, and transfer of RTM to the site by rail. Earthmoving activities would initially include completion of the extended pad embankments for the South Delta Pumping Plant and the Southern Forebay Inlet Structure Tunnel Launch Shaft. Ground improvements would be completed, as necessary. Completion of the Southern Forebay Emergency Spillway and Southern Forebay Outlet Structure would follow construction of the embankment and the work required for the South Delta Conveyance Facilities dual tunnel drives.
- **South Delta Conveyance Facilities:** Initial partial excavation works, including transport of materials to the Southern Forebay work area, for the South Delta Conveyance Facilities would be scheduled before construction of the two tunnel reception shafts at the South Delta Outlet and Control Structure along the approach channel to the Banks Pumping Plant. The remaining excavation and completion of the South Delta Outlet and Control Structure would follow completion of the dual tunnels and removal of the TBMs. The construction of the California Aqueduct Control Structure would also occur between the initial and final stage of the South Delta Outlet and Control Structure construction.

6.10 Preliminary Information for EIR Air Quality and Traffic Analyses

As described in Section 1, this EPR was prepared to provide information to DWR for development of the EIR. A portion of the information needed to develop air quality and traffic analyses in the EIR includes assumptions related to construction and operations and maintenance quantities of equipment and vehicle use, employee travel needs, and earthwork quantities, as applicable.

These construction assumptions for the construction phase were prepared based on the conceptual engineering drawings and preliminary construction schedules and are included in Appendix F for the Central Corridor and Appendix G for the Eastern Corridor. The assumptions included estimates of travel times for employees and materials deliveries. It was assumed that most employees would be located in nearby metropolitan areas with specialty skilled workers traveling from the eastern San Francisco Bay Area. For example, it was assumed that workers for construction sites in Sacramento County would primarily commute from Sacramento; and workers in southern San Joaquin County and eastern Contra Costa County would commute from Stockton metropolitan area or eastern Alameda and Contra Costa counties. Building materials were assumed to be transported from nearby metropolitan areas along major roadways, such as materials from Sacramento or Stockton along Interstate 5. As described in subsequent sections of this EPR, soil materials would be provided from the construction sites and would be either used on-site or stockpiled permanently on-site to reduce truck traffic from quarries. Rock and gravel were assumed to be obtained from local quarries, including those in Sacramento County and near Vernalis in San Joaquin County. Ready-mix concrete would be provided from project batch plants or existing concrete manufacturers in Sacramento and San Joaquin counties within a maximum distance that would allow pouring of the concrete within 90 minutes. Pre-cast tunnel segments were assumed to be manufactured in several offsite locations at existing pre-cast concrete manufacturers in San Joaquin, Contra Costa, or Yolo counties and delivered by railroad trains at tunnel launch shaft sites in the Twin Cities Complex, Lower Roberts Island, and Southern Complex or delivered by truck from San Joaquin County manufacturing plants to Bouldin Island.

The equipment identified in this EPR optimized the use of electrical equipment, hybrid electrical/diesel engines, and Tier 4 engines as compared to traditional diesel engines. Technical specifications from equipment manufacturers were reviewed to identify equipment engines commercially available in the United States at the time of preparation of the EPR. Based upon current information available from manufacturers and professional associations, it appears that more types of equipment will become available in the next 5 to 10 years to reduce the use of diesel engines (e.g., drill rigs, haul trucks, cranes). However, this equipment either is not available or approved for use in the United States or California at this time. During the design phase, the ability to optimize use of electrical and hybrid engines and tools would be analyzed.

As described in Section 6.7.3, the construction assumptions in the EPR included preparation of a Fugitive Dust Control Plan to address methods to reduce dust generation. Dust reduction measures assumed in the EPR including use of gravel or pavement on construction roadways, covering of loads in haul trucks, and stabilization of excavated and disturbed soils on the construction sites.

Similarly, equipment assumptions associated with operations and maintenance of the DCP facilities were developed to provide information to DWR for the EIR air quality and traffic analyses.

The construction and operations and maintenance assumptions are included in Appendix H for the Central Corridor and Appendix I for the Eastern Corridor. For most locations, it was assumed that DWR employees would access the new facilities from existing DWR maintenance yards.

7. Project Design Capacity Options

The NOP described two corridor options for the DCP to convey up to 6,000 cfs from the intakes to the Southern Forebay, Central Corridor and Eastern Corridor, with continued conveyance to the approach channel of the Banks Pumping Plant. The NOP also identified a range of project design capacities from 3,000 cfs to 7,500 cfs to be considered in the EIR (DWR 2020a). Different project design capacities for 3,000 cfs, 4,500 cfs, and 7,500 cfs would affect the size of the intake facilities, tunnel diameter and volume of material removed during tunneling operations, sizes of facilities at tunnel shafts where the tunneling operations would take place (tunnel launch shaft sites), and sizes of several buildings at the South Delta Pumping Plant. All other facilities would be the same for all project design capacities.

As described in Section 1.1, the DWR EIR would evaluate the Central and Eastern Corridor options with project design capacities of 6,000 cfs, 7,500 cfs, 3,000 cfs, and 4,500 cfs. The 6,000 cfs project design capacity for the Central and Eastern corridors was presented in in Sections 2 through 6 of this EPR. Sections 7.1, 7.2, and 7.3 present the 7,500 cfs, 3,000 cfs, and 4,500 cfs project design capacity options, respectively. As described in Section 1.1, DWR uses different nomenclature than this EPR to describe the various alternatives. The equivalent nomenclature and the relevant sections of this EPR are described as follows:

DWR EIR Alternative	**EPR Nomenclature and EPR Section**
• Alternative 1: Central Corridor with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Central Corridor using Intakes C-E-3 and C-E-5 (Sections 2-6)
• Alternative 2a: Central Corridor with a project design capacity of 7,500 cfs and Intakes A, B, and C	• 7,500 cfs project design capacity for the Central Corridor using Intakes C-E-2, C-E-3, and C-E-5 (Section 7.1)
• Alternative 2b: Central Corridor with a project design capacity of 3,000 cfs and Intake C	• 3,000 cfs project design capacity for the Central Corridor using Intake C-E-5 (Section 7.2)
• Alternative 2c: Central Corridor with a project design capacity of 4,500 cfs and Intakes B and C	• 4,500 cfs project design capacity for the Central Corridor using Intakes C-E-3 and C-E-5 (Section 7.3)
• Alternative 3: Eastern Corridor with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Eastern Corridor using Intakes C-E-3 and C-E-5 (Sections 2-6)
• Alternative 4a: Eastern Corridor with a project design capacity of 7,500 cfs and Intakes A, B, and C	• 7,500 cfs project design capacity for the Eastern Corridor using Intakes C-E-2, C-E-3, and C-E-5 (Section 7.1)
• Alternative 4b: Eastern Corridor with a project design capacity of 3,000 cfs and Intake C	• 3,000 cfs project design capacity for the Eastern Corridor using Intake C-E-5 (Section 7.2)
• Alternative 4c: Eastern Corridor with a project design capacity of 4,500 cfs and Intakes B and C	• 4,500 cfs project design capacity for the Eastern Corridor using Intakes C-E-3 and C-E-5 (Section 7.3)

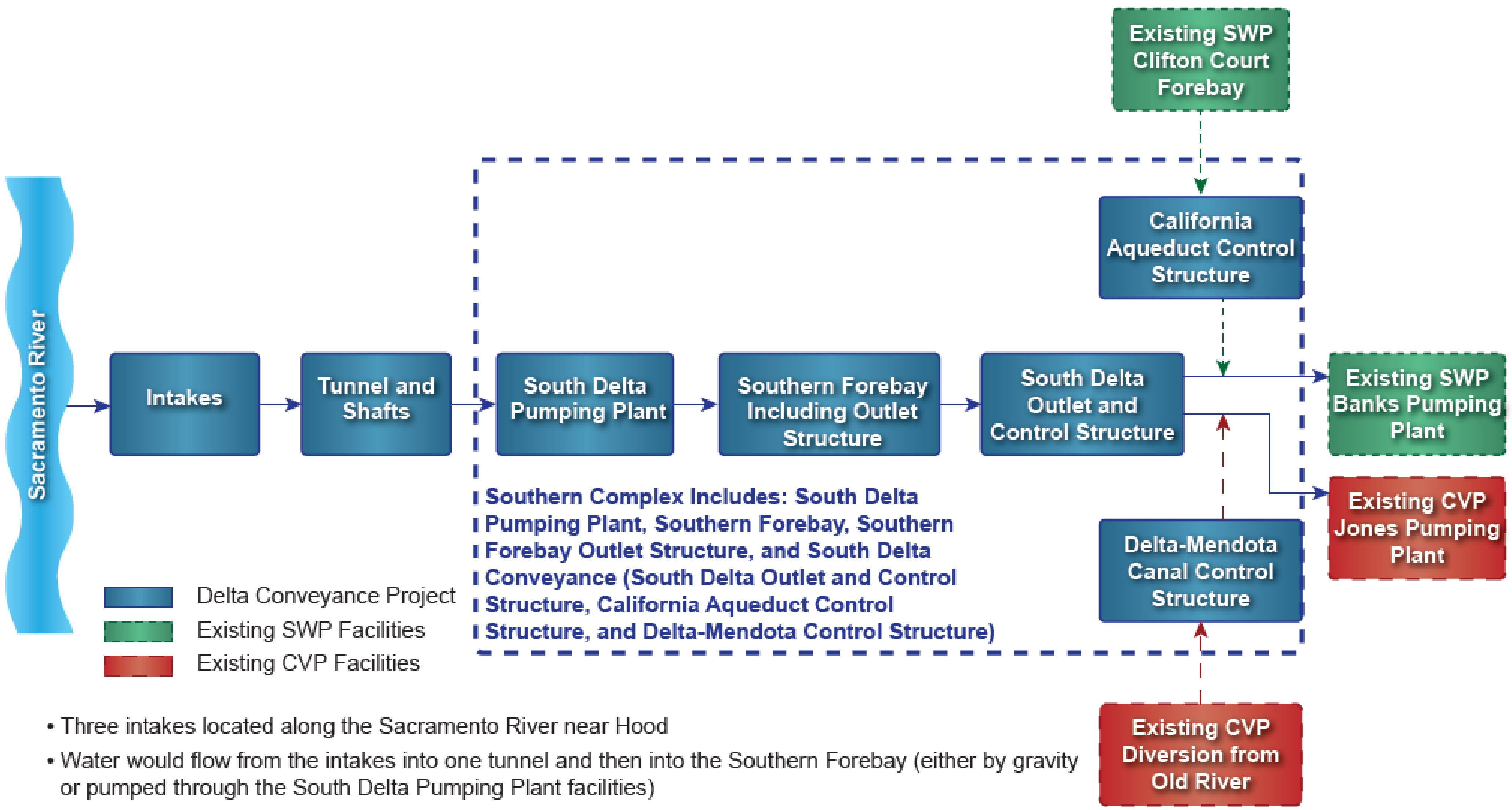
7.1 Project Design Capacity for 7,500 cfs Option

The 7,500 cfs project design capacity option would provide 6,000 cfs to the existing SWP Banks Pumping Plant and 1,500 cfs to the existing CVP C.W. "Bill" Jones (Jones) Pumping Plant. The facilities described in this section represent the facilities in the DWR EIR Alternative 2a (Central Corridor) and Alternative 4a (Eastern Corridor).

This option would include all of the facilities described in Sections 2 through 6 for the 6,000 cfs project design capacity including the tunnel alignments between Intake C-E-3 and the Southern Complex along the Central and Eastern corridors. The 7,500 cfs project design capacity would also include one additional intake (Intake C-E-2) with connecting tunnel to Intake C-E-3, modification of the South Delta Outlet and Control Structure to include a Jones Control Structure, a Jones Outlet Structure along the Jones Pumping Plant approach channel, a tunnel between shafts located in the Jones Control Structure and the Jones outlet Structure, plus the Delta-Mendota Control Structure, as schematically shown in Figures 13, 14A, and 14B.

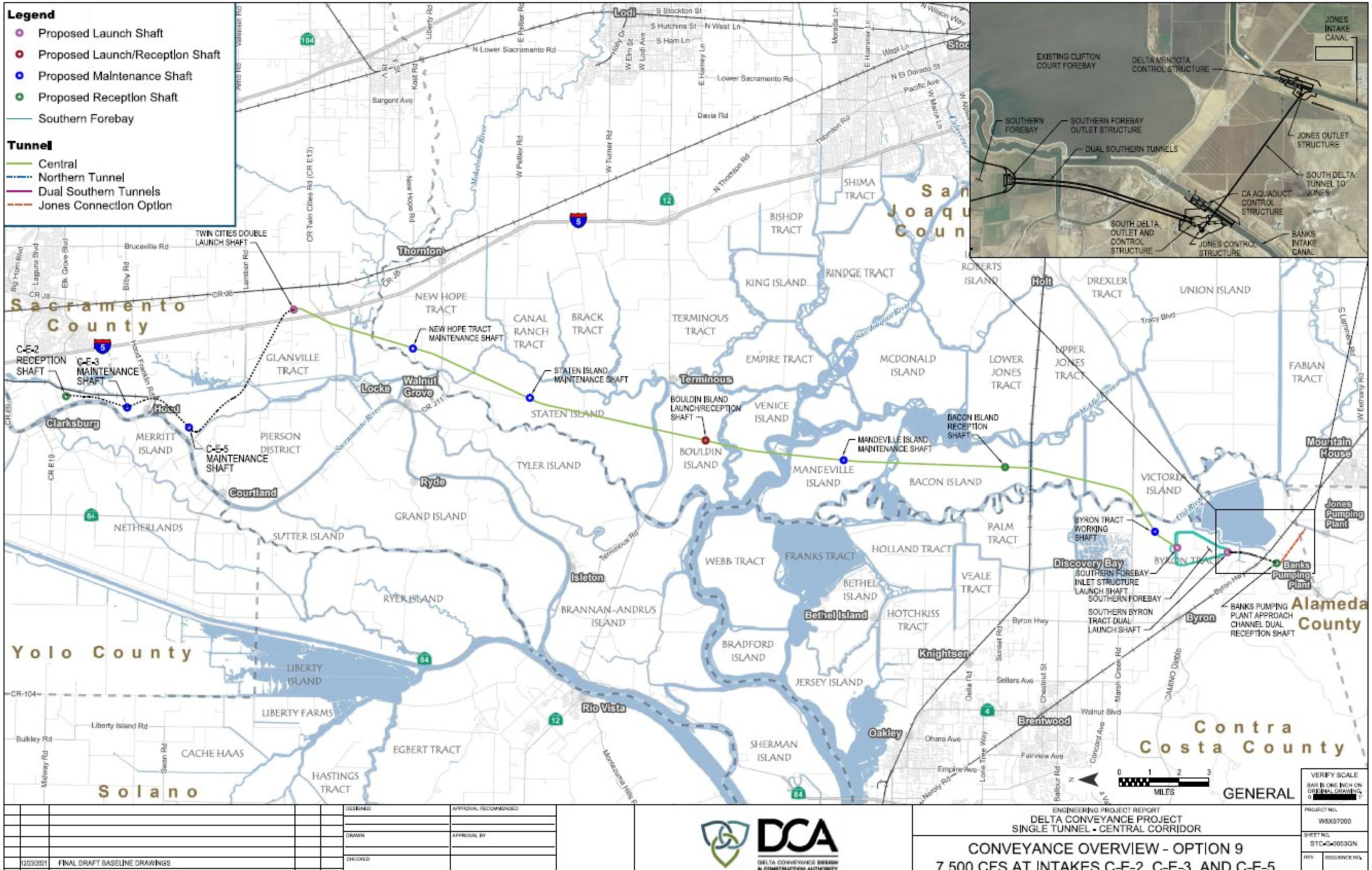
A summary of the physical characteristics is presented in Table 11. Additionally, Table 12 summarizes the construction and post-construction site requirements as well as post-construction site reclamation for the major features. More detailed information about these facilities is presented in engineering concept drawings and Appendix B of this EPR.

FIGURE 13. SCHEMATIC OF CENTRAL AND EASTERN CORRIDOR OPTIONS FACILITIES TO CONVEY WATER FROM SACRAMENTO RIVER TO SWP BANKS PUMPING PLANT AND CVP JONES PUMPING PLANT WITH PROJECT DESIGN CAPACITY OF 7,500 CFS



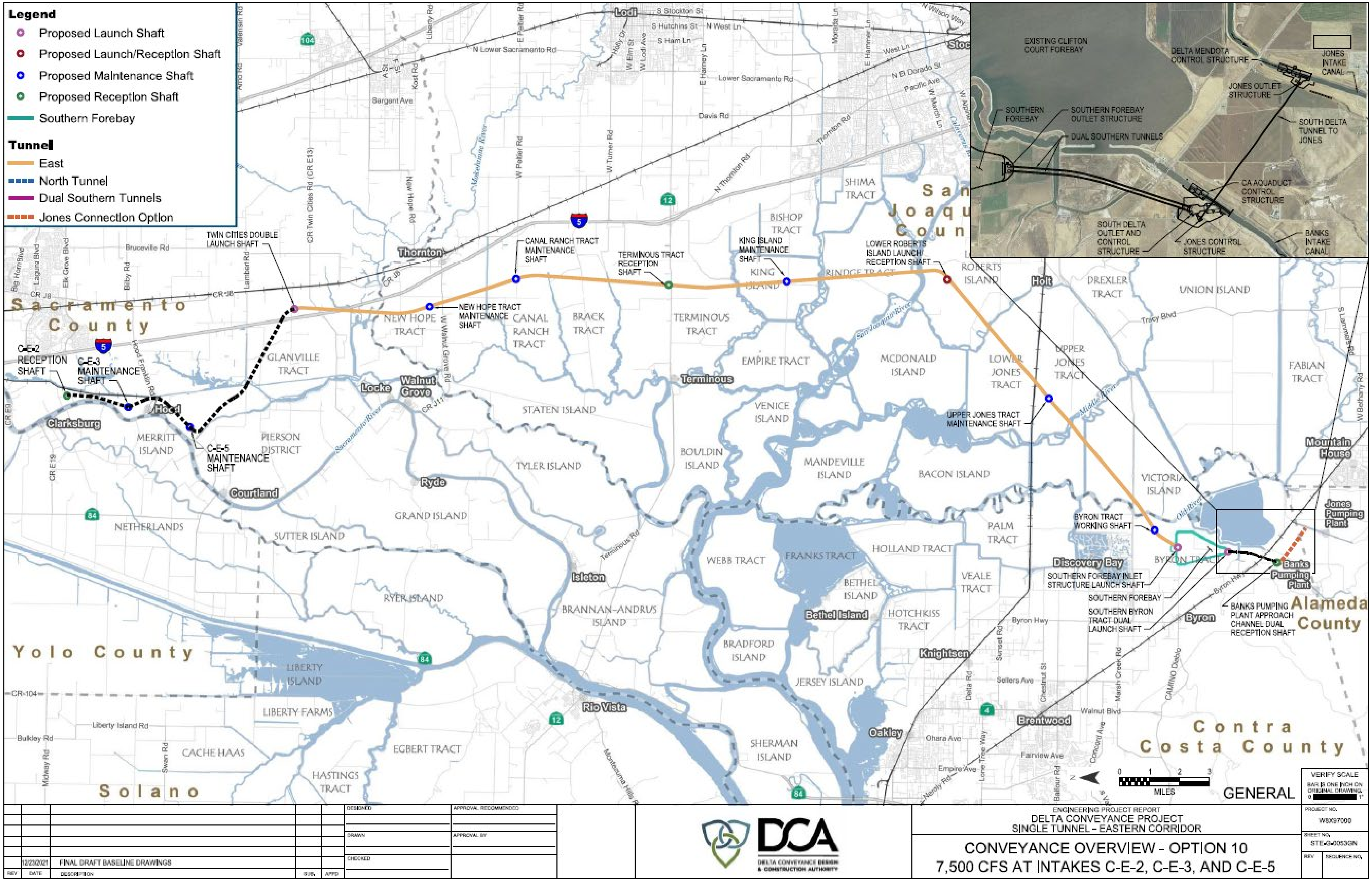
- Three intakes located along the Sacramento River near Hood
- Water would flow from the intakes into one tunnel and then into the Southern Forebay (either by gravity or pumped through the South Delta Pumping Plant facilities)
- Water would flow from Southern Forebay through the South Delta Conveyance Facilities dual tunnels to an outlet structure along the existing Banks Pumping Plant approach channel. South Delta Conveyance Facilities also would include a flow control structure to provide “Dual Conveyance” for the SWP
- Water would also flow from South Delta Conveyance Facilities outlet structure through a tunnel that would extend to an outlet structure along the existing Jones Pumping Plant approach channel. A flow control structure would be included to provide “Dual Conveyance” for the CVP
- Existing SWP south Delta diversion facilities and Clifton Court Forebay would continue to operate as part of “Dual Conveyance”
- Existing CVP south Delta diversion facilities would continue to operate as part of “Dual Conveyance”

FIGURE 14A. CENTRAL CORRIDOR FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO SWP BANKS PUMPING PLANT AND CVP JONES PUMPING PLANT FOR 7,500 CFS PROJECT DESIGN CAPACITY



(From Engineering Concept Drawings, Volume 2, 01-GN)

FIGURE 14B. EASTERN CORRIDOR FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO SOUTHERN COMPLEX FOR 7,500 CFS PROJECT DESIGN CAPACITY



(From Engineering Concept Drawings, Volume 2, 01-GN)

TABLE 11. SUMMARY OF THE PHYSICAL CHARACTERISTICS FOR PROJECT DESIGN CAPACITY OF 7,500 CFS

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Project Design Capacity		• 7,500 cfs	
Intake Facilities			
Number of Intakes with Fish Screens		• 3 with cylindrical tee fish screens	
Design Flow Capacity of Each Intake		• One Intake at 1,500 cfs (with Reception Shaft) (Intake C-E-2) • One Intake at 3,000 cfs (with Maintenance Shaft) (Intake C-E-3) • One Intake at 3,000 cfs (with Maintenance Shaft) (Intake C-E-5)	
Tunnel and Tunnel Shafts			
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)		• Maximum Capacity – 1,500 cfs between Intakes C-E-2 and C-E-3 – 3,000 cfs between Intake C-E-3 and Intake C-E-5 – 6,000 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 40 feet • Tunnel Outside Diameter: 44 feet • Tunnel Length: 54,202 feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex Dual Launch Shaft) • Launch Shafts Inside Diameter (feet): 120 • Number of Reception Shafts: 1 (C-E-2) • Number of Maintenance Shafts: 2 (C-E-3 and C-E-5) • Maintenance and Reception Shafts Inside Diameter (feet): 83 (all are intake outlet shafts)	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Tunnel Reaches between Twin Cities Complex and Southern Complex	• Reach 2: Between Twin Cities Complex and Bouldin Island • Reach 3: Between Bouldin Island and Bacon Island • Reach 4: Between Bacon Island and Southern Forebay • Maximum Capacity: 7,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 40 feet • Tunnel Outside Diameter: 44 feet • Tunnel Length: 165,078 feet • Number of Tunnel Launch Shafts: 3 • Number of Working (Launch) Shafts: 1 • Number of Reception Shafts: 1 (note that one launch shaft would be a combined launch/reception shaft) • Number of Maintenance Shafts: 3 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 120 • Byron Tract Working Shaft: Inside Diameter (feet): 120 • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 120 • Maintenance and Reception Shafts Inside Diameter (feet): 76		• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Southern Forebay • Maximum Capacity: 7,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 40 feet • Tunnel Outside Diameter: 44 feet • Tunnel Length: 179,332 feet • Number of Tunnel Launch Shafts: 3 • Number of Working (Launch) Shafts: 1 • Number of Reception Shafts: 1 (note that one launch shaft would be a combined launch/reception shaft) • Number of Maintenance Shafts: 4 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 120 • Byron Tract Working Shaft: Inside Diameter (feet): 120 • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 120 • Maintenance and Reception Shafts Inside Diameter (feet): 76

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
South Delta Pumping Plant at the Northern Southern Forebay Embankment		• Eight pumps at 960 cfs, each, including up to two standby pumps (Up to seven pumps would operate at any one time for a total of 5,760 to 6,300 cfs capacity) • Three pumps at 600 cfs, each, including one standby pump (Up to two pumps would operate at any one time for a total of 1,200 cfs capacity) • Two portable pumps to dewater tunnel • Maximum Total Dynamic Head of Pumping Plant: 80 feet (in unprimed operation)	

Southern Forebay		• Normal Operating Capacity: 9,000 acre-feet with a surface area of approximately 750 acres
		• Average Surface Water Surface Elevation: 11.5 feet, or approximately the half-way point within the range of normal operating elevation 5.5 to 17.5 feet
		  – Minimum elevation of 5.5 feet would provide gravity flow up to 10,600 cfs to Banks Pumping Plant
		  – Maximum elevation of 17.5 feet would provide a 12-foot operational range within the forebay
		• Southern Forebay Floor Elevation: Range from 0 to – 7 feet
		• Southern Forebay Area (including exterior embankment slopes, toe drains, and exterior circumference access roads): approximately 1,000 acres	

Tunnel Reaches 5E and 5W between Southern Forebay and South Delta Outlet Structure		• Maximum Combined Flow of Tunnels 5E and 5W: 12,170 cfs (per DWR) • Number of Tunnels: 2 • Tunnel Inside Diameter: 40 feet (to maintain gravity flow) • Tunnel Outside Diameter: 44 feet • Tunnel Length: 8,816 +/- feet for each tunnel • Number of Tunnel Launch Shafts: 2 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 0 • Launch Shafts Inside Diameter (feet): 115 • Reception Shafts Inside Diameter (feet): 90	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
South Delta Outlet and Control Structure		• Maximum Capacity: 10,670 cfs • Includes Jones Control Structure (below)	
California Aqueduct Control Structure		• Maximum Capacity: 10,670 cfs	
Tunnel Reach 6 between Jones Control Structure and Jones Outlet Structure		• Maximum Flow in Tunnel: 1,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 20 feet (to maintain gravity flow) • Tunnel Outside Diameter: 22 feet • Tunnel Length: 7,900 feet • Number of Tunnel Launch Shafts: 1 • Number of Reception Shafts: 1 • Number of Maintenance Shafts: 0 • Launch Shaft Inside Diameter (feet): 90 • Reception Shaft Inside Diameter (feet): 55	
Jones Control Structure (part of South Delta Outlet and Control Structure)		• Maximum Capacity: 1,500 cfs	
Jones Outlet Structure (adjacent to the Jones Pumping Plant approach channel)		• Maximum Capacity: 1,500 cfs	
Delta-Mendota Control Structure		• Maximum Capacity: 4,600 cfs	

TABLE 12. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 7,500 CFS

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E- 2	Central and Eastern	166	78	88 (agriculture or habitat)
Intake C-E-3	Central and Eastern	242	123	119 (agriculture or habitat)
Intake C-E-5	Central and Eastern	239	109	130 (agriculture or habitat)
Lambert Road Concrete Batch Plant	Central and Eastern	15	14	N/A
Twin Cities Complex	Central	546	285	260 (agriculture or habitat) 275 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Central	11	11	N/A
Staten Island Shaft Site	Central	12	12	N/A
Bouldin Island Shaft Site	Central	657	544	91 (agriculture or habitat) 225 (RTM stockpile planted with native grasses)
Mandeville Island Shaft Site	Central	14	14	N/A
Bacon Island Shaft Site	Central	15	15	N/A
Twin Cities Complex	Eastern	546	302	244 (agriculture or habitat) 291 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Eastern	11	11	N/A
Canal Ranch Tract Shaft Site	Eastern	11	11	N/A
Terminous Tract Shaft Site	Eastern	13	13	N/A
King Island Shaft Site	Eastern	12	12	N/A
Lower Roberts Island Shaft Site	Eastern	445	207	215 (agriculture or habitat) 93 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	Eastern	13	13	N/A
Southern Complex on Byron Tract (Southern Forebay Inlet Structure tunnel launch shaft, Working Shaft tunnel launch shaft and tunnel maintenance shaft, South Delta Pumping Plant, Southern Forebay, Southern Forebay Outlet Structure and dual tunnel launch shafts)	Central	1,457	1,189	229 (agriculture or habitat) 62 (peat stockpile planted with native grasses)
Southern Complex on Byron Tract	Eastern	1,512	1,244	226 (agriculture or habitat) 113 (RTM and peat stockpile planted with native grasses)

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Southern Complex located to the West of Byron Highway (South Delta Outlet and Control Structure, California Aqueduct Control Structure, Jones Control Structure, Jones Outlet Structure, and Delta-Mendota Control Structure)	Central and Eastern	293	210	83 (agriculture or habitat)

Notes:

Acreage is approximate; exact area should be obtained from the GIS. Acreages include ring levees or other levee modifications, and generally exclude access roads, except for levee modification access roads.

Intake acreages are based on cylindrical tee screens. Acreages for intakes with vertical flat plate screens are included in Appendix E.

RTM and peat stockpiles planted with native grasses would be located within the post-construction boundary.

N/A = Not Applicable

7.1.1 Intakes for Project Design Capacity of 7,500 cfs

For the 7,500 cfs project design capacity option, Intake C-E-2 was selected for a smaller intake with a design capacity of 1,500 cfs. The tunnel would be extended from Intake C-E-3 to a tunnel reception shaft at Intake C-E-2, and at Intakes C-E-3 and C-E-5 would be tunnel maintenance shafts. All shafts at the intakes would also serve as intake outlet shafts for the completed facility. The intake haul road would extend from Intake C-E-3 to Intake C-E-2. Intake C-E-2 would be constructed and operated in the same manner as described in Section 2.1, Intakes.

Quantitative descriptions of the intake construction are presented for Intakes C-E-3 and C-E-5 at a 3,000 cfs design capacity in Appendix A for and for Intake C-E-2 at a 1,500 cfs design capacity in Appendix B.

7.1.2 Tunnels for Project Design Capacity of 7,500 cfs

The tunnels between the Intakes and the Southern Complex would be constructed in the same manner as described in Section 2.2, Tunnels and Tunnel Shafts. The tunnel dimensions are summarized in Tables 11 and 12, and quantitative descriptions of the tunnel shaft construction are presented in Appendix B.

7.1.3 Southern Complex Facilities on Byron Tract for Project Design Capacity of 7,500 cfs

The Southern Complex facilities on Byron Tract, including the South Delta Pumping Plant, Southern Forebay embankments, and Southern Forebay Outlet Structure would be constructed as described in Section 2.3, Southern Complex. The Southern Forebay would be identical in size as for the project design capacity of 6,000 cfs. The operating volume size was selected to provide the operational flexibility needed to support dual operation of both the DCP and the existing SWP facilities at CCF and the Banks Pumping Plant. The size is dependent on the Banks Pumping Plant capacity and is therefore independent of DCP design flow capacity. The size of the tunnel launch facilities, South Delta Pumping Plant, and Southern Forebay Outlet Structure would be different than for the project design capacity of 6,000 cfs. The sizes of these facilities for a project design capacity of 7,500 cfs are summarized in Tables 11 and 12, and Appendix B.

7.1.4 Southern Complex Facilities Located to the West of the Byron Highway for Project Design Capacity of 7,500 cfs

Dual tunnels would be bored from the Southern Forebay Outlet Structure tunnel launch shafts to the South Delta Outlet Control Structure dual reception shafts (adjacent to the Banks Pumping Plant approach channel) as described in Section 2.3.3, South Delta Conveyance Facilities. The size of the tunnels, Southern Forebay Outlet Structure, and South Delta Outlet Control Structure would be different than for the project design capacity of 6,000 cfs. The sizes of these facilities for a project design capacity of 7,500 cfs are summarized in Table 13 and Appendix B. The California Aqueduct Control Structure would be identical to the facility described in Section 3.3.5, California Aqueduct Control Structure for the project design capacity of 6,000 cfs.

The option with a project design capacity of 7,500 cfs, would also include a tunnel launch shaft adjacent to the South Delta Outlet Control Structure (Jones Control Structure), a tunnel to the Jones Outlet Structure along the Delta-Mendota Canal approach channel, Jones Outlet Structure, and Delta-Mendota Control Structure, as described below and summarized in Tables 11 and 12, and Appendix B.

See TM – South Delta Conveyance Facilities System Configuration (Attachment E) for detailed information

See TM – South Delta Conveyance Facilities Hydraulic Analysis Criteria and Analysis (Attachment E) for detailed information

See TM – South Delta Conveyance Facilities Operations and Maintenance Equipment and Facility Needs (Attachment E) for detailed information

See TM – Delta-Mendota Canal Connection — Tunnel and Canal Options Summary Comparison

7.1.4.1 Jones Control Structure

Jones Control Structure would be located adjacent to the South Delta Outlet and Control Structure to allow a portion of the flow from the Southern Forebay to be conveyed through the Jones Tunnel to the existing Jones Pumping Plant approach channel. The Jones Control Structure would include a launch shaft for the Jones Tunnel and radial gates to control the rate of flow into the existing CVP system. The Jones Control Structure would include two large gates for controlling up to 1,500 cfs of flow into the CVP system. An additional small gate would be provided for minor flow controls. Final gate types, numbers, and sizing would be determined during final design. A double row of bulkhead panels would allow isolation and dewatering of individual gate bays for maintenance and repair. 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 be equal to or higher than the maximum water surface elevation in the Southern Forebay, including freeboard.

7.1.4.2 Jones Tunnel

The Jones Tunnel would convey water to the Jones Outlet Structure and Delta-Mendota Control Structure as close as practical to the Byron Highway bridge over the Delta-Mendota Canal. The alignment would extend centrally between two high-voltage power line towers to comply with power company requirements.

7.1.4.3 Jones Outlet Structure

Jones Outlet Structure would be located adjacent to the Jones Pumping Plant approach channel and would include the reception shaft for the Jones Tunnel. At the reception shaft, the flows would transition from the tunnel to an open channel discharge into the Delta-Mendota Canal. The structure would be a flow-through facility with no operational control and would have no electrical or control systems. A double bulkhead panel system would be included to allow isolation of the tunnel for dewatering, inspection, maintenance, or repair.

7.1.4.4 Delta-Mendota Control Structure

Delta-Mendota Control Structure would be constructed in the Delta-Mendota Canal between the Jones Outlet Structure and the Byron Highway bridge over the canal. This control structure would allow flows from the DCP and the existing CVP water supply from Old River to be operated either independently or in combination with each other at any flow rate up to the 1,500 cfs capacity of the Jones Tunnel and the pumping capacity of the Jones Pumping Plant.

The main component of the Delta-Mendota Control Structure would be a series of radial gates that would control upstream flow from Old River, including three large gates and a smaller gate for minor flow controls. Final gate types, numbers, and sizing would 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. A double bulkhead panel system would be included to isolate the radial gates for inspection, maintenance, or repair.

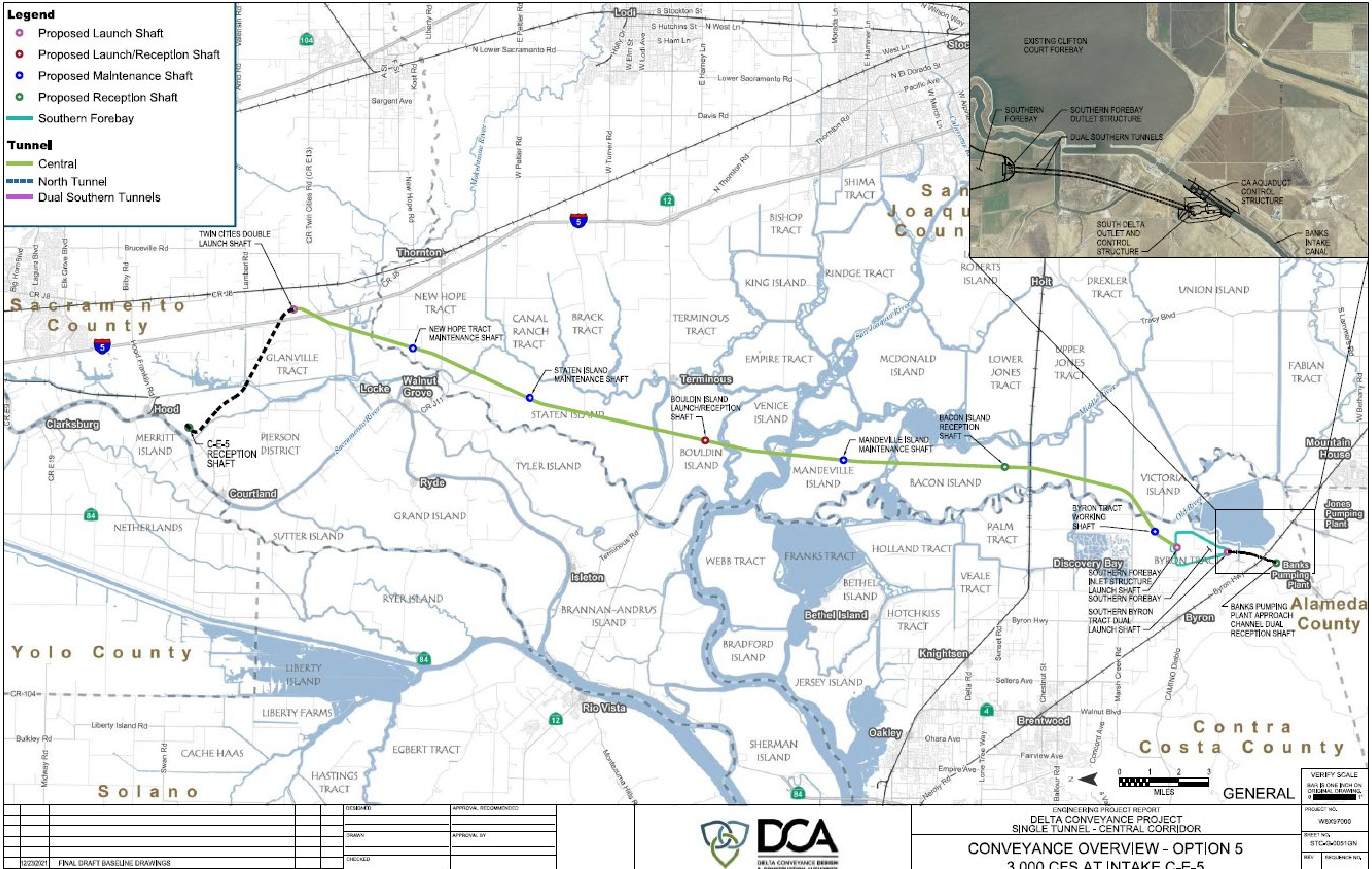
7.2 Project Design Capacity Option for 3,000 cfs

One project design capacity option would provide 3,000 cfs to the existing SWP Banks Pumping Plant. The facilities described in this section represent the facilities in the DWR EIR Alternative 2b (Central Corridor) and Alternative 4b (Eastern Corridor).

This option would include all of the facilities described in Sections 2 through 6 for the 6,000 cfs project design capacity except Intake C-E-3 and the tunnel alignment and intake haul road between Intake C-E-3 and Intake C-E-5. The facilities for this option with a project design capacity of 3,000 cfs are schematically shown in Figures 15A, and 15B.

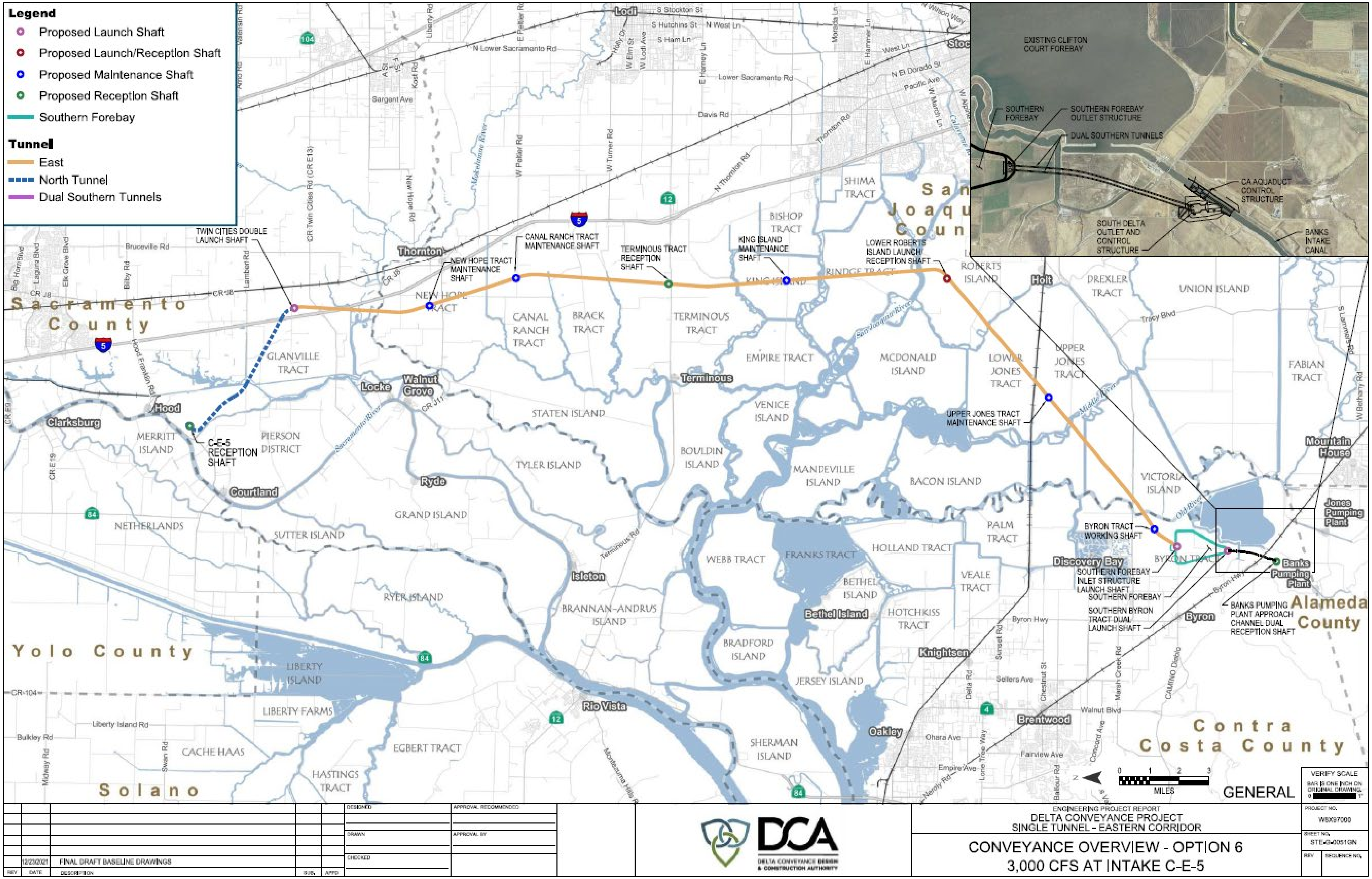
A summary of the physical characteristics is presented in Table 13. Additionally, Table 14 summarizes the construction and post-construction site requirements as well as post-construction site reclamation for the major features. More detailed information about these facilities are presented in engineering concept drawings and Appendix C of this EPR.

FIGURE 15A. CENTRAL CORRIDOR FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO SOUTHERN COMPLEX FOR PROJECT DESIGN CAPACITY OF 3,000 CFS



(From Engineering Concept Drawings, Volume 2, 01-GN)

FIGURE 15B. EASTERN CORRIDOR FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO SOUTHERN COMPLEX FOR PROJECT DESIGN CAPACITY OF 3,000 CFS



(From Engineering Concept Drawings, Volume 2, 01-GN)

TABLE 13. SUMMARY OF THE PHYSICAL CHARACTERISTICS FOR PROJECT DESIGN CAPACITY OF 3,000 CFS

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Project Design Capacity		• 3,000 cfs	
Intake Facilities			
Number of Intakes with Fish Screens		• 1 with cylindrical tee fish screens	
Design Flow Capacity of Each Intake		• One Intake at 3,000 cfs (with Reception Shaft) (Intake C-E-5)	
Tunnel and Tunnel Shafts			
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)		• Maximum Capacity – 3,000 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 26 feet • Tunnel Outside Diameter: 28 feet 4 inches • Tunnel Length: 29,828 feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex Dual Launch Shafts) • Launch Shaft Inside Diameter (feet): 110 • Number of Reception Shafts: 1 • Number of Maintenance Shafts: 0 • Maintenance and Reception Shafts Inside Diameter (feet): 83 (Intake Outlet Shaft)	
Tunnel Reaches between Twin Cities Complex and Southern Complex	• Reach 2: Between Twin Cities Complex and Bouldin Island • Reach 3: Between Bouldin Island and Bacon Island • Reach 4: Between Bacon Island and Southern Forebay • Maximum Capacity: 3,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 26 feet • Tunnel Outside Diameter: 28 feet 4 inches		• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Southern Forebay • Maximum Capacity: 3,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 26 feet • Tunnel Outside Diameter: 28 feet 4 inches • Tunnel Length: 179,332 feet

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
	• Tunnel Length: 165,078 feet • Number of Tunnel Launch Shafts: 3 • Number of Working (Launch) Shafts: 1 • Number of Reception Shafts: 1 (note that one launch shaft would be a combined launch/reception shaft) • Number of Maintenance Shafts: 3 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 • Byron Tract Working Shaft Inside Diameter: 110 feet • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 110 • Maintenance and Reception Shafts Inside Diameter (feet): 53		• Number of Tunnel Launch Shafts: 3 • Number of Working (Launch) Shafts: 1 • Number of Reception Shafts: 1 (note that one launch shaft would be a combined launch/reception shaft) • Number of Maintenance Shafts: 4 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 • Byron Tract Working Shaft Inside Diameter: 110 feet • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 110 • Maintenance and Reception Shafts Inside Diameter (feet): 53
South Delta Pumping Plant at the Northern Southern Forebay Embankment		• Five pumps at 960 cfs, each, including up to two standby pumps (Up to two or three would operate at any one time for a total of 1,920 to 2,880 cfs capacity) • Three pumps at 600 cfs, each, including one standby pump (Up to two pumps would operate at any one time for a total of 1,200 cfs capacity) • Two portable pumps to dewater tunnel • Maximum Total Dynamic Head of Pumping Plant: 80 feet (in unprimed operation)	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Southern Forebay		• Normal Operating Capacity: 9,000 acre-feet with a surface area of approximately 750 acres • Average Surface Water Surface Elevation: 11.5 feet, or approximately the half-way point within the range of normal operating elevation 5.5 to 17.5 feet. – Minimum elevation of 5.5 feet would provide gravity flow up to 10,600 cfs to Banks Pumping Plant – Maximum elevation of 17.5 feet would provide a 12-foot operational range within the forebay • Southern Forebay Floor Elevation: Range from 0 to – 7 feet • Southern Forebay Area (including exterior embankment slopes, toe drains, and exterior circumference access roads): approximately 1,000 acres	
Tunnel Reaches 5E and 5W between Southern Forebay and South Delta Outlet Structure		• Maximum Combined Flow of Tunnels 5E and 5W: 10,160 cfs (per DWR) • Number of Tunnels: 2 • Tunnel Inside Diameter: 38 feet (to maintain gravity flow) • Tunnel Outside Diameter: 41 feet • Tunnel Length: 8,816 +/- feet for each tunnel • Number of Tunnel Launch Shafts: 2 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 0 • Launch Shafts Inside Diameter (feet): 115 • Reception Shafts Inside Diameter (feet): 90	
South Delta Outlet and Control Structure		• Maximum Capacity: 10,670 cfs	
California Aqueduct Control Structure		• Maximum Capacity: 10,670 cfs	

TABLE 14. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 3,000 CFS

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E-5	Central and Eastern	239	109	130 (agriculture or habitat)
Lambert Road Concrete Batch Plant	Central and Eastern	8	7	N/A
Twin Cities Complex	Central	322	26	296 (agriculture or habitat) 15 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Central	11	11	N/A
Staten Island Shaft Site	Central	12	12	N/A
Bouldin Island Shaft Site	Central	540	436	88 (agriculture or habitat) 129 (RTM stockpile planted with native grasses)
Mandeville Island Shaft Site	Central	14	14	N/A
Bacon Island Shaft Site	Central	15	15	N/A
Twin Cities Complex	Eastern	322	26	296 (agriculture or habitat) 15 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Eastern	11	11	N/A
Canal Ranch Tract Shaft Site	Eastern	11	11	N/A
Terminous Tract Shaft Site	Eastern	13	13	N/A
King Island Shaft Site	Eastern	12	12	N/A
Lower Roberts Island Shaft Site	Eastern	327	136	175 (agriculture or habitat) 33 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	Eastern	13	13	N/A
Southern Complex on Byron Tract (Southern Forebay Inlet Structure tunnel launch shaft, Working Shaft tunnel launch shaft and tunnel maintenance shaft, South Delta Pumping Plant, Southern Forebay, Southern Forebay Outlet Structure and dual tunnel launch shafts)	Central and Eastern	1,457	1,189	229 (agriculture or habitat) 62 (peat stockpile planted with native grasses)

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Southern Complex located to the West of Byron Highway (South Delta Outlet and Control Structure and California Aqueduct Control Structure)	Central and Eastern	164	112	53 (agriculture or habitat)

Notes:

Acreage is approximate; exact area should be obtained from the GIS. Acreages include ring levees or other levee modifications, and generally exclude access roads, except for levee modification access roads.

Intake acreages are based on cylindrical tee screens. Acreages for intakes with vertical flat plate screens are included in Appendix E.

RTM and peat stockpiles planted with native grasses would be located within the post-construction boundary.

N/A = Not Applicable

7.2.1 Intakes for Project Design Capacity of 3,000 cfs

As described in Section 2.1.3, Site Selection of Intakes, three intake locations were identified for potential intake locations. For the 3,000 cfs project design capacity option, Intake C-E-5 was selected because it would eliminate the need for a maintenance shaft, require the shortest tunnel between the intake and Twin Cities Complex, and require the shortest intake haul road.

Quantitative descriptions of the intake construction for Intake C-E-5 at a 3,000 cfs design capacity is presented in Appendix A.

7.2.2 Tunnels for Project Design Capacity of 3,000 cfs

The tunnels between the Intakes and the Southern Complex would be constructed in the same manner as described in Section 2.2, Tunnels and Tunnel Shafts. The tunnel dimensions are summarized in Tables 13 and 14, and quantitative descriptions of the tunnel shaft construction are presented in Appendix C.

7.2.3 Southern Complex Facilities for Project Design Capacity of 3,000 cfs

The Southern Complex facilities would be constructed as described in Section 2.3, Southern Complex. The Southern Forebay and South Delta Conveyance Facilities would be identical in size as for the project design capacity of 6,000 cfs. The operating volume size was selected to provide the operational flexibility needed to support dual operation of both the DCP and the existing SWP facilities at CCF and the Banks Pumping Plant. The size is dependent on the Banks Pumping Plant capacity and is therefore independent of DCP design flow capacity. The size of the tunnel launch facilities and South Delta Pumping Plant would be different than for the project design capacity of 6,000 cfs. The sizes of these facilities for a project design capacity of 3,000 cfs are summarized in Tables 13 and 14, and Appendix C.

7.3 Project Design Capacity Option for 4,500 cfs

One project design capacity option would provide 4,500 cfs to the existing SWP Banks Pumping Plant. The facilities described in this section represent the facilities in the DWR EIR Alternative 2c (Central Corridor) and Alternative 4c (Eastern Corridor).

This option would include all of the facilities described in Sections 2 through 6 for the 6,000 cfs project design capacity, including Intake C-E-3 and Intake C-E-5. The facilities for this option with a project design capacity of 4,500 cfs are schematically shown in Figures 3A and 3B.

A summary of the physical characteristics is presented in Table 15. Additionally, Table 16 summarizes the construction and post-construction site requirements as well as post-construction site reclamation for the major features. More detailed information about these facilities are presented in engineering concept drawings and Appendix D of this EPR.

TABLE 15. SUMMARY OF THE PHYSICAL CHARACTERISTICS FOR PROJECT DESIGN CAPACITY OF 4,500 CFS

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Project Design Capacity		• 4,500 cfs	
Intake Facilities			
Number of Intakes with Fish Screens		• 2 with cylindrical tee fish screens	
Design Flow Capacity of Each Intake		• One Intake at 3,000 cfs (with Reception Shaft) (Intake C-E-3) • One Intake at 1,500 cfs (with Maintenance Shaft) (Intake C-E-5)	
Tunnel and Tunnel Shafts			
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)		• Maximum Capacity – 4,500 cfs between Intake C-E-3 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 31 feet • Tunnel Outside Diameter: 33feet 8 inches • Tunnel Length: 43,081 feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex Dual Launch Shafts) • Launch Shaft Inside Diameter (feet): 110 • Number of Reception Shafts: 1 • Number of Maintenance Shafts: 1	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
		• Maintenance and Reception Shafts Inside Diameter (feet): 83 (Intake Outlet Shafts)	
Tunnel Reaches between Twin Cities Complex and Southern Complex	• Reach 2: Between Twin Cities Complex and Bouldin Island • Reach 3: Between Bouldin Island and Bacon Island • Reach 4: Between Bacon Island and Southern Forebay • Maximum Capacity: 4,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 31 feet • Tunnel Outside Diameter: 33 feet 8 inches • Tunnel Length: 165,078 feet • Number of Tunnel Launch Shafts: 3 • Number of Working (Launch) Shafts: 1 • Number of Reception Shafts: 1 (note that one launch shaft would be a combined launch/reception shaft) • Number of Maintenance Shafts: 3 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 • Byron Tract Working Shaft: Inside Diameter (feet): 110 • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 110 • Maintenance and Reception Shafts Inside Diameter (feet): 63		• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Southern Forebay • Maximum Capacity: 4,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 31 feet • Tunnel Outside Diameter: 33 feet 8 inches • Tunnel Length: 179,332 feet • Number of Tunnel Launch Shafts: 3 • Number of Working (Launch) Shafts: 1 • Number of Reception Shafts: 1 (note that one launch shaft would be a combined launch/reception shaft) • Number of Maintenance Shafts: 4 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 • Byron Tract Working Shaft: Inside Diameter (feet): 110 • Launch Shaft or Launch/Reception Shaft at Other Locations: Inside Diameter (feet): 110 • Maintenance and Reception Shafts Inside Diameter (feet): 63
South Delta Pumping Plant at the Northern Southern Forebay Embankment		• Six pumps at 960 cfs, each, including up to two standby pumps (Up to three to four pumps would operate at any one time for a total of 2,880 to 3,840 cfs capacity) • Three pumps at 600 cfs, each, including one standby pump (Up to two pumps would operate at any one time for a total of 1,200 cfs capacity) • Two portable pumps to dewater tunnel • Maximum Total Dynamic Head of Pumping Plant: 80 feet (in unprimed operation)	

Feature Description	Unique to the Central Corridor	Same for the Central and Eastern Corridors	Unique to the Eastern Corridor
Southern Forebay		• Normal Operating Capacity: 9,000 acre-feet with a surface area of approximately 750 acres • Average Surface Water Surface Elevation: 11.5 feet, or approximately the half-way point within the range of normal operating elevation 5.5 to 17.5 feet. – Minimum elevation of 5.5 feet would provide gravity flow up to 10,600 cfs to Banks Pumping Plant – Maximum elevation of 17.5 feet would provide a 12-foot operational range within the forebay • Southern Forebay Floor Elevation: Range from 0 to – 7 feet • Southern Forebay Area (including exterior embankment slopes, toe drains, and exterior circumference access roads): approximately 1,000 acres	
Tunnel Reaches 5E and 5W between Southern Forebay and South Delta Outlet Structure		• Maximum Combined Flow of Tunnels 5E and 5W: 10,670 cfs (per DWR) • Number of Tunnels: 2 • Tunnel Inside Diameter: 38 feet (to maintain gravity flow) • Tunnel Outside Diameter: 41 feet • Tunnel Length: 8,816 +/- feet for each tunnel • Number of Tunnel Launch Shafts: 2 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 0 • Launch Shafts Inside Diameter (feet): 115 • Reception Shafts Inside Diameter (feet): 90	
South Delta Outlet and Control Structure		• Maximum Capacity: 10,670 cfs	
California Aqueduct Control Structure		• Maximum Capacity: 10,670 cfs	

TABLE 16. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 4,500 CFS

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E-3	Central and Eastern	242	123	119 (agriculture or habitat)
Intake C-E-5	Central and Eastern	220	86	134 (agriculture or habitat)
Lambert Road Concrete Batch Plant	Central and Eastern	15	14	N/A
Twin Cities Complex	Central	392	63	329 (agriculture or habitat) 52 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Central	11	11	N/A
Staten Island Shaft Site	Central	12	12	N/A
Bouldin Island Shaft Site	Central	585	479	87 (agriculture or habitat) 168 (RTM stockpile planted with native grasses)
Mandeville Island Shaft Site	Central	14	14	N/A
Bacon Island Shaft Site	Central	15	15	N/A
Twin Cities Complex	Eastern	392	95	297 (agriculture or habitat) 84 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Eastern	11	11	N/A
Canal Ranch Tract Shaft Site	Eastern	11	11	N/A
Terminous Tract Shaft Site	Eastern	13	13	N/A
King Island Shaft Site	Eastern	12	12	N/A
Lower Roberts Island Shaft Site	Eastern	376	158	199 (agriculture or habitat) 50 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	Eastern	13	13	N/A
Southern Complex on Byron Tract (Southern Forebay Inlet Structure tunnel launch shaft, Working Shaft tunnel launch shaft and tunnel maintenance shaft, South Delta Pumping Plant, Southern Forebay, Southern Forebay Outlet Structure and dual tunnel launch shafts)	Central	1,457	1,189	229 (agriculture or habitat) 62 (peat stockpile planted with native grasses)
Southern Complex on Byron Tract	Eastern	1,475	1,207	228 (agriculture or habitat) 79 (RTM and peat stockpile planted with native grasses)
Southern Complex located to the West of Byron Highway (South Delta Outlet and Control	Central and Eastern	164	112	53 (agriculture or habitat)

Key Feature	Corridor	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Structure and California Aqueduct Control Structure)				

Notes:

Acreage is approximate; exact area should be obtained from the GIS. Acreages include ring levees or other levee modifications, and generally exclude access roads, except for levee modification access roads.

Intake acreages are based on cylindrical tee screens. Acreages for intakes with vertical flat plate screens are included in Appendix E.

RTM and peat stockpiles planted with native grasses would be located within the post-construction boundary.

N/A = Not Applicable

7.3.1 Intakes for Project Design Capacity of 4,500 cfs

As described in Section 2.1.3, Site Selection of Intakes, three intake locations were identified for potential intake locations. For the 4,500 cfs project design capacity option, Intake C-E-5 was selected to be a 1,500 cfs intake.

Quantitative descriptions of the intake construction are presented for Intake C-E-3 at a 3,000 cfs design capacity in Appendix A for and for Intake C-E-5 at a 1,500 cfs design capacity in Appendix D.

7.3.2 Tunnels for Project Design Capacity of 4,500 cfs

The tunnels between the Intakes and the Southern Complex would be constructed in the same manner as described in Section 2.2, Tunnels and Tunnel Shafts. The tunnel dimensions are summarized in Table 13 and quantitative descriptions of the tunnel shaft construction are presented in Appendix D.

7.3.3 Southern Complex Facilities for Project Design Capacity of 4,500 cfs

The Southern Complex facilities would be constructed as described in Section 2.3, Southern Complex. The Southern Forebay and South Delta Conveyance Facilities would be identical in size as for the project design capacity of 6,000 cfs. The operating volume size was selected to provide the operational flexibility needed to support dual operation of both the DCP and the existing SWP facilities at CCF and the Banks Pumping Plant. The size is dependent on the Banks Pumping Plant capacity and is therefore independent of DCP design flow capacity. The size of the tunnel launch facilities and South Delta Pumping Plant would be different than for the project design capacity of 6,000 cfs. The sizes of these facilities for a project design capacity of 4,500 cfs are summarized in Table 13 and Appendix D.

8. Vertical Flat Plate Fish Screen-Type Option

8.1 Purpose of This Section

Section 2.1, Intakes, presented information related to intakes using cylindrical tee fish screens. During the preparation of the EPR, a second fish screen option was developed based upon vertical flat plate fish screens, schematically shown in Figure 16.

Intakes with vertical flat plate fish screens would be comprised of an on-bank structure with fish screens to protect, among others, species listed under the Federal Endangered Species Act and California Endangered Species Act from entering the DCP system, as described in Section 2.1.1.2, Fish Screens. Both cylindrical tee fish screens and vertical flat plate screens would include flow isolation and flow control equipment to maintain an even flow rate through the face of the screens. Settleable solids in the diverted flow would be captured by gravity in a sedimentation basin, and periodically removed to sediment drying lagoons for drying before being hauled to an off-site disposal site.

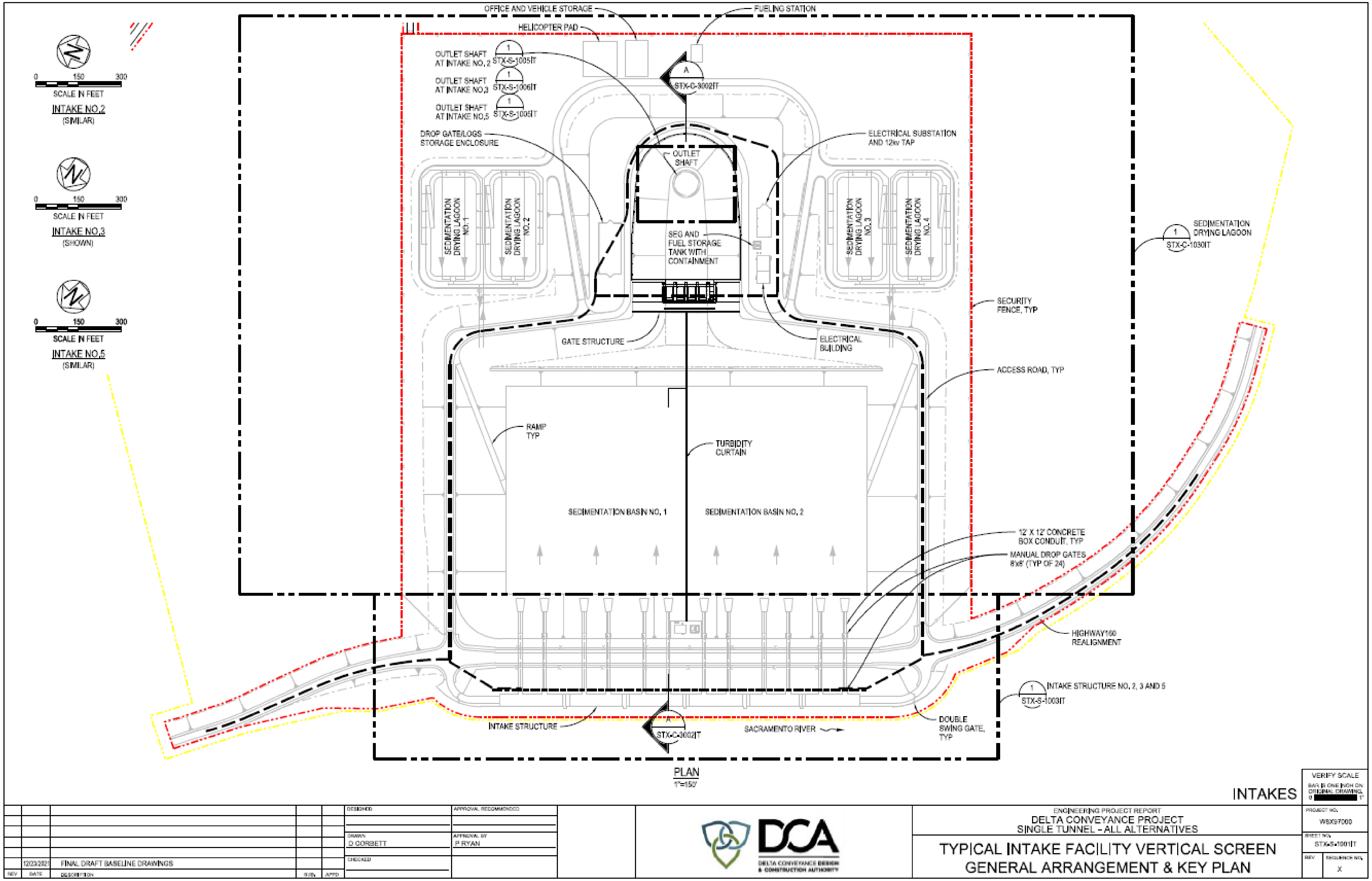
See TM – Intake Structural Configuration and Fish Screen Type Analysis (Attachment A) for detailed information

See TM – Intake Screen Sizing-North Delta Intakes (Attachment A) for detailed information

Construction of intakes with vertical flat plate fish screens would require an integrated re-location of the existing levee to a temporary position to provide a construction site for the intake, and a subsequent re-location of the levee to a location near the existing location of State Route 160, as described in Section 2.1.2, Facility Description. The intakes with vertical flat plate fish screens would also include a sedimentation basin and sediment drying lagoons, as described in Section 2.1.2.3, Sedimentation Basin and Sediment Drying Lagoons. Therefore, this section focuses on the installation of the intake structure with vertical flat plate screens.

See TM – Intakes Operations and Maintenance Equipment and Facility Needs (Attachment A) for detailed information

FIGURE 16. TYPICAL INTAKE FACILITIES: POST-CONSTRUCTION INTAKE SITE PLAN WITH VERTICAL FLAT PLATE FISH SCREEN



(From Engineering Concept Drawings, Volume 2, O1-IT)

8.2 Intakes with Vertical Flat Plate Fish Screens

Water would flow from the Sacramento River through the vertical flat plate fish screens and through a perforated baffle system immediately behind the fish screen to promote uniform approach velocity through the screen panels. A brush screen cleaner system would be provided along the river-side face of the screens to remove debris and help avoid biofouling. Water would continue through the intake structure and a series of control gates at the back of the structure would control the flow rate through the screens, then discharge the water through concrete box conduits into the sedimentation basin. A control structure at the back of the sedimentation basin would hold the water in the basin at a constant water level relative to the river level and allow the diverted flow into the intake outlet shaft.

See TM – Conceptual Intake Cofferdam Construction (Attachment A) for detailed information

The intake structure would be divided into six sections each rated for diversion of 500 cfs. Each section would be isolated from other sections and includes its own screen cleaner system and a set of two control gates and box conduits leading to the common sedimentations basins. Subdividing the structure into sections would facilitate uniform diversion flow control along the length of the intake structure.

Because of the slow approach velocity and slow velocity of the diverted river water inside the structure, sediment suspended in the river flow would settle in the slower velocity intake structure areas. A sediment jetting system would use water jets discharged through a series of nozzles positioned in front of and inside the intake structure. These jets would stir up the sediment so that even at the slow velocities within the intake structure, the sediment would be swept into the sedimentation basin or swept downstream by flow in front of the screens. Jetting would be performed frequently so only minimal amounts of settled material are ever stirred up at any one time.

Most construction methods for intakes with vertical flat plate fish screen would be the same as described in Section 2.1.2, Facility Description, including minimizing intake construction area by not including tunnel launch shafts, temporary levee and State Route 160 relocation, cofferdam construction, concrete batch plants and parking for more than 200 employees to be located remote from the intakes. The intake construction sequencing would also be established to minimize import or export of major soil volumes. To minimize disturbances that could occur during pile driving, vibratory pile driving and drilled piers would be used if supported by additional geotechnical information to be collected from the intake sites.

See TM – Conceptual Intake Cofferdam Construction (Attachment A) for detailed information

As described for intakes with cylindrical tee fish screens in Section 2.1.2, Facility Description, construction would be initiated concurrently at Intakes C-E-3 and C-E-5; however, the construction duration would be 10 years and 8 years, respectively. The differences in construction periods reflect different site layouts and riverbank conditions and removal of the TBM equipment from the tunnel at Intake C-E-3.

8.2.1 Vertical Flat Plate Fish Screen Construction Methods

See TM – Intake Structural Configuration and Fish Screen Type Analysis (Attachment A) for detailed information

See TM – Intakes Operations and Maintenance Equipment and Facility Needs (Attachment A) for detailed information

The vertical flat plate fish screens would be part of an overall system that includes the screens, guide rails for installing them on the face of the structure, solid panels, baffle panels, and a screen cleaning system. The vertical flat plate fish screen panels would be stainless steel metal fabrications conforming to the dimensions shown on the engineering concept drawings. The panels would consist of a tube steel frame overlaid with a slotted screen material fabricated from 1.75 millimeter wide wedge wire, similar to a well screen. The screen material would include 1.75 millimeter gaps between individual wedge wires to provide about 50 percent open area, which complies with the regulatory requirements of a minimum 27 percent open area. The screen panels include minor support bars behind the screens. They would also include ultrahigh molecular weight polyethylene (UHMWPE) runners along each side of the panels to facilitate installation as well as to allow custom fit adjustment in the field. The screens would be fabricated to high straightness tolerance for the frame and the screen face area (within plus or minus 0.125 inches from a plane). Frame straightness would provide no gaps larger than 1/16 inch around the edges and at the interfaces on the top and the bottom.

Screens would be installed in stainless steel guide rails that extend down the face of the concrete structure at a spacing to accept a 15-foot nominal width screen panels. Guide rail fabrication tolerances would be compatible with the gap allowances stated above. The UHMWPE runners would be planted in the field, if necessary, to achieve the desired fit.

Solid panels, with dimensions similar to the screen panels, would be installed in the guide rails above the screen panels. The quantity of solid panels would be sufficient to extend slightly above the intake structure top deck. Since these panels would be solid, they would effectively force all diverted water to flow through the screen panels. The solid panels would be metal fabrications made using stainless steel or carbon steel with a coating. Solid panel structural frames would have the same straightness tolerances as screen panels since they would also be excluding fish from the structure.

The baffle plates would be a series of adjustable stainless steel (or other materials to be determined) plates installed immediately behind the fish screen panels. The baffle plates would have an identical orifice opening pattern covering each pair of aligned plates. Several plate pairs would be arranged into a single panel behind the screen to manage screen flow in sections. The plates would move independent of one another to adjust the size of the orifice openings and therefore affect the flow through that portion of the fish screen directly between the baffle panel. The baffle panels would be installed in a dedicated guide rail behind the fish screen panels. The panels would be adjustable. The exact configuration of the panels and guide rails would be developed during design.

A fish screen cleaning system would be installed on the outside face of the structure to brush the face of the fish screen to remove debris and facilitate biogrowth control. The screen cleaner is a large brush, the full height of the screen panel, with several independently articulating brush sections. A counterweight system keeps the brush sections pressed against the fish screen. The brush assembly would run back and forth on a monorail system installed above the screen panels. A gear motor with a cable and pulley system pulls the cleaning brush back and forth across the screens. The fish screen cleaner would be fabricated from painted carbon steel with nylon brushes and a stainless steel wire rope cable.

Ground improvement methods considered at the intake locations are described in Section 6.3.3, Ground Improvement Methods.

Quantifications of construction conditions for the intakes are summarized in Appendix E.

8.2.2 Vertical Flat Plate Fish Screen Operation Methods

Operations and maintenance (O&M) activities at the intakes with vertical flat plate fish screens would be essentially the same as described in Section 2.1.2.5 for the cylindrical tee screens except the screen and baffle panels and screen cleaning system O&M would be slightly different as described in this section.

Screen and panel cleaning would be required to remove algae growth, freshwater sponges, and freshwater snails that populate on the back of the various panels. This activity would be conducted from the top deck of the intake structure approximately every three months when river depth is low enough to prevent flow into the structure as solid panels are moved to the center guide slot. The frequency would be increased or decreased depending on actual build-up of material that fouls the panels. The goal would be to conduct cleaning before substantial biofouling is present.

See TM – Intakes Operations and Maintenance Equipment and Facility Needs (Attachment A) for detailed information

The cleaning procedure would involve the following actions:

- If needed, the baffle panel would be retrieved up the back guide slot to the top of the structure, inspected, and cleaned using a high-pressure spray washer and returned to the original location.
- Next, the upper solid panel would be retrieved to the top of the structure, inspected, and cleaned with the high-pressure spray. The solid panel would be lowered into the (empty) center guide slot immediately behind the screen panel.
- The process would be repeated for each solid panel. Since the solid panels are placed in the slot just behind the screens, they create a solid barrier preventing fish from being drawn into the structure. By conducting the work during low water level periods, or by using spare solid panels, the river level would never be higher than the panels in either the front or center guide slot, whichever is higher.
- After all the solid panels are cleaned and temporarily placed in the guide slot behind the screen, the fish screen would be pulled up and thoroughly cleaned and inspected. The fish screen would be replaced in its original position and the solid panels and baffle plate would be returned to their original positions in reverse order.

Initially when the facility is placed in service, baffle plates that provide inflow porosity control would be adjusted to achieve the best uniform flow profile over the surface of all of the fish screens in each 500 cfs flow section of the intake. This adjustment would be guided by three-dimensional velocity readings taken by a meter positioned in front of the screens to give real time measurements of the approach velocity. Normally, the approach velocity would be measured in the field using a velocity probe positioned in front of the screen panel using a jig attached to the screen cleaner monorail assembly. The probe position would be manually adjusted by technicians in a boat moored along the face of the screen. The porosity adjustments would be made at full flow since the approach velocity would drop as the flow capacity is reduced. After setting the baffle plates, the baffle plates would periodically be verified for effectiveness, about once a year, preferably at variable river depths.

The screen cleaner would be inspected while operational along with the screens. In accordance with the inspection results, the brushes could be replaced, additional counterweight could be added, or the entire assembly could be removed and replaced or repaired. Operations staff would continuously monitor the sag in the wire rope cable that drives the screen cleaner and adjust the tension to account for temperature changes or deformation of the cable over time.

9. References

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10. Appendices

Appendices A through D to the Final Draft Engineering Project Report provide summaries of quantitative information from the engineering concept drawings for the Central Corridor and Eastern Corridor Options for the project design capacities of 6,000 cfs, 7,500 cfs, 3,000 cfs, and 4,500 cfs using cylindrical tee fish screens.

Appendix E provides summary of quantitative information from the engineering concept drawings for intakes using vertical flat plate screen. Appendices F through I include preliminary construction and operations and maintenance information for the EIR air quality and traffic analyses.

The appendices do not include information presented in the Technical Memoranda unless the information is relative to information from the engineering concept drawings. For example, information related to providing connections to electrical supplies is included in the Electrical Power Load and Routing Study Technical Memorandum in Attachment G, Utilities. In a similar manner, all quantifications of excavated soil and Reusable Tunnel Material (RTM) are presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. Therefore, the appendices do not include information related to electric power transmission, geotechnical information, soil balance, hydraulic analysis criteria, levee vulnerability, siting analyses, or design and construction methods.

APPENDIX A - Summary of Information for the Project Design Capacity of 6,000 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 6,000 cfs with cylindrical tee fish screens.

This appendix includes the following sections.

- **Section 10.1.1 Intakes C-E-3 and C-E-5**
  - **Table A1.** Construction Conditions and Constructed Facilities Summary for Intakes C-E-3 and C-E-5 for 3,000 cfs Design Capacity, each, with Cylindrical Tee Fish Screens
- **Section 10.1.2 Tunnels – Central Corridor between Intakes and Southern Complex**
  - **Table A2.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for Central Corridor between Intakes and Southern Complex for a Project Design Capacity of 6,000 cfs
  - **Table A3.** Construction Conditions and Constructed Facilities Summary for Twin Cities Complex and Dual Tunnel Launch Shafts
  - **Table A4.** Construction Conditions and Constructed Facilities Summary of New Hope Tract Tunnel Maintenance Shaft (Central Corridor)
  - **Table A5.** Construction Conditions and Constructed Facilities Summary of Staten Island Tunnel Maintenance Shaft
  - **Table A6.** Construction Conditions and Constructed Facilities Summary for Bouldin Island Tunnel Reception and Launch Shaft
  - **Table A7.** Construction Conditions and Constructed Facilities Summary of Mandeville Island Tunnel Maintenance Shaft
  - **Table A8.** Construction Conditions and Constructed Facilities Summary of Bacon Island Tunnel Reception Shaft
- **Section 10.1.3 Tunnels – Eastern Corridor between Intakes and Southern Complex**
  - **Table A9.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for Eastern Corridor from Intakes to Southern Complex for a Project Design Capacity of 6,000 cfs
  - **Table A10.** Summary of RTM Storage at Twin Cities Complex for a Project Design Capacity of 6,000 cfs
  - **Table A11.** Construction Conditions and Constructed Facilities Summary of New Hope Tract Tunnel Maintenance Shaft (Eastern Corridor)
  - **Table A12.** Construction Conditions and Constructed Facilities Summary of Canal Ranch Tract Tunnel Maintenance Shaft
  - **Table A13.** Construction Conditions and Constructed Facilities Summary of Terminous Tract Tunnel Reception Shaft

  - **Table A14.** Construction Conditions and Constructed Facilities Summary of King Island Tunnel Maintenance Shaft
  - **Table A15.** Construction Conditions and Constructed Facilities Summary for Lower Roberts Island Tunnel Reception and Launch Shaft
  - **Table A16.** Construction Conditions and Constructed Facilities Summary of Upper Jones Tract Tunnel Maintenance Shaft
- **Section 10.1.4 Southern Complex on Byron Tract**
  - **Table A17.** Construction Conditions and Constructed Facilities Summary for Byron Tract Tunnel Working Shaft and Southern Forebay Inlet Structure Tunnel Launch Shaft
  - **Table A18.** Construction Conditions and Constructed Facilities Summary for the Southern Forebay and Overall Conditions at the Southern Complex on Byron Tract
  - **Table A19.** Construction Conditions and Constructed Facilities Summary for the South Delta Pumping Plant
  - **Table A20.** Construction Conditions and Constructed Facilities Summary for Southern Forebay Outlet Structure Dual Tunnel Launch Shaft
  - **Table A21.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths from the Southern Forebay to Banks Pumping Plant Approach Channel
- **Section 10.1.5 Southern Complex Located to the West of Byron Highway**
  - **Table A22.** Construction Conditions and Constructed Facilities Summary for South Delta Outlet And Control Structure, including Reception Shaft, and California Aqueduct Control Structure
- **Section 10.1.6 Access Roads**
  - **Table A23.** Access Roads to Construction Sites for Project Design Capacity of 6,000 cfs
  - **Table A24.** Piles and Piers for Access Roads for Project Design Capacity of 6,000 cfs

10.1.1 Intakes C-E-3 and C-E-5

Table A1. Construction Conditions and Constructed Facilities Summary for Intakes C-E-3 and C-E-5 for 3,000 cfs Design Capacity, each, with Cylindrical Tee Fish Screens

TABLE A1. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR INTAKES C-E-3 AND C-E-5 FOR 3,000 CFS DESIGN CAPACITY, EACH, WITH CYLINDRICAL TEE FISH SCREENS

Items	Quantities
Construction Hours for Intake C-E-3 and Intake C-E-5, each	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Connection of relocated State Route 160 onto temporary levee and permanent levee: at night if allowed by Caltrans Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.

Items	Quantities
Temporary Levee and State Route 160 Levee Dimensions for Intake C-E-3 and Intake C-E-5	Length of Temporary Levee • Intake C-E-3: 4,250 feet along the centerline • Intake C-E-5: 4,200 feet along the centerline Top elevation of Temporary Levee • Intake C-E-3: approximately 30 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 23 feet) with sea level rise for 2040 and 3 feet of freeboard • Intake C-E-5: approximately 29 feet (18 to 20 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 22 feet) with sea level rise for 2040 and 3 feet of freeboard Width of Top of Temporary Levee = 60 feet including State Route 160 Width of Bottom of Temporary Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus shoulders and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Temporary Levee for Intake C-E-3 and Intake C-E-5	The temporary levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee would only be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee • Intake C-E-3 would extend to an elevation -24 feet (this elevation is just above the nearby portions of the river bottom) • Intake C-E-5 would extend to an elevation -20 feet (this elevation is just above the nearby portions of the river bottom)

Items	Quantities
Permanent Levee and State Route 160 Dimensions (State Route 160 would be relocated to a fill pad between the intake structure and the sedimentation basin) for Intake C-E-3 and Intake C-E-5	Length of Permanent Levee • Intake C-E-3: 7,600 feet along the centerline • Intake C-E-5: 6,200 feet along the centerline Top elevation of Permanent Levee • Intake C-E-3: 30.3 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 27.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020b) • Intake C-E-5: 29.3 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 26.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020b) Width of Top of Permanent Levees = 60 feet including State Route 160 Width of Bottom of Permanent Levees = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus deceleration and turning lanes for intake site access, shoulders, and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Permanent Levee for Intake C-E-3 and Intake C-E-5, each	The permanent levee embankment would be constructed around the sedimentation basin and the outlet channel. The levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee placement would be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would be within the excavation footprint for the sedimentation basin and would extend to elevation -20 feet (this elevation is just above the nearby portions of the river bottom) Native grass would be planted on the non-water side of the levee. Erosion protection would be placed on the interior side of the sediment basin embankment. The inside of the levee would be protected from erosion as described above. The outside of the embankment would be planted with native grass.
Ground Improvement for Intake C-E-3 and Intake C-E-5, each	Ground improvement would be installed under the levees and facilities embankments. The quantity of improved ground would be approximately 1.5 to 2.0 million cubic yards of mixed wall sections and approximately 250,000 to 350,000 tons of cement.

Items	Quantities
Cofferdam at Intake C-E-3	Length = 2942 feet (including sheet piles and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Cofferdam at Intake C-E-5	Length = 2897 feet (including sheet piles and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-3	Length of cofferdam and training wall sheet pile system = 1928 feet Approximate number of piles ("Z" sheet pairs) = 420 (includes 343 in front row of cofferdam and training walls) Preliminary cofferdam sheet pile tip elevations = -60 feet Length of cofferdam DMM wall system = 714 feet Preliminary DMM wall bottom elevation = -100 Approximate number of drilled piers within cofferdam = 1215 Preliminary drilled pier tip elevation = -100 Pile drivability: Number of blows per sheetpile pair = 19 Total number of blows = 7980 Estimated total impact pile driving time (time for the partial vibratory pile installation, equipment setup, periodic alignment check, and downtime are not included) = 15 hours
Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-5	Length of cofferdam and training wall sheet pile system = 1883 feet Approximate number of piles ("Z" sheet pairs) = 410 (includes 332 in front row of cofferdam and training walls) Preliminary cofferdam sheet pile tip elevations = -55 feet Length of cofferdam DMM wall system = 714 feet Preliminary DMM wall bottom elevation = -100 Approximate number of drilled piers within cofferdam = 1215 Preliminary drilled pier tip elevation = -100 Pile drivability: Number of blows per sheetpile pair = 10 Total number of blows = 4100 Estimated total impact pile driving time (time for the partial vibratory pile installation, equipment setup, periodic alignment check, and downtime are not included) = 14 hours
Intake Structure at Intake C-E-3	Length = 1574 feet along river including training walls Length = 964 feet along river for concrete structure only Top elevation = 30.3 feet which would be about 55 to 65 feet above river bottom; Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 10 feet

Items	Quantities
	River elevation at this location = -25 to -30 feet Intake Structure floor elevation would be at the bottom of screen panel = -16 feet Intake Structure concrete front slab elevation = -17 feet Fish Screen Elevation at the bottom of the fish screen = -13 feet Gantry Crane on top of Intake Structure width = 35 feet Gantry Crane on top of Intake Structure top elevation = 70 feet (40 feet above Intake Structure)
Intake Structure at Intake C-E-5	Length = 1528 feet along river including training walls Length = 964 feet along river for concrete structure only Top elevation = 29.3 feet which would be about 41 to 51 feet above river bottom; Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 11.3 feet River elevation at this location = -15 to -22 feet Intake Structure floor elevation would be at the bottom of screen panel = -16 feet Intake Structure concrete front slab elevation = -17 feet Fish Screen Elevation at the bottom of the fish screen = -13 feet Gantry Crane on top of Intake Structure width = 35 feet Gantry Crane on top of Intake Structure top elevation = 69 feet (40 feet above Intake Structure)
Cylindrical Tee Screen Assembly for Intake C-E-3 and Intake C-E-5, each	Number of Fish Screen Units = 30 Each unit: 8 feet in diameter and 30 feet long, including fish screen and manifold assembly, and mounted on the face of the structure Each unit includes internal and external fixed brush cleaning system Each unit would extend about 12 feet from the intake structure into the river Complete assembly includes 60-inch diameter piping and control gates from the screen unit to the sedimentation basin
Portable Fish Screen Pressure Washer (not mounted on Intake Structure) for Intake C-E-3 and Intake C-E-5, each	Trailer mounted rig to maneuver equipment for pressure washing screens would be approximately 6 feet tall, 6 feet wide, and 8 feet long. A standard pickup truck would tow this rig.
Portable Mobile Crane (not mounted on Intake Structure) for Intake C-E-3 and Intake C-E-5, each	Mobile crane to load and unload intake features would be approximately 15 feet tall, 20 feet wide, and 400 feet long. A 100-foot long boom would be extended from the main crane. Standard tractor trailer rig with a flat-bed trailer would be used to transport panels to and from the intake.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment for Intake C-E-3	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep for a total of approximately 8,600 cubic yards of riprap, or 16 barge round trips (assuming 1 barge with a capacity of 1000 tons).

Items	Quantities
	About 13,300 cubic yards of excavated material would be dredged from the river outside the cofferdam to support intake construction and riprap placement. This material would be transported to an existing and properly permitted off-site disposal area using 28 barge round trips. An additional 3 barge round trips would be required to support riprap placement, dredging, and log boom installation. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard. Barges would only move through the Delta during weekday daylight hours.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment for Intake C-E-5	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep for a total of approximately 6,800 cubic yards of riprap, or 12 barge round trips (assuming 1 barge with a capacity of 1000 tons). About 8,700 cubic yards of excavated material would be dredged from the river outside the cofferdam to support intake construction and riprap placement. This material would be transported to an existing and properly permitted off-site disposal area using 19 barge round trips. An additional 3 barge round trips would be required to support riprap placement, dredging, and log boom installation. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard. Barges would only move through the Delta during weekday daylight hours.
Sedimentation Basin Dimensions for Intake C-E-3	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1300 feet long and 650 feet wide at top of the embankment. Top elevation of embankment = 30.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 27 feet Each cell would be 990 feet long and 500 feet wide at bottom of the embankment. Bottom elevation: -18 feet Sedimentation Basin Side Slopes - Side slopes would be 3H:1V. Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.

Items	Quantities
Sedimentation Basin Dimensions for Intake C-E-5	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1300 feet long and 645 feet wide at top of the embankment. Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 26 feet Each cell would be 990 feet long and 500 feet wide at bottom of the embankment. Bottom elevation: -18 feet Sedimentation Basin Side Slopes - Side slopes would be 3H:1V. Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sediment Basin Radial Gate Flow Control Structure at the Junction with the Outlet Structure and Intake Outlet Shaft for Intake C-E-3	Four Large Radial Gates: 30 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 30.3 feet Bottom elevation of Flow Control Structure = - 8.8 feet
Sediment Basin Radial Gate Flow Control Structure at the junction with the Outlet Structure and Intake Outlet Shaft for Intake C-E-5	Four Large Radial Gates: 30 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 29.3 feet Bottom elevation of Flow Control Structure = - 9 feet
Outlet Channel from Flow Control Structure to Intake Outlet Shaft at Intake C-E-3	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 146 feet wide Top elevation of embankment = 30.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 8.8 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Outlet Channel from Flow Control Structure to Intake Outlet Shaft at Intake C-E-5	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 146 feet wide Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 9 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Sediment Drying Lagoons Dimensions for Intake C-E-3 and Intake C-E-5, each	Four sediment drying lagoons

Items	Quantities
	Each lagoon would be approximately 146 feet wide and 350 long at the bottom of the embankment. Each lagoon would be approximately 15 to 18 feet deep and contain an average of 10 to 12 feet of water. Embankment slopes would be 1H:1V. Side slopes and bottom would be concrete lined to facilitate removal of dried sediment. Sediment depth approximately 1 foot distributed over the floor of the lagoon during operations.
Sediment Drying Lagoons Outlet Structure (to convey water from the lagoons to a pump that to return any water to the Sediment Basin) for Intake C-E-3 and Intake C-E-5, each	Each lagoon would have an outlet structure: approximate 15 feet wide by 15 feet tall. Top elevation at the top of lagoon embankment. Bottom elevation 20 to 25 feet below top elevation.
On-site Electrical Substations – during Construction and Operation Phases for Intake C-E-3 and Intake C-E-5, each	An electrical substation would be established near the haul road entrance to the work site at the eastern boundary of the intake site. The substation would include switches, transformers, and related electrical gear housed within a 75 foot wide by 125 foot long enclosure with a separate safety and security fence. The substation would also be within the fenced secure total construction site area. After construction of the embankment, this substation would be relocated to the top of the embankment as shown on the engineering concept drawings. Smaller transformers less than 10 feet wide by 10 feet long would be positioned at several locations around the site. The transformers would have suitable containment, if required, and would be within the fenced secure total construction site area and additional security would not be needed.
Standby Engine Generator/Fuel Tank – during Construction and Operation Phases for Intake C-E-3 and Intake C-E-5, each	A 1 megawatt standby engine generator with a 1528 horsepower engine would be used primarily to supply the office complex and possibly to recharge electrical equipment during construction. The standby engine generator would be installed inside a fenced area of about 30 feet by 30 feet, including both the generator and the fuel tank. The fuel would be provided by a diesel tank with suitable containment or a propane tank stored above ground. After construction of the embankment, the standby engine generator would be replaced with new permanent generators at locations on the top of the embankment as described above and as shown on the engineering concept drawings. The permanent standby engine generators would provide energy to operate the valves and gates, including the ability to stop diversions at the intake structure.
Appurtenant Structures Dimensions – during Construction Phase for Intake C-E-3 and Intake C-E-5, each	Office trailers, showers/washrooms, a canteen and common area, and a bus shelter would be installed to serve the construction workers and other on-site personnel. Most of these buildings would be 15-feet tall or less (one story). Other buildings for warehousing for materials and temporary work enclosures would be less than 20 feet tall.
Appurtenant Structures Dimensions – during Operations Phase for Intake C-E-3 and Intake C-E-5, each	One of the construction buildings would be used for indoor storage of portable equipment and vehicles used for maintenance of all intakes during operations.
Duration for Concrete Pours	For each Intake:

Items	Quantities
	• Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month, not sequential For Intake C-E-3: • Daytime concrete pour would throughout 358 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 145 weeks over the 358-week period. For Intake C-E-5: • Daytime concrete pour would throughout 307 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 148 weeks over the 307-week period.
On-Site Access Roads – during Construction Phase for Intake C-E-3 and Intake C-E-5, each	Approximately 2.5 miles of roads would be constructed within the intake site. Most of the interior roads would be covered with gravel, gravel over geotextile material, or paved depending upon the amount of vehicle use envisioned. Roads leading to the access road would be paved, including roads at the main office buildings and bus shelter.
On-Site Access Roads – during Operations Phase for Intake C-E-3 and Intake C-E-5, each	Towards the end of construction, about 8,900 feet (Intake C-E-3) and 8,300 feet (Intake C-E-5) of paved permanent access roads would be installed. Access to the intake site would occur from State Route 160 and from an access/haul road located to the west of the abandoned railroad embankment that would be installed during construction. These access roads would be 24-foot wide paved roads. Several internal access roads would be constructed around the base of the outlet shaft area, along the top of the embankments, and on ramps up the side of the embankments. These roads would receive substantial vehicle use, and therefore, would also be 24-foot wide paved roads. Approximately 6,500 feet of 20-foot wide gravel roads would be constructed around the sediment drying lagoons, along the length of the sedimentation basin parallel to State Route 160, and to provide access along the sediment loading areas.
On-Site Parking and Construction Materials and Vehicle Staging Areas – during Construction Phase for Intake C-E-3 and Intake C-E-5, each	An area approximately 100 feet wide by 200 feet long would be provided near the office complex for employee parking. Several small parking areas would be located near the office buildings and laydown areas to support vehicles for special tools and deliveries. An area approximately 200 feet wide by 200 feet long would be provided a bus that would transport employees from the park and ride lots near Interstate 5. Approximately 30 acres would be used for construction material staging and equipment management, including 15 acres for vehicle and equipment storage and maintenance. Areas used for equipment maintenance would use gravel surfaces, and areas used for vehicle and equipment storage would use unpaved surfaces. Areas with containment structures would be used for refueling and maintenance using grease, oils, or other similar chemical compounds.

Items	Quantities
On-Site Parking – during Operations Phase for Intake C-E-3 and Intake C-E-5, each	An area approximately 50 feet wide by 100 feet long would be provided for operations and maintenance workers and vehicle storage. Two areas located to the east of the sediment drying lagoons, approximately 3.5 acres, each, would be used to stage loading of the dried sediment into trucks for disposal.
Fencing and Security – during Construction Phase for Intake C-E-3 and Intake C-E-5, each [1]	Approximately 20,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include 24-hours site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations and security personnel would be in contact using cell phones or short wave radio.
Fencing and Security – during Operations Phase for Intake C-E-3 and Intake C-E-5, each [1]	Approximately 10,000 feet (Intake C-E-3) and 9,600 feet (Intake C-E-5) of 8-foot tall permanent chain link security fencing to enclose both the river side and land side of the facility along State Route 160. Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information.
Lighting Facilities – during Construction and Operations Phases for Intake C-E-3 and Intake C-E-5, each	Lights on land would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. Lights along the waterway would be for safety and navigational purposes only. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Emergency Response Facilities - during Construction Phase for Intake C-E-3	An emergency services building would be about 30 feet tall. The facilities would include an emergency services building, ambulance with accommodations for two sets of full-time staff during work hours (up to 7 people), a rescue boat, and a fire truck with accommodations for a full-time crew (approximately 5 people covering each construction shift). The emergency personnel could include construction management staff that would be crossed trained. During construction, the emergency response facility would be located in the building that would ultimately be used for General Maintenance and Storage during operations. The building would include 7 to 8 bays to maintain the facilities. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.

Items	Quantities
Wastewater Facilities – during Construction and Operations Phases for Intake C-E-3 and Intake C-E-5, each	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be maintained during long-term operations. The septic tank and leach field would be located near the eastern boundary of the intake but outside of the ground improvement areas. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site at the intake site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits.
SWPPP Facilities – during Construction for Intake C-E-3 and Intake C-E-5, each	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases for Intake C-E-3 and Intake C-E-5, each	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to the Sacramento River.
Fire Water Supplies Stored On-site for Intake C-E-3	300,000 gallons to provide up to 2,500 gallons/minute for 2 hours
Fire Water Supplies Stored On-site for Intake C-E-5	300,000 gallons to provide up to 2,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.2 Tunnels – Central Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 6,000 cfs for the Central Corridor are summarized in Table A2. Information for the tunnel shafts between the intakes and Southern Complex for the Central Corridor are presented in Tables A3 through A8. Information related to construction of the tunnel shafts at the intakes are included in Table A1.

TABLE A2. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FOR CENTRAL CORRIDOR BETWEEN INTAKES AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 6,000 CFS

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Reception Shaft at Intake C-E-3	-143	148	Not Applicable	Not Applicable
Tunnel Maintenance Shaft at Intake C-E-5	-144	152	13,254	Not Applicable
Tunnel Launch Shaft Site on Twin Cities Complex	-146	156	29,828	Snodgrass Slough
Tunnel Maintenance Shaft on New Hope Tract	-148	149	22,365	Mokelumne River
Tunnel Maintenance Shaft on Staten Island	-151	141	22,168	South Fork Mokelumne River
Tunnel Reception Shaft and Tunnel Launch Shaft on Bouldin Island	-154	135	31,971	South Fork Mokelumne River
Tunnel Maintenance Shaft on Mandeville Island	-156	141	24,624	Potato Slough San Joaquin River
Tunnel Reception Shaft on Bacon Island	-159	145	28,481	Old River
Tunnel Working Shaft Site on Byron Tract (within Southern Complex)	-162	153	30,401	Railroad Cut Indian Slough Old River
Tunnel Launch Shaft Site on Byron Tract (Southern Forebay Inlet Structure at the South Delta Pumping Plant)	-163	157	5,069	Not Applicable
TOTAL TUNNEL LENGTH			208,160	

10.1.2.1 Twin Cities Complex

TABLE A3. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR TWIN CITIES COMPLEX AND DUAL TUNNEL LAUNCH SHAFTS (CENTRAL CORRIDOR)

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 5 days for each pour. Tunneling would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. RTM drying and testing would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. Tunnel segment and materials deliveries – could occur at night due to railroad schedules and/or traffic congestion.
Ground Improvement	No ground improvement would be required for construction of the launch shafts, materials and equipment storage areas, tunnel liner segment storage area, and RTM handling and storage areas. No ground improvement is anticipated at this site because it is either

Items	Quantities
	underlain by soils with a low compressibility or by Riverbank old alluvium that are more dense and less compressible than flood plain deposits; and therefore liquefaction would not be anticipated at this site.
Tunnel Launch Shaft Pad for Dual Launch Shafts	Top of shaft pad = 11 feet above ground Top of shaft pad elevation = 21 feet Top of shaft pad length = 500 feet Top of shaft pad width = 300 feet Depth of ground improvement = 0 feet Finished shaft elevation = 35 feet
Tunnel Launch Shaft Pad Gantry Crane	Gantry Crane = 90-foot high crane over each launch shaft Crane Pad on Shaft Pad = 80-foot wide x 35-foot long for each launch shaft
Dual Tunnel Shaft, one for each Shaft	Shaft Depth during construction = 172 feet Shaft Depth during operations = 186 feet
Shaft Ventilation Fan Housing, one for each Shaft	30-foot wide x 20-foot long, up to 30 feet tall
Tunnel Liner Segment Storage, one for each Shaft	6 acres for 4-months supply plus 1 acre staging/unloading area (assume segments stored 4-segments high [10-foot high])
TBM Storage Building and Laydown Area, one for each Shaft	Each building = 70-foot wide x 125-foot long, up to 12 feet tall Each laydown area = 60-foot wide x 170-foot long
Diaphragm Wall Slurry Plant, one for each Shaft	Each with an area = 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
TBM Grout Slurry Plant and Facilities, one for each Shaft	Each has an area for slurry/grout mixing plant= 35-foot wide x 55-foot long Each with silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos (six total silos)
Mechanical Drying Area, one for each Shaft	2 acres
Temporary Dry Stockpile, one for each Shaft	4.3 acres x 10 feet high
Temporary Wet Stockpile, one for each Shaft	9.1 acres x 5 feet high
Wet Storage, one for each Shaft	7.3 acres x 5 feet high
Drying Area, one for each Shaft	36.6 acres
Temporary Stockpile, tunnel reach 1	56 acres x 20 feet high
Temporary Stockpile, tunnel reach 2	99 acres x 20 feet high
RTM Mechanical Dryer Equipment	Sixteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Emergency Response Facilities during Construction	The facilities would include two ambulances because there are two launch shafts. Each with accommodations for one set of full-time staff during work hours (up to 7 people) and a fire truck with accommodations for a full-time crew (approximately 5 people covering each construction shift). The emergency personnel could include construction management staff that would be crossed trained. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.

Items	Quantities
Contractor's and Owner's Offices	Two sets of eight buildings, all up to 12 feet tall Miner's Site Facility – 100 feet by 30 feet Contractor Offices – 100 feet by 60 feet Health and Safety – 60 feet by 20 feet Owner's Offices – 80 feet by 60 feet TBM Part Storage – 125 feet by 70 feet General Tool Equipment Storage – 100 feet by 50 feet TBM Tool and Equipment storage – 35 feet by 50 feet Steel Stockpile Storage – 35 feet by 70 feet
Equipment Storage and Ventilation Equipment Storage Buildings, one for each Shaft	Two buildings for each shaft, 100-foot wide x 50-foot long, up to 20 feet tall each (four buildings total)
Steel Fabrication Area and Miscellaneous Steel Storage Buildings, one for each Shaft	Two buildings for each shaft, 70-foot wide x 35-foot long, up to 20 feet tall each (four buildings total)
Maintenance Shop, one for each Shaft	60-foot wide x 35-foot long, up to 25 feet tall each
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month (for both tunnel shafts) Daytime concrete pour would throughout 108 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 28 weeks over the 108-week period.
Parking Spaces during Construction, one for each Shaft	Parking spaces, each with 60 10-foot by 20-foot parking spaces
Standby Engine Generator during Construction	A standby engine generator would be required in case of power interruptions to provide essential services to the tunnel and TBM, including ventilation, lighting, lift, and sump pumps. Isolated fuel tank, 8-foot diameter tank x 25-foot long installed on a 20-foot x 30-foot concrete pad with a containment lined area with berms.
Standby Engine Generators during Operations	Two portable standby engine generators loaded on trailers, 10-foot wide x 40-foot long, each. One generator would be 1.5 megawatt with a 2000 brake-horsepower engine; and one generator would 2.0 megawatt with a 2,500 brake-horsepower engine.
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Rail-Served Materials Depot Facilities	3.6 miles of new track 15 rail turnouts of sizes between "#15 and #9" Aggregate unloading pit Public-at-grade crossing at Franklin Boulevard
Fencing and Security – during Construction Phase [1]	Approximately 19,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.
Fencing and Security – during Operations Phase [1]	During operations, approximately 12,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards

Items	Quantities
	would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, RTM, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, or temporary silt fence would be installed on any slope greater than 2H:1V, not including the RTM processing area.
Wastewater Facilities during Construction	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be constructed for use during construction. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits. The septic system would be abandoned in accordance with county regulations at the end of construction.
Wastewater Facilities during Operations	Portable restrooms would be hauled to the tunnel shaft site during maintenance activities.
SWPPP Facilities - during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to adjacent drainage.
RTM Area	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 130 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.

Items	Quantities
Fire Water Supplies Stored On-site	1,000,000 gallons to provide up to 4,500 gallons/minute for 4 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.2.2 New Hope Tract (Central Corridor)

TABLE A4. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF NEW HOPE TRACT TUNNEL MAINTENANCE SHAFT (CENTRAL CORRIDOR)

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for the pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 50 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 17 feet above ground Top of shaft pad elevation = 18 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 50 feet Finished shaft elevation = 35 feet
Tunnel Shaft	Shaft Depth during construction = 171 feet Shaft Depth during operations = 188 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor’s and Owner’s Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel Storage – 10 feet by 20 feet, up to 15 feet tall Generator Building – 10 feet by 20 feet, up to 12 feet tall, 100-foot wide x 40-foot long steel fabrication area.
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 36 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 7 weeks over the 36-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces

Items	Quantities
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 2,900 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 2,900 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.

Items	Quantities
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.2.3 Staten Island

TABLE A5. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF STATEN ISLAND TUNNEL MAINTENANCE SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for the pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 55 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 24 feet above ground Top of shaft pad elevation = 14 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 15 feet Finished shaft elevation = 35.5 feet
Tunnel Shaft	Shaft Depth during construction = 170 feet Shaft Depth during operations = 192 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor's and Owner's Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel storage – 10 feet by 20 feet, up to 15 feet tall Generator – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long steel fabrication area
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month

Items	Quantities
	Daytime concrete pour would throughout 34 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 12 weeks over the 34-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 2,900 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 2,900 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the

Items	Quantities
	site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.2.4 Bouldin Island

TABLE A6. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR BOULDIN ISLAND TUNNEL RECEPTION AND LAUNCH SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for the pour. Tunneling would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. RTM drying and testing would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. Tunnel segment and materials deliveries – could occur at night due to traffic congestion.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 55 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Launch Shaft Pad	Top of shaft pad = 32 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 420 feet Top of shaft pad width = 320 feet Depth of ground improvement = 55 feet Finished shaft elevation = 34 feet
Tunnel Launch Shaft Pad Gantry Crane	Gantry Crane = 90-foot high crane over the launch shaft Crane Pad on Shaft Pad = 80-foot wide x 35-foot long
Tunnel Shaft	Shaft Depth during construction = 172 feet

Items	Quantities
	Shaft Depth during operations = 193 feet
Shaft Ventilation Fan Housing	Area = 30-foot wide x 20-foot long, up to 30 feet tall
Tunnel Liner Segment Storage	Area = 6 acres for 4-months supply plus 1 acre staging/unloading area (assume segments stored 4-segments high [10-foot high])
TBM Storage Building and Laydown Area	Building = 70-foot wide x 125-foot long Laydown Area = 60-foot wide x 170-foot long
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
TBM Grout Slurry Plant and Facilities	Area for Slurry/Grout Mixing Plant = 35-foot wide x 55-foot long Silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos
RTM Initial Storage Stockpile	Area = 14 acres and 10 feet high
RTM Natural Drying / Long Term Storage	Area = 196 acres x 6 feet high The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Temporary Topsoil/Peat Storage	Topsoil Area – 18 acres to the north of the shaft pad Peat Area – 0.5 acres to the northeast of the shaft pad
Emergency Response Facilities during Construction	The facilities would include one ambulance with accommodations for one set of full-time staff during work hours (up to 7 people) and a fire truck with accommodations for a full-time crew (approximately 5 people covering each construction shift). The emergency personnel could include construction management staff that would be crossed trained. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.
Contractor's and Owner's Offices	Eight buildings, all up to 12 feet tall Miner's Site Facility – 100 feet by 30 feet Contractor Offices – 100 feet by 60 feet Health and Safety – 60 feet by 20 feet Owner's Offices – 80 feet by 60 feet TBM Part Storage – 125 feet by 70 feet General Tool Equipment Storage – 100 feet by 50 feet TBM Tool and Equipment storage – 35 feet by 50 feet Steel Stockpile Storage – 35 feet by 70 feet
Equipment Storage and Ventilation Equipment Storage Buildings	Two buildings, 100-foot wide x 50-foot long, each
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel storage – 20 feet by 30 feet, up to 15 feet tall Generator – 10 feet by 40 feet, up to 12 feet tall, 2 each 100-foot wide x 405-foot long steel fabrication area.
Maintenance Shop	One building, 60-foot wide x 35-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 51 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 8 weeks over the 51-week period.
Parking Spaces during Construction	60 spaces: 10-foot by 20-foot parking spaces

Items	Quantities
Standby Engine Generator during Construction	A standby engine generator would be required in case of power interruptions to provide essential services to the tunnel and TBM, including ventilation, lighting, lift, and sump pumps. Isolated fuel tank, 8-foot diameter tank x 25-foot long installed on a 20-foot x 30-foot concrete pad with a containment lined area with berms.
Standby Engine Generators during Operations	Two portable standby engine generators loaded on trailers, 10-foot wide x 40-foot long, each. One generator would be 1.5 megawatt with a 2000 brake-horsepower engine; and one generator would 2.0 megawatt with a 2,500 brake-horsepower engine.
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 17,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.
Fencing and Security – during Operations Phase [1]	Approximately 16,500 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights on land and on in-river structures would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, RTM, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, or temporary silt fence would be installed on any slope greater than 2H:1V, not including the RTM processing area.

Items	Quantities
Wastewater Facilities during Construction	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be designed and constructed in accordance with the San Joaquin County Onsite Wastewater Treatment System Standards. The septic tank and leach field would be constructed on-site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits. The septic system would be abandoned in accordance with county regulations at the end of construction.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to adjacent drainage.
RTM Area	Approximately 196 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time.
Fire Water Supplies Stored On-site	1,000,000 gallons to provide up to 4,500 gallons/minute for 4 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.2.5 Mandeville Island

TABLE A7. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF MANDEVILLE ISLAND TUNNEL MAINTENANCE SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for the pour.

Items	Quantities
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 45 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 28 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 15 feet Finished shaft elevation = 32 feet
Tunnel Shaft	Shaft Depth during construction = 174 feet Shaft Depth during operations = 193 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor's and Owner's Offices	Two buildings, 12-foot wide x 40-foot long, up to 112 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel storage – 10 feet by 20 feet, up to 15 feet tall Generator – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long steel fabrication area.
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 34 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 7 weeks over the 34-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 3,200 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 3,200 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at

Items	Quantities
	periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.2.6 Bacon Island

TABLE A8. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF BACON ISLAND TUNNEL RECEPTION SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days to the pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 55 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Reception Shaft Pad	Top of shaft pad = 27 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 300 feet Top of shaft pad width = 250 feet

Items	Quantities
	Depth of ground improvement = 15 feet Finished shaft elevation = 30.3 feet
Tunnel Shaft	Shaft Depth during construction = 177 feet Shaft Depth during operations = 194 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Concrete Batch Plant	A typical concrete batch plant site would be 600-foot wide x 600-foot long with a 50 to 75-foot tall batch plant with three bulk cement storage silos; a portable cement silo (trailer 10 feet tall by 60 feet long); a 500-square-foot batch trailer; four propane tanks; a 6,800-square-foot concrete block casting area; a 2,000 to 4,000-gallon diesel fuel tank; a 120,000-gallon reclaimed water system consisting of six 20,000 gallons storage tanks and related collection facilities for stormwater and wash water; an admix area that would include a pump house, admixture storage tanks, and secondary containment barriers encompassing approximately 500 square feet; an aggregate storage area consisting of four common aggregate stockpiles and multiple specialty aggregate storage bays; a wash area for concrete mixing trucks and related returned concrete collection facilities; and parking for concrete trucks and employee vehicles. The concrete batch plant would include batcher, silo, and truck mixer dust collectors to minimize particulates in the surrounding air. Materials collected in the air filter bags would be hauled to licensed off-site disposal locations or added to the raw materials used to produce concrete.
Contractor's and Owner's Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel storage – 10 feet by 20 feet, up to 15 feet tall Generator – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long steel fabrication area.
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 20 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 7 weeks over the 20-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.

Items	Quantities
Fencing and Security – during Construction Phase [1]	Approximately 3,400 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 3,400 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operations Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 2,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3 Tunnels – Eastern Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 6,000 cfs for the Eastern Corridor are summarized in Table A9. Information for the tunnel shafts between the intakes and Southern Complex for the Central Corridor are presented in Tables A10 through A16. Information related to construction of the tunnel shafts at the intakes are included in Table A1.

TABLE A9. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FOR EASTERN CORRIDOR FROM INTAKES TO SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 6,000 CFS

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Reception Shaft at Intake C-E-3	-140	143	Not Applicable	Not Applicable
Tunnel Maintenance Shaft at Intake C-E-5	-142	150	13,254	Not Applicable
Tunnel Launch Shaft Site on Twin Cities Complex	-145	155	29,828	Snodgrass Slough
Tunnel Maintenance Shaft on New Hope Tract	-147	153	24,111	Snodgrass Slough Mokelumne River
Tunnel Maintenance Shaft on Canal Ranch Tract	-149	152	15,857	Beaver Slough
Tunnel Reception Shaft on Terminous Tract	-151	148	27,001	Hog Slough Sycamore Slough
Tunnel Maintenance Shaft on King Island	-154	142	20,820	White Slough San Joaquin River
Tunnel Reception Shaft and Tunnel Launch Shaft on Lower Roberts Island	-156	145	29,329	White Slough
Tunnel Maintenance Shaft on Upper Jones Tract	-159	150	27,344	Whiskey Slough Hayes Slough Old River
Tunnel Working Shaft Site on Byron Tract (within Southern Complex)	-162	153	29,801	Middle River Woodward Canal – North Victoria Canal Old River
Tunnel Launch Shaft Site on Byron Tract (Southern Forebay Inlet Structure at the South Delta Pumping Plant)	-163	157	5,069	Not Applicable
TOTAL TUNNEL LENGTH			222,413	

10.1.3.1 Twin Cities Complex

Tunnel shaft at the Twin Cities Complex would occur as presented in Table A3 in Section 10.12.1. However, due to the different tunnel lengths for the Eastern Corridor as compared to the Central Corridor, the RTM volumes would be different, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table A10.

TABLE A10. SUMMARY OF RTM STORAGE AT TWIN CITIES COMPLEX FOR A PROJECT DESIGN CAPACITY OF 6,000 CFS (EASTERN CORRIDOR)

Items	Quantities
RTM Mechanical Drying Area, one for each Shaft	2 acres
RTM Temporary Dry Stockpile, one for each Shaft	4.3 acres x 10 feet high
RTM Temporary Wet Stockpile, one for each Shaft	9.1 acres x 5 feet high
RTM Wet Storage, one for each Shaft	7.3 acres x 5 feet high
RTM Drying Area, one for each Shaft	36.6 acres
RTM Temporary Stockpile, tunnel reach 1	60 acres x 20 feet high
RTM Temporary Stockpile, tunnel reach 2	93 acres x 20 feet high
RTM Mechanical Dryer Equipment	Sixteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 159 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Fencing and Security – during Operations Phase [1]	During operations, approximately 13,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3.2 New Hope Tract (Eastern Corridor)

TABLE A11. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF NEW HOPE TRACT TUNNEL MAINTENANCE SHAFT (EASTERN CORRIDOR)

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 50 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 13 feet above ground Top of shaft pad elevation = 19 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet

Items	Quantities
	Depth of ground improvement = 50 feet Finished shaft elevation = 36 feet
Tunnel Shaft	Shaft Depth during construction = 171 feet Shaft Depth during operations = 188 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor's and Owner's Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel Storage – 10 feet by 20 feet, up to 15 feet tall Generator Building – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long steel fabrication area, each
Vehicle and Equipment Staging Area	200-foot x 300-foot long
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 36 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 12 weeks over the 36-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 2,700 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 2,700 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be

Items	Quantities
	treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate, as described in Section 6.2.3.3.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3.3 Canal Ranch Tract

TABLE A12. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF CANAL RANCH TRACT TUNNEL MAINTENANCE SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 15 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 12 feet above ground Top of shaft pad elevation = 15 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 15 feet Finished shaft elevation = 36 feet
Tunnel Shaft	Shaft Depth during construction = 169 feet Shaft Depth during operations = 190 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor’s and Owner’s Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall

Items	Quantities
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel Storage – 10 feet by 20 feet, up to 15 feet tall Generator Building – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long Steel fabrication area,
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 34 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 12 weeks over the 34-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 2,700 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 2,700 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.

Items	Quantities
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3.4 Terminous Tract

TABLE A13. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF TERMINOUS TRACT TUNNEL RECEPTION SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 60 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Reception Shaft Pad	Top of shaft pad = 16 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 300 feet Top of shaft pad width = 250 feet Depth of ground improvement = 60 feet Finished shaft elevation = 34.75 feet
Tunnel Shaft	Shaft Depth during construction = 169 feet Shaft Depth during operations = 191 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor's and Owner's Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel Storage – 10 feet by 20 feet, up to 15 feet tall Generator Building – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 70-foot long for the steel fabrication area

Items	Quantities
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 9 calendar weeks. The concrete pours would occur consistently through the 9-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 3,100 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 3,100 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.

Items	Quantities
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3.5 King Island

TABLE A14. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF KING ISLAND TUNNEL MAINTENANCE SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 15 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 25 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 15 feet Finished shaft elevation = 34 feet
Tunnel Shaft	Shaft Depth during construction = 172 feet Shaft Depth during operations = 193 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor’s and Owner’s Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings

Items	Quantities
	Fuel Storage – 10 feet by 20 feet, up to 15 feet tall Generator Building – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long steel fabrication area.
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 34 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 12 weeks over the 34-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 2,900 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 2,900 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.

Items	Quantities
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3.6 Lower Roberts Island

TABLE A15. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR LOWER ROBERTS ISLAND TUNNEL RECEPTION AND LAUNCH SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed approximately 3 days per pour. Tunneling would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. RTM drying and testing would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. Tunnel segment and materials deliveries – could occur at night due to railroad schedules and/or traffic congestion.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 50 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.

Items	Quantities
Tunnel Launch Shaft Pad	Top of shaft pad = 24 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 420 feet Top of shaft pad width = 320 feet Depth of ground improvement = 50 feet Finished shaft elevation = 30.3 feet
Tunnel Launch Shaft Pad Gantry Crane	Gantry Crane = 90-foot high crane over the launch shaft Crane Pad on Shaft Pad = 80-foot wide x 35-foot long
Tunnel Shaft	Shaft Depth during construction = 174 feet Shaft Depth during operations = 191 feet
Shaft Ventilation Fan Housing	Area = 30-foot wide x 20-foot long, 30 feet tall
Tunnel Liner Segment Storage	Area = 6 acres for 4-months supply plus 1 acre staging/unloading area (assume segments stored 4-segments high [10-foot high])
TBM Storage Building and Laydown Area	Building = 70-foot wide x 125-foot long, up to 12 feet tall Laydown Area = 60-foot wide x 170-foot long
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
TBM Grout Slurry Plant and Facilities	Area for Slurry/Grout Mixing Plant = 35-foot wide x 55-foot long Silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos
RTM Initial Storage Stockpile	Area = 13 acres and 10 feet high
Temporary Topsoil/Peat Storage	Topsoil Area = 22 acres to the south of the permanent RTM stockpile Peat Area = 1.5 acres to the north of the shaft pad
Emergency Response Facilities during Construction	The facilities would include one ambulance with accommodations for one set of full-time staff during work hours (up to 7 people) and a fire truck with accommodations for a full-time crew (approximately 5 people covering each construction shift). The emergency personnel could include construction management staff that would be crossed trained. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.
Contractor's and Owner's Offices	Eight buildings, all up to 12 feet tall Miner's Site Facility – 100 feet by 30 feet Contractor Offices – 100 feet by 60 feet Health and Safety – 60 feet by 20 feet Owner's Offices – 80 feet by 60 feet TBM Part Storage – 125 feet by 70 feet General Tool Equipment Storage – 100 feet by 50 feet TBM Tool and Equipment storage – 35 feet by 50 feet Steel Stockpile Storage – 35 feet by 70 feet
Equipment Storage and Ventilation Equipment Storage Buildings	Two buildings, 100-foot wide x 50-foot long, up to 20 feet tall each
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel Storage – 20 feet by 30 feet, up to 15 feet tall Generator Building – 10 feet by 40 feet, up to 12 feet tall, two for each shaft 100-foot wide x 405-foot long steel fabrication area.
Maintenance Shop	One building, 60-foot wide x 35-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 66 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 18 weeks over the 66-week period.

Items	Quantities
Parking Spaces during Construction	60 spaces: 10-foot by 20-foot parking spaces
Standby Engine Generator during Construction	A standby engine generator would be required in case of power interruptions to provide essential services to the tunnel and TBM, including ventilation, lighting, lift, and sump pumps. Isolated fuel tank, 8-foot diameter tank x 25-foot long installed on a 20-foot x 30-foot concrete pad with a containment lined area with berms.
Standby Engine Generators during Operations	Two portable standby engine generators loaded on trailers, 10-foot wide x 40-foot long, each. One generator would be 1.5 megawatt with a 2000 brake-horsepower engine; and one generator would 2.0 megawatt with a 2,500 brake-horsepower engine.
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 19,400 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 18,000 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lighting Facilities – during Construction and Operation Phases	Lights on land and on in-river structures would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, RTM, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be constructed for use during construction and operations because Intake C-E-3 would include permanent restrooms, showers, and sinks. The septic system would be designed and constructed in accordance with the San Joaquin County Onsite Wastewater Treatment System Standards. The septic tank and leach field would be constructed on-site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized

Items	Quantities
	based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits. The septic system would be abandoned in accordance with county regulations at the end of construction.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to adjacent drainage.
RTM Area	Approximately 20 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 71 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Fire Water Supplies Stored On-site	1,000,000 gallons to provide up to 4,500 gallons/minute for 4 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.3.7 Upper Jones Tract

TABLE A16. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY OF UPPER JONES TRACT TUNNEL MAINTENANCE SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 40 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Maintenance Shaft Pad	Top of shaft pad = 22 feet above ground Top of shaft pad elevation = 13 feet

Items	Quantities
	Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 40 feet Finished shaft elevation = 30.3 feet
Tunnel Shaft	Shaft Depth during construction = 177 feet Shaft Depth during operations = 194 feet
Shaft Ventilation Fan Housing	Area = 12-foot wide x 15-foot long, up to 30 feet tall
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Contractor's and Owner's Offices	Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Crew Facilities	One building, 24-foot wide x 40-foot long, up to 12 feet tall
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings Fuel Storage – 10 feet by 20 feet, up to 15 feet tall Generator Building – 10 feet by 20 feet, up to 12 feet tall 100-foot wide x 40-foot long steel fabrication area
Maintenance Shop	One building, 20-foot wide x 30-foot long, up to 25 feet tall
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month Daytime concrete pour would throughout 11 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 7 weeks over the 11-week period.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1]	Approximately 3,000 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Fencing and Security – during Operations Phase [1]	Approximately 3,000 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).

Items	Quantities
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
Wastewater Facilities during Operations	Portable restroom would be hauled to tunnel shaft site during maintenance activities.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.4 Southern Complex on Byron Tract

10.1.4.1 Byron Tract Working Shaft and Southern Forebay Inlet Structure Tunnel Launch Shaft

TABLE A17. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR BYRON TRACT TUNNEL WORKING SHAFT AND SOUTHERN FOREBAY INLET STRUCTURE TUNNEL LAUNCH SHAFT

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for the pour. Tunneling and RTM removal would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week.

Items	Quantities
	Tunnel segment and materials deliveries – could occur at night due to railroad schedules and/or traffic congestion.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 50 feet to reduce liquefaction potential on the site. Ground improvement could be minimized through the use of wick drains during construction of the tunnel shaft. Peat soil generated during shaft excavation would be stored on-site and covered by topsoil stripped from the site and soil excavated from the shaft.
Tunnel Launch Shaft Pad – Working Shaft	Top of shaft pad = 22 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 420 feet Top of shaft pad width = 320 feet Depth of ground improvement = 50 feet Finished shaft elevation = 30.3 feet Gantry Crane = 90-foot high crane over the launch shaft Crane Pad on Shaft Pad = 80-foot wide x 35-foot long Shaft Depth during construction = 180 feet Shaft Depth during operations = 197 feet
Tunnel Launch Shaft Pad – Southern Forebay Inlet Structural Tunnel Launch Shaft	Top of shaft pad = 34 feet above ground Top of shaft pad elevation = 29 feet Top of shaft pad length = 420 feet Top of shaft pad width = 320 feet Mobile Gantry Crane over the launch shaft, 90- foot high Crane Pad on Shaft Pad = 80-foot wide x 35-foot long Shaft Depth during construction = 196 feet Shaft Depth during operations = 196 feet
Shaft Ventilation Fan Housing - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Area = 30-foot wide x 20-foot long, up to 30 feet tall
TBM Storage Building and Laydown Area - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Building = 70-foot wide x 125-foot long Laydown Area = 60-foot wide x 170-foot long
Diaphragm Wall/Trench Slurry Plant - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
TBM Grout Slurry Plant and Facilities	Working Shaft: Area for Slurry/Grout Mixing Plant = 35-foot wide x 55-foot long Southern Forebay Inlet Structural Tunnel Launch Shaft: 65-foot wide x 122-foot long Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site: Silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos
Emergency Response Facilities during Construction	See Table A18.

Items	Quantities
Contractor's and Owner's Offices	Working Shaft: • Eight buildings, each up to 12 feet tall • Miner's Site Facility – 100 feet by 30 feet • – 100' x 30' • Contractor Offices – 100 feet by 60 feet • Health and Safety – 60 feet by 20 feet • Owner's Offices – 80 feet by 60 feet • TBM Part Storage – 125 feet by 70 feet • General Tool Equipment Storage – 100 feet by 50 feet • TBM Tool and Equipment storage – 35 feet by 50 feet • Steel Stockpile Storage – 35 feet by 70 feet Southern Forebay Inlet Structural Tunnel Launch Shaft: Fourteen buildings, 12-foot wide x 60-foot long, up to 12 feet tall each
Equipment Storage and Ventilation Equipment Storage Buildings - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Two buildings, 100-foot wide x 50-foot long, up to 20 feet tall each
Steel Fabrication Area and Miscellaneous Steel Storage Buildings - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Two buildings, 70-foot wide x 35-foot long, up to 20 feet tall each
Maintenance Shop - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	One building, 60-foot wide x 35-foot long, up to 25 feet tall
Duration for Concrete Pours	For each tunnel shaft: • Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month
Parking Spaces during Construction	Working Shaft: 60 spaces: 10-foot by 20-foot parking spaces Southern Forebay Inlet Structural Tunnel Launch Shaft: 125 spaces: 10-foot by 20-foot parking spaces
Standby Engine Generator during Construction - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Two standby engine generators loaded on trailers, 10-foot wide x 40-foot long, each. One generator would be 1.5 megawatt with a 2000 brake-horsepower engine; and one generator would 2.0 megawatt with a 2,500 brake-horsepower engine. Isolated fuel tank, 8-foot diameter tank x 25-foot long installed on a 20-foot x 30-foot concrete pad
Standby Engine Generators during Operations – Working Shaft, only	Portable standby engine generators, stored in buildings at the South Delta Pumping Plant, would be used during operations, if needed.
On-site Access Road during Construction - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security – during Construction Phase [1] – Working Shaft, only	Approximately 4,000 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Fencing would also be part of the overall facilities at the Southern Complex on Byron Tract. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information.

Items	Quantities
	Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.
Fencing and Security – during Operations Phase [1] – Working Shaft, only	Fencing and security would be part of the overall facilities at the Southern Complex.
Lighting Facilities – during Construction and Operation Phases - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, and temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction – Working Shaft	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be designed and constructed in accordance with the Contra Costa County Health Officer Regulations for Sewage Collection and Disposal, October 2018. The septic tank and leach field would be constructed on-site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits. The septic system would be abandoned in accordance with county regulations at the end of construction.
Wastewater Facilities during Construction - Southern Forebay Inlet Structure Tunnel Launch Shaft	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. This septic system also would be used for the construction teams for the pumping plant and Southern Forebay embankments.
Wastewater Facilities during Operations - Working Shaft, only	Restroom facilities would be provided at the South Delta Pumping Plant
SWPPP Facilities – during Construction - Working Shaft and Southern Forebay Inlet Structure Tunnel Launch Shaft, at each site	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phase – Working Shaft, only	See Table A18.
Fire Water Supplies Stored On-site	See Table A18.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.4.2 Facilities on Southern Complex on Byron Tract

Table A18 includes information related to Southern Forebay and overall conditions on the Southern Complex on Byron Tract. Specific information for the construction and operation of the South Delta Pumping Plant is presented in Table A19. Specific information for the construction and operation of the Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft is presented in Table A17. Information related to the Southern Forebay Outlet Structure Dual Tunnel Launch Shaft and South Delta Conveyance tunnels are presented in Tables A20 and 21, respectively.

Information related to the Southern Complex located to the west of Byron Highway is presented in Table A22.

TABLE A18. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE SOUTHERN FOREBAY AND OVERALL CONDITIONS AT THE SOUTHERN COMPLEX ON BYRON TRACT

Items	Quantities
Construction Hours	Unless otherwise specified, most construction, including formation of the embankments, would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days for each pour. RTM drying and testing would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. RTM movement from temporary storage to dry stockpile areas would occur 5 days/week from sunrise to sunset.
Southern Forebay Embankments	Top of Forebay Embankment Elevation = 28 feet Height of Forebay Embankment above Ground Surface = 28 to 36 feet Embankment Crest Width = 32 feet Bottom of Forebay Embankment Foundation Elevation = 0 to -8 feet Interior and Exterior Slopes = 4H:1V Interior Slope Covered by Riprap Exterior Slope Covered by Hydroseeded Vegetation
Southern Forebay Reservoir	Southern Forebay Reservoir Bottom Elevations = 0 to -7 feet. The bottom of the forebay would be graded to promote gravity flow across the forebay. Maximum Normal Operating Water Surface Elevation = 17.5 feet
Slurry Wall using Soil-Bentonite to be Placed within the Embankment	Total Length = 4. 7 miles Cross-section = 3 feet wide x 68 feet high Bottom Depth to elevation – 50 feet for at least 5-feet depth into fine grained confining soils
Emergency Spillway	Spillway Channel = 300 feet wide x 300 feet long Spillway Crest Elevation = 29 feet Spillway Invert Elevation = 21 feet
Emergency Spillway Discharge Channel into Italian Slough	Discharge Channel = 600 feet wide x 600 to 700 feet long Embankment Crest Width = 20 feet Top of Spillway Discharge Embankments Elevation = 14 feet Interior and Exterior Slopes = 3H:1V
Emergency Spillway Turbidity Curtain within Italian Slough	Turbidity curtains would be installed within Italian Slough to reduce siltation into Italian Slough during removal of approximately 500 feet of the existing levee.
Emergency Outlet	Emergency outlet would become part of the Southern Forebay Outlet Construction Structure

Items	Quantities
Southern Forebay Outlet Structure	Outlet Structure = 427 feet wide x 464 feet long Top of Outlet Structure Elevation = 28 feet (at the Southern Forebay embankment grade) Excavation below the Southern Forebay Embankment Grade = 10 feet Isolation Stop Log Gates for Tunnel Inspection: • Ten 34 feet wide x 43 feet high stop logs • Stop logs would be operated within guide frames in each opening • Permanent gantry crane would place and remove stop logs
Southern Forebay Outlet Structure Electrical Control Building	Electrical Control Building = 50 feet wide x 60 feet long and less than 30 feet high Transformer Pad = 10 feet wide x 10 feet long
RTM Handling from On-Site Tunnel Launch Shaft Sites – generated by Byron Tract tunnel working shaft, Southern Forebay Inlet Structure tunnel launch shaft, and Southern Forebay Outlet Structure dual tunnel launch shaft	RTM Temporary Dry Stockpile = 9 acres x 10 feet high RTM Temporary Wet Stockpile = 19 acres x 5 feet high RTM Wet Storage Area = 15 acres x 5 feet high 16 Mechanical Dryers Area = each 55-feet long x 13-feet wide and 14-feet high over 4.5 acres RTM Natural Drying Area = 75 acres x 1.5 feet high RTM Permanent Storage (Eastern only) = 30 acres x 15 feet high
Storage of Peat Soils	Area = 51 acres to the north of the Southern Forebay
Storage of Topsoil and Other Soil Material	Area (Central) = 39 acres to the north of the Southern Forebay Area (Eastern) = 41 acres to the north of the Southern Forebay
Emergency Response Facilities during Construction	Two ambulances, each with accommodations for a set of full-time staff during work hours (up to seven people) Fire truck with accommodations for a full-time crew (nominally comprising 5 personnel covering each construction shift). The emergency personnel could include construction management staff that would be crossed trained. 60-foot diameter paved helipad without tree coverage would be constructed. The helipad would only be used for emergency evacuations.
Concrete Batch Plants	A typical concrete batch plant site would be 600-foot wide x 600-foot long with a 50 to 75-foot tall batch plant with three bulk cement storage silos; a portable cement silo (trailer 10 feet tall by 60 feet long); a 500-square-foot batch trailer; four propane tanks; a 6,800-square-foot concrete block casting area; a 2,000 to 4,000-gallon diesel fuel tank; a 120,000-gallon reclaimed water system consisting of six 20,000 gallons storage tanks and related collection facilities for stormwater and wash water; an admix area that would include a pump house, admixture storage tanks, and secondary containment barriers encompassing approximately 500 square feet; an aggregate storage area consisting of four common aggregate stockpiles and multiple specialty aggregate storage bays; a wash area for concrete mixing trucks and related returned concrete collection facilities; and parking for concrete trucks and employee vehicles. The concrete batch plant would include batcher, silo, and truck mixer dust collectors to minimize particulates in the surrounding air. Materials collected in the air filter bags would be hauled to licensed off-site disposal locations or added to the raw materials used to produce concrete.
Contractor's and Owner's Offices	Area = 5 acres to the southwest of the Southern Forebay
Toe Drain Return Pump during Operations of Southern Forebay	4 sump pumps to return flow collected within the perimeter toe drain conveyance ditch and discharge back into the reservoir through a small diameter pipe. The discharge pipe would be buried shallow within the embankment and discharge into the reservoir within the freeboard. A backflow prevention device would be fitted to the discharge line to prevent wave-driven backflow.

Items	Quantities
Diesel and Gasoline Fuel Stations and Tanks	Diesel and gas fuel would be stored in fuel tanks at multiple fueling station located within the interior of the Southern Forebay. The fuel tanks would be surrounded by protective bollards for collision protection. A protective containment would be used beneath each of the fuel tanks and a protective area would be constructed beneath the refueling area to help contain leaks that may occur during fueling. Three to four fuel stations would be constructed throughout the Southern Forebay site. Each fuel station would consist of multiple diesel and gasoline tanks. The fuel tanks would be above ground and would be surrounded by protective bollards to protect against collisions. Protection from leakage from the fuel storage tanks would be provided using double walled tanks with built-in secondary containment or external secondary containment provided beneath/around the tanks. Spill containment kits would be placed at each of the fueling locations.
Duration for Concrete Pours for Southern Complex on Byron Tract	For each tunnel shaft at Southern Forebay Outlet Structure • Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month, per shaft (there are 4 shafts) For the South Delta Pumping Plant • Night-time concrete pour for tremie concrete: up to 2 months All other structures • Daytime concrete pour would throughout 383 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 21 weeks over the 383-week period.
Access Roads during Construction	Graveled 24-foot access roads throughout the construction site with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
On-site Access Roads during Construction	Embankment Crest: 24-foot wide and 4.7 mile long graveled access road. Bridge Across Emergency Spillway: paved bridge Exterior Embankment Toe: 16-foot wide and 5.2 mile long graveled access road.
Parking Spaces during Construction	25,000 square-foot parking area near the southwestern boundary of the Southern Forebay 8,000 square-foot parking area near the Emergency Response buildings
Parking Spaces during Operations (not including parking at the South Delta Pumping Plant)	Six parking areas = 25 spaces: 10-foot by 20-foot parking spaces, each Four parking areas would be near the southern boundary of the Southern Forebay Two parking areas at the emergency spillway site
Fencing and Security during Construction and Operation Phases [1]	Approximately 64,000 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.

Items	Quantities
Lighting Facilities – during Construction and Operation Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control	Most areas of the site would be covered with pavement, RTM, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch.
Southern Complex Rail-Served Materials Depot	14.4 miles of new track 22 rail turnouts of sizes between "#15 and #11" 30 miles of UPRR track rehabilitation Aggregate unloading pit New track would be installed on existing pilings of existing railroad bridge over the California Aqueduct located to the east of Byron Highway
Wastewater Facilities during Construction	Portable toilets would be located around the Southern Forebay construction site. Buildings with toilets, sinks, and showers would be provided at the South Delta Pumping Plant construction site.
Wastewater Facilities during Post-Construction	Toilets, sinks, and showers would be provided at the South Delta Pumping Plant post-construction site.
SWPPP Facilities - during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant as reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to Italian Slough. Several settling basins would be located around the site due to the extent of the site.
Vector Control – during Operations Phase	Small scale vector control would be addressed with measures such as insect repellent wipes, yellow jacket catchers, and rodent traps near forebay facilities. Large scale vector control (i.e. mosquitos) would be undertaken by the local vector control district. The Contra Costa Mosquito & Vector Control District has jurisdiction in the Southern Forebay area. Upon request, the local vector control district could perform inspections to determine if mosquito problems are present and provide advice on controlling their populations. Population control typically involves reducing breeding sites by application of pesticides (larvicides and adulticides) registered by the US EPA. Application of the pesticides is typically performed via truck-mounted sprayers or by aircraft and is conducted by certified and licensed applicators.
Permanent Stockpiles	Approximately 39 acres (41 acres for Eastern) of the site would be used for permanent topsoil stockpiles for future projects by other agencies that are not identified at this time.
Fire Water Supplies Stored On-site	1,000,000 gallons to provide up to 4,500 gallons/minute for 4 hours for each launch shaft pad location.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.4.3 South Delta Pumping Plant

TABLE A19. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE SOUTH DELTA PUMPING PLANT

Items	Quantities
Construction Hours	Unless otherwise specified, most construction would occur 5-days/week from sunrise to sunset(assumed to be approximately 10 hours on average). Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately three days per pour.
Ground Improvement	Ground improvement would need to be applied to an approximate depth of 50-feet for construction of the South Delta Pumping plant. See Section 4.3.2.1.
Pumping Plant Pad	Top of Pumping Plant Pad Elevation = 28 to 29 feet Top of Pumping Plant Pad Site = 755 foot wide x 1,482 feet long Pad Side Slopes (prior to becoming incorporated into the Southern Forebay) = 4H:1V
Foundational Piles	Approximately 120 drilled piers would be installed 55 feet deep below the gravity flow/surge overflow outlet structure (near the Southern Forebay Inlet Structure tunnel launch shaft site and at the pump discharge basin and weir well structure).
Pump Station	Area of Structure = 99 feet wide x 378 feet long Top of Structure above Pad = 70 feet Top of Structure Elevation = 98 feet
Pumps	Seven pumps at 960 cfs, each, including two standby pumps Three pumps at 600 cfs, each, including one standby pump Two Portable Pumps to Dewater Tunnel
Electrical Building – on Pumping Plant Pad	Area of Structure = 86 wide x 192 feet long Top of Structure above Pad = 42 feet Top of Structure Elevation = 70 feet
Equipment Storage Building – on Pumping Plant Pad	Area of Structure = 195 wide x 235 feet long Top of Structure above Pad = 70 feet Top of Structure Elevation = 98 feet
Electrical Substation – on Pumping Plant Pad during Construction and Operation Phases	Area = 82 feet wide x 260 feet long, within a separately fenced area
Standby Engine Generator Building	Area of Structure = 45 feet x 75 feet long Top of Structure above Pad = 21 feet Top of Structure Elevation = 49 feet Electrical Generator = 30 kilowatts with less than 50 brake horsepower
Fuel Tank for Standby Engine Generator	Diesel Fuel Tank (elevated) within a containment area
Gantry Crane on Top of Outlet Structure	200 feet wide x 370 feet long x 50 feet high
Construction Contractor Working Area – not located on Pumping Plant Pad	Concrete Forms and Rebar Storage Area = 120 feet wide x 400 feet long Warehouse = 80 feet wide x 100 feet long Other Storage Area = 200 feet wide x 350 feet long (includes area to collect site runoff as part of the SWPPP) Laydown Area = 100 feet wide x 200 feet long Metal Fabrication Area = 200 feet wide x 350 feet long in the southeast portion of the site; plus portion of the area used for rebar storage Contractor’s and Owner’s Offices Area = 90 feet wide x 100 feet long, up to 12 feet tall Equipment Storage Area = 200 feet wide x 350 feet long, up to 20 feet tall Maintenance Shop Area = 90 feet wide x 120 feet long, up to 25 feet tall Parking Spaces Area = 200 feet wide x 400 feet long Construction Crew Facilities Area = 100 feet wide x 200 feet long

Items	Quantities
Fuel Station – during Construction Phase	One 4,000 gallon elevated diesel tank to be refilled every other day One 4,000 gallon elevated gasoline tank to be refilled once each week
Duration for Concrete Pours for South Delta Pumping Plant	Information provided in Table A18 for the entire Southern Complex
On-Site Access Roads – during Construction Phase	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
On-Site Access Roads – during Operation Phase	5,175 feet of concrete paved 12-foot wide roads with vertical curbs and gutters and asphalt paved shoulders. 7 reinforced concrete paved ramps on interior of reservoir for maintenance access to the forebay floor or launching of maintenance watercraft.
On-Site Parking on top of Pumping Plant Pad – during Construction Phase	Area = 114,600 square feet of graveled parking lot
On-Site Parking on top of Pumping Plant Pad – during Operation Phase	Area = 26,300 square feet of paved parking lot
Fencing and Security – during Construction Phase [1]	Approximately 10,000 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences with 24-hours site access management and site surveillance. The area this fencing encompasses includes the South Delta Pumping Plant pad, the South Delta Pumping Plant contractors' area, the tunnel contractors' area and the concrete batch plant located near the South Delta Pumping Plant.
Fencing and Security – during Operation Phase	Site would be within the overall Southern Complex security fencing (Table A18).
Security Fencing	Site would be within the overall Southern Complex security fencing (Table A18).
Lighting Facilities – during Construction and Operations Phases	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Erosion Control – during Construction Phase	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch.
Emergency Response Facilities	See Table A18.
Wastewater Facilities - during Construction Phase and Operation Phase	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. This system would be constructed for use during both the construction and operation phases. The septic system would be required during operations to serve the offices and other activities at the pumping plant. The septic system during construction would initially be coordinated with the activities at the initial launch shaft site. When the launching activities move to the Working Shaft, the septic system would be used by construction teams for the pumping plant and the Southern Forebay embankment. During construction, portable restrooms would also be placed at ground surface level below the embankment to be used by construction teams for the pumping plant and Southern Forebay embankment.

Items	Quantities
	The septic tank and leach field would be designed and constructed in accordance with the Contra Costa County Health Officer Regulations for Sewage Collection and Disposal, October 2018. The septic tank and leach field would be constructed on-site at the Pumping Plant on top of the Southern Forebay embankment which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field on the pad would be sited in accordance with setback limits, including 100 feet away from edge of the embankment around the Southern Forebay and 150 feet away from the future well that would be constructed for use during operations phase for water, toilets, and shower water.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to ground level outside of the external toe drain located around the Southern Forebay embankment.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.4.4 Southern Forebay Outlet Structure Dual Tunnel Launch Shaft

TABLE A20. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR SOUTHERN FOREBAY OUTLET STRUCTURE DUAL TUNNEL LAUNCH SHAFT

Items	Quantities
Construction Hours	Placement of slurry walls, diaphragm walls, and ground improvement: 10 hours/day Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 5 days. Tunneling and RTM removal would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. Tunnel segment and materials deliveries – could occur at night due to railroad schedules and/or traffic congestion.
Tunnel Launch Shaft Pad	Top of shaft pad = 32 feet above ground Top of shaft pad elevation = 30 feet Top of shaft pad length = 500 feet Top of shaft pad width = 300 feet
Tunnel Launch Shaft Pad Gantry Crane	Gantry Crane = 90-foot high crane over the launch shaft Crane Pad on Shaft Pad = 80-foot wide x 35-foot long
Tunnel Shaft	Shaft Depth during construction = 153 feet Shaft Depth during operations = 156 feet
Shaft Ventilation Fan Housing	Area = 30-foot wide x 20-foot long, up to 30 feet tall

Items	Quantities
Tunnel Liner Segment Storage	Area = 6 acres for 4-months supply plus 1 acre staging/unloading area (assume segments stored 4-segments high [10-foot high])
TBM Storage Building and Laydown Area	Building = 70-foot wide x 125-foot long, up to 12 feet tall Laydown Area = 60-foot wide x 170-foot long
Diaphragm Wall/Trench Slurry Plant	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
TBM Grout Slurry Plant and Facilities	Area for Slurry/Grout Mixing Plant = 65-foot wide x 122-foot long Silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos
Emergency Response Facilities during Construction	See Table A18.
Contractor's and Owner's Offices	Fourteen buildings, 12-foot wide x 40-foot long, up to 12 feet tall each
Equipment Storage and Ventilation Equipment Storage Buildings	Two buildings, 100-foot wide x 50-foot long, up to 20 feet tall each
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two buildings, 70-foot wide x 35-foot long, up to 20 feet tall each
Maintenance Shop	One building, 60-foot wide x 35-foot long, up to 25 feet tall
Parking Spaces during Construction	125 spaces: 10-foot by 20-foot parking spaces
Standby Engine Generator during Construction	Two generators loaded on trailers, 10-foot wide x 40-foot long, each. One generator would be 1.5 megawatt with a 2000 brake-horsepower engine; and one generator would 2.0 megawatt with a 2,500 brake-horsepower engine. Isolated fuel tank, 8-foot diameter tank x 25-foot long installed on a 20-foot x 30-foot concrete pad
Duration for Concrete Pours for Southern Forebay Outlet Structure Dual Tunnel Launch Shaft	Information provided in Table A18 for the entire Southern Complex
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security during Construction Phase of the shaft	See Table A18.
Lighting Facilities during Construction Phase	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods.
Erosion Control during Construction Phase	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch.

Items	Quantities
Wastewater Facilities - during Construction	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be designed and constructed in accordance with the Contra Costa County Health Officer Regulations for Sewage Collection and Disposal, October 2018. The septic tank and leach field would be constructed on-site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits. The septic system would be abandoned in accordance with county regulations at the end of construction.
SWPPP Facilities – during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.

10.1.4.5 South Delta Conveyance Tunnels

TABLE A21. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FROM THE SOUTHERN FOREBAY TO BANKS PUMPING PLANT APPROACH CHANNEL

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Launch Shaft at Southern Forebay Outlet Structure for Dual Tunnels	-120	118	Not Applicable	Not Applicable
Tunnel Reception Shaft at South Delta Outlet & Control Structure for Dual Tunnels	-121	181	8,800, each tunnel alignment of the dual tunnels	Italian Slough – two crossings
TOTAL TUNNEL LENGTH			8,800, each tunnel alignment of the dual tunnels	

10.1.5 Southern Complex Located to the West of Byron Highway

TABLE A22. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR SOUTH DELTA OUTLET AND CONTROL STRUCTURE, INCLUDING RECEPTION SHAFT, AND CALIFORNIA AQUEDUCT CONTROL STRUCTURE

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab (as needed for cofferdam and excavations) – construction continuous until concrete pour is completed, approximately 3 days per pour.
Tunnel Reception Shaft Pad	Top of shaft pad = 30 feet below existing ground (to be pre-excavated to top of shaft pad elevation) Top of shaft pad elevation = 30 feet Top of shaft pad length = 300 feet Top of shaft pad width = 250 feet Shaft Depth during construction = 156 feet Shaft Depth during operations = 157 feet Shaft Ventilation Fan Housing Area = 12-foot wide x 15-foot long, up to 30 feet tall Diaphragm Wall/Trench Slurry Plant Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
South Delta Outlet and Control Structure	Outlet and Control Structure = 400 feet wide x 1250 feet long x 45 feet high Control Structure Bottom Width = 207 feet Site Grade Elevation = 30 feet Control Structure Invert (bottom) Elevation = -15 feet Radial Gates • Six Radial Gates = 24 feet wide x 40 feet high • One Radial Gate = 15 feet wide x 8 feet high • Final gate size, type, and quantity to be determined during final design. Isolation Stop Log Gates for Tunnel Inspection • Twenty 34 feet wide x 21.5 feet high stop logs

Items	Quantities
	• Block walled area for stop log storage = 80 feet x 200 feet long x 12 feet high Mobile truck crane (not permanent structure) would place and remove stop logs Isolation Stop Log Gates for Gate Inspection • Twelve 24 feet wide x 21.5 feet high stop logs • Four 17 feet wide x 21.5 feet high stop logs • Stop logs would be stored on-site within an enclosed storage area • Mobile bridge crane (not permanent structure) would place and remove stop logs Grading Side Slopes: Interior and Exterior Slopes = 3H:1V
California Aqueduct Control Structure	California Aqueduct Control Structure = 89 feet wide x 392 feet long x 43 feet high Control Structure Bottom Width = 60 feet Embankment Crest Elevation = 15 feet Control Structure Invert (bottom) Elevation = -31 feet Radial Gates • Six Radial Gates = 24 feet wide x 30 feet high • One Radial Gate = 15 feet wide x 8 feet high • Final gate size, type, and quantity to be determined during final design. • Block walled area for panel storage per South Delta Outlet and Control Structure Isolation Stop Log Gates for Gate Inspection • Twenty-four 26 feet wide x 16.5 feet high stop logs • Four 17 feet wide x 16.5 feet high stop logs • Stop logs would be stored on-site within an enclosed storage area • Mobile bridge crane (not permanent structure) would place and remove stop logs
Electrical Control Building	Electrical Control Building = 50 feet wide x 60 feet long x less than 20 feet high
Standby Engine Generator	South Delta Outlet and Control Structure: 200 kilowatt engine generator and fuel tank California Aqueduct Control Structure: Portable 200 kilowatt mobile generator and fuel tank would be used on this site
Contractor's Facilities	South Delta Outlet and Control Structure • Five trailers = 50 feet wide x 60 feet long x 11 feet high • 10 Equipment Storage Containers = 8 feet wide x 40 feet long x 8 feet high South Delta Outlet and Control Structure Tunnel Reception Shaft • Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each • Crew Facilities = One building, 24-foot wide x 40-foot long, up to 12 feet tall • Steel Fabrication Area and Miscellaneous Steel Storage Buildings = Two buildings, 70-foot wide x 35-foot long, up to 15 feet tall each • Maintenance Shop = One building, 20-foot wide x 30-foot long, up to 25 feet tall
Fuel Station	Fuel Station within Confined Area = 8 feet wide x 12 feet long x 8 feet high
Duration for Concrete Pours for Southern Complex West of Byron Highway	For each tunnel shaft at South Delta Outlet and Control Structure • Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month All other structures • Daytime concrete pour would throughout 333 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 81 weeks over the 333-week period.
On-site Access Road during Construction	South Delta Outlet and Control Structure: 160,000 square feet of gravel on-site access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. California Aqueduct Control Structure: 80,000 square feet of gravel access roads for on-site paved access roads with truck tire washes, track-out plates, and/or gravel

Items	Quantities
	aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
On-site Parking during Construction	Separate facilities would be provided for both the South Delta Outlet and Control Structure and California Aqueduct Control Structure. Each facility would include: • 50,000 square feet of gravel pavement for vehicle parking • 150,000 square feet of gravel pavement for equipment parking South Delta Outlet and Control Structure Reception Shaft: 7200 square feet of gravel pavement for vehicle parking
Lighting Facilities during Construction Phase	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods.
Erosion Control	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch.
Wastewater Facilities - during Construction and Operations	Portable restrooms would be placed on-site during construction and hauled to the site during maintenance activities.
SWPPP Facilities – during Construction and Operation Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

10.1.6 Access Roads

TABLE A23. ACCESS ROADS TO CONSTRUCTION SITES FOR PROJECT DESIGN CAPACITY OF 6,000 CFS

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access to Intake Haul Road Along Lambert Road (Central and Eastern Corridors)	Franklin Boulevard	Concrete Batch Plant Driveway	Lambert Road		No Changes		Mid-Construction & End of Construction
	Lambert Road	Franklin Boulevard	Intake Haul Road	22-feet wide: Two 10-foot paved lanes with 1-foot shoulders	Widen 3.22 Miles paved road No Change to Snodgrass Slough Bridge	32-feet wide: Two 12-foot paved lanes with 4-foot shoulders	Mid-Construction & End of Construction
Access to Intake Haul Road Along Hood-Franklin Road (Central	Hood-Franklin Road and Bridge over Snodgrass Slough	East of Snodgrass Slough Bridge	Intake Haul Road	32-feet wide: 2 lanes with 6 bridge spans	Widen 180-feet of bridge and roadway on either side of bridge	54-feet wide: add two paved turn lanes onto Intake Haul Road	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
and Eastern Corridors)	Hood-Franklin Road	East of Interstate 5	Intake Haul Road				Mid-Construction & End of Construction
New Intake Haul Road and Access to Intakes C-E-3 And C-E-5 (Central and Eastern Corridors)	Intake Haul Road	Lambert Road	Intake C-E-5 Access Road		New 1.85-mile paved road to the west of the abandoned railroad embankment	32-feet wide: two 12-foot paved lanes with 4-foot-wide shoulders on both sides	Mid-Construction & End of Construction
	Intake Haul Road	Intake C-E-5 Access Road	Hood-Franklin Road		New 1.3 mile paved road to the west of the abandoned railroad embankment	32-feet wide: two 12-foot paved lanes with 4-foot-wide shoulders on both sides	Mid-Construction & End of Construction
	Intake Haul Road	Hood-Franklin Road	Intake C-E-3 Access Road		New 0.43 mile paved road to the west of the abandoned railroad embankment	32-feet wide: two 12-foot paved lanes with 4-foot-wide shoulders on both sides	Mid-Construction & End of Construction
	State Route 160	Lambert Road	Cosumnes River Boulevard				Mid-Construction following Re-alignment of highway at intakes
Twin Cities Complex Road Improvements (Central and Eastern Corridors)	Dierssen Road	Franklin Boulevard	East Side of Interstate 5	18-feet wide: Two 9-foot paved lanes without shoulders	Widen 1.0-mile paved road	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders	Mid-Construction & End of Construction
	Franklin Boulevard	Twin Cities Road	0.5 miles north of Dierssen Road	32-feet wide: Two 12-foot paved lanes with 4-foot shoulders	Re-align and Widen 0.6 miles paved road	40-feet wide: two 12-foot paved lanes with 8-foot wide shoulders	Mid-Construction & End of Construction
	Twin Cities Road	0.15 miles east of Franklin Boulevard	Interstate 5	32-feet wide: Two 10-foot paved lanes with 1-foot shoulders	Widen 1.4 mile paved road	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road to New Hope Tract Tunnel Maintenance Shaft (Central Corridor)	W. Lauffer Road	Vail Road	New Hope Tract Tunnel Shaft	32-feet wide: Two 10-foot dirt lanes with 1-foot shoulders	Widen 0.83 miles road	32-feet wide: two 12-foot graveled lanes with 4-foot wide shoulders	
Access Road to Staten Island Tunnel Maintenance Shaft (Central Corridor)	Staten Island Road	Walnut Grove Road	Staten Island Shaft	22-feet wide: Two 10-foot paved lanes with 1-foot shoulders	No Change		
Access Road to Bouldin Island Tunnel Reception and Launch Shaft (Central Corridor)	State Route 12	Interstate 5	Little Potato Slough Bridge	44-feet wide: Two 12-foot paved lanes with 10 foot shoulders with median barrier	Widen 5.29 miles	64-feet wide: Add two 12-foot paved lanes with reduced 8-foot wide shoulders	Mid-Construction & End of Construction
Access Road to Bouldin Island Tunnel Reception and Launch Shaft (Central Corridor)	State Route 12 Bridge over Little Potato Slough	Little Potato Slough Bridge	Bouldin Island Road (new intersection)	44-feet wide: Two 12-foot paved lanes with 10-foot shoulders with median barrier	Widen 2.86 miles Widen bridge over Farm Road: 77 feet wide x 60 feet long	64-feet wide: Add two 12-foot paved lanes with reduced 8-foot wide shoulders	Mid-Construction & End of Construction
	State Route 12 Bridge over Little Potato Slough			48-feet wide bridge: Two 12-foot paved lanes with 10-foot shoulders with a median barrier	Widen 2,980-foot moveable bridge (2,670-foot permanent spans and 310-foot moveable swing bridge)	63-feet wide: two 12-foot paved lanes with 8-foot wide shoulders	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	Bouldin Island Road (new road)	Bouldin Island Road (new intersection)	Bouldin Island Tunnel Shaft	Agricultural Land	New 2.1-mile paved road New bridge over State Route 12: 32 feet wide x 120 feet long: two 12-foot lanes with no shoulders	New interchange at State Route 12 74-foot wide: two 12-foot paved lanes with no shoulders	Mid-Construction & End of Construction
Access Road to Mandeville Island Tunnel Maintenance Shaft and Bacon Island Reception Shaft (Central Corridor) (Access Route to Mandeville Island Site Passes By Bacon Island Site) (Central Corridor)	New South Holt Road Overpass over BNSF tracks and EBMUD Mokelumne Aqueducts	South Holt Road	West Lower Jones Road	22-feet wide underpass: two 11-foot lanes with no shoulders	Construct a Bridge over Railroad Track and Aqueducts	New bridge: 24 feet wide by 240 ft long: two 12-foot wide lanes with no shoulders Bridge height: 23 feet 4 inches above top of railroad tracks Overall overpass: 0.24 miles long	
Access Road to Mandeville Island Tunnel Maintenance Shaft and Bacon Island Reception Shaft (Central Corridor) (Access Route to Mandeville Island Site Passes By Bacon Island Site) (Central Corridor)	West Lower Jones Road (gravel)	South Holt Road	West Lower Jones Road (paved)	Dirt road	Upgraded 0.55 miles Road	New road: 32 feet wide: two 12-foot paved lanes with 4-foot shoulders	
	West Lower Jones Road (gravel)	West Lower Jones Road (paved)	Lower Jones Tract New Access Road	Gravel road	Upgraded 5.17 miles road	32-feet wide: two 12-foot paved lanes, 0.55 miles with no shoulders and 4.62 miles with 4-foot shoulders	
	Lower Jones Tract New Access Road and across Middle River Bridge	West Lower Jones Road	Bacon Island New Access Road	Gravel road	Upgrade 4.8 miles road No change to Middle River Bridge	24-feet wide: two 12-foot gravel lanes with no shoulders	
	Bacon Island New Access Road	Bacon Island Tunnel Shaft Access Road	New Connection Slough Bridge	Agricultural land	Upgrade 4.1 miles road	24-feet wide: two 12-foot gravel lanes with no shoulders	

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	New Connection Slough Bridge	Bacon Island New Access Road	Mandeville Island New Access Road		New 375-foot long x 32-foot wide moveable bridge Removal of existing Connection Slough Bridge	New 375-foot long x 32-foot wide moveable bridge	
	Mandeville Island New Access Road	New Connection Slough Bridge	Mandeville Island Shaft	Agricultural land	Upgrade 3.2 miles road	24-feet wide: two 12-foot gravel lanes with no shoulders	
	Bacon Island Tunnel Shaft Access Road	Bacon Island New Access Road	Bacon Island Tunnel Shaft	Levee road	Upgrade 0.4 miles of levee road	24-feet wide: two 12-foot gravel lanes with no shoulders	
Access Road to New Hope Tract Tunnel Maintenance Shaft (Eastern Corridor)	New Hope Tract Tunnel Shaft Access Road	Blossom Road	New Hope Tract Tunnel Shaft	Agricultural land	New 0.29 miles gravel road	24-feet wide: two 12-foot gravel lanes with no shoulders	Access Road to New Hope Tract Tunnel Maintenance Shaft - Eastern
Access Road to Canal Ranch Tract Tunnel Maintenance Shaft (Eastern Corridor)	West Pelletier Road	West of Interstate 5	Canal Ranch Tract Tunnel Shaft	20-foot wide: two 10-foot lanes with no shoulders.	Overlay West Pelletier Road	Only an overlay prior to shaft construction	Mid-Construction & End of Construction
Improvements to State Route 12 to access Terminous Tract Tunnel Reception Shaft	State Route 12	Interstate 5	Terminous Tract Tunnel Shaft	40-foot wide: two 12-foot lanes with 8-foot shoulders.	Improve 2.3 miles	New pavement and striping	Mid-Construction & End of Construction
Access Road to Terminous Tract Tunnel Reception Shaft (Eastern Corridor)	State Route 12	East of Driveway of Terminous Tract Tunnel Shaft	West of Driveway of Terminous Tract Tunnel Shaft	40-foot wide: two 12-foot lanes with 8-foot shoulders.	New paved acceleration and deacceleration lanes	New paved acceleration and deacceleration lanes	
Access Road to King Island Tunnel Maintenance Shaft (Eastern Corridor)	West Eight Mile Road	Regatta Lane	King Island Tunnel Shaft	24-foot wide: two 10-foot lanes with no shoulders.	No change	No change	Pre-Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road to Lower Roberts Island Tunnel Reception Shaft and Launch Shaft (Eastern Corridor)	Rough and Ready Access Road	West Fyffe Street	Lower Roberts Western Yard Track New Access Road	24-foot wide: two 10-foot lanes with no shoulders	Widen 1.12 miles paved road	32-foot wide: two 12-foot paved lanes with 4-foot shoulders	Mid-Construction & End of Construction
	Burns Cut New Access Road	Lower Roberts Western Yard Track New Access Road	West House Road		New 0.3 miles paved road New Bridge over Burns Cut: 24 feet wide x 340 feet long: two 12-foot lanes with 4-foot shoulders.	32-foot wide: two 12-foot paved lanes with 4-foot shoulders. Construction Easement: 75 feet wide	Mid-Construction & End of Construction
	West House Road	Burns Cut New Access Road	Lower Roberts New Access Road	16-foot wide: two 8-foot lanes with no shoulders	Widen 3.2 miles paved road	32-foot wide: two 12-foot paved lanes with 4-foot shoulders	Mid-Construction & End of Construction
	Lower Roberts New Access Road	West House Road	North Holt Road		New 1.6 miles paved road New Bridge over Black Slough: New bridge: 24 feet wide x 350 feet long: two 12-foot lanes with 4-foot shoulders	32-foot wide: two 12-foot paved lanes with 4-foot shoulders	Mid-Construction & End of Construction
	Port of Stockton Expressway	State Route 4	West Fyffee Street		No change	No change	Mid-Construction & End of Construction
	West Fyffee Street	Port of Stockton Expressway	Rough and Ready Access Road		No change	No change	Mid-Construction & End of Construction
Access Road Upper Jones Tract Tunnel Maintenance Shaft (Eastern Corridor)	Bacon Island Road	State Route 4	Upper Jones Tract New Access Road	20-foot wide: two 10-foot lanes with no shoulders	No change	No change	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	Upper Jones Tract New Access Road	Bacon Island Road	Upper Jones Tract Tunnel Shaft New Access Road		New 0.8-mile road	24-feet wide: two 12-foot paved lanes with no shoulders	
Access Road to Southern Complex on Byron Tract (Central and Eastern Corridors)	Extension of Discovery Bay Boulevard	State Route 4	Southern Forebay On-Site Access Roads	Agricultural land	New 0.8 miles road	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders	Mid-Construction & End of Construction
	Western Farms Ranch Road	Byron Highway	Southern Forebay On-Site Access Roads	Gravel road	Relocated 0.8 miles road	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders	Mid-Construction & End of Construction
Access Road to Southern Complex West of Byron Highway (Central and Eastern Corridors)	Re-aligned Byron Highway with new traffic circle, Extension of Armstrong Road, and Truck Bypass Ramp Over Byron Highway	Western Byron Tract	Byron Hot Springs Road	Agricultural land	Realigning Byron Highway and adding a connection to Armstrong Road	40-feet wide: two 12-foot paved lanes with 8-foot wide shoulders 32-feet wide overpass as truck bypass: two 16-foot paved lanes with no shoulders	Mid-Construction & End of Construction
	Clifton Court Road	Re-aligned Byron Highway at New Traffic Circle	Southern Forebay On-Site Access Roads	Agricultural land	Extend road for 0.09 miles	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders	Mid-Construction & End of Construction
	Clifton Court Road	Byron Highway	North Bruns Way	Paved road	Widen 0.61 miles road	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	North Bruns Way	Clifton Court Road	South Delta Outlet and Control Structure Site	Paved road	Widen 0.7 miles paved road New 180-foot long and 32-foot wide bridge over Re-aligned Byron Highway New 220-foot long and 40-foot wide bridge over Re-aligned Byron Highway	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders. New 3-way intersection for on ramp	Mid-Construction & End of Construction

TABLE A24. PILES AND PIERS FOR ACCESS ROADS FOR PROJECT DESIGN CAPACITY OF 6,000 CFS

Purpose of Access	Bridge	Crossing	Modification	Piles/Piers	Installation Notes
Access to Intake Haul Road Along Hood-Franklin Road (Central and Eastern Corridors)	Widen Hood-Franklin Bridge Existing: 32-feet wide: 2 lanes	Snodgrass Slough	Widen 180-feet (length) of bridge by adding 1 lane on each side of bridge to connect to turning lanes onto Intake Haul Road	Estimated 46 total piles: -26 permanent driven piles for bridge support -20 vibrated H piles for trestle 50-feet deep, 16-inches diameter	Install 6 piles/day Blow counts for driven piles not determined at this time
Access Road to Bouldin Island Tunnel Reception and Launch Shaft (Central Corridor)	State Route 12 Bridge over Little Potato Slough Existing: 48-feet wide bridge: Two 12-foot paved lanes with 10 foot shoulders with a median barrier	Little Potato Slough	Widen 2,980-foot moveable bridge (2,670-foot permanent spans and 310-foot moveable swing bridge) by adding 1 lane on each side of bridge (two 12-foot paved lanes with 8-foot wide shoulders with total of new 63-feet width)	Estimated 237 total piles: -42 permanent driven piles for bridge support -195 vibrated H piles for trestle 80-feet deep	Install 2 permanent piles/day Install 10 vibrated piles/day Blow counts for driven piles not determined at this time

Purpose of Access	Bridge	Crossing	Modification	Piles/Piers	Installation Notes
Access Road to Bouldin Island Tunnel Reception and Launch Shaft (Central Corridor)	State Route 12 Bridge over a Farm Road (east of new Bouldin Island Access Road Interchange) Existing: 44-feet wide: Two 12-foot paved lanes with 10 foot shoulders with median barrier	Farm Road	Widen fixed bridge: 77 feet wide x 60 feet long	16 permanent driven piles for bridge support 50-feet deep	4 piles/day
	New Bridge over State Route 12 to access Bouldin Island	State Route 12	74 feet wide x 120 feet long: two 12-foot lanes with no shoulders.	56 permanent driven piles for bridge support 75-feet deep, 6-feet diameter	0.5 piles/day
Access Road to Mandeville Island Tunnel Maintenance Shaft and Bacon Island Reception Shaft (Access Route to Mandeville Island Site Passes By Bacon Island Site) (Central Corridor)	New Bridge Overpass over BNSF tracks and EBMUD Mokelumne Aqueducts – to replace 22-foot wide undercrossing of South Holt Road with two 11-foot lanes with no shoulders	BNSF tracks and EBMUD Mokelumne Aqueducts	32 feet wide x 0.24 miles long: two 120-foot lanes with 4-foot shoulders.	Estimated 118 total piles: -88 permanent driven piles for bridge support -30 vibrated H piles for trestle 50-feet deep, 6-feet diameter	10 piles/day Some work will occur in adjacent wetlands

Purpose of Access	Bridge	Crossing	Modification	Piles/Piers	Installation Notes
Mandeville Island Tunnel Maintenance Shaft Access Road (Central Corridor)	New Bridge	Connection Slough	New 375-foot long x 32-foot wide moveable bridge	Estimated 218 total piles: -90 permanent driven piles for bridge -120 vibrated H piles for trestle and sheet piles -8 vibrated H piles for falsework 1 pier (15-foot diameter) for swing span 3 piers in water (4-foot diameter columns) 2 piers for 45-foot x 25-foot cofferdam 2 piers for 25-foot x 25-foot cofferdam 80-feet deep, one 15 foot diameter for swing span, and three 4 foot diameter columns for bents	2 permanent piles/day 10 vibrated trestle piles/day 10 pairs of sheet piles/day
Access Road Lower Roberts Island Tunnel Reception Shaft and Launch Shaft	New Bridge over Burns Cut	Burns Cut	New bridge: 32 feet wide x 340 feet long with two 12-foot lanes with 4-foot shoulders.	Estimated 94 total piles: -50 permanent driven piles for bridge -44 vibrated H piles for trestle 75-feet deep, 24-foot diameter	Install 6 piles/day
Access Road Lower Roberts Island Tunnel Reception Shaft and Launch Shaft	New Bridge over Black Slough	Black Slough	New bridge: 32 feet wide x 350 feet long: two 12-foot lanes with 4-foot shoulders.	6 permanent driven piles for bridge 50-feet deep, 24-foot diameter	Install 6 piles/day
Access Road to Southern Complex West of Byron Highway (Central and Eastern Corridors)	New Bridge to Overpass to North Bruns Road	Re-aligned Bryon Highway	New 180-foot long and 32-foot wide bridge over Re-aligned Byron Highway (two 12-foot paved lanes with 4-foot wide shoulders)	56 permanent driven piles 50-feet deep, 6-feet diameter	8 piles/day

Purpose of Access	Bridge	Crossing	Modification	Piles/Piers	Installation Notes
Access Road to Southern Complex West of Byron Highway (Central and Eastern Corridors)	New Bridge across Re-aligned Byron Highway	Re-aligned Bryon Highway	New 220-foot long and 40-foot wide bridge over Re-aligned Byron Highway (two 12-foot paved lanes with 4-foot wide shoulders)	40 cast in drilled hole piles 50-feet deep	2 piles/day

APPENDIX B - Summary of Information for the Project Design Capacity of 7,500 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 7,500 cfs with cylindrical tee fish screens. The facilities required for a project design capacity of 7,500 cfs would utilize all of the facilities included for the project design capacity of 6,000 cfs plus an additional intake and facilities to convey water to the Central Valley Project. The higher project design capacity also would result in changes in tunnel diameters and South Delta Pumping Plant building sizes, as described in this appendix.

This appendix includes the following tables.

- **Section 10.2.1 Intakes C-E-2, C-E-3, and C-E-5**
  - **Table B1.** Construction Conditions and Constructed Facilities Summary for Intake C-E-2 for 1,500 cfs Design Capacity with Cylindrical Tee Fish Screens
- **Section 10.2.2 Tunnels – Central Corridor between Intakes and Southern Complex**
  - **Table B2.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for Central Corridor from Intakes to Southern Complex for a Project Design Capacity of 7,500 cfs
  - **Table B3.** Summary of Finished Central Corridor Shaft Elevations for a Project Design Capacity of 7,500 cfs
  - **Table B4.** Summary of RTM Storage for Central Corridor at Twin Cities Complex, Bouldin Island, and Southern Complex for a Project Design Capacity of 7,500 cfs
- **Section 10.2.3 Tunnels – Eastern Corridor between Intakes and Southern Complex**
  - **Table B5.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for Eastern Corridor from Intakes to Southern Complex for a Project Design Capacity of 7,500 cfs
  - **Table B6.** Summary of Finished Eastern Corridor Shaft Elevations for a Project Design Capacity of 7,500 cfs
  - **Table B7.** Summary of RTM Storage for Central Corridor at Twin Cities Complex, Lower Roberts Island, and Southern Complex for a Project Design Capacity of 7,500 cfs
- **Section 10.2.5 Southern Complex Located to the West of Byron Highway**
  - **Table B8.** Construction Conditions and Constructed Facilities Summary for South Delta Outlet Structure and Jones Control Structure for a Project Design Capacity of 7,500 cfs
  - **Table B9.** Construction Conditions and Constructed Facilities Summary for Jones Outlet Structure, including Reception Shaft, and Delta-Mendota Control Structure for a Project Design Capacity of 7,500 cfs

10.1.7 Intakes C-E-2, C-E-3, and C-E-5

Intake facilities to provide a project design capacity of 7,500 cfs would include use of two intakes with design capacity of 3,000 cfs, each, (Intake C-E-3 and Intake C-E-5) and one 1,500 cfs intake.

Information for Intake C-E-3 and Intake C-E-5 is presented in Table A1 in Appendix A, Section 10.1.1.

Information for Intake C-E-2 is presented in Table B1.

TABLE B1. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR INTAKE C-E-2 FOR 1,500 CFS DESIGN CAPACITY WITH CYLINDRICAL TEE FISH SCREENS

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Connection of relocated State Route 160 onto temporary levee and permanent levee: at night if allowed by Caltrans Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.
Temporary Levee and State Route 160 Levee Dimensions	Length of Temporary Levee • Intake C-E-2: 3,500 feet along the centerline Top elevation of Temporary Levee • Intake C-E-2: approximately 30 to 31 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 23 feet) with sea level rise for 2040 and 3 feet of freeboard Width of Top of Temporary Levee = 60 feet including State Route 160 Width of Bottom of Temporary Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus shoulders and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Temporary Levee	The temporary levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee would only be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee • Intake C-E-2 would extend to an elevation -17 feet (this elevation is about 4 feet below the river bottom)

Items	Quantities
Permanent Levee and State Route 160 Dimensions (State Route 160 would be relocated to a fill pad between the intake structure and the sedimentation basin)	Length of Permanent Levee • Intake C-E-2: 7,000 feet along the centerline Top elevation of Permanent Levee • Intake C-E-2: 31.2 feet (16 to 26 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 26.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020b) Width of Top of Permanent Levees = 60 feet including State Route 160 Width of Bottom of Permanent Levees = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus deceleration and turning lanes for intake site access, shoulders, and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Permanent Levee for Each Intake	The permanent levee embankment would be constructed around the sedimentation basin and the outlet channel. The levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee placement would be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would be within the excavation footprint for the sedimentation basin and would extend to elevation -17 feet (this elevation is about 4 feet above the river bottom) Native grass would be planted on the non-water side of the levee. Erosion protection would be placed on the interior side of the sediment basin embankment, as described below. The inside of the levee would be protected from erosion as described above. The outside of the embankment would be planted with native grass.
Ground Improvement for Each Intake	Ground improvement would be installed under the levees and facilities embankments. The quantity of improved ground would be approximately 1.5 to 2.0 million cubic yards of mixed wall sections and approximately 250,000 to 350,000 tons of cement.
Cofferdam at Intake C-E-2	Length = 1751 feet (including cofferdam and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-2	Length of cofferdam and training wall sheet pile system = 1232 feet Approximate number of piles (”Z” sheet pairs) = 269 (includes 217 in front row of cofferdam and training walls)

Items	Quantities
	Preliminary cofferdam sheet pile tip elevations = -55 feet Length of cofferdam DMM wall system = 519 feet Preliminary DMM wall bottom elevation = -100 Approximate number of drilled piers within cofferdam = 591 Preliminary drilled pier tip elevation = -100 Pile drivability: Number of blows per sheetpile pair = 20 Total number of blows = 5380 Estimated total impact pile driving time (time for the partial vibratory pile installation, equipment setup, periodic alignment check, and downtime are not included) = 9 hours
Intake Structure at Intake C-E-2	Length = 996 feet along river including training walls Length = 469 feet along river for concrete structure only Top elevation = 31.2 feet which would be about 43 to 45 feet above river bottom; Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 25.2 feet River elevation at this location = -12 to -15 feet Intake Structure floor elevation would be at the bottom of screen panel = -12 feet Intake Structure concrete front slab elevation = -13 feet Fish Screen Elevation at the bottom of the fish screen = -9 feet Gantry Crane on top of Intake Structure width = 35 feet Gantry Crane on top of Intake Structure top elevation = 71 feet (40 feet above Intake Structure)
Cylindrical Tee Screen Assembly for Intake C-E-2	Number of Fish Screen Units = 15 Each unit: 8 feet in diameter and 30 feet long, including fish screen and manifold assembly, and mounted on the face of the structure Each unit includes internal and external fixed brush cleaning system Each unit would extend about 12 feet from the intake structure into the river Complete assembly includes 60-inch diameter piping and control gates from the screen unit to the sedimentation basin
Portable Fish Screen Pressure Washer (not mounted on Intake Structure) for Intake C-E-2	Trailer mounted rig to maneuver equipment for pressure washing screens would be approximately 6 feet tall, 6 feet wide, and 8 feet long. A standard pickup truck would tow this rig.
Portable Mobile Crane (not mounted on Intake Structure) for Intake C-E-2	Mobile crane to load and unload intake features would be approximately 15 feet tall, 20 feet wide, and 400 feet long. A 100-foot long boom would be extended from the main crane. Standard tractor trailer rig with a flat-bed trailer would be used to transport panels to and from the intake.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment for Intake C-E-2	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep for a total of approximately 4,100 cubic yards of riprap, or 8

Items	Quantities
	barge round trips (assuming 1 barge with a capacity of 1000 tons). About 4,200 cubic yards of excavated material would be dredged from the river outside the cofferdam to support intake construction and riprap placement. This material would be transported to an existing and properly permitted off-site disposal area using 10 barge round trips. An additional 3 barge round trips would be required to support riprap placement, dredging, and log boom installation. Barges would only move through the Delta during weekday daylight hours. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard.
Sedimentation Basin Dimensions for Intake C-E-2	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1400 feet long and 395 feet wide at top of the embankment. Top elevation of embankment = 31.2 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 26 feet Each cell would be 1088 feet long and 239 feet wide at bottom of the embankment. Bottom elevation • Intake C-E-2: -14 feet Sedimentation Basin Side Slopes - Side slopes would be 3H:1V. Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sediment Basin Radial Gate Flow Control Structure at the junction with the Outlet Structure and Intake Outlet Shaft for Intake C-E-2	Four Large Radial Gates: 15 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 31.2 feet Bottom elevation of Flow Control Structure = - 8.7 feet
Outlet Channel from Flow Control Structure to Intake Outlet Shaft at Intake C-E-2	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 75 feet wide Top elevation of embankment = 31.2 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 8.7 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Sediment Drying Lagoons Dimensions for Intake C-E-2	Four sediment drying lagoons Each lagoon would be approximately 146 feet wide and 175 long at the bottom of the embankment.

Items	Quantities
	Each lagoon would be approximately 15 to 18 feet deep and contain an average of 10 to 12 feet of water. Embankment slopes would be 1H:1V. Side slopes and bottom would be concrete lined to facilitate removal of dried sediment. Sediment depth approximately 1 foot distributed over the floor of the lagoon during operations.
Sediment Drying Lagoons Outlet Structure (to convey water from the lagoons to a pump that to return any water to the Sediment Basin) for Intake C-E-2	Each lagoon would have an outlet structure: approximate 15 feet wide by 15 feet tall. Top elevation at the top of lagoon embankment. Bottom elevation 20 to 25 feet below top elevation.
On-site Electrical Substations – during Construction and Operation Phases for Intake C-E-2	An electrical substation would be established near the haul road entrance to the work site at the eastern boundary of the intake site. The substation would include switches, transformers, and related electrical gear housed within a 75 foot wide by 125 foot long enclosure with a separate safety and security fence. The substation would also be within the fenced secure total construction site area. After construction of the embankment, this substation would be relocated to the top of the embankment as shown on the engineering concept drawings. Smaller transformers less than 10 feet wide by 10 feet long would be positioned at several locations around the site. The transformers would have suitable containment, if required, and would be within the fenced secure total construction site area and additional security would not be needed.
Standby Engine Generator/Fuel Tank – during Construction and Operation Phases for Intake C-E-2	A 1 megawatt standby engine generator with a 1528 horsepower engine would be used primarily to supply the office complex and possibly to recharge electrical equipment during construction. The standby engine generator would be installed inside a fenced area of about 30 feet by 30 feet, including both the generator and the fuel tank. The fuel would be provided by a diesel tank with suitable containment or a propane tank stored above ground. After construction of the embankment, the standby engine generator would be replaced with new permanent generators at locations on the top of the embankment as described above and as shown on the engineering concept drawings. The permanent standby engine generators would provide energy to operate the valves and gates, including the ability to stop diversions at the intake structure.
Appurtenant Structures Dimensions – during Construction Phase for Intake C-E-2	Office trailers, showers/washrooms, a canteen and common area, and a bus shelter would be installed to serve the construction workers and other on-site personnel. Most of these buildings would be 15-feet tall or less (one story). Other buildings for warehousing for materials and temporary work enclosures would be less than 20 feet tall.
Appurtenant Structures Dimensions – during Operations Phase for Intake C-E-2	One of the construction buildings would be used for indoor storage of portable equipment and vehicles used for maintenance of all intakes during operations.
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month, not sequential

Items	Quantities
	Daytime concrete pour would throughout 250 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 130 weeks over the 250-week period.
On-Site Access Roads – during Construction Phase for Intake C-E-2	Approximately 2 miles of roads would be constructed within the intake site. Most of the interior roads would be covered with gravel, gravel over geotextile material, or paved depending upon the amount of vehicle use envisioned. Roads leading to the access road would be paved, including roads at the main office buildings and bus shelter.
On-Site Access Roads – during Operations Phase for Intake C-E-2	Towards the end of construction, about 9,500 feet of paved permanent access roads would be installed. Access to the intake site would occur from State Route 160 and from an access/haul road located to the west of the abandoned railroad embankment that would be installed during construction. These access roads would be 24-foot wide paved roads. Several internal access roads would be constructed around the base of the outlet shaft area, along the top of the embankments, and on ramps up the side of the embankments. These roads would receive substantial vehicle use, and therefore, would also be 24-foot wide paved roads. Approximately 6,000 feet of 20-foot wide gravel roads would be constructed around the sediment drying lagoons, along the length of the sedimentation basin parallel to State Route 160, and to provide access along the sediment loading areas.
On-Site Parking and Construction Materials and Vehicle Staging Areas – during Construction Phase for Intake C-E-2	An area approximately 100 feet wide by 200 feet long would be provided near the office complex for employee parking. Several small parking areas would be located near the office buildings and laydown areas to support vehicles for special tools and deliveries. An area approximately 200 feet wide by 200 feet long would be provided a bus that would transport employees from the park and ride lots near Interstate 5. Approximately 30 acres would be used for construction material staging and equipment management, including 15 acres for vehicle and equipment storage and maintenance. Areas used for equipment maintenance would use gravel surfaces, and areas used for vehicle and equipment storage would use unpaved surfaces. Areas with containment structures would be used for refueling and maintenance using grease, oils, or other similar chemical compounds.
On-Site Parking – during Operations Phase for Intake C-E-2	An area approximately 50 feet wide by 100 feet long would be provided for operations and maintenance workers and vehicle storage. Two areas located to the east of the sediment drying lagoons, approximately 2.5 acres, each, would be used to stage loading of the dried sediment into trucks for disposal.
Fencing and Security – during Construction Phase for Intake C-E-2 1	Approximately 18,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information.

Items	Quantities
	Construction site security would include 24-hours site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations and security personnel would be in contact using cell phones or short wave radio.
Fencing and Security – during Operations Phase for Intake C-E-2 [1]	Approximately 8,100 feet of 8-foot tall permanent chain link security fencing to enclose both the river side and land side of the facility along State Route 160. Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information.
Lighting Facilities – during Construction and Operations Phases for Intake C-E-2	Lights on land would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. Lights along the waterway would be for safety and navigational purposes only. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Wastewater Facilities – during Construction and Operations Phases for Intake C-E-2	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be maintained during long-term operations. The septic tank and leach field would be located near the eastern boundary of the intake but outside of the ground improvement areas. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site at the intake site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits.
SWPPP Facilities – during Construction for Intake C-E-2	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.

Items	Quantities
SWPPP Facilities – during Operations Phases for Intake C-E-2	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to the Sacramento River.
Fire Water Supplies Stored On-site for Intake C-E-2	300,000 gallons to provide up to 2,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.8 Tunnels – Central Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 7,500 cfs for the Central Corridor are summarized in Table B2.

Tunnel shaft construction between the intakes and Southern Complex for the Central Corridor would be the same as for facilities to provide a project design capacity of 6,000 cfs, as presented in Tables A3 through A8 in Appendix A, Section 10.1.2, unless otherwise indicated below.

The finished shaft elevations would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs due to the difference in hydraulic grade line, as discussed in the Hydraulic Analysis of Delta Conveyance Options –-Main Tunnel System Technical Memorandum in Attachment H to this EPR. The finished shaft elevations are summarized in Table B3.

The RTM volumes at each launch shaft site would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table B4.

Information related to construction of the tunnel shafts at the intakes are included in Table A1 for Intake C-E-3 and Intake C-E-5, and in Table B1 for Intake C-E-2.

TABLE B2. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FOR CENTRAL CORRIDOR FROM INTAKES TO SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Reception Shaft at Intake C-E-2	-140	147	Not Applicable	Not Applicable
Tunnel Maintenance Shaft at Intake C-E-3	-143	148	11,121	Drainage
Tunnel Maintenance Shaft at Intake C-E-5	-144	152	13,254	Not Applicable

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Launch Shaft Site on Twin Cities Complex	-146	156	29,828	Snodgrass Slough
Tunnel Maintenance Shaft on New Hope Tract	-148	149	22,365	Mokelumne River
Tunnel Maintenance Shaft on Staten Island	-151	140	22,168	South Fork Mokelumne River
Tunnel Reception Shaft and Tunnel Launch Shaft on Bouldin Island	-154	134	31,971	South Fork Mokelumne River
Tunnel Maintenance Shaft on Mandeville Island	-156	141	24,624	Potato Slough San Joaquin River
Tunnel Reception Shaft on Bacon Island	-159	145	28,481	Old River
Tunnel Working Shaft Site on Byron Tract (within Southern Complex)	-162	153	30,401	Railroad Cut Indian Slough Old River
Tunnel Launch Shaft Site on Byron Tract (within Southern Complex)	-163	157	5,069	Not Applicable
TOTAL TUNNEL LENGTH			219,281	

TABLE B3. SUMMARY OF FINISHED SHAFT ELEVATIONS FOR THE CENTRAL CORRIDOR FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Twin Cities Complex Tunnel Launch Shaft Pad	Finished shaft elevation = 37 feet
New Hope Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 36.5 feet
Staten Island Tunnel Maintenance Shaft Pad	Finished shaft elevation = 36.5 feet
Bouldin Island Tunnel Reception Shaft and Tunnel Launch Shaft Pad	Finished shaft elevation = 35 feet
Mandeville Island Tunnel Maintenance Shaft Pad	Finished shaft elevation = 31.3 feet
Bacon Island Tunnel Reception Shaft Pad	Finished shaft elevation = 31.2 feet
Byron Tract Tunnel Working Shaft Pad	Finished shaft elevation = 31.2 feet
Southern Forebay Inlet Structure Launch Shaft Pad	Finished shaft elevation = 31.2 feet

TABLE B4. SUMMARY OF RTM STORAGE FOR CENTRAL CORRIDOR AT TWIN CITIES COMPLEX, BOULDIN ISLAND, AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Twin Cities Complex RTM Initial Storage Stockpile	Temporary Dry Area = 10 acres x 10 feet high Temporary Wet Area = 21 acres x 5 feet high
Twin Cities Complex RTM Wet Storage	Area = 17 acres x 5 feet high
Twin Cities Complex RTM Natural Drying Area	Area = 83 acres x 1.5 feet high
Twin Cities Complex RTM Mechanical Dryer Equipment	Eighteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Twin Cities Complex Treated RTM Stockpile	North Stockpile Area = 94 acres x 20 feet high South Stockpile Area = 132 acres x 20 feet high
Twin Cities Permanent RTM Surplus Stockpile	Area = 275 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require

Items	Quantities
	treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 275 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Twin Cities Complex Fencing and Security – during Operations Phase [1]	During operations, approximately 20,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Bouldin Island RTM Initial Storage Stockpile	Area = 15 acres x 10 feet high
Bouldin Island RTM Natural Drying / Long Term Storage	Area = 225 acres x 7 feet high The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Bouldin Island Temporary Topsoil/Peat Storage	Topsoil Area = 21 acres to the north of the shaft pad Peat Area = 0.5 acres to the northeast of the shaft pad
Bouldin Island RTM Areas	Approximately 225 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Bouldin Island Fencing and Security – during Construction Phase [1]	Approximately 18,300 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.
Bouldin Island Fencing and Security – during Operations Phase [1]	Approximately 17,400 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Dry Stockpile	Area = 10 acres x 10 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Wet Stockpile	Area = 21 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Wet Storage	Area = 17 acres x 5 feet high
Mechanical Dryers at Southern Complex	Eighteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Natural Drying	Area = 83 acres x 1.5 feet high

Items	Quantities
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Treated RTM Stockpile	Area = 289 acres x 7 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Permanent RTM Surplus Storage	No surplus RTM Note: This only represents the RTM portion of this stockpile. Excess topsoil will also be stockpiled at this location.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.9 Tunnels – Eastern Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 7,500 cfs for the Eastern Corridor are summarized in Table B5.

Tunnel shaft construction between the intakes and Southern Complex for the Eastern Corridor would be the same as for facilities to provide a project design capacity of 6,000 cfs, as presented in Table A3 in Appendix A, Section 10.1.1 and Tables A10 through A16 in Appendix A, Section 10.1.3, unless otherwise indicated below.

The finished shaft elevations would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs due to the difference in hydraulic grade line, as discussed in the Hydraulic Analysis of Delta Conveyance Options –-Main Tunnel System Technical Memorandum in Attachment H to this EPR. The finished shaft elevations are summarized in Table B6.

The RTM volumes at each launch shaft site would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table B7.

Information related to construction of the tunnel shafts at the intakes are included in Table A1 for Intake C-E-3 and Intake C-E-5, and in Table B1 for Intake C-E-2.

TABLE B5. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FOR EASTERN CORRIDOR FROM INTAKES TO SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Reception Shaft at Intake C-E-2	-140	147	Not Applicable	Not Applicable
Tunnel Reception Shaft at Intake C-E-3	-140	143	11,121	Drainage
Tunnel Maintenance Shaft at Intake C-E-5	-142	150	13,254	Not Applicable
Tunnel Launch Shaft Site on Twin Cities Complex	-146	155	29,828	Snodgrass Slough

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Maintenance Shaft on New Hope Tract	-147	155	24,111	Snodgrass Slough Mokelumne River
Tunnel Maintenance Shaft on Canal Ranch Tract	-149	151	15,857	Beaver Slough
Tunnel Reception Shaft on Terminous Tract	-152	150	27,001	Hog Slough Sycamore Slough
Tunnel Maintenance Shaft on King Island	-154	143	20,820	White Slough
Tunnel Reception Shaft and Tunnel Launch Shaft on Lower Roberts Island	-157	146	29,329	White Slough
Tunnel Maintenance Shaft on Upper Jones Tract	-159	161	27,344	Whiskey Slough Hayes Slough Old River
Tunnel Working Shaft Site on Byron Tract (within Southern Complex)	-162	153	29,801	Middle River Woodward Canal – North Victoria Canal Old River
Tunnel Launch Shaft Site on Byron Tract (Southern Forebay Inlet Structure at the South Delta Pumping Plant)	-163	157	5,069	Not Applicable
TOTAL TUNNEL LENGTH			233,534	

TABLE B6. SUMMARY OF FINISHED SHAFT ELEVATIONS FOR THE EASTERN CORRIDOR FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Twin Cities Complex Tunnel Launch Shaft Pad	Finished shaft elevation = 37 feet
New Hope Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 37.5 feet
Canal Ranch Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 37.5 feet
Terminous Tract Tunnel Reception Shaft Pad	Finished shaft elevation = 36 feet
King Island Tunnel Maintenance Shaft Pad	Finished shaft elevation = 34.5 feet
Lower Roberts Island Tunnel Reception Shaft and Tunnel Launch Shaft Pad	Finished shaft elevation = 31.2 feet
Upper Jones Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 31.2 feet
Byron Tract Tunnel Working Shaft Pad	Finished shaft elevation = 31.2 feet
Southern Forebay Inlet Structure Launch Shaft Pad	Finished shaft elevation = 31.2 feet

TABLE B7. SUMMARY OF RTM STORAGE FOR EASTERN CORRIDOR AT TWIN CITIES COMPLEX, LOWER ROBERTS ISLAND, AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Twin Cities Complex RTM Initial Storage Stockpile	Temporary Dry Area = 10 acres x 10 feet high Temporary Wet Area = 21 acres x 5 feet high
Twin Cities Complex RTM Wet Storage	Area = 17 acres x 5 feet high
Twin Cities Complex RTM Natural Drying Area	Area = 83 acres x 1.5 feet
Twin Cities Complex RTM Mechanical Dryer Equipment	Eighteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Twin Cities Complex Treated RTM Stockpile	North Stockpile Area = 225 acres x 11 feet South Stockpile Area = 64 acres x 11 feet
Twin Cities Permanent RTM Surplus Stockpile	Area = 51 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 51 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Twin Cities Complex Fencing and Security – during Operations Phase [1]	During operations, approximately 21,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lower Roberts Island RTM Initial Storage Stockpile	Area = 16 acres x 10 feet high
Lower Roberts Island RTM Natural Drying	Area = 225 acres x 8 feet
Lower Roberts Island RTM Long Term Storage	Area = 93 acres x 15 feet The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Lower Roberts Island Temporary Topsoil/Peat Storage	Topsoil Area = 24 acres to the south of the permanent RTM stockpile Peat Area = 1.5 acres to the north of the shaft pad
Lower Roberts Island RTM Areas	Approximately 20 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 93 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Lower Roberts Island Fencing and Security – during Construction Phase [1]	Approximately 20,000 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).

Items	Quantities
Lower Roberts Island Fencing and Security – during Operations Phase [1]	Approximately 18,100 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Dry Stockpile	Area = 10 acres x 10 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Wet Stockpile	Area = 21 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Wet Storage	Area = 17 acres x 5 feet high
Mechanical Dryers at Southern Complex	Eighteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Natural Drying	Area = 81 acres x 1.5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Treated RTM Stockpile	Area = 289 acres x 11 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Permanent RTM Surplus Storage	Area = 51 acres x 15 feet high Note: This only represents the RTM portion of this stockpile. Excess topsoil will also be stockpiled at this location.

Notes:

[1] Site sizes are approximate; exact area should be obtained from the GIS.

[2] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.10 Southern Complex on Byron Tract

The Bryon Tract Working Shaft and Southern Forebay Inlet Structure Tunnel Launch Shaft facilities and Southern Forebay Outlet Structure Dual Tunnel Launch Shaft would be the same as for facilities to provide a project design capacity of 6,000 cfs, as presented in Tables A17 and A20 in Appendix A, Section 10.1.4, respectively. The RTM volumes at each launch shaft site would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations.

The South Delta Pumping Plant for a project design capacity of 7,500 cfs would be similar to a project design capacity of 6,000 cfs, as presented in Table A19 in Appendix A, Section 10.1.4, except:

- Pump Station Building: 99-foot wide x 413-foot length.
- Electrical Building: 91-foot wide x 207-foot length.

  The tunnel reach lengths and shaft invert elevations and depths from the Southern Forebay to Banks Pumping Plant approach channel for a project design capacity of 7,500 cfs would be similar to a project design capacity of 6,000 cfs, as presented in Table A21 in Appendix A, Section 10.1.4, except that the tunnel inside diameter would be 40-feet (44-foot outside diameter).

10.1.11 Southern Complex Located to the West of Byron Highway

South Delta Outlet and Control Structure, including Reception Shaft, and California Aqueduct facilities for project design capacity of 7,500 cfs would be similar to facilities described in Section 10.1.5 for project design capacity of 6,000 cfs, as presented in Table A22 in Appendix A, Section 10.1.5.

The South Delta Outlet and Control Structure would be slightly modified to accommodate the Jones Control Structure with a tunnel launch shaft for a project design capacity of 7,500 cfs, as summarized in Table B8. Information related to the tunnel reception shaft at the Jones Outlet Structure adjacent to the Jones Pumping Plant approach channel, and the Delta-Mendota Control Structure is summarized in Table B9. These facilities would result in a larger Southern Complex area located to the west of Byron Highway and the construction and post-construction acreages are provided in Table 12.

TABLE B8. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR SOUTH DELTA OUTLET STRUCTURE AND JONES CONTROL STRUCTURE FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities and Description
Construction Hours for South Delta Outlet and Control Structure and Jones Control Structure	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab (as needed for cofferdam and excavations) – construction continuous until concrete pour is completed, approximately 3 days per pour. Jones Control Structure: Tunneling and RTM removal would occur 20 hours/day for 5 days/week and equipment maintenance would occur for 10 hours/day for another day each week. Tunnel segment and materials deliveries – could occur at night due to railroad schedules and/or traffic congestion.
South Delta Outlet and Control Structure Tunnel Reception Shaft Pad	See Table A22 in Appendix A, Section 10.1.5.
South Delta Outlet and Control Structure	See Table A22 in Appendix A, Section 10.1.5.
Jones Control Structure at the South Delta Outlet and Control Structure	Control Structure = 222 feet wide x 370 feet long x 45 feet high Control Structure Bottom Width = 150 feet Site Grade Elevation = 30 feet Control Structure Invert (bottom) Elevation = -15 feet Radial Gates • Two Radial Gates = 16 feet wide x 40 feet high • One Radial Gate = 15 feet wide x 8 feet high • Final gate size, type, and quantity to be determined during final design. Isolation Stop Log Gates for Gate Maintenance • Eight 16 feet wide x 21.5 feet high stop logs • Block walled area for stop log storage = 80 feet x 200 feet long x 12 feet high Mobile truck crane (not permanent structure) would place and remove stop logs
Tunnel Launch Shaft Pad at Jones Control Structure	Top of shaft pad = 20 feet below ground (pre-excavated to top of shaft pad elevation) Top of shaft pad elevation = 30 feet
Tunnel Launch Shaft Pad Gantry Crane at Jones Control Structure	Gantry Crane = 90-foot high crane over the launch shaft Crane Pad on Shaft Pad = 80-foot wide x 35-foot long

Items	Quantities and Description
Tunnel Shaft at Jones Control Structure	Shaft Depth during construction = 122 feet Shaft Depth during operations = 140 feet
Shaft Ventilation Fan Housing at Jones Control Structure	Area = 30-foot wide x 20-foot long, up to 30 feet tall
Tunnel Liner Segment Storage at Jones Control Structure	Area = 6 acres for 4-months supply plus 1 acre staging/unloading area (assume segments stored 4-segments high [10-foot high])
TBM Storage Building and Laydown Area at Jones Control Structure	Building = 70-foot wide x 125-foot long, up to 12 feet tall Laydown Area = 60-foot wide x 170-foot long
Diaphragm Wall/Trench Slurry Plant at Jones Control Structure	Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
TBM Grout Slurry Plant and Facilities at Jones Control Structure	Area for Slurry/Grout Mixing Plant = 65-foot wide x 122-foot long Silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos
Emergency Response Facilities during Construction	See Table A18 in Appendix A, Section 10.1.5.
Contractor’s Facilities	See Table A22 in Appendix A, Section 10.1.5.
Electrical Control Building	See Table A22 in Appendix A, Section 10.1.5.
Standby Engine Generator	See Table A22 in Appendix A, Section 10.1.5.
Contractor’s Facilities	See Table A22 in Appendix A, Section 10.1.5.
Fuel Station	See Table A22 in Appendix A, Section 10.1.5.
Duration for Concrete Pours for South Delta Outlet and Control Structure and Jones Control Structure	For each tunnel shaft • Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month All other structures • Daytime concrete pour would throughout 403 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 111 weeks over the 403-week period.
On-site Access Road during Construction	See Table A22 in Appendix A, Section 10.1.5.
On-site Parking during Construction	See Table A22 in Appendix A, Section 10.1.5.
Lighting Facilities during Construction Phase	See Table A22 in Appendix A, Section 10.1.5.
Erosion Control	See Table A22 in Appendix A, Section 10.1.5.
California Aqueduct Control Structure	See Table A22 in Appendix A, Section 10.1.5.
Wastewater Facilities - during Construction and Operations	See Table A22 in Appendix A, Section 10.1.5.
SWPPP Facilities – during Construction and Operation Phases	See Table A22 in Appendix A, Section 10.1.5.
Fire Water Supplies Stored On-site	1,000,000 gallons to provide up to 4,500 gallons/minute for 4 hours

TABLE B9. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR JONES OUTLET STRUCTURE, INCLUDING RECEPTION SHAFT, AND DELTA-MENDOTA CONTROL STRUCTURE FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities and Description
Construction Hours at Jones Outlet Structure and Delta-Mendota Control Structure	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Placement of concrete for tremie slab (as needed for cofferdam and excavations) – construction continuous until concrete pour is completed, approximately 3 days per pour.
Tunnel Reception Shaft Pad at Jones Outlet Structure	Top of shaft pad = at, or near, ground level

Items	Quantities and Description
	Top of shaft pad elevation = 38 feet (unless site degraded pro to construction-TBD during design phase) Shaft Depth during construction = 121 feet Shaft Depth during operations = 121 feet Shaft Ventilation Fan Housing Area = 12-foot wide x 15-foot long, up to 30 feet tall Diaphragm Wall/Trench Slurry Plant Area: 20-foot wide x 30-foot long plant and 50-foot wide x 50-foot long pond
Jones Outlet Structure	Outlet Structure = varies, 220 feet to 450 feet wide x 350 feet to 500 feet long x 32 feet high Structure Bottom Width = varies, 150 to 370 feet Embankment Crest Elevation = varies, 13 to 40 feet Outlet Structure Invert (bottom) Elevation = -6.5 feet Isolation Stop Log Panels • Sixteen 33.5 feet long x 20-feet wide stop logs with stop logs stacked two-high. • Stop logs would be stored in a 100 foot by 80 foot block wall enclosed storage facility.
Delta-Mendota Control Structure	Delta-Mendota Control Structure = 312 feet wide x 1,031 feet long, top elevation = 24 feet, invert elevation = -14 to -17 feet Radial Gates • Three Radial Gates = 24 feet wide x 37 feet high • One Radial Gates = 15 feet wide x 19 feet high • Final gate size, type, and quantity to be determined during final design. Isolation Stop Log Gates for Gate Inspection • Twelve 26 feet wide x 13.5 feet high stop logs • Four 17 feet wide x 13.5 feet high stop logs • Stop logs would be stored on-site within 100-foot by 80-foot block wall enclosed storage facility
Electrical Control Building at Jones Outlet Structure	Electrical Control Building = 50 feet wide x 60 feet long x less than 20 feet high
Standby Engine Generator at Jones Outlet Structure	Portable 200 kilowatt mobile generator and fuel tank would be used on this site
Contractor's Facilities at Jones Outlet Structure and Delta-Mendota Control Structure	Jones Outlet Structure • Five trailers = 50 feet wide x 60 feet long x 11 feet high • 10 Equipment Storage Containers = 8 feet wide x 40 feet long x 8 feet high Jones Outlet Structure Tunnel Reception Shaft • Two buildings, 12-foot wide x 40-foot long, up to 12 feet tall each • Crew Facilities = One building, 24-foot wide x 40-foot long, up to 12 feet tall • Steel Fabrication Area and Miscellaneous Steel Storage Buildings = Two buildings, 70-foot wide x 35-foot long, up to 15 feet tall each • Maintenance Shop = One building, 20-foot wide x 30-foot long, up to 25 feet tall
Fuel Station at Jones Outlet Structure	Fuel Station within Confined Area = 8 feet wide x 12 feet long x 8 feet high
Duration for Concrete Pours for Jones Outlet Structure and Delta-Mendota Canal Control Structure	For each tunnel shaft • Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month All other structures • Daytime concrete pour would throughout 146 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 55 weeks over the 146-week period.

Items	Quantities and Description
On-site Access Road during Construction at Jones Outlet Structure and Delta-Mendota Control Structure	80,000 square feet of gravel access roads for on-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along the access roads to provide water sprays onto excavated soils for dust control.
On-site Parking during Construction at Jones Outlet Structure and Delta-Mendota Control Structure	40,000 square feet of gravel pavement for vehicle parking 125,000 square feet of gravel pavement for equipment parking
Lighting Facilities during Construction Phase at Jones Outlet Structure and Delta-Mendota Control Structure	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods.
Erosion Control at Jones Outlet Structure and Delta-Mendota Control Structure	Most areas of the site would be covered with pavement, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch.
Fencing and Security during Construction at Jones Outlet Structure and Delta-Mendota Control Structure	The site would be within the security fencing established by the Project. About 6,000 linear feet of fencing would be provided.
Wastewater Facilities - during Construction and Operations at Jones Outlet Structure and Delta-Mendota Control Structure	Portable restrooms would be placed on-site during construction and hauled to the site during maintenance activities.
SWPPP Facilities – during Construction and Operation Phases at Jones Outlet Structure and Delta-Mendota Control Structure	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

10.1.12 Access Roads

Access roads for a project design capacity of 7,500 cfs would be similar to facilities described in Section 10.1.6 for project design capacity of 6,000 cfs, as presented in Table A23 in Appendix A, Section 10.1.6. Additional access would be required for Intake C-E-2 and for access to the Jones Outlet Structure and Delta-Mendota Control Structure, as described below.

> Access to Intake C-E-2 would be provided by a 2.54 mile extension of the Intake Access Road from Intake C-E-3. The paved road would be 32-feet wide with two 12-foot lanes and 4-foot-wide shoulders on both sides. This access road also would include a 350-foot long and 32-foot wide bridge over a drainage channel.
>
> Access to the Jones Outlet Structure and Delta-Mendota Control Structure would be provided along existing roads, including Herdlyn Road and an existing access road to the CVP Jones Pumping Plant.

The required piles and piers for access roads for a project design capacity of 7,500 cfs would be similar to those described in Section 10.1.6. However, there would be additional piles required for the access road from Intake C-E-3 to Intake C-E-2 for both the Central and Eastern corridors. The access road from Intake C-E-3 to Intake C-E-2 would include a new 350-foot long and

32-foot wide bridge over a drainage channel. The bridge would require 50 permanent driven piles and 44 vibrated H piles. They would be 50-feet deep and 16-inches in diameter installed at 6 piles per day.

APPENDIX C - Summary of Information for the Project Design Capacity of 3,000 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 3,000 cfs with cylindrical tee fish screens. The facilities required for a project design capacity of 3,000 cfs would utilize all of the facilities included for the project design capacity of 6,000 cfs except that there would only be one intake, Intake C-E-5, with a design capacity of 3,000 cfs. The lower project design capacity would result in changes in tunnel diameters and South Delta Pumping Plant building sizes, as described in this appendix.

This appendix includes the following tables.

- **Section 10.3.2 Tunnels – Central Corridor between Intakes and Southern Complex**
  - **Table C1.** Summary of RTM Storage for Central Corridor at Twin Cities Complex, Bouldin Island, and Southern Complex for a Project Design Capacity of 3,000 cfs
- **Section 10.3.3 Tunnels – Eastern Corridor between Intakes and Southern Complex**
  - **Table C2.** Summary of RTM Storage for Central Corridor at Twin Cities Complex, Lower Roberts Island, and Southern Complex for a Project Design Capacity of 3,000 cfs

10.1.13 Intake C-E-5

Intake facilities to provide a project design capacity of 3,000 cfs would include use of one intake with a design capacity of 3,000 cfs, Intake C-E-5. Information for Intake C-E-5 is presented in Table A1 in Appendix A, Section 10.1.1. Intake C-E-5 would also include the Emergency Response Facilities designated for Intake C-E-3 in Table A.1 in Appendix A, Section 10.1.1.

10.1.14 Tunnels – Central Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 3,000 cfs for the Central Corridor would be the same as shown for Intake C-E-5 to the Southern Forebay in Table A2 in Appendix A, Section 10.1.2. However, the tunnel would be based on a 26-foot inside diameter (approximately 28-foot outside diameter) tunnel that would extend between Intake C-E-5 to the Southern Complex. Tunnel shaft construction would be as presented in Tables A3 through A8 in Appendix A, Section 10.1.2. Information related to construction of the tunnel shafts at the intakes are included in Table A1 for Intake C-E-5 in Appendix A, Section 10.1.1.

The RTM volumes at each launch shaft site would be different for a project design capacity of 3,000 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table C1.

TABLE C1. SUMMARY OF RTM STORAGE FOR CENTRAL CORRIDOR AT TWIN CITIES COMPLEX, BOULDIN ISLAND, AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 3,000 CFS

Items	Quantities and Description
Twin Cities Complex RTM Initial Storage Stockpile	Temporary Dry Area = 6 acres x 10 feet high Temporary Wet Area = 12 acres x 5 feet high
Twin Cities Complex RTM Wet Storage	Area = 10 acres x 5 feet high
Twin Cities Complex RTM Natural Drying Area	Area = 48 acres x 1.5 feet high
Twin Cities Complex RTM Mechanical Dryer Equipment	Twelve dryers which are each 55-feet long x 13-feet wide and 14-feet high
Twin Cities Complex Treated RTM Stockpile	North Stockpile Area = 17 acres x 20 feet high South Stockpile Area = 42 acres x 20 feet high
Twin Cities Permanent RTM Surplus Stockpile	Area = 15 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 15 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Twin Cities Complex Fencing and Security – during Operations Phase [1]	During operations, approximately 5,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Bouldin Island RTM Initial Storage Stockpile	Area = 9 acres x 10 feet high
Bouldin Island RTM Natural Drying / Long Term Storage	Area = 129 acres x 7 feet high The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Bouldin Island Temporary Topsoil/Peat Storage	Topsoil Area = 13 acres to the north of the shaft pad Peat Area = 0.5 acres to the northeast of the shaft pad
Bouldin Island RTM Areas	Approximately 129 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Bouldin Island Fencing and Security – during Construction Phase [1]	Approximately 15,200 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.

Items	Quantities and Description
Bouldin Island Fencing and Security – during Operations Phase [1]	Approximately 14,600 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Dry Stockpile	Area = 7 acres x 10 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Wet Stockpile	Area = 16 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Wet Storage	Area = 12 acres x 5 feet high
Mechanical Dryers at Southern Complex	14 dryers which are each 55-feet long x 13-feet wide and 14-feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Natural Drying	Area = 62 acres x 1.5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Treated RTM Stockpile	Area = 289 acres x 4 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Permanent RTM Surplus Storage	No surplus RTM Note: This only represents the RTM portion of this stockpile. Excess topsoil will also be stockpiled at this location.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.15 Tunnels – Eastern Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 3,000 cfs for the Eastern Corridor would be the same as shown for Intake C-E-5 to the Southern Forebay in Table A9 in Appendix A, Section 10.1.3. However, the tunnel would be based on a 26-foot inside diameter (approximately 28-foot outside diameter) tunnel that would extend between Intake C-E-5 to the Southern Complex. Tunnel shaft construction would be as presented in Tables A3 in Appendix A, Section 10.1.2 and Tables A10 through A16 in Appendix A, Section 10.1.3. Information related to construction of the tunnel shafts at the intakes are included in Table A1 for Intake C-E-5.

The RTM volumes at each launch shaft site would be different for a project design capacity of 3,000 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table C2.

TABLE C2. SUMMARY OF RTM STORAGE FOR EASTERN CORRIDOR AT TWIN CITIES COMPLEX, LOWER ROBERTS ISLAND, AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 3,000 CFS

Items	Quantities and Description
Twin Cities Complex RTM Initial Storage Stockpile	Temporary Dry Area = 6 acres x 10 feet high Temporary Wet Area = 12 acres x 5 feet high
Twin Cities Complex RTM Wet Storage	Area = 10 acres x 5 feet high
Twin Cities Complex RTM Natural Drying Area	Area = 48 acres x 1.5 feet high
Twin Cities Complex RTM Mechanical Dryer Equipment	Twelve dryers which are each 55-feet long x 13-feet wide and 14-feet high
Twin Cities Complex Treated RTM Stockpile	North Stockpile Area = 20 acres x 20 feet high South Stockpile Area = 44 acres x 20 feet high
Twin Cities Permanent RTM Surplus Stockpile	Area = 15 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 44 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Twin Cities Complex Fencing and Security – during Operations Phase [1]	During operations, approximately 5,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lower Roberts Island RTM Initial Storage Stockpile	Area = 9 acres x 10 feet high
Lower Roberts Island RTM Natural Drying	Area = 129 acres x 5 feet high
Lower Roberts Island RTM Long Term Storage	Area = 33 acres x 15 feet high The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Lower Roberts Island Temporary Topsoil/Peat Storage	Topsoil Area = 16 acres to the south of the permanent RTM stockpile Peat Area = 1.5 acres to the north of the shaft pad
Lower Roberts Island RTM Areas	Approximately 20 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 33 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.

Items	Quantities and Description
Lower Roberts Island Fencing and Security – during Construction Phase [1]	Approximately 18,400 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lower Roberts Island Fencing and Security – during Operations Phase [1]	Approximately 17,100 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Dry Stockpile	Area = 7 acres x 10 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Wet Stockpile	Area = 16 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Wet Storage	Area = 12 acres x 5 feet high
Mechanical Dryers at Southern Complex	14 dryers which are each 55-feet long x 13-feet wide and 14-feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Natural Drying	Area = 62 acres x 1.5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Treated RTM Stockpile	Area = 289 acres x 5.5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Permanent RTM Surplus Storage	No surplus RTM Note: This only represents the RTM portion of this stockpile. Excess topsoil will also be stockpiled at this location.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.16 Southern Complex

The Southern Complex would be the same as for facilities to provide a project design capacity of 6,000 cfs, as presented in Table A17 and A22 in Appendix A, Sections 10.14 and 10.15, respectively. The RTM volumes at each launch shaft site would be different for a project design capacity of 3,000 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations.

The South Delta Pumping Plant for a project design capacity of 3,000 cfs would be similar to a project design capacity of 6,000 cfs, as presented in Table A19 in Appendix A, Section 10.1.4, except:

- Pump Station Building: 99-foot wide x 345-foot length.
- Electrical Building: 86-foot wide x 184-foot length.

  The pump station would include five pumps at 960 cfs, each, including two standby pumps; three pumps at 600 cfs, each, including one standby pump; and two portable pumps to dewater the tunnel.

10.1.17 Access Roads

Access roads for a project design capacity of 3,000 cfs would be similar to facilities described in Section 10.16 for project design capacity of 6,000 cfs, as presented in Table A23 in Appendix A, Section 10.1.6 without the intake access road between Intake C-E-5 and Intake C-E-3. The required piles and piers for access roads for a project design capacity of 3,000 cfs would be similar to those described in Section 10.1.6 for project design capacity of 6,000 cfs except without the widening of the Hood-Franklin Bridge between Intake C-E-5 and Intake C-E-3.

APPENDIX D - Summary of Information for the Project Design Capacity of 4,500 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 4,500 cfs with cylindrical tee fish screens. The facilities required for a project design capacity of 4,500 cfs would utilize all of the facilities included for the project design capacity of 6,000 cfs except that except that the design capacity of Intake C-E-5 would be 1,500 cfs. The lower project design capacity also would result in changes in tunnel diameters and South Delta Pumping Plant building sizes, as described in this appendix.

This appendix includes the following tables.

- **Section 10.4.1 Intakes C-E-3 and C-E-5**
  - **Table D1.** Construction Conditions and Constructed Facilities Summary for Intake C-E-5 for 1,500 cfs Design Capacity with Cylindrical Tee Fish Screens
- **Section 10.4.2 Tunnels – Central Corridor between Intakes and Southern Complex**
  - **Table D2.** Summary of RTM Storage for Central Corridor at Twin Cities Complex, Bouldin Island, and Southern Complex for a Project Design Capacity of 4,500 cfs
- **Section 10.4.3 Tunnels – Eastern Corridor between Intakes and Southern Complex**
  - **Table D3.** Summary of RTM Storage for Central Corridor at Twin Cities Complex, Lower Roberts Island, and Southern Complex for a Project Design Capacity of 4,500 cfs

10.1.18 Intakes C-E-3 and C-E-5

Intake facilities to provide a project design capacity of 4,500 cfs would include use of one intake with a design capacity of 3,000 cfs, Intake C-E-3, and one intake with a design capacity of 1,500 cfs, Intake C-E-5.

Information for Intake C-E-3 is presented in Table A1 in Appendix A, Section 10.1.1.

Information for Intake C-E-5 is presented in Table D1.

TABLE D1. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR INTAKE C-E-5 FOR 1,500 CFS DESIGN CAPACITY WITH CYLINDRICAL TEE FISH SCREENS

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Connection of relocated State Route 160 onto temporary levee and permanent levee: at night if allowed by Caltrans Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.
Temporary Levee and State Route 160 Levee Dimensions	Length of Temporary Levee • Intake C-E-5: 3,500 feet along the centerline

Items	Quantities
	Top elevation of Temporary Levee • Intake C-E-5: approximately 29 feet (18 to 20 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 22 feet) with sea level rise for 2040 and 3 feet of freeboard Width of Top of Temporary Levee = 60 feet including State Route 160 Width of Bottom of Temporary Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus shoulders and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Temporary Levee	The temporary levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee would only be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee • Intake C-E-5 would extend to an elevation -20 feet (this elevation is just above the nearby portions of the river bottom)
Permanent Levee and State Route 160 Dimensions (State Route 160 would be relocated to a fill pad between the intake structure and the sedimentation basin)	Length of Permanent Levee • Intake C-E-5: 5,900 feet along the centerline Top elevation of Permanent Levee • Intake C-E-5: 29.3 feet (18 to 25 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 26.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020b) Width of Top of Permanent Levees = 60 feet including State Route 160 Width of Bottom of Permanent Levees = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus deceleration and turning lanes for intake site access, shoulders, and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Permanent Levee for Each Intake	The permanent levee embankment would be constructed around the sedimentation basin and the outlet channel. The levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee placement would be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would be within the excavation footprint for the sedimentation basin and would extend to elevation -20 feet (this elevation is just above the nearby portions of the river bottom) Erosion protection would be placed on the interior side of the sediment basin embankment, as described below. The inside of the levee would be protected from erosion as described above. The outside of the embankment would be planted with native grass.
Ground Improvement for Each Intake	Ground improvement would be installed under the levees and facilities embankments. The quantity of improved ground would be approximately 1.5 to 2.0 million cubic yards of mixed wall sections and approximately 250,000 to 350,000 tons of cement.

Items	Quantities
Cofferdam at Intake C-E-5	Length = 1789 feet (including cofferdam and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-5	Length of cofferdam and training wall sheet pile system = 1270 feet Approximate number of piles (”Z” sheet pairs) = 277 (includes 225 in front row of cofferdam and training walls) Preliminary cofferdam sheet pile tip elevations = -55 feet Length of cofferdam DMM wall system = 519 feet Preliminary DMM wall bottom elevation = -100 Approximate number of drilled piers within cofferdam = 591 Preliminary drilled pier tip elevation = -100 Pile drivability: Number of blows per sheetpile pair = 10 Total number of blows = 2770 Estimated total impact pile driving time (time for the partial vibratory pile installation, equipment setup, periodic alignment check, and downtime are not included) = 10 hours
Intake Structure at Intake C-E-5	Length = 1034 feet along river including training walls Length = 469 feet along river for concrete structure only Top elevation = Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 18 feet River elevation at this location = -15 to -22 feet Intake Structure floor elevation would be at the bottom of screen panel = -16 feet Intake Structure concrete front slab elevation = -17 feet Fish Screen Elevation at the bottom of the fish screen = -13 feet Gantry Crane on top of Intake Structure width = 35 feet Gantry Crane on top of Intake Structure top elevation = 69 feet (40 feet above Intake Structure)
Cylindrical Tee Screen Assembly for Intake C-E-5	Number of Fish Screen Units = 15 Each unit: 8 feet in diameter and 30 feet long, including fish screen and manifold assembly, and mounted on the face of the structure Each unit includes internal and external fixed brush cleaning system Each unit would extend about 12 feet from the intake structure into the river Complete assembly includes 60-inch diameter piping and control gates from the screen unit to the sedimentation basin
Portable Fish Screen Pressure Washer (not mounted on Intake Structure) for Intake C-E-5	Trailer mounted rig to maneuver equipment for pressure washing screens would be approximately 6 feet tall, 6 feet wide, and 8 feet long. A standard pickup truck would tow this rig.
Portable Mobile Crane (not mounted on Intake Structure) for Intake C-E-5	Mobile crane to load and unload intake features would be approximately 15 feet tall, 20 feet wide, and 400 feet long. A 100-foot long boom would be extended from the main crane. Standard tractor trailer rig with a flat-bed trailer would be used to transport panels to and from the intake.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment for Intake C-E-5	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep for a total of approximately 5,400 cubic yards of riprap, or 10 barge round trips (assuming 1 barge with a capacity of 1000 tons).

Items	Quantities
	About 6,400 cubic yards of excavated material would be dredged from the river outside the cofferdam to support intake construction and riprap placement. This material would be transported to an existing and properly permitted off-site disposal area using 14 barge round trips. An additional 3 barge round trips would be required to support riprap placement, dredging, and log boom installation. Barges would only move through the Delta during weekday daylight hours. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard.
Sedimentation Basin Dimensions for Intake C-E-5	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1050 feet long and 395 feet wide at top of the embankment. Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 26 feet Each cell would be 738 feet long and 239 feet wide at bottom of the embankment. Bottom elevation • Intake C-E-5: -18 feet Sedimentation Basin Side Slopes - Side slopes would be 3H:1V. Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sediment Basin Radial Gate Flow Control Structure at the junction with the Outlet Structure and Intake Outlet Shaft for Intake C-E-5	Four Large Radial Gates: 15 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 29.3 feet Bottom elevation of Flow Control Structure = - 9 feet
Outlet Channel from Flow Control Structure to Intake Outlet Shaft at Intake C-E-5	Top and inside of embankment: 750 feet long and 300 feet wide Bottom and inside of embankment: 750 feet long and 75 feet wide Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 9 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Sediment Drying Lagoons Dimensions for Intake C-E-5	Four sediment drying lagoons Each lagoon would be approximately 146 feet wide and 175 long at the bottom of the embankment. Each lagoon would be approximately 15 to 18 feet deep and contain an average of 10 to 12 feet of water. Embankment slopes would be 1H:1V. Side slopes and bottom would be concrete lined to facilitate removal of dried sediment. Sediment depth approximately 1 foot distributed over the floor of the lagoon during operations.
Sediment Drying Lagoons Outlet Structure (to convey water from the lagoons to a pump that to return any water to the Sediment Basin) for Intake C-E-5	Each lagoon would have an outlet structure: approximate 15 feet wide by 15 feet tall. Top elevation at the top of lagoon embankment. Bottom elevation 20 to 25 feet below top elevation.

Items	Quantities
On-site Electrical Substations – during Construction and Operation Phases for Intake C-E-5	An electrical substation would be established near the haul road entrance to the work site at the eastern boundary of the intake site. The substation would include switches, transformers, and related electrical gear housed within a 75 foot wide by 125 foot long enclosure with a separate safety and security fence. The substation would also be within the fenced secure total construction site area. After construction of the embankment, this substation would be relocated to the top of the embankment as shown on the engineering concept drawings. Smaller transformers less than 10 feet wide by 10 feet long would be positioned at several locations around the site. The transformers would have suitable containment, if required, and would be within the fenced secure total construction site area and additional security would not be needed.
Standby Engine Generator/Fuel Tank – during Construction and Operation Phases for Intake C-E-5	A 1 megawatt standby engine generator with a 1528 horsepower engine would be used primarily to supply the office complex and possibly to recharge electrical equipment during construction. The standby engine generator would be installed inside a fenced area of about 30 feet by 30 feet, including both the generator and the fuel tank. The fuel would be provided by a diesel tank with suitable containment or a propane tank stored above ground. After construction of the embankment, the standby engine generator would be replaced with new permanent generators at locations on the top of the embankment as described above and as shown on the engineering concept drawings. The permanent standby engine generators would provide energy to operate the valves and gates, including the ability to stop diversions at the intake structure.
Appurtenant Structures Dimensions – during Construction Phase for Intake C-E-5	Office trailers, showers/washrooms, a canteen and common area, and a bus shelter would be installed to serve the construction workers and other on-site personnel. Most of these buildings would be 15-feet tall or less (one story). Other buildings for warehousing for materials and temporary work enclosures would be less than 20 feet tall.
Appurtenant Structures Dimensions – during Operations Phase for Intake C-E-5	One of the construction buildings would be used for indoor storage of portable equipment and vehicles used for maintenance of all intakes during operations.
Duration for Concrete Pours	Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month, not sequential Daytime concrete pours would take place throughout 250 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 130 weeks over the 250-week period.
On-Site Access Roads – during Construction Phase for Intake C-E-5	Approximately 2 miles of roads would be constructed within the intake site. Most of the interior roads would be covered with gravel, gravel over geotextile material, or paved depending upon the amount of vehicle use envisioned. Roads leading to the access road would be paved, including roads at the main office buildings and bus shelter.
On-Site Access Roads – during Operations Phase for Intake C-E-5	Towards the end of construction, about 8,000 feet of paved permanent access roads would be installed. Access to the intake site would occur from State Route 160 and from an access/haul road located to the west of the abandoned railroad embankment that would be installed during construction. These access roads would be 24-foot wide paved roads. Several internal access roads would be constructed around the base of the outlet shaft area, along the top of the embankments, and on ramps up the side of the embankments. These roads would receive substantial vehicle use, and therefore, would also be 24-foot wide paved roads. Approximately 6,000 feet of 20-foot wide gravel roads would be constructed around the sediment drying lagoons, along the length of the sedimentation basin parallel to State Route 160, and to provide access along the sediment loading areas.
On-Site Parking and Construction Materials and Vehicle Staging Areas – during Construction Phase for Intake C-E-5	An area approximately 100 feet wide by 200 feet long would be provided near the office complex for employee parking. Several small parking areas would be

Items	Quantities
	located near the office buildings and laydown areas to support vehicles for special tools and deliveries. An area approximately 200 feet wide by 200 feet long would be provided a bus that would transport employees from the park and ride lots near Interstate 5. Approximately 30 acres would be used for construction material staging and equipment management, including 15 acres for vehicle and equipment storage and maintenance. Areas used for equipment maintenance would use gravel surfaces, and areas used for vehicle and equipment storage would use unpaved surfaces. Areas with containment structures would be used for refueling and maintenance using grease, oils, or other similar chemical compounds.
On-Site Parking – during Operations Phase for Intake C-E-5	An area approximately 50 feet wide by 100 feet long would be provided for operations and maintenance workers and vehicle storage. Two areas located to the east of the sediment drying lagoons, approximately 2.5 acres, each, would be used to stage loading of the dried sediment into trucks for disposal.
Fencing and Security – during Construction Phase for Intake C-E-5 [1]	Approximately 17,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include 24-hours site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations and security personnel would be in contact using cell phones or short wave radio.
Fencing and Security – during Operations Phase for Intake C-E-5 [1]	Approximately 8,100 feet of 8-foot tall permanent chain link security fencing to enclose both the river side and land side of the facility along State Route 160. Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information.
Lighting Facilities – during Construction and Operations Phases for Intake C-E-5	Lights on land would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. Lights along the waterway would be for safety and navigational purposes only. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Wastewater Facilities – during Construction and Operations Phases for Intake C-E-5	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be maintained during long-term operations. The septic tank and leach field would be located near the eastern boundary of the intake but outside of the ground improvement areas. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site at the intake site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits.

Items	Quantities
SWPPP Facilities – during Construction for Intake C-E-5	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases for Intake C-E-5	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to the Sacramento River.
Fire Water Supplies Stored On-site for Intake C-E-5	300,000 gallons to provide up to 2,500 gallons/minute for 2 hours

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.19 Tunnels – Central Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 4,500 cfs for the Central Corridor would be the same as shown in Table A2 in Appendix A, Section 10.1.2. However, the tunnel would be based on a 31-foot inside diameter (approximately 34-foot outside diameter) tunnel that would extend between Intake C-E-3 to the Southern Complex. Tunnel shaft construction would be as presented in Tables A3 through A8 in Appendix A, Section 10.1.2. Information related to construction of the tunnel shafts at the intakes are included in Table A1 in Appendix A, Section 10.1.1 for Intake C-E-3 and Table D1 for Intake C-E-5.

The RTM volumes at each launch shaft site would be different for a project design capacity of 4,500 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table D2.

TABLE D2. SUMMARY OF RTM STORAGE FOR CENTRAL CORRIDOR AT TWIN CITIES COMPLEX, BOULDIN ISLAND, AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 4,500 CFS

Items	Quantities and Description
Twin Cities Complex RTM Initial Storage Stockpile	Temporary Dry Area = 7 acres x 10 feet high Temporary Wet Area = 15 acres x 5 feet high
Twin Cities Complex RTM Wet Storage	Area = 12 acres x 5 feet high
Twin Cities Complex RTM Natural Drying Storage	Area = 62 acres x 1.5 feet high
Twin Cities Complex RTM Mechanical Dryer Equipment	14 dryers which are each 55-feet long x 13-feet wide and 14-feet high
Twin Cities Complex Treated RTM Stockpile	North Stockpile Area = 39 acres x 20 feet high South Stockpile Area = 70 acres x 20 feet high
Twin Cities Permanent RTM Surplus Stockpile	Area = 52 acres x 15 feet high

Items	Quantities and Description
Twin Cities Complex RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 52 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Twin Cities Complex Fencing and Security – during Operations Phase [1]	During operations, approximately 8,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Bouldin Island RTM Initial Storage Stockpile	Area = 12 acres x 10 feet high
Bouldin Island RTM Natural Drying / Long Term Storage	Area = 168 acres x 6 feet high The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Bouldin Island Temporary Topsoil/Peat Storage	Topsoil Area = 16 acres to the north of the shaft pad Peat Area = 0.5 acres to the northeast of the shaft pad
Bouldin Island RTM Areas	Approximately 168 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Bouldin Island Fencing and Security – during Construction Phase [1]	Approximately 16,400 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations.
Bouldin Island Fencing and Security – during Operations Phase [1]	Approximately 15,700 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Dry Stockpile	Area = 7 acres x 10 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Wet Stockpile	Area = 15 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Wet Storage	Area = 12 acres x 5 feet high
Mechanical Dryers at Southern Complex	Fifteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Natural Drying	Area = 62 acres x 1.5 feet high

Items	Quantities and Description
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Treated RTM Storage	Area = 289 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Permanent RTM Surplus Storage	No surplus RTM Note: This only represents the RTM portion of this stockpile. Excess topsoil will also be stockpiled at this location.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.20 Tunnels – Eastern Corridor between Intakes and Southern Complex

The preliminary tunnel reach lengths and shaft invert elevations and depths for the facilities to provide a project design capacity of 4,500 cfs for the Eastern Corridor would be the same as shown for in Table A9 in Appendix A, Section 10.1.2. However, the tunnel would be based on a 31-foot inside diameter (approximately 34-foot outside diameter) tunnel that would extend between Intake C-E-3 to the Southern Complex. Tunnel shaft construction would be as presented in Table A3 in Appendix A, Section 10.1.2 and Tables A10 through A16 in Appendix A, Section 10.1.3. Information related to construction of the tunnel shafts at the intakes are included in Table A1 for Intake C-E-3 in Appendix A, Section 10.1.1 and Table D1 for Intake C-E-5.

The RTM volumes at each launch shaft site would be different for a project design capacity of 4,500 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations. The changes in RTM volumes would also change the areas designated at the tunnel launch shaft site for RTM storage and the long-term post-construction site area, as shown in Table D3.

TABLE D3. SUMMARY OF RTM STORAGE FOR EASTERN CORRIDOR AT TWIN CITIES COMPLEX, LOWER ROBERTS ISLAND, AND SOUTHERN COMPLEX FOR A PROJECT DESIGN CAPACITY OF 4,500 CFS

Items	Quantities and Description
Twin Cities Complex RTM Initial Storage Stockpile	Temporary Dry Area = 7 acres x 10 feet high Temporary Wet Area = 15 acres x 5 feet high
Twin Cities Complex RTM Wet Storage	Area = 12 acres x 5 feet high
Twin Cities Complex RTM Natural Drying Area	Area = 62 acres x 1.5 feet high
Twin Cities Complex RTM Mechanical Dryer Equipment	Fourteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Twin Cities Complex Treated RTM Stockpile	North Stockpile Area = 43 acres x 20 feet high South Stockpile Area = 67 acres x 20 feet high
Twin Cities Permanent RTM Surplus Stockpile	Area = 85 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 65 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 84 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.

Items	Quantities and Description
Twin Cities Complex Fencing and Security – during Operations Phase [1]	During operations, approximately 10,000 feet of 8-foot permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lower Roberts Island RTM Initial Storage Stockpile	Area = 12 acres x 10 feet high
Lower Roberts Island RTM Natural Drying	Area = 168 acres x 6 feet high
Lower Roberts Island RTM Long Term Storage	Area = 50 acres x 15 feet high The long-term height of the RTM storage stockpiles would be lower as the RTM subsides into the ground.
Lower Roberts Island Temporary Topsoil/Peat Storage	Topsoil Area = 19 acres to the south of the permanent RTM stockpile Peat Area = 1.5 acres to the north of the shaft pad
Lower Roberts Island RTM Areas	Approximately 20 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 50 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Lower Roberts Island Fencing and Security – during Construction Phase [1]	Approximately 19,000 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include security guards stationed at the main entry and exit gates for 24-hour a day site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations. Once construction is complete, security fencing would remain, and cameras would be monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Lower Roberts Island Fencing and Security – during Operations Phase [1]	Approximately 17,700 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and monitored remotely. Security guards would monitor the site at periodically or if activity is observed by the security cameras (as frequently as once every two hours).
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Dry Stockpile	Area = 8 acres x 10 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Temporary Wet Stockpile	Area = 17 acres x 5 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Wet Storage	Area = 14 acres x 5 feet high
Mechanical Dryers at Southern Complex	Fifteen dryers which are each 55-feet long x 13-feet wide and 14-feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for RTM Natural Drying	Area = 70 acres x 1.5 feet high

Items	Quantities and Description
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Treated RTM Stockpile	Area = 289 acres x 7 feet high
Portion of the Southern Complex RTM Handling related to Byron Tract Working Shaft and Southern Forebay Inlet Structure for Permanent RTM Surplus Storage	Area – 17 acres x 15 feet high Note: This only represents the RTM portion of this stockpile. Excess topsoil will also be stockpiled at this location.

Notes:

[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

10.1.21 Southern Complex

The Southern Complex would be the same as for facilities to provide a project design capacity of 6,000 cfs, as presented in Tables A17 and A22 in Appendix A, Sections 10.14 and 10.15, respectively. The RTM volumes at each launch shaft site would be different for a project design capacity of 4,500 cfs as compared to a project design capacity of 6,000 cfs, as presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations.

The South Delta Pumping Plant for a project design capacity of 4,500 cfs would be similar to a project design capacity of 6,000 cfs, as presented in Table A19 in Appendix A, Section 10.1.4, the pump station would include six pumps at 960 cfs, each, including two standby pumps; three pumps at 600 cfs, each, including one standby pump; and two portable pumps to dewater the tunnel.

10.1.22 Access Roads

Access roads for a project design capacity of 4,500 cfs would be the same as facilities described in Section 10.16 for project design capacity of 6,000 cfs, as presented in Table A23 in Appendix A, Section 10.1.6. The required piles and piers for access roads for a project design capacity of 4,500 cfs would be similar to those described in Section 10.1.6 for project design capacity of 6,000 cfs.

APPENDIX E - Summary of Information for the Project Design Capacity of Vertical Flat Plate Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to intakes using vertical flat plate screens with a design capacity of 3,000 cfs, each, at Intake C-E-3 and Intake C-E-5 locations. This information could be compared to information presented in Section 10.1.1 in Appendix A for intakes with a design capacity of 3,000 cfs, each, with cylindrical tee fish screens. All quantifications of excavated soil and Reusable Tunnel Material (RTM) are presented in the Soil Balance Technical Memorandum in Attachment H, Other Sitewide Considerations.

Information is this section is provided for the original candidate location of the intake structure in the river. The information presented has not been adjusted for relocating the intake structure to account for water surface level impact compliance. If the vertical flat plate intake structure is selected for implementation, some of the information in this section would need to be revised.

This appendix includes the following tables.

- **Section 10.5.1 Intakes C-E-3 and C-E-5**
  - **Table E1.** Construction Conditions and Constructed Facilities Summary for Intakes C-E-3 and C-E-5 for 3,000 cfs Design Capacity, each, with Vertical Flat Plate Fish Screens

10.1.23 Intakes C-E-3 and C-E-5

TABLE E1. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR INTAKES C-E-3 AND C-E-5 FOR 3,000 CFS DESIGN CAPACITY, EACH, WITH VERTICAL FLAT PLATE FISH SCREENS

Items	Quantities
Total Size of Construction Site [1]	Intake C-E-3: 238 acres Intake C-E-5: 243 acres
Total Size of Post-Construction Site [1]	Intake C-E-3: 117 acres Intake C-E-5: 107 acres
Construction Hours for Intake C-E-3 and Intake C-E-5, each	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). Connection of relocated State Route 160 onto temporary levee and permanent levee: at night if allowed by Caltrans Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.
Temporary Levee and State Route 160 Levee Dimensions for Intake C-E-3 and Intake C-E-5	Length of Temporary Levee • Intake C-E-3: 4,300 feet along the centerline • Intake C-E-5: 4,300 feet along the centerline Top elevation of Temporary Levee • Intake C-E-3: approximately 30 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 23 feet) with sea level rise for 2040 and 3 feet of freeboard • Intake C-E-5: approximately 29 feet (18 to 20 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood

Items	Quantities
	elevation (approximately 22 feet) with sea level rise for 2040 and 3 feet of freeboard Width of Top of Temporary Levee = 60 feet including State Route 160 Width of Bottom of Temporary Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus shoulders and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Temporary Levee for Intake C-E-3 and Intake C-E-5	The temporary levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee would only be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee • Intake C-E-3 would extend to an elevation -24 feet (this elevation is just above the nearby portions of the river bottom) • Intake C-E-5 would extend to an elevation -22 feet (this elevation is just above the nearby portions of the river bottom)
Permanent Levee and State Route 160 Dimensions (State Route 160 would be relocated to a fill pad between the intake structure and the sedimentation basin) for Intake C-E-3 and Intake C-E-5	Length of Permanent Levee • Intake C-E-3: 7,500 feet along the centerline • Intake C-E-5: 6,500 feet along the centerline Top elevation of Permanent Levee • Intake C-E-3: 30.3 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 27.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020b) • Intake C-E-5: 29.3 feet (18 to 25 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 26.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020b) Width of Top of Permanent Levees = 60 feet including State Route 160 Width of Bottom of Permanent Levees = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus deceleration and turning lanes for intake site access, shoulders, and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Permanent Levee for Intake C-E-3 and Intake C-E-5, each	The permanent levee embankment would be constructed around the sedimentation basin and the outlet channel. The levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee placement would be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would be within the excavation footprint for the sedimentation basin and would extend to elevation -24 feet (this elevation is just above the nearby portions of the river bottom) Native grass would be planted on the non-water side of the levee.

Items	Quantities
	Erosion protection would be placed on the interior side of the sediment basin embankment. The inside of the levee would be protected from erosion as described above. The outside of the embankment would be planted with native grass.
Ground Improvement for Intake C-E-3 and Intake C-E-5, each	Ground improvement would be installed under the levees and facilities embankments. The quantity of improved ground would be approximately 1.5 to 2.0 million cubic yards of mixed wall sections and approximately 250,000 to 350,000 tons of cement.
Cofferdam at Intake C-E-3	Length = 3586 feet (sheet piles and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Cofferdam at Intake C-E-5	Length = 3765 feet (including sheet piles and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-3	Length of cofferdam and training wall sheet pile system = 2261 feet Approximate number of piles (”Z” sheet pairs) = 493 (includes 409 in front row of cofferdam and training walls) Preliminary cofferdam sheet pile tip elevations = -60 feet Length of cofferdam DMM wall system = 1325 feet Preliminary DMM wall bottom elevation = -100 Approximate number of drilled piers within cofferdam = 1230 Preliminary drilled pier tip elevation = -100 Pile drivability: Number of blows per sheetpile pair = 19 Total number of blows = 9,350 Estimated total impact pile driving time (time for the partial vibratory pile installation, equipment setup, periodic alignment check, and downtime are not included) = 17 hours
Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-5	Length of cofferdam and training wall sheet pile system = 2338 feet Approximate number of piles (”Z” sheet pairs) = 509 (includes 332 in front row of cofferdam and training walls) Preliminary cofferdam sheet pile tip elevations = -55 feet Length of cofferdam DMM wall system = 1427 feet Preliminary DMM wall bottom elevation = -100 Approximate number of drilled piers within cofferdam = 1320 Preliminary drilled pier tip elevation = -100 Pile drivability: Number of blows per sheetpile pair = 10 Total number of blows = 5090 Estimated total impact pile driving time (time for the partial vibratory pile installation, equipment setup, periodic alignment check, and downtime are not included) = 17 hours
Intake Structure at Intake C-E-3	Length = 1876 feet along river including training walls Length = 1275 feet along river for concrete structure only Top elevation = 30.3 feet which would be about 55 to 65 feet above river bottom; Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 15 feet River elevation at this location = -25 to -30 feet

Items	Quantities
	Intake Structure sill elevation would be at the bottom of screen panel = -17 feet Intake Structure concrete front slab elevation = -19 feet Gantry Crane on top of Intake Structure width = 35 feet Gantry Crane on top of Intake Structure top elevation = 70 feet (40 feet above Intake Structure)
Intake Structure at Intake C-E-5	Length = 1953 feet along river including training walls Length = 1377 feet along river for concrete structure only Top elevation = 29.3 feet which would be about 44 to 47 feet above river bottom; Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 15 feet River elevation at this location = -15.5 feet Intake Structure sill elevation would be at the bottom of screen panel = -13.5 feet Intake Structure concrete front slab elevation = -15.5 feet Gantry Crane on top of Intake Structure width = 35 feet Gantry Crane on top of Intake Structure top elevation = 69 feet (40 feet above Intake Structure)
Vertical Flat Plate Screen Assembly for Intake C-E-3 and Intake C-E-5, each	Number of 500 cfs Fish Screen Assemblies = 6 (as shown on the engineering concept drawings) Number of screen cleaning assemblies= 6, one for each 500 cfs screen section Monorail beam to hold fish screen panels: 12-inches wide and 210 feet long for each assembly Monorail beam elevation = approximately 1 foot, or 10 to 12 feet above the top of the fish screen panel Screen cleaner brush arm (will hang vertically in front of fish screens): 28 to 30 feet long (Intake C-E-3) and 25 to 27 feet long (Intake C-E-5)and extend about 3 feet in front of screen at the counterweights and 18 inches at the brush A cable and pulley system would run beneath the monorail gate and above each screen panel. A gear motor and drive, about 5 feet tall, would be located on the top of the Intake Structure for each screen cleaner assembly.
Portable Fish Screen Pressure Washer (not mounted on Intake Structure) for Intake C-E-3 and Intake C-E-5, each	Trailer mounted rig to maneuver equipment for pressure washing screens would be approximately 6 feet tall, 6 feet wide, and 8 feet long. A standard pickup truck would tow this rig.
Portable Mobile Crane (not mounted on Intake Structure) for Intake C-E-3 and Intake C-E-5, each	Mobile crane to load and unload intake features would be approximately 15 feet tall, 20 feet wide, and 400 feet long. A 100-foot long boom would be extended from the main crane. Standard tractor trailer rig with a flat-bed trailer would be used to transport panels to and from the intake.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment for Intake C-E-3 and Intake C-E-5, each	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep. Barge trip estimates were not developed for this configuration, but would be similar to the quantity for the cylindrical tee screen configurations. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard. Barges would only move through the Delta during weekday daylight hours.
Sedimentation Basin Dimensions for Intake C-E-3	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1100 feet long and 810 feet wide at top of the embankment.

Items	Quantities
	Top elevation of embankment = 30.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 27 feet Each cell would be 790 feet long and 650 feet wide at bottom of the embankment. Bottom elevation: -22 feet Sedimentation Basin Side Slopes - Side slopes would be 3H:1V. Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sedimentation Basin Dimensions for Intake C-E-5	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1100 feet long and 845 feet wide at top of the embankment. Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 26 feet Each cell would be 790 feet long and 689 feet wide at bottom of the embankment. Bottom elevation: -19 feet Sedimentation Basin Side Slopes - Side slopes would be 3H:1V. Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sediment Basin Radial Gate Flow Control Structure at the Junction with the Outlet Structure and Intake Outlet Shaft for Intake C-E-3	Four Large Radial Gates: 30 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 30.3 feet Bottom elevation of Flow Control Structure = - 8.8 feet
Sediment Basin Radial Gate Flow Control Structure at the junction with the Outlet Structure and Intake Outlet Shaft for Intake C-E-5	Four Large Radial Gates: 30 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 29.3 feet Bottom elevation of Flow Control Structure = - 9 feet
Outlet Channel from Flow Control Structure to Intake Outlet Shaft at Intake C-E-3	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 146 feet wide Top elevation of embankment = 30.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 8.8 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Outlet Channel from Flow Control Structure to Intake Outlet Shaft at Intake C-E-5	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 146 feet wide Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 9 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.

Items	Quantities
Sediment Drying Lagoons Dimensions for Intake C-E-3 and Intake C-E-5, each	Four sediment drying lagoons. Each lagoon would be approximately 146 feet wide and 350 long at the bottom of the embankment. Each lagoon would be approximately 15 to 18 feet deep and contain an average of 10 to 12 feet of water. Embankment slopes would be 1H:1V. Side slopes and bottom would be concrete lined to facilitate removal of dried sediment. Sediment depth approximately 1 foot distributed over the floor of the lagoon during operations.
Sediment Drying Lagoons Outlet Structure (to convey water from the lagoons to a pump that to return any water to the Sediment Basin) for Intake C-E-3 and Intake C-E-5, each	Each lagoon would have an outlet structure: approximate 15 feet wide by 15 feet tall. Top elevation at the top of lagoon embankment. Bottom elevation 20 to 25 feet below top elevation.
On-site Electrical Substations – during Construction and Operation Phases for Intake C-E-3 and Intake C-E-5, each	An electrical substation would be established near the haul road entrance to the work site at the eastern boundary of the intake site. The substation would include switches, transformers, and related electrical gear housed within a 75 foot wide by 125 foot long enclosure with a separate safety and security fence. The substation would also be within the fenced secure total construction site area. After construction of the embankment, this substation would be relocated to the top of the embankment as shown on the engineering concept drawings. Smaller transformers less than 10 feet wide by 10 feet long would be positioned at several locations around the site. The transformers would have suitable containment, if required, and would be within the fenced secure total construction site area and additional security would not be needed.
Standby Engine Generator/Fuel Tank – during Construction and Operation Phases for Intake C-E-3 and Intake C-E-5, each	A 1 megawatt standby engine generator with a 1528 horsepower engine would be used primarily to supply the office complex and possibly to recharge electrical equipment during construction. The standby engine generator would be installed inside a fenced area of about 30 feet by 30 feet, including both the generator and the fuel tank. The fuel would be provided by a diesel tank with suitable containment or a propane tank stored above ground. After construction of the embankment, the standby engine generator would be replaced with new permanent generators at locations on the top of the embankment as described above and as shown on the engineering concept drawings. The permanent standby engine generators would provide energy to operate the valves and gates, including the ability to stop diversions at the intake structure.
Appurtenant Structures Dimensions – during Construction Phase for Intake C-E-3 and Intake C-E-5, each	Office trailers, showers/washrooms, a canteen and common area, and a bus shelter would be installed to serve the construction workers and other on-site personnel. Most of these buildings would be 15-feet tall or less (one story). Other buildings for warehousing for materials and temporary work enclosures would be less than 20 feet tall.
Appurtenant Structures Dimensions – during Operations Phase for Intake C-E-3 and Intake C-E-5, each	One of the construction buildings would be used for indoor storage of portable equipment and vehicles used for maintenance of all intakes during operations.
Duration for Concrete Pours	For each Intake • Night-time concrete pour for tremie concrete, including tunnel shaft: 1 month, not sequential • Daytime concrete pour would throughout 250 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 130 weeks over the 250-week period.

Items	Quantities
On-Site Access Roads – during Construction Phase for Intake C-E-3 and Intake C-E-5, each	Approximately 2.5 miles of roads would be constructed within the intake site. Most of the interior roads would be covered with gravel, gravel over geotextile material, or paved depending upon the amount of vehicle use envisioned. Roads leading to the access road would be paved, including roads at the main office buildings and bus shelter.
On-Site Access Roads – during Operations Phase for Intake C-E-3 and Intake C-E-5, each	Towards the end of construction, about 9,300 feet (Intake C-E-3) and 8,300 feet (Intake C-E-5) of paved permanent access roads would be installed. Access to the intake site would occur from State Route 160 and from an access/haul road located to the west of the abandoned railroad embankment that would be installed during construction. These access roads would be 24-foot wide paved roads. Several internal access roads would be constructed around the base of the outlet shaft area, along the top of the embankments, and on ramps up the side of the embankments. These roads would receive substantial vehicle use, and therefore, would also be 24-foot wide paved roads. Approximately 6,800 feet (Intake C-E-3) and 6,900 feet (Intake C-E-5) of 20-foot wide gravel roads would be constructed around the sediment drying lagoons, along the length of the sedimentation basin parallel to State Route 160, and to provide access along the sediment loading areas.
On-Site Parking and Construction Materials and Vehicle Staging Areas – during Construction Phase for Intake C-E-3 and Intake C-E-5, each	An area approximately 100 feet wide by 200 feet long would be provided near the office complex for employee parking. Several small parking areas would be located near the office buildings and laydown areas to support vehicles for special tools and deliveries. An area approximately 200 feet wide by 200 feet long would be provided a bus that would transport employees from the park and ride lots near Interstate 5. Approximately 30 acres would be used for construction material staging and equipment management, including 15 acres for vehicle and equipment storage and maintenance. Areas used for equipment maintenance would use gravel surfaces, and areas used for vehicle and equipment storage would use unpaved surfaces. Areas with containment structures would be used for refueling and maintenance using grease, oils, or other similar chemical compounds.
On-Site Parking – during Operations Phase for Intake C-E-3 and Intake C-E-5, each	An area approximately 50 feet wide by 100 feet long would be provided for operations and maintenance workers and vehicle storage. Two areas located to the east of the sediment drying lagoons, approximately 3.5 acres, each, would be used to stage loading of the dried sediment into trucks for disposal.
Fencing and Security – during Construction Phase [2] for Intake C-E-3 and Intake C-E-5, each	Approximately 20,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include 24-hours site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations and security personnel would be in contact using cell phones or short wave radio.
Fencing and Security – during Operations Phase [2] for Intake C-E-3 and Intake C-E-5, each	Approximately 10,000 feet of 8-foot tall permanent chain link security fencing to enclose both the river side and land side of the facility along State Route 160. Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information.

Items	Quantities
Lighting Facilities – during Construction and Operations Phases for Intake C-E-3 and Intake C-E-5, each	Lights on land would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. Lights along the waterway would be for safety and navigational purposes only. During operations, lights would be motion activated to minimize light and glare to adjacent properties.
Emergency Response Facilities - during Construction Phase for Intake C-E-3	An emergency services building would be about 30 feet tall. The facilities would include an emergency services building, ambulance with accommodations for two sets of full-time staff during work hours (up to 7 people), a rescue boat, and a fire truck with accommodations for a full-time crew (approximately 5 people covering each construction shift). The emergency personnel could include construction management staff that would be crossed trained. During construction, the emergency response facility would be located in the building that would ultimately be used for General Maintenance and Storage during operations. The building would include 7 to 8 bays to maintain the facilities. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.
Wastewater Facilities – during Construction and Operations Phases for Intake C-E-3 and Intake C-E-5, each	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be maintained during long-term operations. The septic tank and leach field would be located near the eastern boundary of the intake but outside of the ground improvement areas. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site at the intake site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits.
SWPPP Facilities – during Construction for Intake C-E-3 and Intake C-E-5, each	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities – during Operations Phases for Intake C-E-3 and Intake C-E-5, each	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to the Sacramento River.
Land Restoration for Intake C-E-3 and Intake C-E-5, each	Approximately 122 acres (Intake C-E-3) and 136 acres (Intake C-E-5) would be restored. These lands would be located on the areas used during construction for material/equipment laydown and staging, material stockpiles, slurry batch plant, retention ponds, parking areas, bus drop-off/pick-up, access roads, and facilities/trailers for owners, contractors, and crew.

Items	Quantities
Fire Water Supplies Stored On-site for Intake C-E-3	300,000 gallons to provide up to 2,500 gallons/minute for 2 hours
Fire Water Supplies Stored On-site for Intake C-E-5	300,000 gallons to provide up to 2,500 gallons/minute for 2 hours

Notes:

[1] Site sizes are approximate; exact area should be obtained from the GIS. Total area excludes access road modifications.

[2] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.