DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

Volume 1 of 3

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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) of the Delta Conveyance Design and Construction Authority (DCA).

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1. Introduction

This Concept Engineering Report (CER) provides descriptions of facilities developed by the Delta Conveyance Design and Construction Authority (DCA) and adopted by the California Department of Water Resources (DWR) following preparation of an environmental assessment of the proposed Delta Conveyance Project (DCP or Project). The CER includes a summary report, appendices, engineering concept drawings (Volume 2), and Geographic Information System (GIS) Mapbook (Volume 3) showing the location of the Project facilities.

DWR completed an environmental assessment of the Project's effects consistent with the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA). The Project, 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), included two conveyance corridors: the Central Corridor and Eastern Corridor Options (DCA, 2022). Some of the comments on the NOP were related to concerns about construction of facilities near roadways and communities near the existing Clifton Court Forebay (CCF). DWR considered the scoping comments and methods to reduce environmental disturbances and identified the Bethany Reservoir Alternative that would extend from the intakes along the northern portion of the Eastern Corridor and then, continue along a different tunnel alignment to a new Bethany Reservoir Pumping Plant and continue along the Bethany Reservoir Aqueduct to the Bethany Reservoir Discharge Structure along the rim of the existing Bethany Reservoir. The Bethany Reservoir Pumping Plant with surge basin, Bethany Reservoir Aqueduct, and Bethany Reservoir Discharge Structure are referred to as the "Bethany Complex".

On December 21, 2023, DWR approved the Bethany Reservoir Alternative and certified the Environmental Impact Report (EIR). Based upon an extensive environmental review, as documented in the EIR, DWR selected the Bethany Reservoir Alternative (EIR Alternative 5) with a Project design capacity of 6,000 cubic feet per second (cfs) for further engineering, design, and permitting. Following certification of the EIR, the selected alignment for the Delta Conveyance Project became the Bethany Reservoir Alignment. The Bethany Reservoir Alignment and the Delta Conveyance Project can be interchanged as the selected Project.

The conveyance facility locations described in this document and presented in the attached engineering concept drawings represent the 6,000-cfs Bethany Reservoir Alignment as presented in the Delta Conveyance Engineering Project Report (EPR) – Bethany Reservoir Alternative: Volume 1 Narrative and TMs (DCA, 2022b), Volume 2 Engineering Concept Drawings (DCA, 2022d), updates to the Engineering Project Report (EPR) issued in November 2023 for both the Central and Eastern Options and the Bethany Reservoir Alternative (DCA, 2023a, 2023b); and in the Delta Conveyance Project Engineering Report (EPR) – Central and Eastern Options: Volume 1 Narrative and TMs (DCA, 2022a), Volume 2 Engineering Concept Drawings (DCA, 2022c*)* as related to the selected Bethany Reservoir Alignment which is now the Delta Conveyance Project. The appendices to this report include information from the original Technical Memorandum prepared for the Bethany Reservoir Alternative and the Central and Eastern Corridor Options that have been compiled to only reflect or provide relevant information to the 6,000 cfs Delta Conveyance Project. The engineering concept drawings include post-construction site plans, construction phase site plans, and site ingress and egress layouts, as appropriate.

This document only addresses locations, configurations, construction methods, and long-term maintenance methods for the selected physical facilities of the Delta Conveyance Project. 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 Background

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 less than project design capacity as 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 Project, 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.

In January 2020, DWR launched a new planning effort (DWR, 2020a). The new project included a fresh look at the historical planning information, building on areas of agreement and deviating where new concepts or configurations were identified. As described above, DWR requested information be developed to present the conceptual level engineering description of the Central and Eastern Corridor Options and the Bethany Reservoir Alignment. This CER includes information related to the Bethany Reservoir Alignment conveyance facilities and other facilities to support future design, construction, and operations of these facilities, including the facilities between the intakes and Terminous Tract tunnel shaft which are common facilities between the Eastern Corridor and Bethany Reservoir Alignment.

The CER does not include several items analyzed in the EIR, including the Compensatory Mitigation Plan (CMP) and Community Benefits Program. The EIR identified 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 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; therefore, the CER does not include discussions of this plan.

The EIR also included 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 Engagement Committee (SEC) (see Appendix I2 *Efforts to Minimize Delta Community Effects*). 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 CER does not include discussions of this plan.

1.2 Purpose

The purpose of this report is to compile in a single document all relevant engineering information pertaining to the selected Project from the following previously submitted reports:

- *Delta Conveyance Final Draft Engineering Project Report (EPR), Central and Eastern Options* (DCA, 2022a). This document includes studies and analyses performed for the Eastern Corridor, which were also used for development of the Bethany Reservoir Alignment from Intake C-E-3 down to the Lower Roberts Island Tunnel Launch Shaft.
- *Delta Conveyance Final Draft Engineering Project Report (EPR). Bethany Reservoir Alternative* (DCA, 2022b). This document provides additional studies and analyses unique to the Bethany Reservoir Alignment.
- *Delta Conveyance Final Draft Engineering Project Report (EPR) Update Central and Eastern Corridor Options* (DCA, 2023a). This document provides updates to all alternatives considered in the EIR for the Central and Eastern Corridor.
- *Delta Conveyance Final Draft Engineering Project Report (EPR) Update Bethany Reservoir Alternative* (DCA, 2023b). This document provides updates to all alternatives considered in the EIR for the Bethany Reservoir Alignment.

In December 2023, the Environmental Impact Report (EIR) (DWR, 2023) was released and stated that the Bethany Reservoir Alternative would be the preferred Project and renamed the Bethany Reservoir Alignment as the selected Delta Conveyance Project. No technical changes or revisions to the Delta Conveyance Project are presented in this CER since submittal of the above EPRs. It should be noted that the "Central Corridor" and “Eastern Corridor” are no longer a part of the Project. In some instances, analyses originally intended to support development of the Eastern Corridor were also applied to the common components of the Bethany Reservoir Alignment (i.e. from Intake C-E-3 down to Lower Roberts Island Tunnel Launch Shaft). Therefore, references in this CER and appendices to the terms “Eastern Corridor” or “East Corridor” should be here on interpreted as relevant to the Bethany Reservoir Alignment from Intake C-E-3 down to Lower Roberts Island Tunnel Launch Shaft. It also should be noted that several references to the Central and/or Eastern Corridors remain in this document and appendices to provide a greater extent of background information for portions of the Delta between the intakes and CCF which influenced design considerations for the Project.

1.3 Organization of this Report

The CER is comprised of the following components.

- **Volume 1 - Summary Report and Appendices.** The engineering work that describes the design criteria, design assumptions, alternatives analyses, and planned siting and configurations are found in the attached appendices. Many of the Bethany Reservoir Alignment studies were prepared based upon similar studies for the Eastern Corridor Option, as noted in several appendices.

This summary report is intended to highlight the key findings and conclusions of the appendices and focuses primarily on describing the facilities and the key drivers to their configuration and siting where applicable.

- Section 1: Introduction and Background (as described above)
- Section 2: Project Overview – Delta Conveyance Project
- Section 3: Hydraulics and Operations
- Section 4: Intakes
- Section 5: Main Tunnel and Shafts
- Section 6: Bethany Complex
- Section 7: Logistics
- Section 8: Levee Improvements
- Section 9: Geotechnical, Soil and Seismic Considerations
- Section 10: System Wide Utilities and Coordination
- Section 11: Permitting
- Section 12: Post-Construction Land Reclamation and Site Restoration
- Section 13: Stakeholder Engagement Committee Process
- Section 14: Contra Costa Water District Interconnection Facilities
- Section 15: Project Schedule
- Section 16: References

Volume 1 also includes Attachment 1 with quantitative summaries of information for the Delta Conveyance Project from the appendices and engineering concept drawings. Attachment 2 is a description of the proposed interconnection facilities to the existing Contra Costa Water District water supply distribution system that have been included in the Project. Appendices A through K include all the relevant technical memorandums developed as part of the EPRs (DCA, 2022a and 2022b) and EPR Updates (DCA, 2023a and 2023b) that have been organized and updated to only reflect the 6000 cfs Delta Conveyance Project.

- **Volume 2 - Engineering Concept Drawings.** The engineering concept drawings developed as part of the EPRs Engineering Concept Drawings (DCA, 2022c and 2022d) 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 Delta Conveyance Project.
- **Volume 3 - GIS Mapbook.** The Delta Conveyance Project Mapbook, the Delta Conveyance Project Power Mapbook, and the Delta Conveyance Project SCADA Mapbook utilizes GIS information for the Bethany Reservoir Alignment to display the facility sites and features included in the engineering concept drawings in the context of the existing land use.

2. Project Overview – Delta Conveyance Project

The existing SWP Delta water conveyance facilities, which include Clifton Court Forebay (CCF), Skinner Fish Facility, the Harvey O. Banks (Banks) Pumping Plant, and Bethany Reservoir 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 Project would construct and operate new conveyance facilities in the Delta that would add to the existing SWP infrastructure.

The Project includes new intake facilities as additional points of diversion located in the north Delta along the Sacramento River near the community of Hood; and a tunnel to convey water from the new intakes to the Bethany Reservoir Pumping Plant which is located in the south Delta, south of the CCF. The Bethany Reservoir Pumping Plant would lift water from the tunnel into the Bethany Reservoir Aqueduct and ultimately to the existing SWP Bethany Reservoir where water would be conveyed into the South Bay Aqueduct and California Aqueduct, as shown in Figure 1. 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 facilities, resulting in a system also known as "dual conveyance" because there would be two complementary methods to divert and convey water to the California Aqueduct.

The Project would include the following major facilities.

- Two intake facilities, C-E-3 and C-E-5 (DWR EIR Intakes B and C, respectively), along the Sacramento River in the north Delta near the community of Hood with on-bank intake structures that would include cylindrical tee fish screens.
- A pre-cast concrete segment lined tunnel, and associated vertical tunnel shafts, to convey flow from the intakes about 45 miles to the south to the Bethany Reservoir Pumping Plant and Surge Basin at a location south of the existing SWP CCF.
- A Bethany Reservoir Pumping Plant to lift the water from inside the tunnel below ground into the Bethany Reservoir Aqueduct for conveyance to the Bethany Reservoir Discharge Structure and into the existing Bethany Reservoir.
- Other ancillary facilities to support construction and operation of the conveyance facilities including, but not limited to, access roads, concrete batch plants, fuel stations, and power transmission and/or distribution lines.

2.1 Development of Facilities Plans for the Bethany Reservoir Alignment

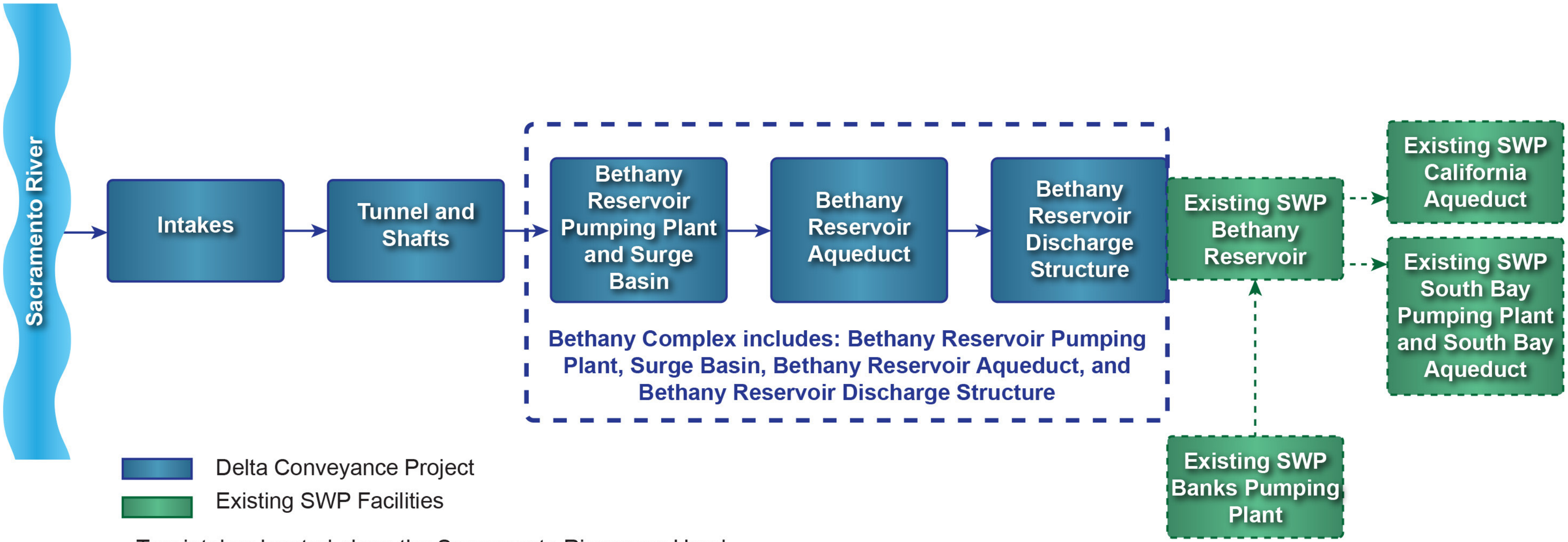
Consistent with DWR's process to develop potential conveyance options, the DCA initially considered multiple conveyance alignments and shaft locations, intake site layouts and locations, and southern Delta facility site layouts near the existing SWP facilities to meet the objectives of the Project. This 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 Corridor Options and Bethany Reservoir Alignment considered siting analyses, as schematically presented in Figure 2, for intakes; tunnel launch, maintenance, and reception shafts; Bethany Reservoir Pumping Plant and Surge Basin; and the Bethany Reservoir Aqueduct. 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 the appendices for the major project facilities. These analyses include siting analyses for the intakes, shafts, Bethany Complex, construction transportation routes, logistic strategies, access roads, and overall siting analyses to minimize Delta community effects.

Overall results of the siting analyses for the Bethany Reservoir Alignment are presented in Figure 3 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 CER.



- Two intakes located along the Sacramento River near Hood
- Water would flow from the intakes into one tunnel and then into a reception shaft at the Surge Basin that would be located adjacent to the Bethany Reservoir Pumping Plant
- Water would be pumped into the Bethany Reservoir Aqueduct (that would include multiple pipelines) and flow to the Bethany Reservoir Discharge Structure to be located on the shoreline of the existing Bethany Reservoir
- Existing SWP south Delta diversion facilities, Clifton Court Forebay, and Banks Pumping Plant would continue to operate and convey water to the existing Bethany Reservoir as part of "Dual Conveyance"

Figure 1. Schematic of Delta Conveyance Project Facilities to Convey Water from Intakes to SWP California Aqueduct for Project Design Capacity of 6,000 cfs

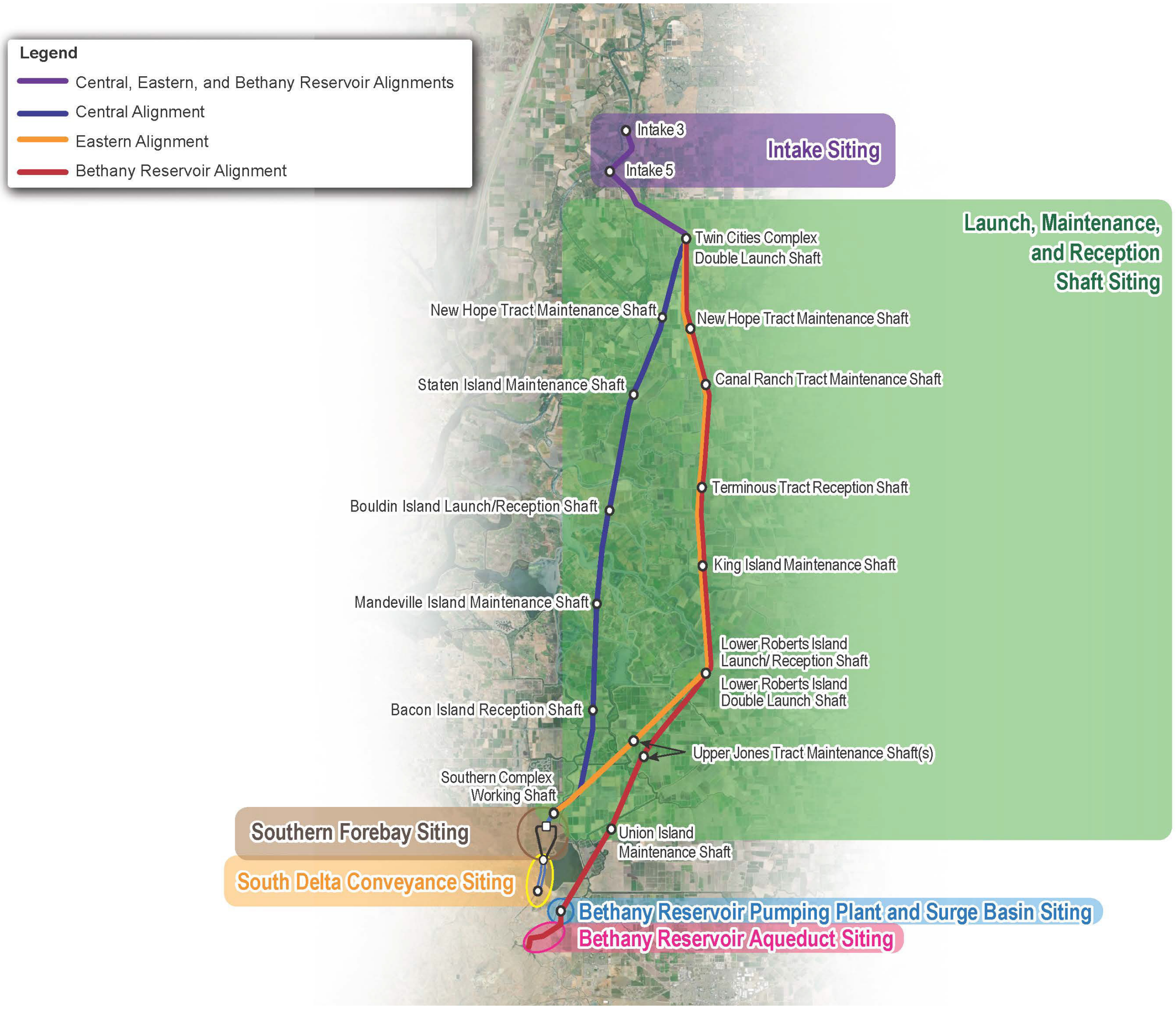


Figure 2. Summary of Delta Conveyance Project Siting Analyses for Intakes, Tunnel Shafts and Alignments, Southern Forebay, South Delta Conveyance, and Bethany Complex.

Note to Reader: All alignments analyzed are shown above. The Bethany Reservoir Alignment was selected for the Project.

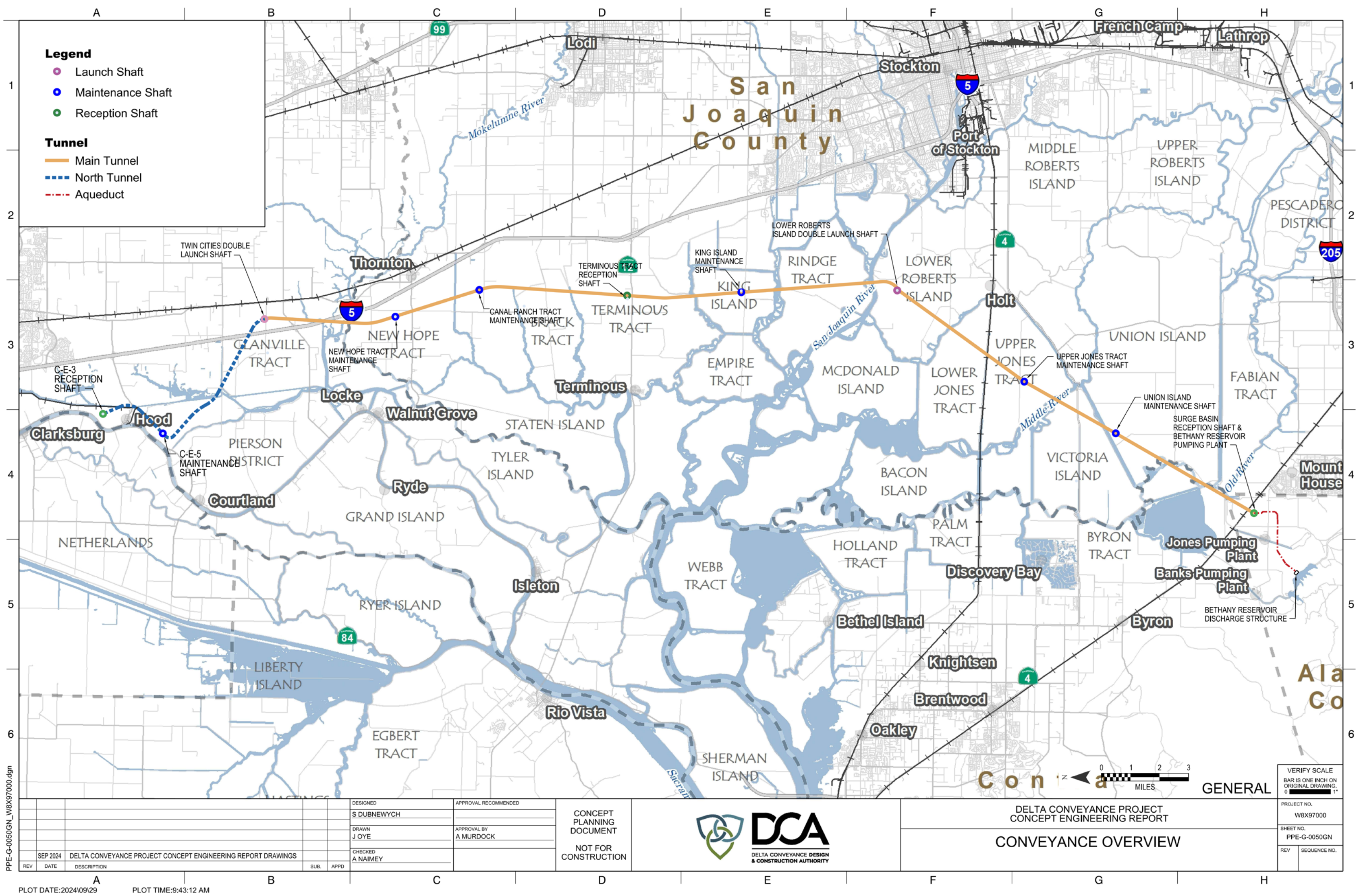


Figure 3. Delta Conveyance Project Facilities Location Map to Convey Water from Intakes to Bethany Complex for Project Design Capacity of 6,000 cfs

2.2 Major Facilities

The Delta Conveyance Project facilities are summarized below.

- Two intakes along the Sacramento River near the community of Hood.
- The Twin Cities Complex would include a dual launch shaft.
  - One shaft of the Twin Cities Complex dual launch shaft site would be used to construct the tunnel north to the intakes (Tunnel Reach 1).
  - The other shaft would be used to construct a tunnel south to a tunnel reception shaft on Terminous Tract (Tunnel Reach 2). Reach 2 would include tunnel maintenance shafts on New Hope Tract and Canal Ranch Tract.
  - The site would be sized to accommodate all facilities and functions necessary for tunneling operations, including Reusable Tunnel Material (RTM) processing, testing, drying and stockpiling.
- Lower Roberts Island would include a dual launch shaft.
  - One shaft of the Lower Roberts Island dual launch shaft site would be used to construct the tunnel north to the tunnel reception shaft on Terminous Tract (Reach 3). Reach 3 would include a tunnel maintenance shaft on King Island.
  - The other shaft would be used to construct the tunnel south to the tunnel reception shaft at the Surge Basin adjacent to the Bethany Reservoir Pumping Plant at the Bethany Complex (Reach 4). Reach 4 would include tunnel maintenance shafts on Upper Jones Tract and Union Island.
  - The site would be sized to accommodate all functions necessary for tunneling operations, including Reusable Tunnel Material (RTM) processing, testing, drying and stockpiling.
- The Bethany Complex would include the following facilities.
  - Tunnel reception shaft at the Surge Basin.
  - Bethany Reservoir Pumping Plant and Surge Basin.
  - Bethany Reservoir Aqueduct which connects the Bethany Reservoir Pumping Plant to the Bethany Reservoir Discharge Structure and including the following facilities.
    - Four 180-inch (15-foot) diameter pipelines.
    - Portions of the Aqueduct would be tunneled under the existing Jones Pumping Plant Penstocks[1] and under a Conservation Easement area to the east of the Bethany Reservoir.
  - Bethany Reservoir Discharge Structure.

A summary of the physical characteristics is presented in Table 1. More detailed information about these facilities are presented in Sections 3 through 6, engineering concept drawings, Attachment 1, and the appendices to this CER. Please note that all elevations presented in this CER are relative to North American Vertical Datum of 1988 (NAVD88).

[1] In the CER, the term “Jones Pumping Plant Penstocks” is used to describe the Jones Discharge Tubes, three 15-foot diameter pipelines that extend from the Jones Pumping Plant approximately 6,500 feet to the open-channel portion of the Delta-Mendota Canal for continued conveyance of CVP water to the San Joaquin Valley.

Table 1. Summary of the Delta Conveyance Project Physical Characteristics for the 6,000 CFS Project Design Capacity

Feature Description	Delta Conveyance Project
Project Design Capacity	• 6,000 cfs
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 3,000 cfs (with Maintenance Shaft) (Intake C-E-5)
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 (approximate): 39 feet • Tunnel Length: 43,081 feet (~8.2 miles) • Number of Tunnel Launch Shafts: 1 • Number of Reception Shafts: 1 • Number of Maintenance Shafts: 1 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 115 (Reach 1, 8.1 miles) • Maintenance and Reception Shafts Inside Diameter (feet): 83 (also known as: Intake Outlet Shafts)
Tunnel Reaches between Twin Cities Complex and Bethany Reservoir Pumping Plant Surge Basin	• Reach 2: Between Twin Cities Complex and Terminous Tract, including New Hope Tract and Canal Ranch Tract tunnel maintenance shafts • Reach 3: Between Lower Roberts Island and Terminous Tract, including King Island tunnel maintenance shaft • Reach 4: Between Lower Roberts Island and Bethany Reservoir Pumping Plant and Surge Basin, including Upper Jones Tract and Union Island tunnel maintenance shafts • Maximum Capacity: 6,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 36 feet • Tunnel Outside Diameter (approximate): 39 feet • Tunnel Length: 194,080 feet (~36.7 miles) • Reach 2: 12.7 miles • Reach 3: 9.5 miles • Reach 4: 14.5 miles • Number of Dual Tunnel Launch Shafts: 2 (Twin Cities Complex and Lower Roberts Island)

Feature Description	Delta Conveyance Project
	• Number of Reception Shafts: 2 (Terminous Tract and Surge Basin) • Number of Maintenance Shafts: 5 (New Hope Tract, Canal Ranch Tract, King Island, Upper Jones Tract, Union Island) • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 115 (Reach 2) • Dual Launch Shafts at Lower Roberts Island: Inside Diameter (feet): 115 (Reach 3 and Reach 4) • Maintenance Shafts and Terminous Tract Reception Shaft Inside Diameter (feet): 70 • Surge Basin Reception Shaft Inside Diameter (feet): 120
Bethany Reservoir Pumping Plant and Surge Basin	• Fourteen pumps at 500 cfs, each, including two standby pumps (Up to twelve pumps would operate at any one time for a total of 6,000 cfs capacity) • Four, 75-foot diameter by 20-feet high one-way surge tanks connected to the Bethany Reservoir Pumping Plant’s discharge pipelines (one tank connected to each pipeline) • Two Portable 60 cfs Pumps to dewater main tunnel for inspection and maintenance, as needed • Four rail-mounted 25 cfs pumps to dewater Surge Basin • One 815-foot by 815-foot Surge Basin with surge overflow capacity
Bethany Reservoir Aqueduct and Discharge Structure	• Number of Pipelines: 4 • Pipeline Inside Diameter: 180-inch (15 feet) • Pipeline Outside Diameter: 182.5-inch +/- • Maximum capacity per pipeline: 1,500 cfs • Each Pipeline Length: Approximately 14,900 feet for each pipeline • Tunnels under Jones Penstocks: length of 200 feet for each tunnel, 4 tunnels, bottom of the tunnel is approximately 50 feet below natural existing ground • Tunnels under Bethany Reservoir Conservation Easement: length of 3,064 feet for each tunnel, 4 tunnels, tunnel depth varies from approximately 45-50 feet from the existing ground to the bottom of the tunnel to approximately 180 feet from existing ground to the bottom of the tunnel • Riser shafts and discharge structure

3. Hydraulics and Operations

Hydraulic steady-state and transient-surge modeling was completed during the conceptual design phase and development of the EPRs for the Project. Results of the hydraulic analyses were used to determine the following:

- Operating hydraulic grade line profiles of the tunnel between Intakes C-E-3 and C-E-5 and the Bethany Reservoir Pumping Plant wet well structure.
- Operating hydraulic grade line profiles of the Aqueduct pipelines between the Bethany Reservoir Pumping Plant and the Bethany Reservoir.
- Sizing, configuration and location of the Surge Basin Structure.
- Sizing and required performance characteristics of the pumps at the Bethany Reservoir Pumping Plant.
- Sizing of the Bethany Reservoir Aqueduct including connecting surge protection facilities.
- Size and configuration of the Bethany Reservoir Discharge Structure.

The general approach to the hydraulic steady-state and transient-surge analyses divided the Project into two, separate components.

- Hydraulic analysis was performed between the Sacramento River and the Bethany Reservoir Pumping Plant.
- Hydraulic analysis was performed between the Bethany Reservoir Pumping Plant and the Aqueduct pipelines point of discharge at the Bethany Reservoir Discharge Structure.

The system component between the Sacramento River and the Bethany Reservoir Pumping Plant is hydraulically controlled by the upstream boundary conditions such as the free-water surface elevations (WSELs) in the river and permissible river diversion flows into the Project and the allowable hydraulic losses in the intakes, tunnels, and other connecting hydraulic facilities between the intakes and the Bethany Reservoir Pumping Plant. The hydraulics of the system components between the Bethany Reservoir Pumping Plant and the Bethany Reservoir Discharge Structure is largely driven by the range of WSELs within the Bethany Reservoir Pumping Plant wet well structure, the operational WSEL of the Bethany Reservoir and the hydraulic losses within the Aqueduct pipeline system.

3.1 System Hydraulics

Based on the results of hydraulic steady-state and transient-surge analyses, the maximum and minimum HGL profile envelopes for the tunnel and Bethany Reservoir Aqueduct were found to be within the conceptual design pressure limits for the boundary conditions evaluated at the Project’s design flow capacity of 6,000 cfs. The top of shaft structure elevations for shafts located between the Sacramento River intakes and the Surge Basin structure have been established in the concept design to provide a minimum 3-foot freeboard above the maximum HGL (at each shaft) calculated per the greater HGL elevation associated with the transient-surge analyses for the main tunnel or the Sacramento River 200-year flood with year 2100 climate change hydrology and sea level rise WSEs at the intakes.

Complete descriptions of the Project system hydraulic criteria, the hydraulic steady-state and transient-surge analyses, and tunnel dewatering analysis are included in Appendix A1 *Hydraulic Analysis Criteria* and Appendix A2 *Hydraulic Analysis of Delta Conveyance Options*.

3.1.1 Hydraulic Operations Model

The Project 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 Bethany Reservoir Discharge Structure, the modeling software InfoWorks ICM was used. Refer to Appendix A1 *Hydraulic Analysis Criteria* and Appendix A2 *Hydraulic Analysis of Delta Conveyance Options* for a detailed description of the ICM model, evaluation methodology, and modeling results.

3.1.2 Transient and Surge Analysis

To replicate systemwide hydraulic transient-surge conditions for the Project tunnel and Aqueduct pipelines, Bentley OpenFlow HAMMER CONNECT Edition Update 3 was used. Transient-surge analyses was conducted for the tunnel and Aqueduct pipelines at the maximum Project design flow condition of 6,000 cfs. Refer to Appendix A1 *Hydraulic Analysis Criteria* and Appendix A2 *Hydraulic Analysis of Delta Conveyance Options* for a detailed description of the transient-surge model, evaluation methodology, and modeling results.

4. Intakes

Intake structures allow the diversion of water from the Sacramento River and represent the most upstream facilities of the Project. The primary features of the Intakes include:

- 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.

Each intake facility would be sized to divert up to 3,000 cfs of Sacramento River water for a total maximum system diversion of 6,000 cfs. Operational diversion patterns will be developed by DWR.

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 Project 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.

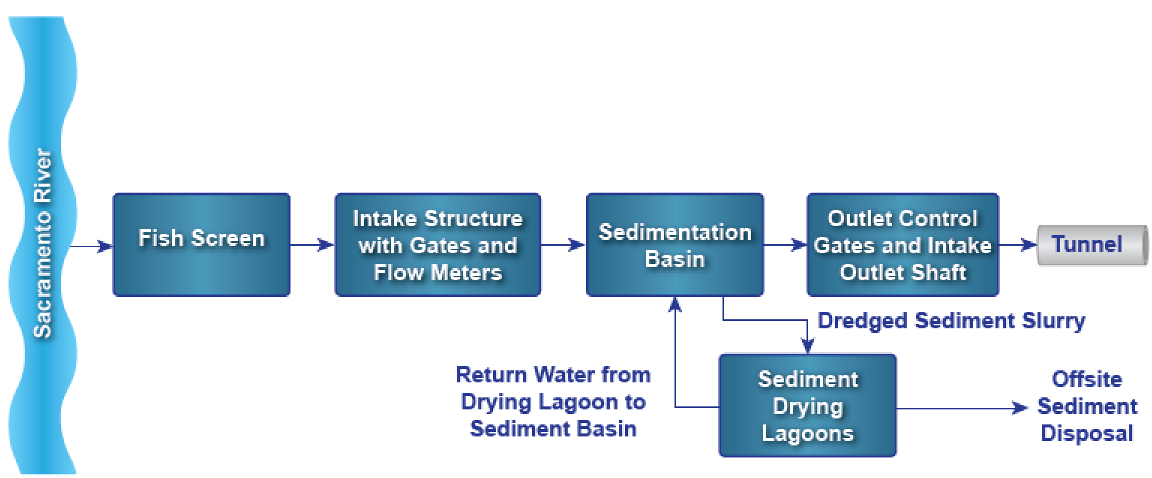


Figure 4. Schematic of Intake Facilities to Convey Water from Sacramento River to the Tunnel

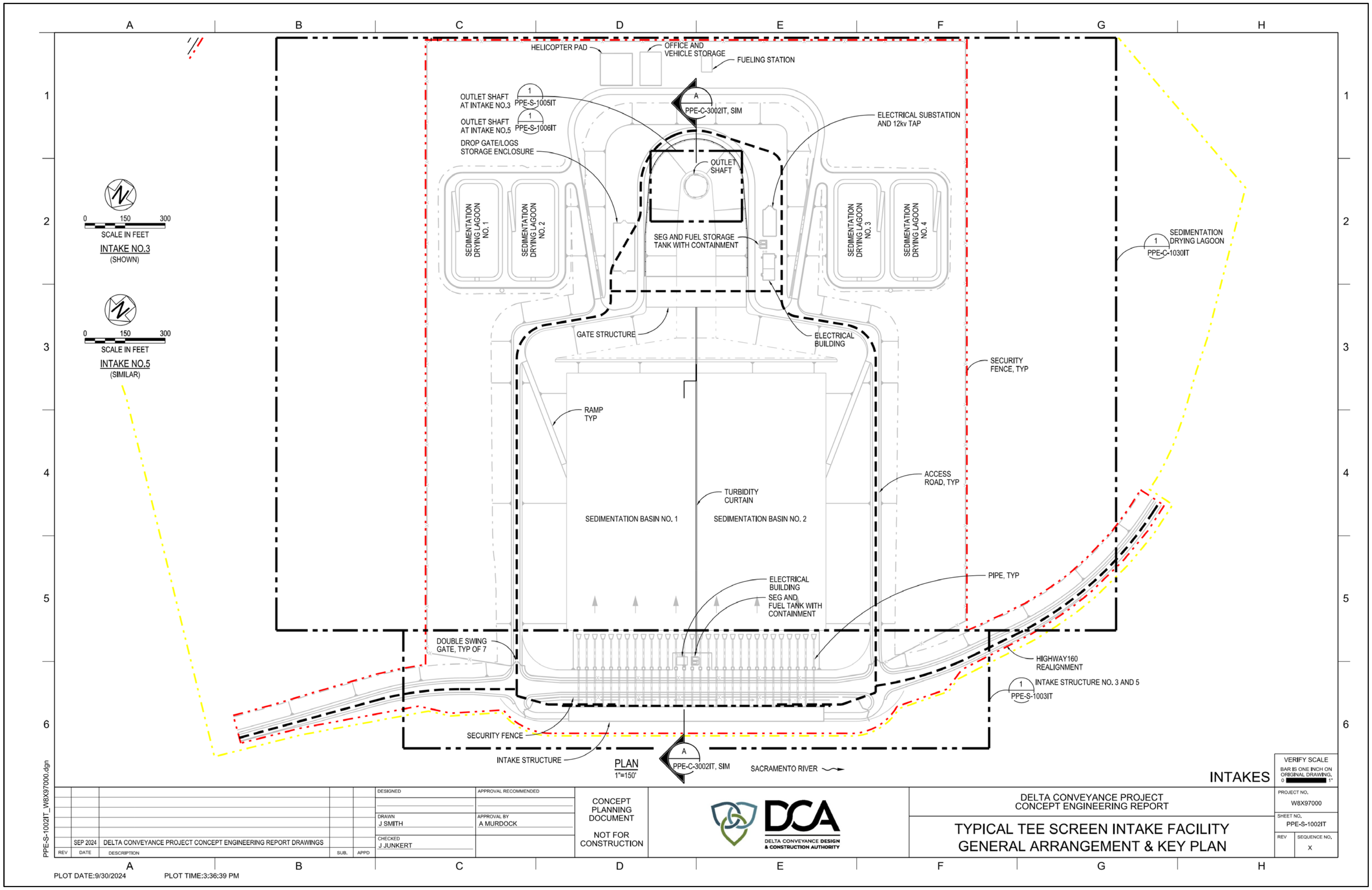


Figure 5. Typical Intake Facilities: Post-Construction Intake Site Plan with Cylindrical Tee Fish Screens

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 during construction of any modifications and long-term operation of the intakes. The existing jurisdictional levee 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 connect to the existing jurisdictional levee at 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 final configuration at the intakes would keep the jurisdictional levee surrounding the perimeter of the sedimentation basin and outlet channel.

Location of intake facilities on the site would be determined to minimize conflicts with existing surface water diversions on adjacent properties. Existing surface water diversions on the properties acquired for the intakes would be used to provide water supplies to the intake facilities.

Below is a general description of the key system components of the proposed intakes. More details are summarized in Appendices B1 through B13.

4.1 Sacramento River Hydrology/Hydraulics

There are a wide variety of water intake configurations used along rivers in the Western United States. For the Project, 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 river 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.

The intakes would be designed to operate over a range from a low water level one percent of the time (99 percent exceedance) to a high-water level consistent with the 200-year return period flood (0.5 percent annual exceedance) using climate change hydrology and sea-level rise for Year 2100 as defined by DWR (DWR, 2020c). 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.

The Project intake hydrologic sizing criteria include establishing the stage-duration data for the Sacramento River WSEL at the intakes. The intake fish screens will be designed to have the capability to function at full capacity 99 percent of the time with the intended operations being less than full capacity. Median annual highest water levels are also of interest at each intake location, as they establish the highest water level that can be expected in what is often referred to as an "ordinary" year.

The intake site stage-duration information was determined by statistical analysis of decades of stage gage data at three locations on the Sacramento River and adjusting that data to the specific intake sites.

Stage data were collected for pertinent Sacramento River gages as follows:

- California Department of Water Resources (DWR) California Data Exchange Center (CDEC) Station on the Sacramento River at I Street Bridge (IST, number [No.] 11447500), obtained from 1984 to 2019 (DWR 2017a)
- U.S. Geological Society (USGS) Station on the Sacramento River at Freeport (FPT, No. 11447650), obtained from 1984 to 2019 (USGS 2019a)
- USGS Station on the Sacramento River above the Delta Cross Channel (SDC, No. 11447890), obtained from 2007 to 2019 (the available data period for this station) (USGS 2019b)

The periods used capture a wide variety of wet, average, and dry water years since both Shasta and Oroville dams were constructed. The stage data were downloaded from the CDEC (DWR 2017a) and USGS (USGS 2019) web sites.

Two intake sites were identified for the Project in Appendix B6 *Intake Site Identification and Evaluation*. The location of these intake sites, along with the DWR and USGS gaging stations, are shown in Appendix B2 *River Hydrologic Criteria for Intake Sizing*. Appendix B2 also shows the low WSELs to be used to size the intakes, as well as the estimated median annual maximum WSEL to show the high-water level at each intake in an "ordinary" year. Figure 6 includes the locations of the intakes, including the selected intake locations: C-E-3 and C-E-5.

4.2 Intake Structure Siting

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. 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 the Delta Conveyance Project.

In addition, DWR assessed alternative intake locations as described below as part of development of the Delta Conveyance Project EIR. The screening exercise found that the additional alternate locations did not meet the project objectives and did not have the potential to lessen potential significant environmental effects.

Accordingly, the following siting criteria were used for selection of candidate 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 the EPR (DCA 2022a and 2022b), 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 6).

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 6 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 considerations
- 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.

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 CER. Each of the intakes would be developed to divert up to 3,000 cfs, each. Refer to Appendix B6 *Intake Site Identification and Evaluation* for additional detail.

4.2.1 Intake C-E-3

This site has suitable river conditions for an intake and its depth is expected to result in an intake structure with minimum length parallel to the river. This site is considered to potentially have the least land-side impacts.. This site is considered the best choice among the candidate sites and was selected as one of the Project intake sites.

About seven properties would be impacted by the intake site, temporary location of SR 160,and subsequent relocation when SR 160 is moved back toward the current location. There would be additional properties affected by construction of the intake haul road to be constructed to the east of the intake to avoid construction traffic on SR 160. The impacts of using this site appear to be lower than all other sites considered.

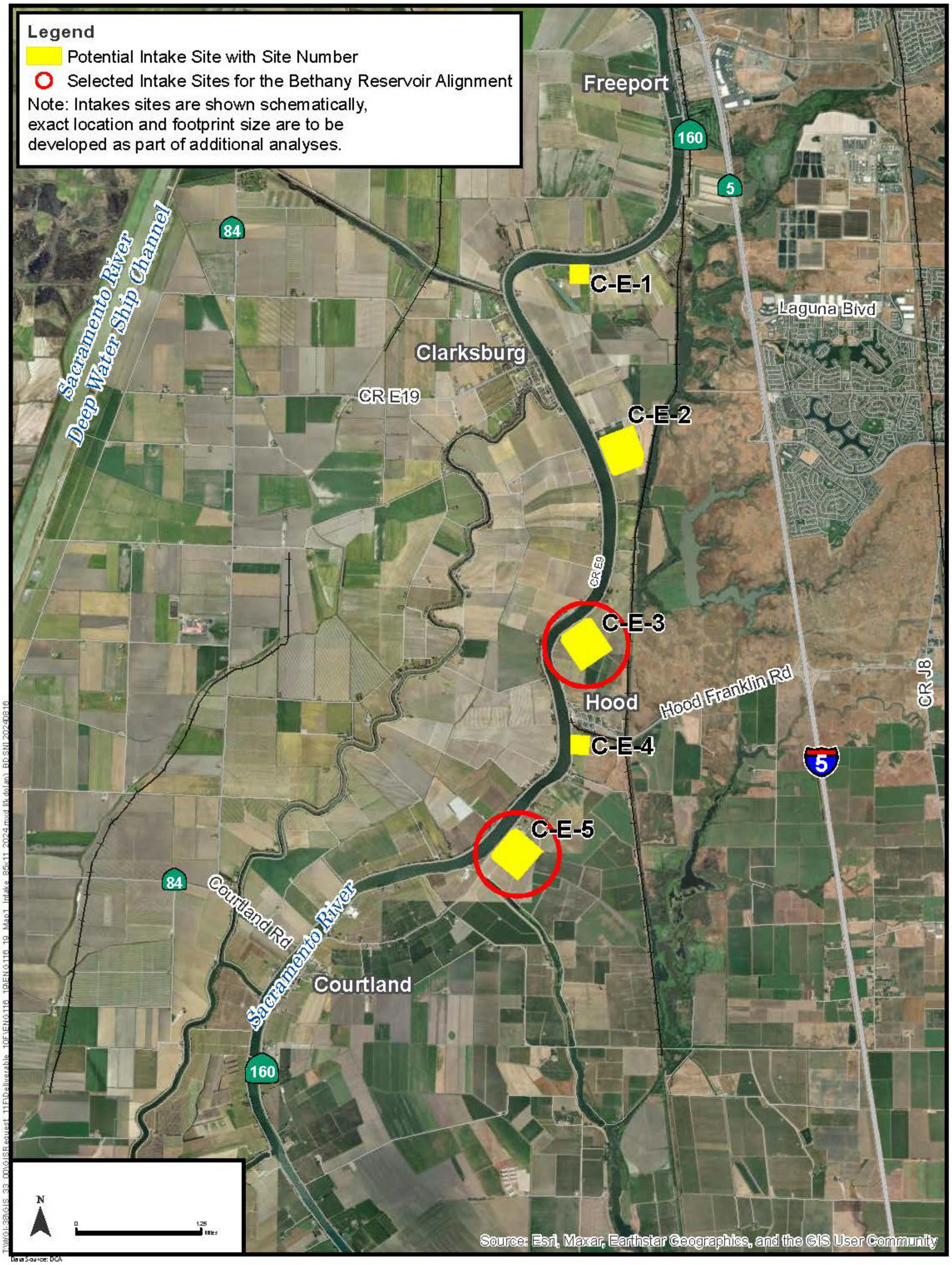


Figure 6. Final Candidate Locations Considered for the Intake Siting Analysis

4.2.2 Intake C-E-5

This site has suitable river conditions for an intake and its depth is expected to result in an intake structure with moderate length parallel to the river. This site generally has lower land-side impacts. This site is considered the second best choice among the candidate sites and was selected as one of the Project intake sites.

About nine properties would be impacted by the intake site, temporary location of SR 160, and subsequent relocation when SR 160 is moved back toward the current location. There would be additional properties affected by construction of the intake haul road to be constructed to the east of the intake to avoid construction traffic on SR 160. The impacts of using this site appear to be consistently lower than all other sites considered except Candidate Site C-E-3.

4.3 Intake Structure Configuration

At each intake, water would flow from the Sacramento River through 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 60-inch diameter piping and control gate assemblies behind each screen, each rated for a diversion capacity of 100 cfs. Control gates in structures along the discharge piping would use flow meter feedback to control the flow rate through each screen. 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. 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.

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.

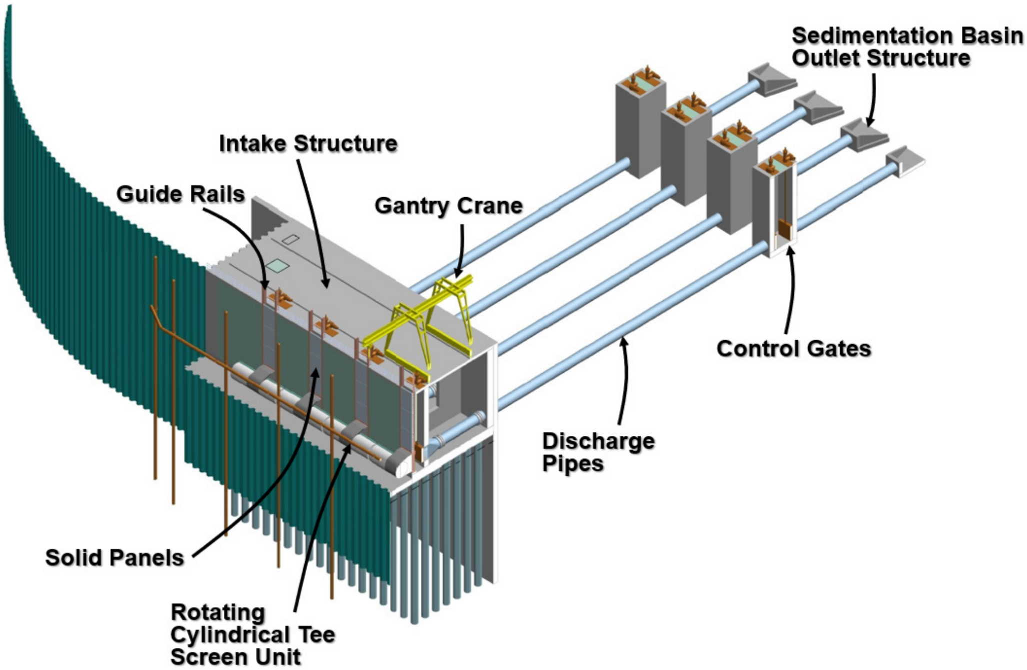


Figure 7. Typical Isometric of Cylindrical Tee Fish Screen Intake Facility Showing Key Features

4.4 Cylindrical Tee Fish Screens

The following sections describe the cylindrical tee fish screen sizing and configuration.

4.4.1 Screen Sizing

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 maximum of 0.2 feet per second (fps) approach velocity toward the screen surface.

Each fish screen unit would be sized at 8 feet in diameter and about 30 feet long with 1.75-millimeter gaps within the screen material which would enable an approach velocity of 0.2 fps. To meet 3,000 cfs design capacity per intake, thirty (30) cylindrical tee-screens would be installed on the river-side of each intake structure, each capable of diverting up to 100 cfs.

For additional detail on screen sizing, see Appendix B7 *Intake Screen Sizing – North Delta Intakes*.

4.4.2 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 7). The two sides of the tee would include fish screen cylinders that divert 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 custom fitted 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.

For details on the fish screen configuration, see Appendix B4 *Intake Structural Configuration and Fish Screen Type Analysis*.

4.5 Sedimentation Basin

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.

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 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 if for some reason the control gates at the intake structure could not provide isolation. The 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 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 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.

See Appendix B8 *Intakes River Sediment Analysis - North Delta Intakes* for more details.

4.6 Operation and Maintenance

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 Appendix B9 *Intakes Operations and Maintenance Equipment and Facility Needs* for more details

4.6.1 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.

4.6.2 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 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 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.

4.6.3 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 from 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.

4.6.4 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. During the annual sedimentation basin dredging period, each drying lagoon would be filled up to three times. Generally, each drying lagoon would be filled only once per year for median project conditions.

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 2 days. 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 while being mixed with agricultural or municipal style mixing implements. 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 4 days, then the sediment would be dried and removed in about 3-4 days. Therefore, the fill and drain/dry sequence would be about 7-8 days, which would approximately match the dredged material filling rate so continuous, or nearly continuous, operation would be possible. Up to about 1,800 to 2,100 cubic yards of sediment would be removed from each lagoon each time this cycle occurs. The volume of sediment collected would depend upon the volume, suspended sediment concentration, and flow rate of water diverted at the intake.

For additional detail, see Appendix B8 *Intakes River Sediment Analysis – North Delta Intakes*.

For additional information on Intakes O&M requirements, see Appendix B9 *Intake Operations and Maintenance Equipment and Facility Needs*.

4.7 Construction Considerations

Construction would be initiated concurrently at Intakes C-E-3 and C-E-5; see Figure 14 for the Project schedule. 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 has been 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 CER 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 preparation of the EPR documents, 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.

Section 9.2 discusses construction dewatering, particularly related to the intakes. For additional detail regarding dewatering of the intakes, see Appendix B13 *Dewatering Estimates for Intakes.*

Ground improvement methods considered at the intake locations are described in Appendix G2 *Liquefaction and Ground Improvement Analysis*.

Quantifications of construction conditions for the intakes are summarized in Attachment 1.

For additional information on construction considerations, refer to the following appendices:

- Appendix B10 *Conceptual Intake Cofferdam Construction*
- Appendix B11 *Intake Flood Management*
- Appendix B12 *North Delta Intake Facilities Configuration, Construction, and Operations*
- Appendix B13 *Dewatering Estimates for Intakes*

5. Main Tunnel and Shafts

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 Project includes a tunnel to convey Sacramento River flows diverted at the intake structures, southward to the Bethany Complex.

A portion of the Bethany Reservoir Aqueduct between the Bethany Reservoir Pumping Plant and the Bethany Reservoir Discharge Structure would include pipelines within two tunnel segments. However, as described in Section 6.2.1.2, Tunnel and Shafts of the Bethany Reservoir Aqueduct , the tunnel construction methods would be different than described in this section because the Bethany Reservoir Aqueduct tunnels would include shorter lengths and different ground conditions. Therefore, locations and construction methods for the tunnels that would be part of the Bethany Complex are presented in Section 6.2.1.2.

In the modern era, most large diameter water tunnels are constructed with tunnel boring machines (TBMs), which use large rotating cutter heads to the soil material. Pre-cast concrete segments that lock into place forming a continuous path of conjoining rings are used to support the excavation. Construction activities within each TBM use an integrated system including automated tunnel liner installation equipment, conveyors to remove the excavated soil, a ventilation system for safety, and other supporting utility systems. For the purposes of this CER, the excavated tunnel material is known as Reusable Tunnel Material (RTM) and is assumed to be permanently stockpiled on-site. The RTM would not be reused for construction of other features. However, RTM would be available to other agencies at some future time for other projects, such as levee embankment repairs. These future uses are not defined at this time and are not included in this CER.

For the Project, the TBM would bore the tunnel from a tunnel launch shaft to a tunnel reception shaft. At each tunnel launch shaft, parts of the TBM would be lowered into the ground to the desired tunnel invert elevation to allow assemblage of the entire TBM. 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 RTM would be removed from the tunnel.

The TBM would bore along the tunnel alignment (also known as a “tunnel drive” or “tunnel reach”) 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 within tunnel maintenance shafts. The tunnel maintenance shaft would allow for 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 shafts included in the Project is presented in Figure 8.

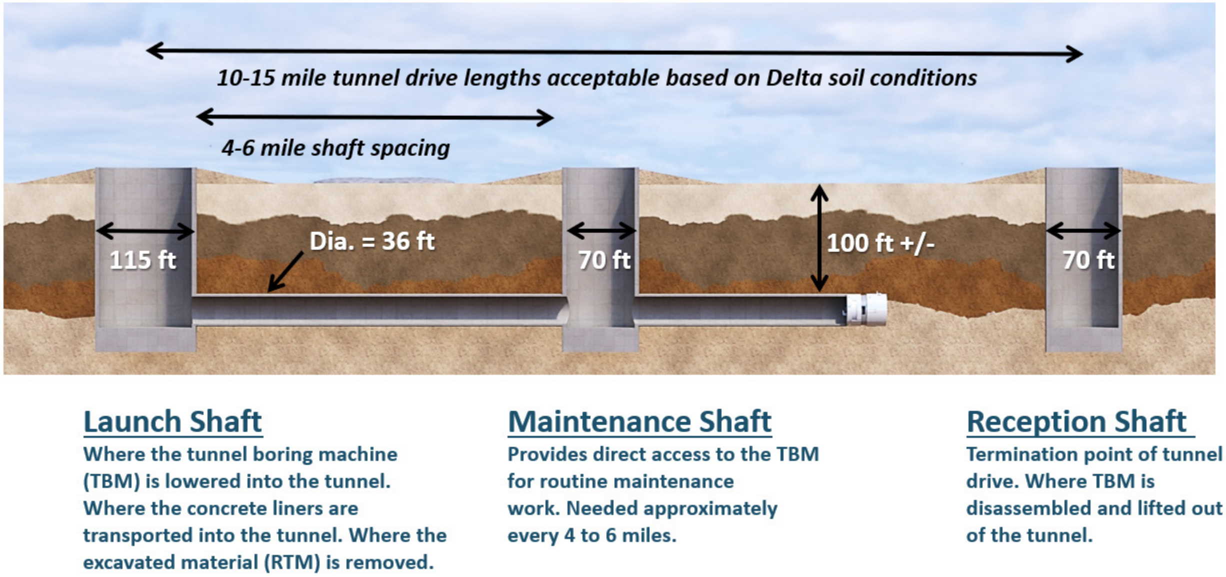


Figure 8. Key Components with General Dimensions of a Tunnel Drive with Tunnel Launch, Maintenance, and Reception Shafts

5.1 Shaft Siting and Tunnel Alignment

During the development of the conceptual design information in support of the EIR, a review of appropriate tunnel lengths between tunnel launch shaft and tunnel reception shafts was conducted based upon anticipated Project tunnel diameter and tunnel depth, anticipated geological conditions, and experience of other tunnel projects. Based on available TBM 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.

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 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 one of the dual tunnel launch shafts on Lower Roberts Island. The second tunnel launch shaft on Lower Roberts Island would be used for the TBM to be bored to the Surge Basin located at the Bethany Complex. See Figure 3 and Figure 9 for locations of shafts.

For additional information on shaft siting, refer to Appendix C5 *Shaft Siting Study*.

5.1.1 Tunnel Launch Shaft Sites

Tunnel launch shaft sites would need to include adequate acreage to accommodate construction of the 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 in the vicinity of the Twin Cities Complex and Lower Roberts Island. The key characteristics of the selected tunnel launch shaft sites are summarized below.

- Twin Cities Complex
  - 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.
  - Near existing power supplies.
  - Adequate space for RTM storage.
  - 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, Union Pacific Railroad (UPRR), and Franklin Field Airport.
- Lower Roberts Island
  - Provided a central location between the Terminous Tract reception shaft and Bethany Complex 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.

5.1.2 Tunnel Maintenance Shaft and Tunnel Reception Shaft Sites

Tunnel reception and maintenance shaft sites would include areas for the shaft with adjacent areas for equipment to excavate the shaft, and cranes and appurtenant items to move equipment into and out of the shaft. 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.

Due to the length of the tunnels and appropriate locations for tunnel reception shaft and tunnel maintenance shafts, the alignment between Twin Cities Complex and Bethany Complex would include five tunnel maintenance shafts (New Hope Tract, Canal Ranch Tract, King Island, Upper Jones Tract, and Union Island) and two tunnel reception shafts (Terminous Tract and the Surge Basin at the Bethany Complex).

The locations of the tunnel launch, reception, and maintenance shafts are shown in Figure 3; and schematics of the shaft locations and tunneling directions are provided in Figure 9 for the Project. The tunnel lengths between shafts for the Delta Conveyance Project are summarized in Table 2.

Quantifications of construction conditions for the shafts and tunnels are summarized in Attachment 1.

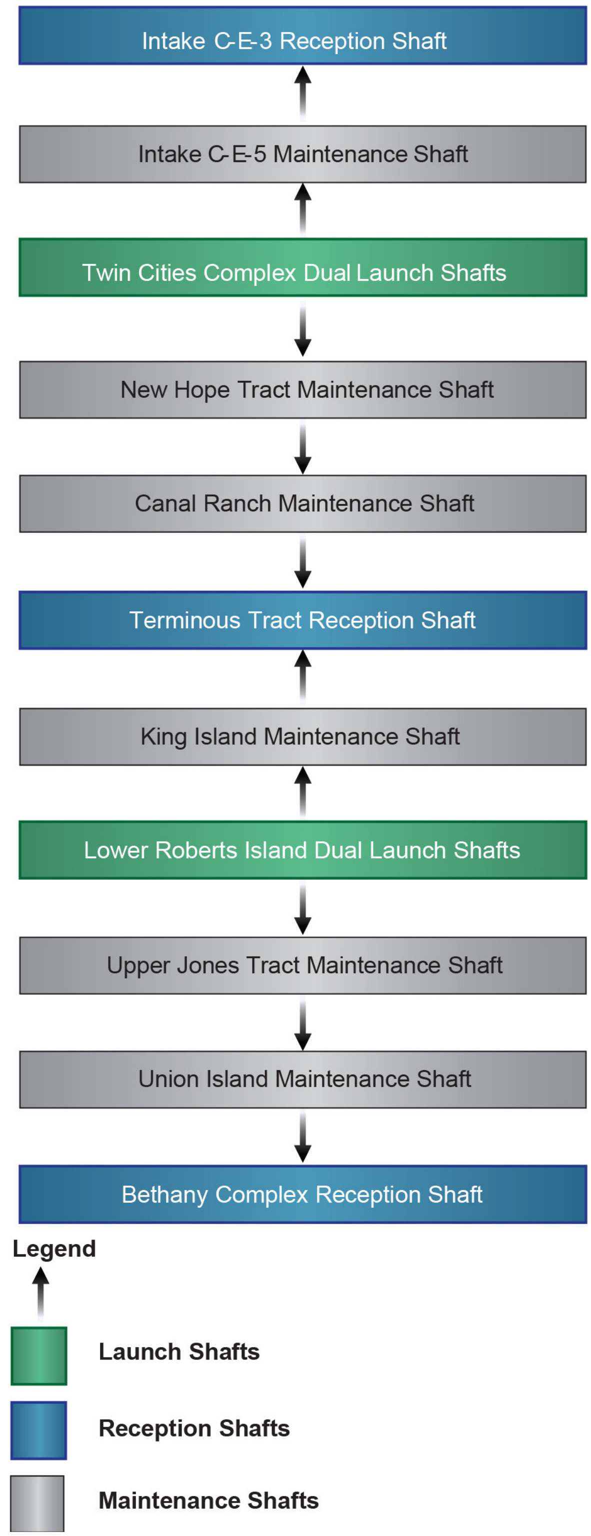


Figure 9. Order of Shafts and Tunneling Directions for The Delta Conveyance Project

Table 2. Tunnel alignment Lengths between Launch and Reception Shafts along The Delta Conveyance Project

Reach	Launch Shaft Site	Reception Shaft	Maintenance Shafts	Drive Length (miles)
1	Twin Cities Complex	Intake C-E-3	Intake C-E-5	8.1
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	Lower Roberts Island	Surge Basin at Bethany Complex	Upper Jones Tract Union Island	14.5

5.1.3 Considerations for Tunnel Features

The tunnel between the intakes and the Bethany Complex 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 conditions during tunnel boring.

5.1.3.1 Tunnel Diameters and Depths Below Ground Surface

During the development of the conceptual design information in support of the EIR, a range of tunnel diameter options were evaluated using a detailed hydraulic head loss analysis considering a range of water surface elevations at the intakes, operational ranges for the Bethany Reservoir Pumping Plant. The evaluation included a hydraulic transient-surge analyses especially for a scenario with the simultaneous shutdown of the pumps at the Bethany Reservoir Pumping Plant (which could occur during a power failure) followed by closure of the sediment basin outlet gates at 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 Appendix A2 for a detailed description and analysis of the tunnel diameter selection along with a hydraulic analysis of the overall conveyance system.

The hydraulic analysis was also used to confirm the bottom elevations (invert) of the tunnels such that the tunnel would operate completely full and submerged under all operating conditions. The invert elevations of the tunnel between the intakes and Twin Cities Complex would range from -139 feet to -145 feet. The invert elevations of the tunnel between Twin Cities Complex and the Bethany Complex would range from -145 feet to -164 feet.

5.1.3.2 Tunnel Liner Considerations

The tunnel would be supported with precast concrete segmental liners. The tunnel liner thickness would be 18 inches thick. This is similar to other water tunnel projects excavated in similar ground conditions with an inside diameter of 36 feet. The TBM cutterhead diameter would be approximately 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. Grout would be injected into the annulus as soon as possible to control surface settlement.

5.1.3.3 Tunnel Boring Methods

A TBM is capable of boring 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.

Two basic types of pressurized TBM machines could potentially be utilized for the Project: an earth pressure balance (EPB) machine or a slurry machine. Based upon anticipated geotechnical investigations along the tunnel alignments, the Project 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. In addition, the assumed use of EPB machines represent a conservative surface footprint area due to the surface area needed to spread and dry RTM before stockpiling.

The tunnel liner would be installed behind the TBM cutterhead. The tunnel liner would provide support for external and internal pressures. External pressures would include TBM construction forces, soil pressure, groundwater pressure and earthquake loads. Internal pressures would be related to water head pressures and surge pressures from the water flowing through the tunnel. Design analyses were performed as part of the conceptual design 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.

Tunnel segmental liners for the Project 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 manufacturer or delivery.

Future geotechnical investigations would be conducted during the 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.

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 Project. 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.

For additional information, refer to the following appendices:

- Appendix C1 *Tunnel Excavation and Drive Assessment*
- Appendix C2 *Conceptual Tunnel Lining Evaluation*
- Appendix C3 *Tunneling Effects Assessment*

5.2 Shafts

5.2.1 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.

The tunnel launch shafts would be 115 feet in inside diameter, as shown in the engineering concept drawings.

A 5-foot-thick slurry wall would be constructed around the outside diameter of the shaft and would extend from the top of the raised shaft pad to below the bottom of the 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 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 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 shaft would be constructed in saturated soil conditions due to high groundwater levels.

During the initial construction phase at the tunnel launch shaft sites, the shaft pad would be constructed above the ground surface to an elevation approximately equal to the adjacent levee system, as described in Appendix C4 *Shaft Conceptual Design* for each site. Following construction, the 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, 2020c), whichever is higher. The heights of the tunnel launch shaft pads and shaft liners are presented for each site in Appendix C4 *Shaft Conceptual Design* and the engineering concept drawings.

The tunnel launch shaft pads on Twin Cities Complex and Lower Roberts Island would be developed from on-site soil excavations. Ground improvement would be required at all tunnel shaft sites except at the Twin Cities Complex and Bethany Complex, as shown in the engineering concept drawings and Appendix C4 *Shaft Conceptual Design*. Ground improvements methods considered at the Lower Roberts Island tunnel launch shaft are described in Appendix G2 *Liquefaction and Ground Improvement Analysis*.

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 construction sites would be sized to accommodate all functions necessary for tunneling operations, including RTM management and storage. Construction and post construction site acreages for the tunnel launch shaft sites are provided in Section 12, Post-Construction Land Reclamation and Site Restoration.. The construction area would include the following facilities.

- 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 Lower Roberts Island site.

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 12, Post-Construction Land Reclamation and Site Restoration.

5.2.2 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.

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 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.

Tunnel maintenance shafts would be constructed in the same manner as described in Section 5.2.1, Launch Shafts. Ground improvement would be required at the maintenance shafts, as shown in the engineering concept drawings and described in Appendix G2 *Liquefaction and Ground Improvement Analysis*.

Soil to construct the maintenance shaft pad located 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, Canal Ranch Tract, and King Island would be provided from on-site excavations and soil imported from the Twin Cities Complex. Soil to construct the tunnel maintenance shaft pad on Upper Jones Tract and Union Island 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. Tunnel maintenance shaft sites along the Project alignment are located at New Hope Tract, Canal Ranch Tract, King Island, Upper Jones Tract, and Union Island. Construction and post construction site acreages for the tunnel maintenance shaft sites are provided in Section 12, Post-Construction Land Reclamation and Site Restoration.

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

- 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.

Following construction, construction equipment and materials would be removed. However, similar to the tunnel reception shafts, 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 grass species to minimize erosion.

5.2.3 Reception Shafts

The TBM would bore from the tunnel launch shaft to the tunnel reception shaft where the TBM would be 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 Table 2.

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 the disassembly of the TBM for subsequent removal out of the shaft. The tunnel reception shaft on Terminous Tract 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 shaft at the Surge Basin within the Bethany Complex would be constructed with an inside diameter of 120-feet.

Tunnel reception shafts would be constructed in the same manner as described in Section 5.2.1, Launch Shafts. Ground improvement would be required at the Terminous Tract tunnel reception shaft, as shown in the engineering concept drawings and described in Appendix G2 *Liquefaction and Ground Improvement Analysis*.

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 Terminous Tract would be provided from on-site excavations and soil from the Twin Cities Complex. The tunnel reception shaft at the Surge Basin within the Bethany Complex would not require a shaft pad due to the higher site elevation.

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. Construction and post construction site acreages for the tunnel reception shaft sites are provided in Section 12, Post-Construction Land Reclamation and Site Restoration.

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

- Shaft and Perimeter Working Pad.
- Area for placement of TBM equipment removed from the tunnel.
- Access Roads.
- Excavated Material Stockpiling.
- Materials Storage.
- Staff Offices and Other Support Space.
- Water Collection, Treatment, and Storage Facilities.
- Utilities.

Following construction, construction equipment and materials would be removed. However, due to the smaller site areas, 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.

5.3 Reusable Tunnel Material

The Project would not include a forebay or other major features that would require significant soil fill quantities during or after RTM generation at the tunnel launch shaft sites. As noted in Section 5.1.3, Considerations for Tunnel Features, a small portion of the soil excavated on Twin Cities Complex and Lower Roberts Island would be used to construct shaft pads at all sites. Additionally, as noted in Section 8.3.1, Flood Risk Management Measures, excavated soil would be used to construct flood management levee modifications at the tunnel launch shaft sites. The RTM would be used to fill the resulting borrow excavations at the tunnel launch shaft sites. The remaining RTM would be stockpiled above grade at the Twin Cities Complex and Lower Roberts Island tunnel launch shaft sites.

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 for future projects that have not been identified at this time.

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. Table 3 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 Project alignment.

Table 3. Volume of Wet Uncompacted RTM at Each Launch Shaft Site of the Bethany Reservoir Alignment for Project Design Capacity of 6,000 cfs

Launch Shaft Site	RTM Generated (millions of cubic yards)
Twin Cities Complex Dual Launch Shafts	6.7
Lower Roberts Island Dual Launch Shaft	7.7

The excavated material would be continuously conveyed from the face of the TBM, toward the tunnel launch shaft, and lifted vertically using a bucket-type vertical conveyor up through 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. 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 RTM drying and stockpiling, as described below.
- **RTM Drying and Stockpiling:** 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. 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 without excessive earth moving requirements.
- **Neither natural drying nor stockpile storage 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.
- **RTM Management Plans:** Storage of RTM, and acreage and heights of RTM storage stockpiles for each tunnel launch shaft site are presented in Appendix C6 *Reusable Tunnel Material*. Locations of RTM handling and 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:
  - **Twin Cities Complex:** The management plan would be to ultimately move RTM to a singular on-site long-term storage area. A portion of the dried RTM would be used to refill the areas excavated at each launch site to provide soil for shaft pads and levee modifications. The long-term storage stockpile of surplus dried RTM would be up to 15 feet high. The long-term RTM storage stockpile would be planted with erosion-control seed mix to stabilize the stockpile and avoid dust generation.

- **Lower Roberts Island:** The management plan would be to ultimately move RTM to a singular long-term on-site storage area. A portion of the dried RTM would be used to refill the areas excavated at each launch site to provide soil for shaft pads and levee modifications. The long-term storage stockpile of surplus dried RTM would be up to 15 feet high. The long-term RTM storage stockpile would be planted with erosion-control seed mix to stabilize the stockpile and avoid dust generation. Due to the soil conditions on Lower Roberts Island, it is anticipated that the RTM stockpile would subside, and the long-term height would be reduced over time.

Odors from construction materials are primarily generated from hydrogen sulfide gases through decomposition of organic materials in the soil particles (Reinhart et. al. 2004). For the majority, the tunnel excavation would occur at least 120 feet below the ground surface, with few locations at depths no less than 110 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. 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.

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.

For additional detail, see Appendix C6 *Reusable Tunnel Material*.

5.4 Operation and Maintenance

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. In some cases, 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 60 cfs dewatering pumps would be installed within the Surge Basin tunnel reception 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 Bethany Reservoir Pumping Plant discharge pipelines and ultimately to the Bethany Reservoir Discharge Structure.

For additional detail, see Appendix C7 *Tunnel Inspection and Maintenance Considerations*.

6. Bethany Complex

The Bethany Complex is generally located south of the Byron Highway, and would include the following facilities.

- Bethany Reservoir Pumping Plant and Surge Basin.
- Bethany Reservoir Aqueduct.
- Bethany Reservoir Discharge Structure.

Figure 10 shows the Bethany Complex temporary and permanent infrastructure layout. A description of the primary facilities located within the Bethany Reservoir Complex is provided in the subsections that follow.

6.1 Bethany Reservoir Pumping Plant

As described previously, Sacramento River water would be diverted at the intakes in the North Delta and flow approximately 45 miles through the main tunnel terminating at a tunnel reception shaft located at the Surge Basin adjacent to the Bethany Reservoir Pumping Plant. The purpose of the Bethany Reservoir Pumping Plant would be to hydraulically lift the water from the conveyance tunnel system to the existing SWP Bethany Reservoir.

Figures 11 show the infrastructure layout associated with the Bethany Reservoir Pumping Plant and Surge Basin facilities.

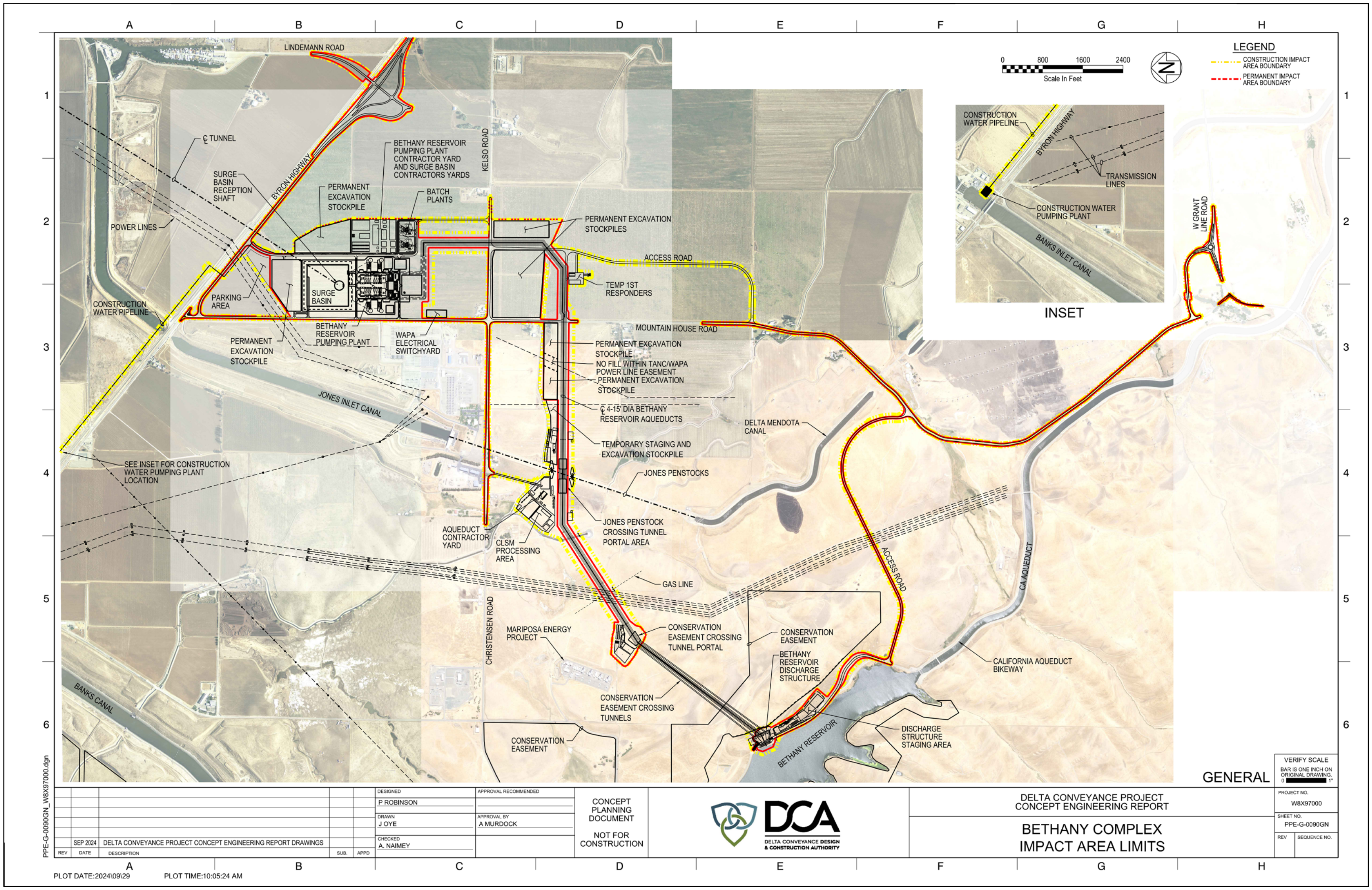


Figure 10. Bethany Complex Facilities Site Plan with Construction and Permanent Boundaries

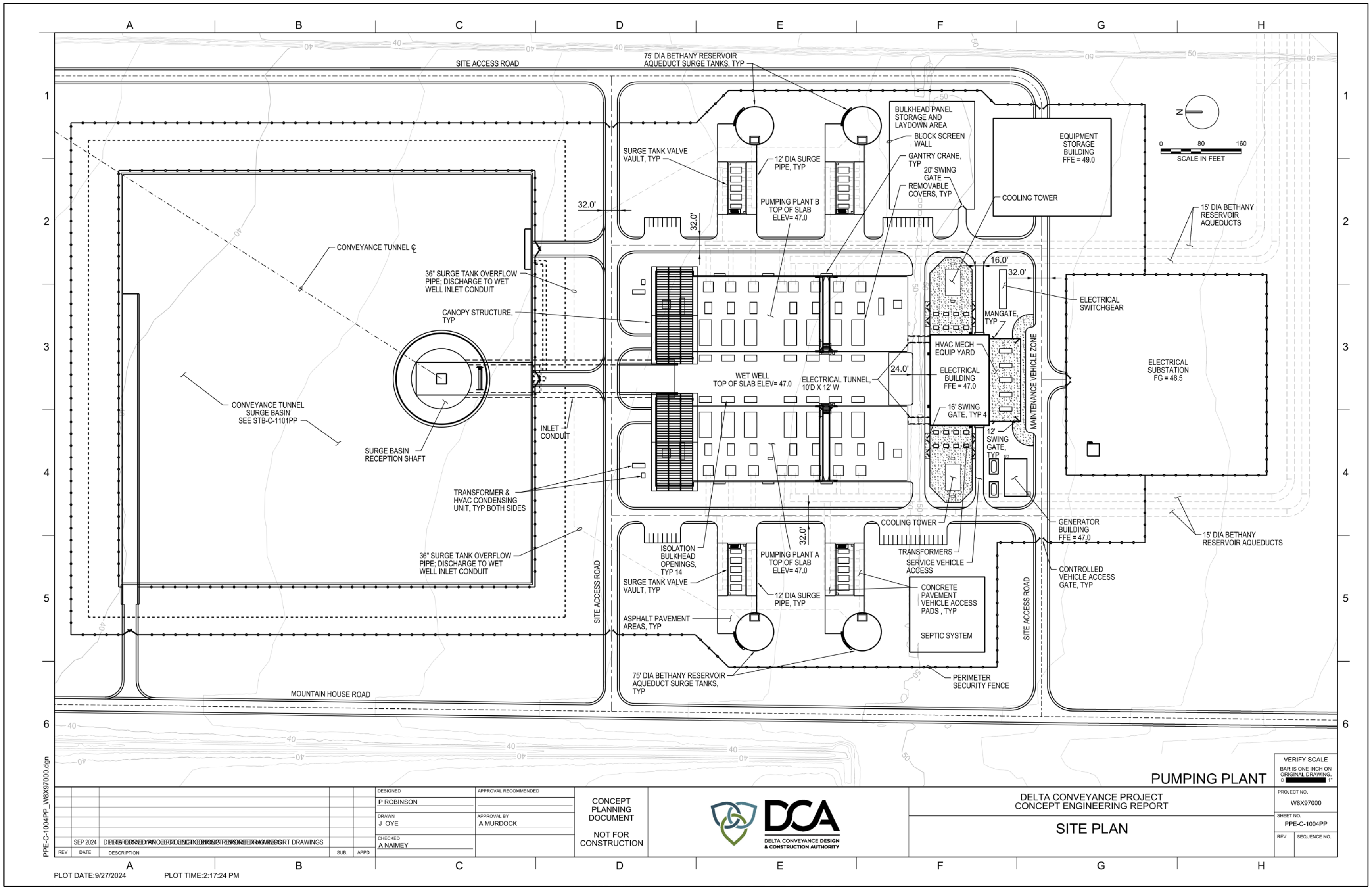


Figure 11. Bethany Reservoir Pumping Plant Facilities: Post-Construction Site Plan

6.1.1 Bethany Reservoir Pumping Plant Siting Study

The purpose of the Bethany Reservoir Pumping Plant would be to lift flows to a hydraulic gradeline sufficient for delivery into Bethany Reservoir, which operates at approximately elevation 245 feet. Accordingly, the Bethany Reservoir Pumping Plant would connect to the Aqueduct, consisting of four pressurized pipelines to the Bethany Reservoir. The purpose of the Surge Basin is to provide an overflow catchment basin at the end in the tunnel between the intakes and the Bethany Reservoir Pumping Plant to mitigate transient surge pressures.

Twelve locations were initially selected as potential sites for the Bethany Reservoir Pumping Plant and Surge Basin in the area between CCF and Bethany Reservoir, as illustrated in Appendix D1 *Facilities Siting Study*.

Each of the sites were evaluated considering the following criteria and subcriteria:

- System Operations and Flexibility Considerations – O&M access, relative O&M complexity, CVP expansion, reservoir water quality impacts from likely discharge location, and hydraulic operations complexity
- Construction Considerations – Proximity to roads suitable for construction traffic, available space, compatibility with tunnel/shaft locations, conflicts with existing infrastructure (power lines, canals, penstocks, and flood risk
- Geotechnical Considerations – Seismicity and challenges associated with soil type, depth, etc.
- Property and Land Use – Parcels affected by surface facilities, future development, farmland impacts, and conflicts with public facilities (schools, housing, airports, parks)
- Environmental Setting – Conservation easements, federal or state special status species or critical habitats (red-legged frog, kit fox, or other special status species critical habitat, vernal pool habitat, or alkali wetlands), and proximity to sensitive receptors

Ultimately, Site PS-10 was selected as the recommended location for the Bethany Reservoir Pumping Plant and Surge Basin, primarily due to its logistical advantages, lack of need for the Aqueduct pipelines to cross the Byron Highway or railroad, proximity to CVP, compatibility with below grade Surge Basin site, and avoidance of conflict with current and potential future infrastructure and development.

For a detailed understanding of how the Bethany Reservoir Pumping Plant was located and site selection of facilities in the Bethany Complex, see Appendix D1 *Facilities Siting Study*.

6.1.2 Inlet Wet Well Conduit

The inlet conduit would convey water from the tunnel reception shaft at the Surge Basin to the Bethany Reservoir Pumping Plant inlet wet well. The inlet wet well conduit would be approximately 400-feet long, 60-feet wide. Two sets of isolation bulkhead gates and openings would be provided in the inlet wet well conduit to isolate water flowing through the conduit and entering the Bethany Reservoir Pumping Plant wet well during inspection or maintenance with double isolation provisions for life-safety of the workers. The overhead mounted gantry crane on the Surge Basin bridge structure would be used to install and remove the bulkhead panels.

6.1.3 Bethany Reservoir Pumping Plant

The Bethany Reservoir Pumping Plant facilities would be located both below grade and above-ground. The finished site pad for the Bethany Reservoir Pumping Plant would be about elevation 46.5 feet which is similar to existing grade, but substantially above the elevation required to protect the facilities from surge events and the 200-year flood event with anticipated sea level rise in Year 2100 (DWR, 2020c).

The pumps would lift water from a wet well hydraulically connected to the tunnel reception shaft via the inlet wet well conduit. The pumps would be operated to maintain the flow rate supplied into the tunnel at the northern Sacramento River intakes.

The desired flow of the pumping plant would range from a minimum of 600 cfs to a maximum of 6,000 cfs. The firm capacity of 6,000 cfs would be achieved with twelve 500 cfs pumps. The pumping plant would also include two additional standby pumps to operate when other pumps require repairs. The maximum total dynamic head of the pumps would be 340 feet at design flow. The pumps would require 25,000 horsepower motors.

The major components of the Bethany Reservoir Pumping Plant are presented in Attachment 1, the engineering concept drawings and summarized below.

- Bethany Reservoir Pumping Plant Site
  - The site would include the below-ground pumping plant and wet well, above-ground water storage tanks for hydraulic transient-surge protection of the discharge pipelines, electrical building with variable speed drives and switchgear, heating and air conditioning mechanical equipment yard, transformer yard, electrical substation adjacent to the electrical building, standby engine generator building with an isolated and fully contained fuel tank, equipment storage building with drive-through access, offices, welding shop, machine shop, storage area for spare aqueduct pipe sections and accessories, and a walled enclosure/storage facility for bulkhead panel gates that would be used to isolate portions of the Bethany Reservoir Pumping Plant during maintenance procedures. The pumping plant would include two separate dry-pit pump bays adjacent to the wet well.
  - Ultrasonic flow meters would be installed on each vertical pump discharge piping system. Flow meters would be used for individual control of each pump's operating speed and corresponding pumped flow output.
  - An isolation valve would be installed in a vault on each vertical pump discharge piping system at the top of the pump bay structures.
  - Gantry cranes and rail systems would be located outside of the buildings to move equipment during maintenance procedures. The site would be surrounded by security fences with four vehicle access gates.
  - Refer to the following appendices for additional details:
    - Appendix D2 *Bethany Pumping Plant Basis of Conceptual Design Criteria*
    - Appendix D3 *Bethany Reservoir Pumping Plant Facilities and Site Configuration*
- Additional Pumping Plant Complex Facilities
  - The electrical building would be located adjacent to the pumping plant building. The electrical building would house the variable frequency drives for the main raw water pumps and the

electrical equipment for the cooling systems associated with the variable frequency drives and the main pump motors.

- A substation would connect two high voltage electrical feeders from nearby transmission lines. 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. The isolated and fully contained fuel tank is not located inside the 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 five pad-mounted, direct expansion air handler units (AHUs) for pumps operated with air cooled variable frequency drives and up to two pad-mounted cooling towers. 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.
- An equipment storage and operations maintenance building would be provided with office space, a welding shop; machine shop; and interior storage for spare pumps and rotating assemblies, motors, and accessories. Interior storage space would also be included for large equipment such as tunnel dewatering pumps, cable reels, and discharge piping assemblies. An exterior isolation bulkhead gate panel storage and equipment laydown area would be provided on the north side of the building.
- Bridge and gantry cranes 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.
- Emergency response facilities would be provided during construction and would include a building with two ambulances, each with a set of full-time staff during work hours, a fire truck with a full-time crew for each construction shift, and a 60-foot diameter paved helipad without tree coverage to be used only for extreme emergency evacuations.

6.1.4 Surge Basin

The tunnel reception shaft located in the Surge Basin at the Bethany Reservoir Pumping Plant would be used to receive and remove the TBM bored from Lower Roberts Island. The tunnel reception shaft would be modified to become the Surge Basin overflow structure and the connection to the inlet wet well conduit to the pumping plant. The Surge Basin would be located immediately to the east of Mountain House Road. The Surge Basin would contain an access ramp that would connect to an access road to Mountain House Road to facilitate removal of the TBM and vehicle access during construction and operation of the Surge Basin.

The Surge Basin would normally be empty and would only be used during infrequent hydraulic transient-surge events. The hydraulic transient-surge events could occur in the tunnel between the intakes and Bethany Reservoir Pumping Plant if there was a simultaneous shutdown of the main raw water pumps in the Bethany Reservoir Pumping Plant followed by the closure of sediment basin outlet gates at an intake. Under these conditions, surge flows in the tunnel would flow into the Surge Basin through the tunnel reception shaft. A circular weir wall would be located around the top of the tunnel reception shaft to allow the surge overflows to enter the Surge Basin but prevent these overflows from immediately re-entering the tunnel. Since the overflow weir at the Surge Basin is sometimes lower in elevation than the Sacramento River at higher river flow stages, during periods of normal operation additional pump control and intake gate management procedures would be implemented to maintain water levels below the top of the overflow weir within the Surge Basin reception shaft. After the hydraulic transient-surge event, DWR operators would open gates through the weir wall to allow the water to flow into the surge basin shaft and flow to the Bethany Reservoir Pumping Plant wet well. The Surge Basin would also include permanently installed and portable pumps, discharging to the Bethany Reservoir Aqueduct, to assist removal of the water. The tunnel shafts would also provide volume to store water during surges.

The Surge Basin structure, located above the tunnel and vertical reception shaft, would be an open top, rectangular, below ground-level structure and would be constructed with diaphragm walls and a reinforced concrete floor slab. The top of the Surge Basin would be at existing grade and the bottom elevation (top of floor slab) at about 30 or 40 feet below the ground surface (elevation 7.0 feet). The Surge Basin would include a 180-foot-diameter circular weir wall surrounding the outlet of the vertical reception shaft. The circular weir wall would extend vertically from the top of floor slab to a top of weir elevation of 18.0 feet and would incorporate six (6) gated openings around its circumference.

The Surge Basin would include a gantry crane on a bridge structure between the southern edge of the basin and the vertical reception shaft. The top of decking elevation of the bridge would be 46.5 feet and constructed immediately over the top of the covered wet well inlet conduit. The bridge structure would include a removable panel centered over the reception shaft and a rail mounted gantry crane that would be used to install portable submersible pumps and connecting discharge piping into the reception shaft for dewatering the tunnel.

6.1.5 Operations and Maintenance

Provisions for operations and maintenance are included in Appendix D3 *Bethany Reservoir Pumping Plant Facilities and Site Configuration*. Particular detail regarding the tunnel dewatering is included below.

6.1.5.1 Tunnel Dewatering

The tunnel dewatering process would use the main pumps within the Bethany Reservoir Pumping Plant and portable submersible pumps installed in the tunnel reception shaft within the Surge Basin structure. The main pumps would be used to initially dewater the tunnel shafts and the Bethany Reservoir Pumping Plant wet well down to a wet well water surface elevation of -50 feet or lower, depending on the allowable suction requirements associated with the main pumps. The radial gates upstream of the Sacramento River intake outlet shafts would be closed and no additional flow from the intakes would enter the tunnels after the start of the dewatering process.

Submersible vertical turbine pumps were considered as the dewatering pumps for the tunnel. The dewatering pumps could normally be stored per the manufacturer’s instructions in the equipment storage building when not in use or they may be left permanently installed in the vertical reception shaft within the surge basin structure. In either case, the pumps would be stored or periodically operated in accordance with the manufacturer's instructions. Each pump would be supported by the surge basin's bridge deck structure. Sole plates would be permanently embedded in the top deck of the bridge structure. A permanent 60-inch pump discharge pipeline supported by the bridge structure would convey the pumped flow from the main tunnel into the Bethany Reservoir Pumping Plant (at the intermediate floor elevation of 3.0 feet) and would be interconnected to a main pump's discharge pipeline. A flow meter and flow control valves would measure and regulate the dewatering flow from up to two dewatering pumps operating in parallel and maintain their operation within the allowable operating range of each pump. The tunnel and wet well dewatering flow would be pumped up to Bethany Reservoir. The variable speed drives for the dewatering pumps would be located within the Bethany Reservoir Pumping Plant in separate mechanical rooms located in the northern end of the structure at the intermediate floor elevation of 3.0 feet.

For additional detail, see Appendix D3 *Bethany Reservoir Pumping Plant Facilities and Site Configuration*.

6.2 Bethany Reservoir Aqueduct

The Bethany Reservoir Aqueduct would convey water from the Bethany Reservoir Pumping Plant to Bethany Reservoir Discharge Structure located along the bank of the existing SWP Bethany Reservoir. The Bethany Reservoir Aqueduct would begin at the Bethany Reservoir Pumping Plant, cross under Kelso and Mountain House roads, go beneath the CVP Jones Pumping Plant penstocks, a main Byron-Bethany Irrigation District (BBID) canal, three petroleum pipelines, two major gas transmission pipelines, a major power transmission corridor, and the Bethany Reservoir Conservation Easement, before ending at the Bethany Reservoir Discharge Structure at the California Aqueduct Bikeway immediately adjacent to Bethany Reservoir. Figure 12 shows the alignment from the November 2023 EPR Update. For additional details on the aqueduct pipeline and discharge structure, see Attachment 1 and Appendix D5 *Conceptual Development of Aqueduct and Discharge Structure*.

Appendix D1 *Facilities Siting Study* includes the selection of the Bethany Reservoir Aqueduct Alignment (Route Study)

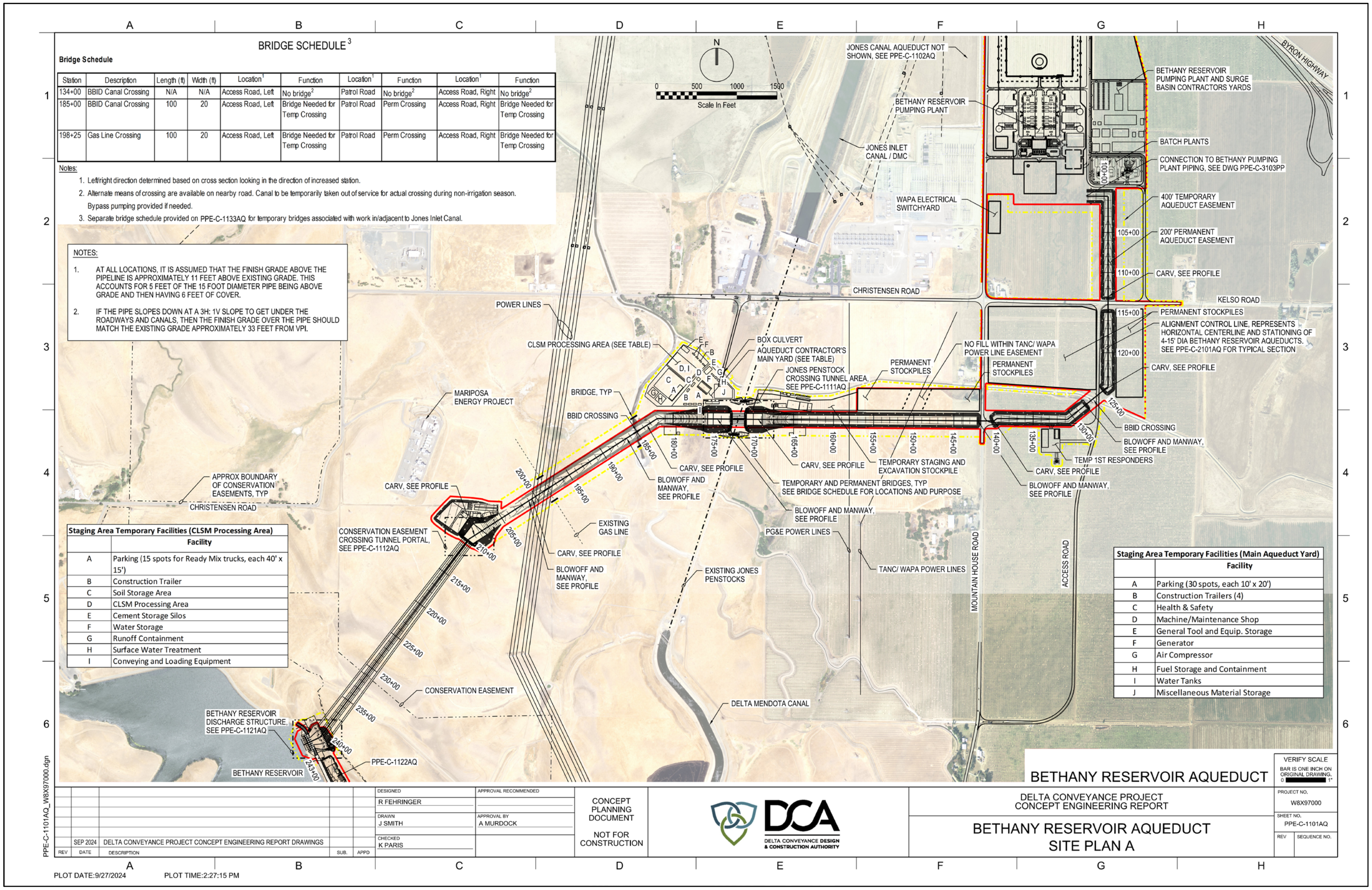


Figure 12. Bethany Reservoir Aqueduct Site Plan

6.2.1 Bethany Reservoir Aqueduct Pipelines

The Bethany Reservoir Aqueduct would consist of four pressurized 180-inch inside diameter welded steel pipes. Each pipeline would convey up to 1,500 cfs. The Aqueduct pipelines would be constructed using open cut and backfill trench methods except where the pipelines cross beneath the existing Jones Pumping Plant discharge penstocks and the existing Bethany Reservoir Conservation Easement near Bethany Reservoir where tunneling methods would be used for Aqueduct construction. The Aqueduct pipelines would also include appurtenances shown on the engineering concept drawings, including manway access, air and vacuum valve assemblies, drainage assemblies, and corrosion protection.

6.2.1.1 Open-Trenched Portions of the Bethany Reservoir Aqueduct Pipelines

For the open-trenched portions of the Bethany Reservoir Aqueduct, the pipelines would be installed so that the center of the pipelines would be separated by 30 feet. The Aqueduct pipelines would be installed in a similar manner as the CVP Jones penstocks with approximately 70 percent of each pipeline to be buried below the existing ground surface. The top of the pipelines would be backfilled with about 6 feet of cover using soil produced during the trench construction or imported from the Pumping Plant excavation. Controlled low strength backfill material (CLSM) would be placed around the pipelines below the existing ground surface. A 24-foot wide permanent gravel-surfaced patrol road would be placed on the completed fill in the center (i. e. Aqueduct control line, as depicted on the engineering concept drawings) of the Bethany Reservoir Aqueduct.

Construction sites for the portion of the Aqueduct constructed by open-trench methods would include parking/staging areas, contractor offices and temporary facilities, temporary roadways, and the CLSM processing area. The facilities in these areas would be removed at the completion of construction and the sites restored to existing native grasses area or agricultural use, as applicable.

6.2.1.2 Tunnels and Shafts of the Bethany Reservoir Aqueduct Pipelines

Tunnels under the Jones penstocks and Bethany Reservoir Conservation Easement would be constructed using a different tunneling method than used for the tunnel between the intakes and the Bethany Complex because the Bethany Reservoir Aqueduct tunnels would be shorter, be constructed in different ground conditions, include multiple parallel tunnels (one per pipeline), and be smaller in diameter.

For the Bethany Reservoir Aqueduct, a tunnel would be constructed for each Aqueduct pipeline from tunnel portals at the Jones penstocks crossing and from a tunnel launch portal near the Bethany Reservoir Conservation Easement to vertical shafts located at the Bethany Reservoir Discharge Structure. The tunnel portals would require large excavations to provide access to the tunnel alignments, as described in the following subsection.

The tunnels could be constructed using a “roadheader” tunneling machine with a boom arm-mounted cutting head attached to an excavator arm within a “digger-shield”. The digger-shield would support the excavation as the tunnel support members (as needed) would be installed and the excavated material would be moved out of the tunnel to the portal. The steel pipelines would be installed in the completed tunnel sections and the annular space between the tunnel and the pipeline would be filled with grout or similar materials such as Low Density Cellular Concrete (LDCC).

Tunnels under the Jones Penstocks

The four Aqueduct pipelines would cross under the Jones penstocks inside four 200-foot long and 20-feet wide tunnels. The space between the pipeline and the initial ground support would be backfilled with grout, or LDCC. The pipelines would be installed in tunnels that would be separated by 40 feet between the center of each tunnel.

Tunnel portals would be established at each end of the tunnels for access during construction. The portal on the east side of the Jones penstock crossing would be the location for the main tunneling operations. The combined tunnel portal sites would include mobile cranes, contractor offices and shops, material and equipment staging and storage, tunnel ventilation system housing, water treatment systems for runoff and dewatering flows, access roads, fence with security gates and guard shacks, temporary electrical substation, portable sanitary facilities, and storage for topsoil.

As part of future work efforts, coordination for design and construction would be conducted with the United States Bureau of Reclamation regarding this crossing.

Tunnels under the Bethany Reservoir Conservation Easement

The four Aqueduct pipelines would transition to tunnels under the Bethany Reservoir Conservation Easement to avoid surface disturbances within the existing conservation easement. The space between the pipeline and the initial ground support would be backfilled with grout, or LDCC.

The tunnel portal would be located to the northeast of the Conservation Easement because the topography and tunnel depth are better suited to a portal at this location as compared to a location immediately adjacent to the easement. The tunnel portal would be located to the west of the existing high voltage power lines.

At the tunnel portal, the pipelines would be installed within the 20-foot inside diameter 3,064-foot long tunnels that would be separated by 40 feet between the center of each tunnel at the entrance portal end to about 80 feet at the shaft end. The pipelines inside of the tunnels would terminate along the northern edge of Bethany Reservoir near the bottom of four 55-foot diameter shafts excavated down from the ground surface. The pipeline in each tunnel would connect to a 90-degree bend at the bottom of each shaft and continue up through the vertical shafts to the concrete channel at the floor of the Bethany Reservoir Discharge Structure. The annulus between the pipeline and the initial ground support would be backfilled with a combination of concrete, soil, CLSM, LDCC, or other similar materials.

The tunnel portal and tunnel shaft areas would each include the following facilities: mobile cranes, contractor offices and shops, material and equipment staging and storage, tunnel ventilation system housing, treatment systems for runoff and dewatering flows, access roads, fence with security gates and guard shacks, temporary electrical substation, portable sanitary facilities, and storage for topsoil. The tunnel shaft area would also include a standby engine generator.

6.2.2 Bethany Reservoir Aqueduct Surge Tanks

The Bethany Reservoir Pumping Plant would lift water into the Bethany Reservoir Aqueduct pipelines that are described in Section 6.2., Bethany Reservoir Aqueduct. Infrequent transient-surge conditions could also occur in the Bethany Reservoir Aqueduct pipelines due to a simultaneous shutdown of the Bethany Reservoir Pumping Plant pumps followed by the rapid closure of pump discharge control valves.

The water would flow from the Aqueduct surge tanks located at the Bethany Reservoir Pumping Plant into the Aqueduct pipelines and excess surge overflow flows would be conveyed into Bethany Reservoir. The Aqueduct pipelines would include air/vacuum valves to facilitate pressure management in the pipelines.

Four above-ground surge tanks would be directly connected to each of the four Aqueduct pipelines by a 12-foot inside diameter welded steel pipe. A below ground vault would contain up to four 72-inch check valves arranged in parallel, as shown on the engineering concept drawings. Each Surge Tank would be 75 feet in diameter (inside) with a side wall height of up to 20 feet to provide the intended storage volume. The water in the surge tanks would not be under pressure. When a hydraulic transient-surge event would occur within the Bethany Reservoir Pumping Plant discharge to the Aqueduct system and the internal pressure within any of the Aqueduct pipelines at the pumping plant would fall below the free-water surface elevation within the connected surge tank, the check valves would open and allow stored water from the surge tank to enter the Aqueduct pipeline to maintain the internal pressure of each Aqueduct pipeline to within safe limits. When operating pressure within each Aqueduct pipeline would be above the surge tank free-water surface elevation, the check valves would remain in the closed and stored water within the surge tank would not enter the connected Aqueduct pipeline. Each tank would include a 36-inch inside diameter overflow pipe to prevent each tank from overfilling by allowing water to spill and conveying the water to the Bethany Reservoir Pumping Plant inlet wet well conduit.

For additional detail, see Appendix D4 *Bethany Reservoir Aqueduct Surge Protection Alternatives*.

6.3 Bethany Reservoir Discharge Structure

The Bethany Reservoir Discharge Structure would include the four tunnel shafts described above as part of the Bethany Reservoir Aqueduct, the discharge structure, contractor staging areas, and ancillary facilities. The discharge structure would be located along the bank of the Bethany Reservoir on a narrow strip of land between the Bethany Reservoir and the Conservation Easement. A 10-foot wide buffer area would be provided between the Conservation Easement and the work area.

The Bethany Reservoir Discharge Structure would be divided into four channels separated by 80-feet between the center of each channel. Each channel width would range from about 80-feet at the tunnel reception shaft to approximately half of that width at the bank of the Bethany Reservoir. The floor of the discharge structure would be at an elevation of 227.0 feet. This elevation would be the same as the existing SWP discharge structure used to convey water from the Banks Pumping Plant to the Bethany Reservoir.

Bethany Reservoir surface water elevations vary from approximately 238 to 245 feet. Water would flow into Bethany Reservoir along the concrete floor of the discharge structure at a flow velocity of 3 feet per second or less. Water depths in the Bethany Reservoir above the discharge structure concrete floor would vary from 11 to 16 feet. A layer of riprap would be placed between the discharge structure and the cofferdam location for the full area enclosed by the cofferdam to stabilize and protect the bank and bed of the Bethany Reservoir.

The Bethany Reservoir Discharge Structure would cross the existing California Aqueduct Bikeway, which is also used as a maintenance road. A 32-foot wide bridge would span the four Bethany Reservoir Discharge Structure channels. Design and construction of the Bethany Reservoir Discharge Structure would be coordinated with DWR, State Department of Parks and Recreation, and State Department of Fish and Wildlife that jointly operate the Bethany Reservoir State Recreation Area.

Each of the four Bethany Reservoir Discharge Structure channels would be divided into two 21-foot-wide bays with radial gates and stoplogs to provide emergency backflow prevention and double isolation of the aqueduct system from Bethany Reservoir. A 16-foot-wide service deck would be installed on the opposite (reservoir) side of the gate and stop log area to facilitate operations and maintenance of the gates and installation and removal of stoplogs. The bridge would include applicable openings for stoplog installation and removal through traffic-rated hatches. Similarly, stoplogs would be installed in open stoplog grooves adjacent to the service deck. The radial gates would automatically close under pressure loss conditions in the Aqueduct pipelines to prevent water from Bethany Reservoir from flowing into the Aqueduct pipelines during the unlikely event of a pipeline break or valve malfunction. Due to the critical control nature of this facility, a standby engine generator would be provided for backup power in case of a power outage.

Construction of the Bethany Reservoir Discharge Structure would occur above and below the surface water level in Bethany Reservoir. To install the portion of the structure below the surface water level, a temporary cofferdam would be constructed within the water near the bank of Bethany Reservoir. The cofferdam would be located within 200 to 300 feet of one of the saddle dams that form the existing Bethany Reservoir. To minimize vibration at this site, the sheet piles would likely be excavated into soft rock and backfilled with tremie concrete to form a water seal at the bottom of the excavation. The sheet piles would be constructed between a series of drilled piles or piers. The cofferdam would allow construction to occur at locations as much as 25 feet below the Bethany Reservoir water surface level. A silt curtain would be installed approximately 50 feet from the cofferdam to reduce turbidity from construction. Water would be collected with a dewatering system inside of the cofferdam, treated, and discharged into Bethany Reservoir outside of the silt curtain.

Beyond the cofferdam area and onshore, the large and deep excavation for the concrete structure and the shafts may be subject to water inflow given the proximity to the reservoir. To minimize water inflow, grouting would be conducted in the rock matrix beneath the site prior to excavation for the structure. Pre-excavation grouting and or curtain grouting would be conducted from the surface at the periphery of the shafts.

Figure 13 shows the Bethany Reservoir Discharge Structure Site Plan.

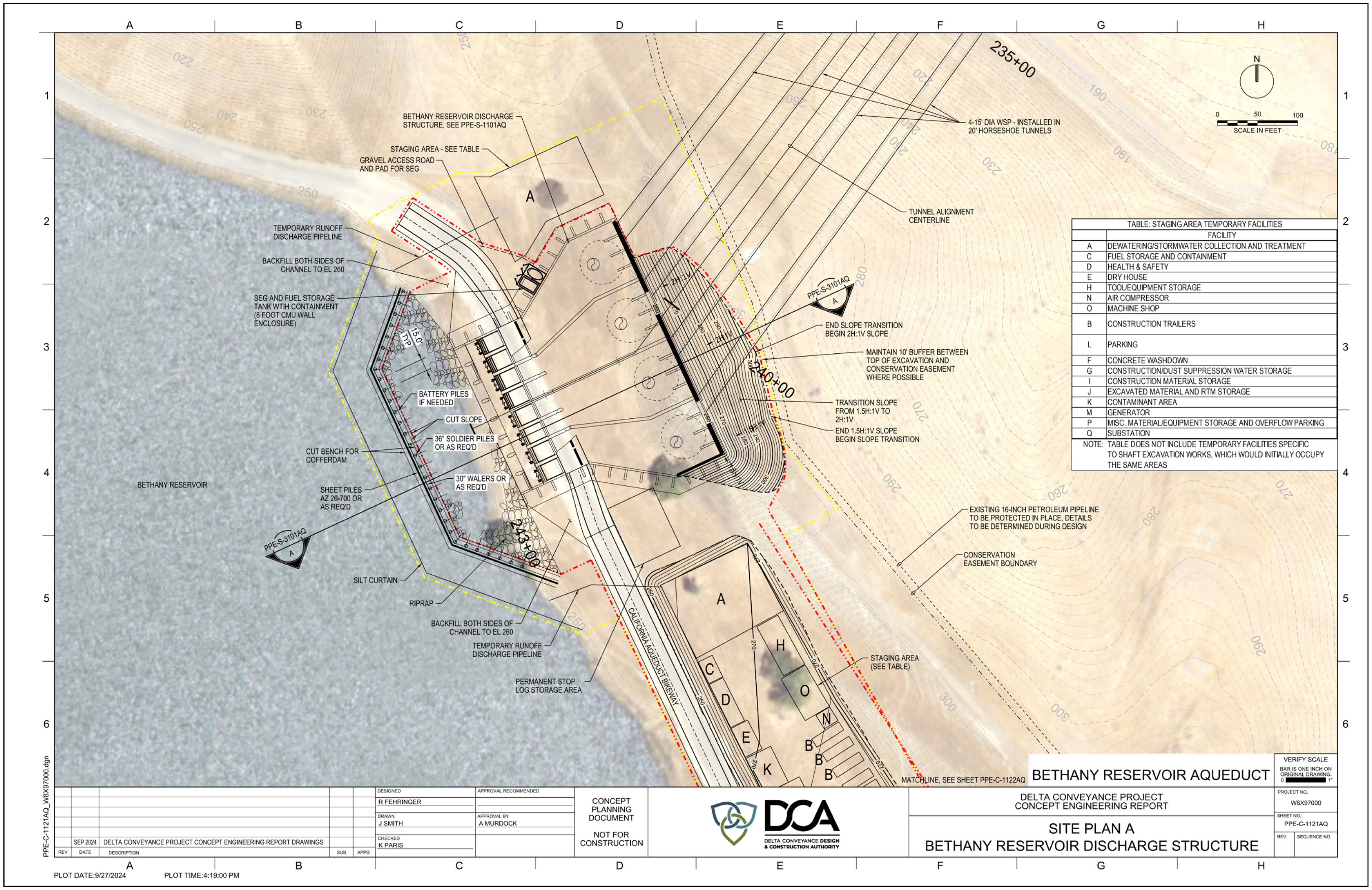


Figure 13. Bethany Reservoir Aqueduct Discharge Structure

7. 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 changes to the environment and residents of the Delta. The Project 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, 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, effects 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 Project, 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 dependence on the local roads and highways.

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

7.1 Roads and Access Routes

Truck access would be required for all construction sites within the project. During the development of the conceptual design information in support of the EIR, analyses were conducted on potential truck routes, including State Routes 4 and 160; Interstates 5 and 205/580; over 30 local roads with direct access to construction sites (many with only two 10-foot-wide lanes and minimal shoulders); and bridges along the state routes and local roads (including bridges that are moveable to allow barge and boat traffic). Pavement conditions on the roads and traffic interruption times for the moveable bridges were considered.

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).

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

Preliminary traffic analysis results were used to identify sites for the tunnel shafts that would have fewer transportation challenges. As the construction site locations were modified to reduce traffic congestion on existing roads, the preliminary traffic analysis was also modified. The traffic analysis was not modified following completion of the 2023 schedule assumptions in the EPR Updates (DCA, 2023a and 2023b). There were no major changes to the features in the 2023 schedule assumptions; rather, the timing of construction of several features changed.

Proposed truck routes, truck traffic histograms, and road improvements were identified for each construction site of the Project. The results of the traffic 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 Project. Service targets used in the analysis include the following items.

- **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 Project:** 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 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. 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.

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 the tunnel shaft on New Hope Tract. 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 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.
- No construction traffic would be allowed on levee roads, including SR 160, except when the highway is re-aligned during intake construction, or for individuals or vehicles traveling from homes or businesses located along levee roads.

Major road improvements that will be needed to service construction of the Project are summarized in Table 4 and included in Attachment 1 and in the engineering concept drawings. Attachment 1 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.

For additional detail, refer to the following appendices:

- Appendix E1 *Logistics Strategy*
- Appendix E2 *Potential Road Access Routes*

Table 4. Major Road Improvements for the Project

Construction Sites	Description of Major Improvements
Intake Haul Road	• Widen 3.2 miles of Lambert Road between Franklin Boulevard and the new intake haul road. • New 3.8 miles 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	• Widening of 0.8 mile of Dierssen Road between Franklin Boulevard and Interstate 5. • Widen 0.48 miles of Franklin Boulevard between a location 0.22 miles north of Dierssen Road to a location 0.25 miles south of Dierssen Road. • Widen 1.0 mile of Twin Cities Road between a location 0.83 miles west of Franklin Boulevard to a location 0.17 miles east of Franklin Boulevard.
New Hope Tract	• New 0.3 miles access road to the shaft site from Blossom Road.
Canal Ranch Tract	• No major road improvements required.
Terminous Tract	• New uncontrolled interchange with longer acceleration and deceleration lanes along westbound State Route 12.
King Island	• No major road improvements required.
Lower Roberts Island	• New 1.2 miles of paved road on Rough and Ready Road on Port of Stockton. • New bridge over Burns Cut from Port of Stockton and new 2 miles of paved road to West House Road; and widen 1.2 miles of West House Road. • New 1.3 miles of paved road from West House Road to North Holt Road and a new bridge over Black Slough.
Upper Jones Tract	• Driveway improvements.
Union Island	• No major road improvements required.

Construction Sites	Description of Major Improvements
Bethany Reservoir Pumping Plant and Surge Basin	• New interchange at Lindemann Road with Byron Highway realignment and widening and extension 0.5 miles paved road on Lindemann Road. • New bridges over UPRR tracks and Byron Highway. • Widen 0.5 miles of Byron Highway to 4 lanes from the new Lindemann Road interchange to Great Valley Parkway. • New 1.2 miles paved frontage road along Byron Highway between Lindemann Road and Mountain House Road. • New 2.1 miles paved road to access Surge Basin between new Byron Highway frontage road and Mountain House Road. • Widen 1.34 miles of Mountain House Road between Byron Highway and Connector Road. • New 0.2 miles paved road to Kelso Access Road from a location 0.2 miles south of Kelso Road to Kelso Road. • Widen merge lane on West Grant Line Road from a location 0.14 miles west of Mountain House Road to Mountain House Road. • New 0.6 miles paved road extension of Mountain House Road between existing West Grant Line and Mountain House roads, including a new roundabout at Grant Line Road and a new bridge over a swale. • Widen 2.2 miles of Mountain House Road between the new extension of Mountain House Road (described in previous bullet) to a location 0.18 miles north of Surge Basin access road. • New temporary driveway from the access road from Mountain House Road to the temporary first responders' site.
Bethany Reservoir Aqueduct	• Widen 1.23 miles paved road of Kelso Road between a location 0.14 miles east of Mountain House Road to the New Access Road to the Pipeline/Aqueduct construction staging area. • New 0.27 miles paved road extension of Connector Road from Mountain House Road to the Surge Basin access road.
Bethany Reservoir Discharge Structure	• Widen 0.6 miles of existing paved road (CA Aqueduct Bikeway) along Bethany Reservoir from new access road to Bethany Reservoir Discharge Structure. • New 1.2 miles of paved access road from Mountain House Road to the existing Bethany Reservoir (CA Aqueduct Bikeway). • The CA Aqueduct Bikeway would not be accessible across the Bethany Reservoir Discharge Structure during construction.

7.2 Barge Access

Barges would only be used to access the intake sites to place riprap near the end of construction and to conduct overwater geotechnical investigations.

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. Therefore, barge access was considered for sites requiring large volumes of material transport to help ease the load on the local roadways, including intakes and the tunnel launch shaft at Lower Roberts Island.

The Sacramento River and other watercourses are characterized by narrow widths, low bridges, and shallow areas that have not been dredged in many locations and have known areas of shoaling, especially from approximately 2 miles north of Rio Vista to Walnut Grove. 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 construction sites. There are also several fixed restrictions along the Sacramento River, 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 would affect road traffic over the bridge.

Therefore, it was determined that barges would not be used for construction except for a short period of time to complete intake construction by delivering riprap rock and remove soil where the riprap would be placed following removal of the cofferdam. 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.

It was also determined that there was not a need for a barge landing on Lower Roberts Island along the adjacent SDWSC/San Joaquin River. There is a small existing barge landing near Windmill Cove that is too small for the Project. 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.

Limited barging would be used to conduct overwater geotechnical investigations. Barges would only move through the Delta during weekday daylight hours. These activities are discussed in Appendix G5 *Potential Future Field Investigations*.

7.3 Railroad Access Routes

Rail access was considered to help ease traffic on the local roadways for the tunnel launch shaft site at Lower Roberts Island since it would require large volumes of material transport. 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 Project, 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 Project would move the rail cars along on-site railroads within the construction site to specific loading or unloading locations. The Project would place the loaded or unloaded rail cars back on tracks in the designated area and the major railroad would move the rail cars. Detailed discussions with the railroad companies would occur during the design phase. For more detail, see Appendix E3 *Rail Potential Study*.

Rail access to Lower Roberts Island could be provided from existing UPRR and Burlington Northern-Santa Fe Railroad tracks located in the Port of Stockton. Rail access would be extended over a new bridge over Burns Cut and continue to the launch shaft site and RTM storage area. For more detail, see Appendix E3 *Rail Potential Study*.

7.4 Park and Ride Lots

In addition to parking facilities included within work sites, two 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 arriving during night hours when site deliveries are restricted. 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.

Two new park and ride facilities were identified to support construction of the Project.

- 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.
- Charter Way Park and Ride Lot: along the south side of Charter Way near the southwest corner of the Interstate 5 overpass to provide parking specifically for employees for the tunnel launch shafts on Lower Roberts Island. 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, Canal Ranch Tract, Terminous Tract, and King Island

The park and ride lots would be removed following construction.

7.5 Emergency Response Planning

The Project 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.

It is assumed that the incident scene could be at any one of the intake structures, tunnel shaft sites, or Bethany Complex locations. 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 Project, 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 Project construction sites (the intakes, tunnel launch shaft sites, and the Bethany Complex) summarized in this CER, 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 provide this secondary backup emergency response services. Emergency response agencies that were considered near to the Project 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 project-provided emergency response services at the construction sites and integration with local agencies.

For more information, see Appendix E4 *Project Emergency Response Plan*.

7.6 Construction Support Facilities and Material Requirements

7.6.1 Pre-Cast Tunnel Segmental Liner Facility

The entire length of the tunnel between the intakes and Bethany Complex would be lined with pre-cast concrete tunnel liner segments. These liner segments would be produced off-site and transported in sufficient quantity to keep pace with tunneling progress. Local, regional, and Southern California pre-cast manufacturing facilities were surveyed to assess capacity to serve the quantities needed for Project. Due to concern about environmental disturbances within the Project boundaries, 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 local pre-cast facilities near the Project 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.

For additional detail, see Appendix E5 *Preliminary Precast Yard Study*.

7.6.2 Concrete Batch Plants

Concrete batch plants would be included as part of the Project. The batch plants would provide concrete to the northern features (e.g., intakes, Twin Cities Complex, New Hope Tract, and Canal Ranch Tract, if necessary) and to all portions of the Bethany Complex. In accordance with DWR criteria, concrete must be placed in the forms within 90 minutes of being loaded onto ready-mix trucks to avoid reduction in concrete strength and other properties, such as workability of the concrete. Travel time to the intakes from Sacramento or Elk Grove and to the Bethany Complex from Stockton or Tracy could easily be more than 90 minutes due to travel time along Interstate 5 and Interstate 580/205. Therefore, concrete batch plants would be needed in the northern portion of the Project and at the Bethany Complex to be compliant with the 90-minute requirement.

The Lambert Road Concrete Batch Plant would be located along Lambert Road to the west of the intersection with Franklin Boulevard. The batch plant would be approximately 15 acres in size and would include two concrete batch plants where raw materials (e.g., cement, sand, and gravel) would be hauled in by truck to be combined to form ready-mix which would then be hauled to the intakes, Twin Cities Complex, and tunnel shafts on New Hope Tract and Canal Ranch Tract. Concrete from existing commercial batch plants in Stockton will be used for Terminous Tract, King Island, Lower Roberts Island, Upper Jones Tract, and Union Island. The Bethany Complex concrete batch plants would be located north of Kelso Road, adjacent to the Bethany Reservoir Pumping Plant and Surge Basin contractors' yards east of Bethany Reservoir Pumping Plant. The batch plants area would be approximately 11.5 acres in size and would include two concrete batch plants where raw materials (e.g., cement, sand, and gravel) would be hauled in by truck to be combined to form ready-mix which would then be hauled to the various Bethany Complex structures. The batch plants were sited to allow a central delivery location for cement and aggregate and allow a centrally positioned site for distribution of the concrete around the Bethany Complex area, as shown on the engineering concept drawings.

8. Levee Improvements

8.1 Flood Risk Management

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 agricultural standards specific to the Delta (DWR, 1993).

Major flood risks in the Delta were considered during the development of the conceptual design information in support of the EIR to develop a flood risk reduction strategy for the Project and determine improvements needed to protect the Project sites both during and post construction.

The Project facilities would be designed for long-term operations to be protected from the 200-year flood event with climate change induced hydrology and 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, 2020c).

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 water surface elevations assumptions for the Project facilities in Year 2100 with 200-year flood event and 10.2 feet of sea level rise at the Golden Gate are provided below. The simulations used by DWR to develop these water surface elevations assumed only in-channel flows in the San Joaquin River at the Vernalis node in the model without levee overtopping in the simulation.

- Sacramento River upstream of Hood (Intake C-E-3): 27.3 feet.
- Sacramento River upstream of Randall Island (Intake C-E-5): 26.3 feet.
- Stone Lakes Preserve at Lambert Road: 25.2 feet.
- Snodgrass Slough: 25.2 feet.
- Cosumnes River at Twin Cities Road: 25.2 feet.
- Beaver Slough between New Hope Tract and Canal Ranch: 21.6 feet.
- Hog Sough between Canal Ranch and Brack Tract: 20.0 feet.
- Sycamore Slough between Brack Tract and Terminous Tract: 19.7 feet.
- White Slough at confluence with Bishop Cut (near King Island): 19.6 feet
- San Joaquin River/Stockton Deep Water Ship Channel along Lower Roberts Island: 19.7 feet.
- Whiskey Slough between Lower Roberts Island and Lower Jones Tract: 19.6 feet.
- Middle River between Upper Jones Tract and Woodward Island (near Union Island): 19.7 feet.
- Old River along Byron Tract: 20.5 feet.

For additional detail, see Appendix F1 *Flood Risk Management*.

8.2 Levee Assessment

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.

During the development of the conceptual design information in support of the EIR, a levee vulnerability assessment was developed 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 could be extracted from topographic data.

- 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 (if present) to the levee toe which may thin or penetrate subsurface fine-grained blanket layers and increase under-seepage and slope instability susceptibility.
- Vulnerability to sea level rise which evaluates the current condition of levees under increasing future water levels.
- 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 along the Project, including the following criteria.

- Criterion 1- Levees meeting levee geometry standards.
- Criterion 2 - Freeboard against the 100-year flood elevation.
- Criterion 3 - Proximity of toe ditch (if present) to landside toe of levee or berm.
- Criterion 4 - Vulnerability to sea level rise.
- 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).

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.

The full assessment is included in Appendix F2 *Levee Vulnerability Assessment*.

8.3 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 several 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 (PL84-99) 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.

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.

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.

For additional detail, see Appendix F1 *Flood Risk Management*.

8.3.1 Flood Risk Management Measures

The Project 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.

As described in Section 5.2, Shafts, 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 or slightly higher than 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, 2020c), and to provide height and freeboard for hydraulic surge events, whichever is higher. The heights of the tunnel shaft pads and shaft liners are presented in Attachment 1 and Volume 2 Engineering Concept Drawings (DCA, 2024a) for each site. Structural measures for the intake structures and surrounding levees and the pumping plant would also 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, 2020c). The Bethany Complex would be located on higher ground above the flood elevations for the 200-year flood event with sea level rise and climate change hydrology for Year 2100 (DWR, 2020c). 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.

The non-structural measures would involve fully integrating the Project 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.

8.3.1.1 Measures to Reduce Flood Risks along Existing Levees

Development of this CER included considerations to minimize effects on existing levees, such as avoiding or minimizing the use of existing levees as construction haul routes for the Project 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.

8.4 Intake Levees

As described in Section 4, 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.

As described in Section 4, 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 Project 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.

8.5 Levee Improvement Along the Project Alignment

The levee systems surrounding each Delta island along the Project Alignment would provide the first line of defense against flooding. Their reliability was evaluated during the development of the conceptual design information in support of the EIR in terms of their compliance with PL 84-99 criteria. PL 84-99 criteria were considered an intermediate standard between the Delta Hazard Mitigation Plan and the DWR Bulletin 192-82 criteria.

Among the shaft locations, 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, Lower Roberts Island would be 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. For this site, it is recommended that levee improvements be initiated at the beginning of the Project to achieve minimum PL 84-99 standards for the perimeter levees. The Twin Cities Complex launch site would have a different challenge. For this site it is recommended that a ring levee be constructed around the worksite rather than constructing a new levee adjacent to the existing railroad embankment along the eastern boundary of the district.

8.5.1 Twin Cities Complex – Ring Levee

The Twin Cities Complex would be located to the east of Interstate 5 on an upland area within the eastern portion of Glanville Tract. Glanville Tract is not fully protected by perimeter levees and relies upon a railroad embankment to provide upstream (eastern) protection from flooding. The UPRR railroad embankment was not designed to perform as a levee and may fail when floodwaters pond on the east side of the embankment creating a flood barrier. Flooding issues in the area occur primarily during high flows in the Cosumnes River, which exacerbates regional drainage constrictions creating backwater conditions that pond against the the railroad embankment. Hydraulic loading of the railroad embankment has lead to past breaches and contributed to overland flooding within Glanville Tract, as demonstrated in both 1986 and 1997. To protect the 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. The Twin Cities Complex geotechnical conditions are more stable than 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 PL 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).

Provisions for flood management at the tunnel launch shafts at Twin Cities Complex are summarized below.

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.

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 degrading 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.

8.5.2 Lower Roberts Island Levee Improvements

Provisions for flood management at the tunnel launch shafts at Lower Roberts Island are summarized below.

Repairs and improvements 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 PL84-99 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 PL84-99 geometry and historic performance issues during a potential high-water event. Multiple areas have been identified as not meeting the PL84-99 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 PL84-99 standard provides minimum freeboard and levee geometry requirements based on levee height and the thickness of peat in the levee foundation. Following the PL84-99 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 concept drawings. Access roads for conducting the temporary levee modifications 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 soft peat and organic 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.

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

For more detail, refer to Appendix F2 *Levee Vulnerability Assessment*.

9. Geotechnical, Soil and Seismic Considerations

Existing geotechnical information and data were reviewed during the development of the conceptual design information in support of the EIR 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 investigations would be completed during the design phase prior to completion of the geotechnical and seismic design.

9.1 Surface and Subsurface Soil Conditions

The DWR collected preliminary geotechnical exploration data in the Delta from 2009 to 2012 and on Bouldin Island in 2018, while preparing the Environmental Impact Report and Environmental Impact Statement for the former WaterFix Project. Approximately 125 soil borings and 85 cone penetrometer tests (CPTs) were completed for the WaterFix Project between 2009 and 2013 (DWR, 2013); an additional 11 soil borings and 13 CPTs were completed on Bouldin Island in 2018 (DWR, 2018b); and 11 soil borings and 7 CPTs were completed in 2020 (DWR, 2020e). Additional soil boring and CPT sounding logs were also available from DWR's Atlas database and were used to supplement geotechnical information collected for Delta Conveyance while other data was digitized by DCA from nearby projects. References for each source of geotechnical data are given in the sections in which they are used.

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 feet below ground surface (bgs) within much of the Delta, however, historical boring logs at the C.W. Bill Jones Pumping Plant (Central Valley Project) indicate the groundwater level deepens toward the southern end of the Delta (DWR, 2013).

South of the Bethany Reservoir Pumping Plant location, the geology changes beyond the margins of the historical Delta and consists of colluvium from the Coast Range. Farther to the south, the Bethany Reservoir Discharge Structure is underlain by the Panoche Formation, consisting of marine sandstones, clay shales, and minor siltstones. The sandstones are occasionally concretionary, and the clay shales are often thinly bedded, deeply weathered, soft, and friable. These sedimentary formation beds generally dip to the northeast at 20 degrees from horizontal.

9.1.1 Soil Liquefaction Potential

Screening-level liquefaction-triggering potential was evaluated 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.

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 that support this CER 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 and most tunnel shaft sites based on preliminary estimated ground motions, as described in Appendix G2 *Liquefaction and Ground Improvement Analysis*, and Appendix G3 *Concept Design Seismic Site Analysis*. Liquefaction was not identified for structures that were sited outside the margins of the Delta soils, such as the pumping plant, aqueducts, and discharge structure. Design-level analyses will be conducted using empirical and/or numerical modeling and the results of future seismic ground motion study and subsurface exploration and testing.

For the sites where liquefaction was identified, implementation of ground improvement is 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 and seismic investigations and studies, including the intakes, tunnel shafts, and Bethany Complex facilities. See Appendix G1 *Concept Seismic Design and Geohazard Criteria* for detail.

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 testing, and cone penetration tests.

9.1.2 Ground Improvement Methods

Acceptable long-term performance of large facilities at the intakes and tunnel shafts 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.

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.

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. 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.

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. 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 Bethany Complex. For additional information, see Appendix G2 *Liquefaction and Ground Improvement Analysis*.

9.1.2.1 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.

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.

9.1.2.2 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.

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, nor at the Surge Basin reception shaft located outside the margins of the soft compressible Delta soils.

9.1.2.3 Ground Improvement at the Bethany Complex

Available information indicates that ground improvement methods described above would not be required at the Bethany Reservoir Pumping Plant and Surge Basin site, along the Bethany Reservoir Aqueduct, and at the Bethany Reservoir Discharge Structure.

9.2 Dewatering Estimates

Dewatering would occur at most construction sites. The most substantial dewatering activities would occur at the intakes. During preparation of the EPRs, groundwater modeling was conducted to estimate dewatering rates and durations for dewatering at the intake facilities.

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.

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. For Intake C-E-5, modeling included the construction and maintenance scenarios for the sedimentation basins.

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.

9.3 Seismic Considerations

Conceptual seismic design criteria were developed during the development of the conceptual design information. This included 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 Project including the following facilities.

- Intakes.
- Bethany Reservoir Pumping Plant and Surge Basin.

- Bethany Reservoir Aqueduct.
- Bethany Reservoir Discharge Structure.
- Appurtenant Works and Buildings.
- Tunnel and Tunnel Shafts.
- Temporary Facilities.
- Bridges and Roads.

The Project 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 the following items.

- 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. The human-occupied facilities (e.g., the Bethany Reservoir 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 Project. The planned seismic loadings considered two-levels of design earthquakes.

- 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 the 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 update 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 following steps were completed using existing information to identify performances 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.
- Evaluated the effects of local soils on ground motions based upon available information.
- Developed acceleration, velocity, and displacement time histories and response spectra, based upon available information, to evaluate the seismic performance of critical facilities.

As soils and geotechnical investigations are completed in the future, including revisions to Appendix G2 *Liquefaction and Ground Improvement Analysis*, these analyses would be reviewed and updated.

The Bethany Reservoir Pumping Plant and Surge Basin could be located near the West Tracy Fault, a fault currently thought to have potential for surface rupture along the western portion of its alignment. Several previous reports indicated that the West Tracy Fault may have experienced movement within the past 35,000 years and therefore could be potentially active. It is currently unknown whether the West Tracy Fault is capable of rupturing to the ground surface to the south of the CCF 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.

Soil borings and cone penetration tests would be completed to a depth of 150 feet; and soil samples from test borings collected to conduct age-dating laboratory testing. Additional studies may be conducted associated with fault zones in the vicinity of the Bethany Reservoir Aqueduct, such as the West Tracy Fault.

For additional detail, see Appendix G1 *Concept Seismic Design and Geohazard Criteria* and Appendix G3 *Concept Design Seismic Site Analysis*.

9.4 Earthwork Balance

The Project would require an extensive amount of soil materials for fill at intakes, tunnel shafts, and lesser amounts at the Bethany Reservoir Pumping Plant and Surge Basin and the Bethany Reservoir Aqueduct. Construction would also produce an extensive amount of excavated soil materials at most of these facilities, including Bethany Reservoir Pumping Plant and Surge Basin, Bethany Reservoir Aqueduct, Bethany Reservoir Discharge Structure, and RTM at the tunnel launch shaft sites. 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 Bethany Complex.

Construction of the Project would occur over a period of years at most construction sites and construction 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.

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. The Earthwork Model did not include other construction materials, such as concrete and asphalt. All soil materials not obtained from the Project 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, as summarized in Table 5.

For additional detail, see Appendix G4 *Soil Balance*.

Table 5. 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; and shaft pads on New Hope Tract, Canal Ranch Tract, Terminous Tract, and King Island • RTM material from the on-site tunneling operations at Twin Cities Complex would be used to backfill on-site excavations • On-site excavated soil from the Lower Roberts Island site would be used for the tunnel shaft pads on Lower Roberts Island, Upper Jones Tract, and Union Island 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 excavations • RTM material would be stockpiled at Twin Cities Complex and Lower Roberts Island, as summarized in Attachment 1
Bethany Reservoir Pumping Plant and Surge Basin	• On-site soils would be used to form minor fills on the Bethany Reservoir Pumping Plant and Surge Basin site • Additional soil material from Bethany Reservoir Pumping Plant and Surge Basin excavations would be stockpiled on-site

Facility	Structural Fill Balance
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	• On-site soils would be used to develop backfill materials for the Bethany Reservoir Aqueduct and the Bethany Reservoir Discharge Structure • Excess excavated materials from other Bethany Complex excavations would be used to develop backfill materials for the Bethany Reservoir Aqueduct • Excess excavated materials from the Bethany Reservoir Discharge Structure excavations would be used to develop backfill materials for the Bethany Reservoir Aqueduct and would be stockpiled at the Bethany Reservoir Pumping Plant and Surge Basin site
Roads and Bridges	• Soils would be imported from commercial sources

9.5 Future Field Investigations

Future geotechnical, hydrogeological, and agronomic testing, as well as construction test projects (geotechnical investigations) would be conducted during pre-construction and construction periods following the completion of the EIR for the Project to more specifically identify appropriate construction methods addressed in the final design documents (DWR, 2023). These investigations would also address the establishment of geological and groundwater monitoring programs that could extend during the design and construction phases of the adopted project.

Because these investigations would be conducted following the adoption of the EIR, the investigations would be focused to address the selected Bethany Reservoir Alignment. The following discussions describe assumptions related to the types and potential extent of the future geotechnical investigations.

The field investigation appendix (Appendix G5 *Potential Future Field Investigations*) addresses the selected Bethany Reservoir Alignment for the Project design capacity of 6,000 cubic feet per second (cfs), including lists and summaries of the types of potential future investigations by facility and method to support permitting, design, and construction phases; types of instrumentation by facility; and worker, vehicle, and equipment assumptions.

10. System Wide Utilities and Coordination

The construction sites for the Project would require utility services during construction and permanent operations. Utility services would include power, SCADA (Supervisory Controls and Data Acquisition), water, and wastewater services would be provided at the intakes, tunnel launch shafts, Bethany Reservoir Pumping Plant, and Bethany Reservoir Discharge Structure.

10.1 Existing and Future Utility Crossings

Appendix H1 *Summary of Utility Crossings* discusses the following crossings in detail.

10.1.1 Potential Crossings with Local Wastewater Facilities at Construction Sites

Wastewater service for most of the structures near the Project 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.

The interceptor between the community of Courtland and the regional pumping plant at the RCCC was constructed under Lambert Road. The Project 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.

10.1.2 Potential Crossings with Local Water Facilities at Construction Sites

Water service for structures near the Project 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.

Information regarding potential crossings with local water facilities at construction sites, along the tunnel alignment, or at the Bethany Complex would cross several regional water facilities, including:

- The City of Stockton Delta Water Supply Raw Water Pipeline located along West Eight Mile Road
- The Byron-Bethany Irrigation District raw water supply pipelines and canals
- The East Bay Municipal Utilities District (EBMUD) Mokelumne Aqueducts
- The U.S. Bureau of Reclamation Jones Penstocks

10.1.3 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 or irrigation 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 Project 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 Project 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.

Coordination would be conducted, and provisions would be included in the design, for crossings of BBID canals along the Bethany Reservoir Aqueduct. Such crossings would be designed to fully restore BBID's facilities to pre-construction conditions and coordinate construction with BBID during the non-irrigation season. Construction phase features would include bypasses if such seasonal provisions do not fully avoid BBIDs need to use the canals.

All Project features would be designed to not increase peak runoff flows into adjacent storm drains, drainage ditches, or rivers and sloughs, as described in Section 10.4, Water Supply. 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.

10.1.4 Potential Crossings with Existing Communication Facilities

Existing communications facilities in the 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 Project facilities are described in Section 10.3, Project Communications.

10.1.5 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. The Bethany Reservoir Aqueduct would also cross several transmission pipelines.

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.

10.2 Project Electrical Power

Power supplies would be needed at construction sites for the intakes, tunnel shafts, Bethany Complex facilities including the Bethany Reservoir Pumping Plant, concrete batch plants, and park and ride lots. Power supplies would also be needed during operations of the intakes, Bethany Complex facilities, including the Bethany Reservoir Pumping Plant and Bethany Reservoir Discharge Structure, plus lights and security at all locations.

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 Project 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 Project 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.
- 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 be used to construct some new transmission towers along a new transmission line.

Discussions with SMUD, WAPA, and PG&E are ongoing as this original EPRs were prepared. The current concepts to provide interconnection service and power, either concurrently or eventually, to Project facilities are presented in Appendix H2 *Electrical Power Load and Routing Study* and briefly summarized in Table 6.

Table 6. Summary of Power Supply Connections for The Project

Key Feature	Existing Facilities	Proposed Changes
Intakes	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	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	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	An existing 11 kV PG&E overhead line along West Peltier Road	• Install a new underground cable along the new access road
Terminous Tract	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

Key Feature	Existing Facilities	Proposed Changes
King Island	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	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	An existing 11 kV PG&E overhead line along West Bacon Road	• Install a new underground cable from power line adjacent to site.
Union Island	An existing 11 kV PG&E overhead line along Bonetti Road	• Install a new underground cable from power line adjacent to site.
Bethany Reservoir Pumping Plant and Surge Basin	Several high-voltage power lines, including two 230 kV WAPA lines and a 500 kV PG&E line	• Expand WAPA Tracy Substation on Bethany Reservoir Pumping Plant site for a new 230-kV switchyard. • Install new 230-kV transmission line from expanded WAPA Tracy Substation. The new connection would include overhead power poles.
Bethany Reservoir Aqueduct CLSM Processing Area	An existing PG&E overhead line along Kelso Road	• Install a new overhead line from power line on Kelso to site along access road.
Bethany Reservoir Discharge Structure	An existing 69-kV PG&E overhead line along Christensen Road	• Install a new overhead line along the existing reservoir public access road, around the public access parking lot, and along the California Aqueduct Bikeway to the site.
Lambert Road Concrete Batch Plant	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

Key Feature	Existing Facilities	Proposed Changes
Hood-Franklin Park and Ride Lot for lights and electric vehicle charging station	An existing SMUD overhead line along Hood-Franklin Road	• Install a new underground cable from the existing power lines
Charter Way Park and Ride Lot for lights and electric vehicle charging station	An existing PG&E overhead line adjacent to the site	• Connect to the existing power lines on-site

10.3 Project Communications

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 Project will need to be integrated into this system to allow for coordinated operations. The communications network for the Project would connect three major data centers, two intakes, and four remote data sites and 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 Bethany Reservoir Pumping Plant. As shown in the engineering concept drawings, the system would include ring communication topology for redundancy purposes.

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 the following locations.

- Intakes.
- Tunnel Shafts (launch shafts plus select maintenance or reception shafts, only).
- Bethany Reservoir Pumping Plant.
- Bethany Reservoir Discharge 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 Project would use existing telecommunications infrastructure, dedicated conduits within Project 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 Project 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,. 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 alignment. 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 northern portion of the Bethany alignment that follows the eastern corridor. Further assessment of radio-based communications will need to be performed for the southern portion of the Bethany alignment after it diverts from the Eastern alignment.

For additional detail, see Appendix H3 *SCADA/Communications Routing and Basic Design Approach*.

10.4 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), intake sites, and Bethany Reservoir Pumping Plant. 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 and Bethany 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 Bethany 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 Project 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 be treated prior to discharge to adjacent water bodies.

10.5 Wastewater Facilities

Wastewater facilities for most of the Project construction sites would be provided with portable restrooms. Septic systems would be constructed at the intakes, Twin Cities Complex, Lower Roberts Island, and Bethany Reservoir Pumping Plant and Surge Basin site. 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.

11. Permitting

11.1 Environmental Construction Permitting

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.

11.1.1 Spill Prevention and Control 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 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.

11.1.2 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.

11.2 Air Quality and Dust Control Reduction Measures

11.2.1 Dust Control Reduction Measures

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 would be covered with gravel.

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.

11.2.2 Preliminary Information for EIR Air Quality and Traffic Analyses

A portion of the information needed to develop air quality and traffic analyses in the EIR includes assumptions related to construction quantities of equipment and vehicle use, employee travel needs, and earthwork quantities. These assumptions were prepared based on the conceptual engineering drawings and preliminary construction schedules and are included in Appendix J *Preliminary Operations and Maintenance Information for EIR Air Quality and Traffic Analyses*.

The construction assumptions for the construction phase were prepared based on the conceptual engineering drawings and preliminary construction schedules and are included in Appendix J. 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 CER, 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 trucks at tunnel launch shaft sites in the Twin Cities Complex and Lower Roberts Island.

The equipment identified in this CER 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 EPRs 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.

The construction assumptions included preparation of a Fugitive Dust Control Plan to address methods to reduce dust generation. Dust reduction measures assumed 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, assumptions associated with operations and maintenance of the Project facilities were developed to provide information to DWR for the EIR air quality and traffic analyses. These assumptions are included in Appendix J *Preliminary Operations and Maintenance Information for EIR Air Quality and Traffic Analyses*. it was assumed that DWR employees would access most of the new facilities from existing DWR maintenance yards or the Bethany Reservoir Pumping Plant.

12. Post-Construction Land Reclamation and Site Restoration

The engineering concept drawings and GIS files for this CER 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 7 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 Bethany 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 7 and Attachment 1.

For additional detail, see Appendix I1 *Post-Construction Land Reclamation Supplement*.

Table 7. Summary of Construction and Post-Construction Site Requirements at Major Features for Project Design Capacity of 6,000 cfs

Key Feature	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E-5	242	123	119 (Agriculture or habitat)
Intake C-E-3	239	109	130 (Agriculture or habitat)
Lambert Road Concrete Batch Plant	15	14	Not reclaimable
Twin Cities Complex	586	222	364 (agriculture or habitat) 214 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	11	11	Not applicable due to size
Canal Ranch Tract Shaft Site	11	11	Not applicable due to size
Terminous Tract Shaft Site	13	13	Not applicable due to size
King Island Shaft Site	12	12	Not applicable due to size
Lower Roberts Island Shaft Site	610	300	269 (agriculture or habitat) 189 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	11	11	Not applicable due to size

Key Feature	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Union Island Shaft Site	14	14	Not applicable due to size
Bethany Reservoir Pumping Plant and Surge Basin Site	213	184	29 (agriculture or habitat) 70 (excavated material stockpile planted with native grasses)
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	143	81	60 (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.

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

The batch plant parcels are not considered to be reusable for agriculture or habitat uses due to the extensive use by heavy equipment and other vehicles. The pavement and other features would be removed after construction and a cover crop would be planted for erosion control. However, the soils may be too compacted for viable agricultural or habitat land uses.

Park-and-ride lots are not considered to be reusable for agriculture or habitat uses due to the extensive use by heavy equipment and other vehicles. The pavement and other features would be removed after construction and a cover crop would be planted for erosion control. However, the soils may be too compacted for viable agricultural or habitat land uses. If local communities are interested in maintaining these lots in the future, these parcels could be considered to be provided through the Community Benefits Program.

N/A = Not Applicable

12.1 Post-Construction Site Reclamation

As discussed above and summarized in Table 7, 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 Bethany Complex. DWR would acquire the land for construction and would determine final restoration methods and potential transfer of the lands to other parties.

Several methods could be used to restore the land to agricultural or habitat land uses. To determine remedial efforts necessary to reclaim construction-disturbed 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 EPRs.

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 changes, 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, and areas to be restored to agricultural use could be seeded with an erosion control seed mix.

Areas that were excavated at the tunnel launch shaft sites to create borrow soil materials, would be refilled to existing grade with soil and/or RTM from existing stockpiles during 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 occur at the Twin Cities Complex and Lower Roberts Island 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. A gravel 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.

Permanent excavated soil stockpiles would occur at the Bethany Reservoir Pumping Plant and Surge Basin site resulting from excess excavated materials originating within the Bethany Complex. These stockpiles would be elevated above the surrounding grades and would be planted with native grasses primarily for erosion control. The stockpiled soil would be suitable for structural fill and available for other uses not included in the Project. Planned treatments for permanent soil stockpiles would include spreading topsoil, cross discing, and planting native grasses.

Ground improvement would be required to support concrete slabs at the tunnel launch shaft site on 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.

13. Stakeholder Engagement Committee Process

The SEC was formed by DCA to provide (1) a forum for Delta stakeholders to provide input and feedback on technical and engineering issues related to the DCA activities, including development of facilities and options for additional study; (2) an opportunity to identify engineering and design considerations that would avoid or minimize effects from constructions and facility siting; and (3) a forum for committee members to relay information between respective groups and the SEC.

The SEC consisted of members from various Delta communities and interests. These included:

- Sacramento, Yolo, San Joaquin, and Contra Costa counties
- Tribal governments
- Delta recreation, public safety, local businesses, and community entities
- Agricultural, historical and heritage, fish and wildlife, and Delta water agencies

Ex-officio members with expertise on public parks, levee engineering, and public safety also participated. The size of the SEC fluctuated but generally included 19 public members, two DCA Director representatives, and three ex-officios.

The SEC was convened in 2019, and the first meeting was held on November 13, 2019. From November 2019 to December 2021, 19 SEC meetings were held. Meetings were initially held in person at various locations in the Delta, and were open to the public and otherwise conducted in compliance with the Brown Act. They were also livestreamed, and meeting materials were all uploaded to DCA's website (DCDCA.org). Starting in April 2020, meetings were shifted to a virtual only setting due to COVID-19 and associated Executive Orders and legislation that permitted meetings in this forum. Following the conclusion of the SEC meetings in December 2021, DCA completed preliminary conceptual project designs to be used by DWR for environmental analysis of the project alternatives under the California Environmental Quality Act (CEQA) in the 2022 draft EIR.

A variety of DCA engineering topics were discussed at the SEC meetings. Past meeting topics included an overview of potential conveyance features, siting of key features, and outcomes from efforts to minimize community effects. Additionally, DWR representatives participated in the meetings and provided presentations and updates on the project's CEQA process.

SEC members attended meetings, asked questions, and provided feedback. They were asked to share meeting materials and details with others in their communities. The SEC meetings provided a forum for SEC members to discuss their own input and community concerns and questions. The SEC members provided valuable input and feedback to the DCA to inform the engineering design and construction planning process.

The following list provides examples of SEC member input that was incorporated into DCA's project conceptual designs:

- Removal of barge landings to avoid effects on Delta recreational boaters.

- Changes to the intakes construction phase cofferdam to minimize the number of impact-driven sheet piles and the associated noise.

- Minimization of construction traffic, except for employee shuttle buses or vans and small trucks, on Hood-Franklin Road due to traffic congestion concerns, and to minimize noise, light, and air quality effects on greater sandhill cranes and the Stone Lakes National Wildlife Refuge headquarters.
- Avoidance of using levee roads for heavy construction traffic to reduce potential impacts to levees.
- Adjustment of the Staten Island maintenance shaft site location to minimize adverse effects on greater sandhill cranes.
- Relocation of the tunnel maintenance shaft from Brack Tract to Canal Ranch Tract to minimize disturbance along flight paths of greater sandhill cranes and other birds between units of the Woodbridge Ecological Reserve.
- Relocation of the Byron Tract working shaft site and elimination of the Victoria Island shaft due to traffic congestion concerns on State Route 4 at bridges on the eastern and western sides of Victoria Island.
- Modifications to Byron Highway due to traffic congestion concerns.
- Decision to only use Intake C-E-2 as a 1,500 cubic feet per second (cfs) intake for the 7,500 cfs project design capacity option due to comments from Tribal representatives and its proximity to the community of Clarksburg.

Appendix I2 *Efforts to Minimize Delta Community Effects* includes more detail.

14. Contra Costa Water District Interconnection Facilities

As the Delta Conveyance Project Environmental Impact Report (EIR) was being prepared, DWR requested that the DCA conduct a preliminary analysis of a potential new interconnection facility as part of the Project that would allow water to be conveyed from the proposed Union Island Tunnel Maintenance Shaft through a pump station, a raw water conveyance pipeline, and interconnection valve to the existing Contra Costa Water District (CCWD) existing Middle River Pipeline (also known as the Victoria Island Pipeline). A description of the proposed Interconnection Facilities for the CCWD is provided in Attachment 2.

15. Project Schedule

A project schedule was developed to represent major phases of the project that includes permits, procurement, design, construction, and startup. The schedule was developed by estimating the duration of time required to complete the design and construction of each major project element along with the logical sequencing of activities required to complete the entire project such that testing and startup can occur in years 2043 and 2044 with the project becoming fully operational at the beginning of year 2045. Figure 14 shows the overall Project schedule and logical sequences of the major project elements.

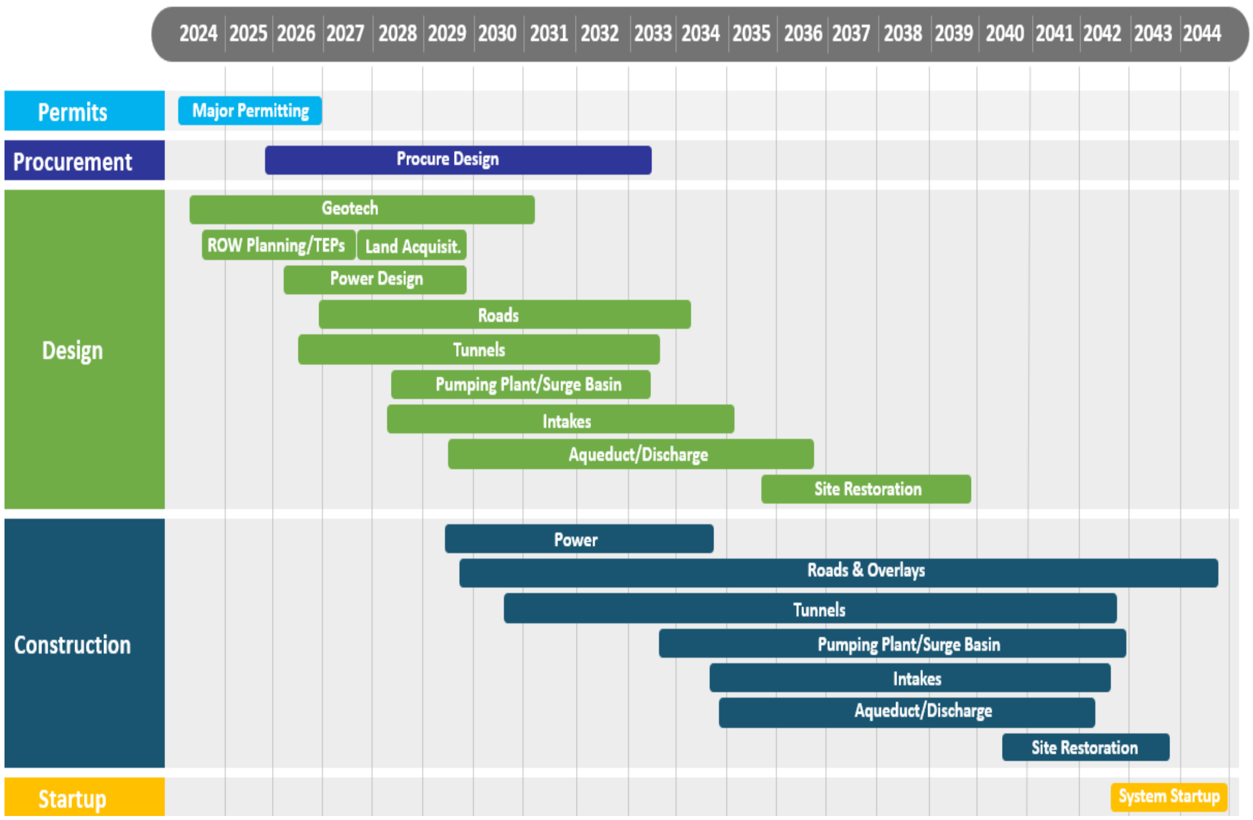


Figure 14. Delta Conveyance Project Schedule

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 Project (see Appendix K *Preliminary Construction Schedules*) 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:** Four tunnel contracts were assumed in the schedules for the tunnel between the intakes and Bethany Complex. Tunnel drive contracts would generally include shaft construction. The contract arrangements for the temporary shaft pad at the intakes would be determined during future design efforts. At Twin Cities Complex and Lower Roberts Island, the first tunnel contract would include completion of a double launch shaft before using one of the cells for the second tunnel contract.
  - 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 the tunnel construction direction. The tunnel receptions shaft at the Terminus Tract would receive two tunnel drives and would be included in the tunnel contract that would be planned to arrive first. The reception shaft at the Bethany Complex Surge Basin would be constructed early within the Reach 4 tunnel contract to allow construction of the Bethany Reservoir Pumping Plant and Surge Basin contracts.
  - 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.
- **Bethany Reservoir Pumping Plant:** The Bethany Reservoir Pumping Plant construction would include construction of a deep box structure, mechanical and electrical buildings, pumping equipment, associated pipework, and surge tank facilities. Pipe work within and around the box structure would be included in the contract to the southern portion of the site where the facilities would join the Bethany Reservoir Aqueduct pipeline contract.
  - The pumping plant box structure would be sequenced as a top-down construction and the installation of the perimeter diaphragm walls and columns would be followed by the construction of the ground level slab of the pumping plant. Subsequent excavation would occur below the ground level slab to install intermediate slabs sequentially to support the walls as the excavation progressed. Internal walls and bulkheads would be installed at each slab level once sufficient clearance would exist for excavation to the next slab construction below. This method would enable construction of surrounding buildings while the main box structure would be excavated.
  - The pumping plant contract would include construction of a wet well conduit from the northern side of the pumping plant to the tunnel reception shaft at the Surge Basin site. The inlet conduit from the tunnel reception shaft to the pumping plant would be constructed at the same time as the main wet well using the same methods as for the box structure (described above).
- **Bethany Reservoir Surge Basin:** The Surge Basin construction would be initiated after completion of the adjacent tunnel reception shaft. Also, the part of the wet well conduit under the Surge Basin would be completed on a similar timeframe. The perimeter diaphragm walls would be installed followed sequentially by excavation of the Surge Basin with tie back anchors, holding down piles, base slab, and access ramp. These activities could occur concurrently with construction of the

remainder of the wet well conduit and the pumping plant after the second level slab at the pumping plant would be completed.

  - The top sections of the reception shaft/Surge Basin shaft and the pumping plant wet well inlet conduit diaphragm walls would be removed by the Surge Basin contractor before completion of the overlying section of the pumping plant slab well. Final works to install the dewatering bridge structure and weir wall around the surge shaft would be delayed until the completion of the tunnel reception shaft and removal of the TBM.

- **Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure:** Initial site clearance work of the Bethany Reservoir Aqueduct would include preparation of the site access roads to the tunnel portal areas adjacent to the Jones Penstocks and the Conservation Easement. The Aqueduct tunnel contract would include two sets of four tunnels to be constructed under the Jones Penstocks and the Conservation Easement.
  - Riser shafts at the downstream end of the tunnels under the Conservation Easement at the Bethany Reservoir Discharge Structure would be constructed concurrently with the tunnels; and therefore, shafts would be completed before the tunnels arrived at the vertical shafts. Completion of the Bethany Reservoir Discharge Structure over the vertical shafts would be delayed until after the pipelines would be installed within the shaft excavations.
  - The pipelines within the Aqueduct tunnel sections would be installed before excavation of the open-trench cut-and-cover sections of the Aqueduct in order to use the excavated soil material from the portals and tunnels to backfill the portals. Excavation for the Aqueduct open trench sections with pipeline installation could continue with concurrent backfilling of the trenches. Construction of the Bethany Reservoir Discharge Structure would occur concurrent with construction at the Bethany Reservoir Pumping Plant and Surge Basin site.

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Attachment 1
Summary of Information for the Project Design Capacity of 6,000 cfs with Cylindrical Tee Fish Screens

Attachment 1. Summary of Information for the Project Design Capacity of 6,000 cfs with Cylindrical Tee Fish Screens

This attachment 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 attachment includes the following sections.

- **Intakes C-E-3 and C-E-5**
  - **Table A1.** Quantifications of Construction Conditions and Constructed Facilities Summary for Intakes C-E-3 and C-E-5 for 3,000 cfs Design Capacity, each, with Cylinder Tee Fish Screens
- **Tunnels – Between Intakes and Bethany Complex**
  - **Table A2.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for The Project from Intakes to Bethany Complex for a Project Design Capacity of 6,000 cfs
  - **Table A3.** Quantifications of Construction Conditions and Constructed Facilities Summary for Twin Cities Complex Dual Tunnel Launch Shafts
  - **Table A4.** Quantifications of Construction Conditions and Constructed Facilities Summary for New Hope Tract Tunnel Maintenance Shaft
  - **Table A5.** Quantifications of Construction Conditions and Constructed Facilities Summary for Canal Ranch Tract Tunnel Maintenance Shaft
  - **Table A6.** Quantifications of Construction Conditions and Constructed Facilities Summary for Terminous Tract Tunnel Reception Shaft
  - **Table A7.** Quantifications of Construction Conditions and Constructed Facilities Summary for King Island Tunnel Maintenance Shaft
  - **Table A8.** Quantifications of Construction Conditions and Constructed Facilities Summary for Lower Roberts Island Dual Tunnel Launch Shafts
  - **Table A9.** Quantifications of Construction Conditions and Constructed Facilities Summary for Upper Jones Tract Tunnel Maintenance Shaft
  - **Table A10.** Quantifications of Construction Conditions and Constructed Facilities Summary for Union Island Tunnel Maintenance Shaft
- **Bethany Complex**
  - **Table A11.** Quantifications of Construction Conditions and Constructed Facilities Summary for Tunnel Reception Shaft at the Surge Basin Site
  - **Table A12.** Quantifications of Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Pumping Plant and Surge Basin
  - **Table A13.** Quantifications of Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Aqueduct

- **Table A14.** Quantifications of Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Discharge Structure

- **Access Roads**
  - **Table A15.** Access Roads to Construction Sites for Project Design Capacity of 6,000 cfs
  - **Table A16.** Piles and Piers for Access Roads for Project Design Capacity of 6,000 cfs

- **Lambert Road Concrete Batch Plant**
  - **Table A17.** Quantifications of Construction Conditions and Constructed Facilities Summary for the Lambert Road Concrete Batch Plant

1.1 Intakes C-E-3 and C-E-5

Table A1. Quantifications of 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.
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.

Items	Quantities
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)
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, 2020c) • 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, 2020c) 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.

Items	Quantities
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.
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.

Items	Quantities
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

Items	Quantities
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 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.

Items	Quantities
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). 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.

Items	Quantities
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.
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

Items	Quantities
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 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.

Items	Quantities
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 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.

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 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.
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.

Items	Quantities
Fencing and Security – during Construction Phase for Intake C-E-3 and Intake C-E-5, each[a]	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[a]	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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1 Tunnels – Between Intakes and Bethany 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 between the Intakes and the Bethany Complex are summarized in Table A2. Information for the tunnel shafts between the intakes and the Bethany Complex are presented in Tables A3 through A10. Information related to construction of the tunnel shafts at the intakes are included in Table A1. Information related to construction of the tunnel shafts at the Bethany Complex are included in Table A11.

Table A2. Tunnel Reach Lengths and Shaft Invert Elevations and Depths for The Project Between Intakes and Bethany 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	13,200	Not Applicable
Tunnel Launch Shaft Site on Twin Cities Complex	-150	160	29,600	Snodgrass Slough
Tunnel Maintenance Shaft on New Hope Tract	-152	158	24,300	Snodgrass Slough Mokelumne River
Tunnel Maintenance Shaft on Canal Ranch Tract	-154	157	15,800	Beaver Slough
Tunnel Reception Shaft on Terminous Tract	-157	153	26,900	Hog Slough Sycamore Slough
Tunnel Maintenance Shaft on King Island	-159	147	20,600	White Slough
Tunnel Launch Shaft on Lower Roberts Island	-161	150	29,600	Disappointment Slough San Joaquin River
Tunnel Maintenance Shaft on Upper Jones Tract	-164	157	26,900	Whiskey Slough Hayes Slough Old River
Tunnel Maintenance Shaft Site on Union Island	-166	160	22,200	Middle River Victoria Canal
Tunnel Reception Shaft Site at Surge Basin within Bethany Complex	-169	209	27,500	West Canal Jones Pumping Plant Approach Channel
TOTAL TUNNEL LENGTH	Not Applicable	Not Applicable	**236,600**	Not Applicable

Notes: Values listed are approximate; refer to GIS or Engineering Concept Drawings for more precise values.

1.1.1.1 Twin Cities Complex

Table A3. Quantifications of Construction Conditions and Constructed Facilities Summary for Twin Cities Complex Dual Tunnel Launch Shafts

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average), unless otherwise noted. 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 handling 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 – off peak traffic hours; could occur at night due to 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 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	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 = 30.3 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 tunnel	Shaft Depth during construction = 171 feet Shaft Depth during operations = 180 feet
Shaft Ventilation Fan Housing	Two sets, each with an area = 30-foot wide x 20-foot long, up to 30 feet tall
Tunnel Liner Segment Storage	Two sets, each with an area = 6 acres for 4-month supply plus 1 acre staging/unloading area (assume segments stored 4-segments high [10-foot high])
TBM Storage Building and Laydown Area	Two sets, each building = 70-foot wide x 125-foot long, up to 12 feet tall Two sets, each laydown area = 60-foot wide x 170-foot long

Items	Quantities
Diaphragm Wall Slurry Plant	Two sets, 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	Two sets, each has an area for slurry/grout mixing plant= 35-foot wide x 55-foot long Two sets, each with silos for fly ash, cement, chemical additives, and bentonite = three 30-feet high and 16-foot diameter silos (six total silos)
RTM Temporary Wet Stockpile	Area = 27 acres x 10 feet high
RTM Natural Drying Area	North Stockpile Area = 196 acres x 6 feet high South Stockpile Area = 196 acres x 9 feet high
Treated (permanent) RTM Storage	Area = 214 acres x 15-feet high
Emergency Response Facilities during Construction	The facilities would include two ambulances because there are two launch shafts. Each 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	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	Two sets of two buildings, 100-foot wide x 50-foot long, up to 20 feet tall each (four buildings total)
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two sets of two buildings, 70-foot wide x 35-foot long, up to 20 feet tall each (four buildings total)
Maintenance Shop	Two buildings (one for each shaft site) 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 101 weeks over the 108-week period.

Items	Quantities
Parking Spaces during Construction	Two sets of parking spaces, each with 60 10-foot by 20-foot parking spaces
Standby Engine Generator during Construction	Standby engine generators would be required in case of power interruptions to provide essential services to the tunnel and TBM, including ventilation, lighting, lift, and sump pumps. Two portable 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 by 25-foot long installed on a 20-foot by 30-foot concrete pad with a lined containment area with berms.
Standby Engine Generators during Operations	None. Portable standby engine generators would be mobilized, if needed. Size would depend on activity. Frequency expected to be multiple years between uses.
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[a]	Approximately 31,000 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.
Fencing and Security during Operations Phase[a]	During operations, approximately 14,500 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).
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, 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.

Items	Quantities
RTM Areas	Approximately 214 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. Approximately 40 acres of excavated areas within the limits of the permanent RTM stockpile would be filled with RTM to raise the elevation to existing ground levels. The RTM could require additives to provide appropriate soil pH or nutrients for future uses for agriculture or habitat if the overlying RTM stockpile was off-hauled for other uses at a later date. 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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.2 New Hope Tract

Table A4. Quantifications of Construction Conditions and Constructed Facilities Summary of New Hope 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 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 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

Items	Quantities
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[a]	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[a]	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).

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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.3 Canal Ranch Tract

Table A5. Quantifications of 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.

Items	Quantities
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
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.

Items	Quantities
Fencing and Security – during Construction Phase [a]	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[a]	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.
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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.4 Terminous Tract

Table A6. Quantifications of 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

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 70-foot long for the 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 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[a]	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[a]	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).

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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.5 King Island

Table A7. Quantifications of 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.

Items	Quantities
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 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.

Items	Quantities
Fencing and Security – during Construction Phase[a]	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[a]	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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.6 Lower Roberts Island

Table A8. Quantifications of Construction Conditions and Constructed Facilities Summary for Lower Roberts Island dual Tunnel Launch Shafts

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average), unless otherwise noted. Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 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 pad. 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 = 24 feet above ground Top of shaft pad elevation = 13 feet Top of shaft pad length = 650 feet Top of shaft pad width = 350 feet Depth of ground improvement = 50 feet Finished shaft elevation = 36 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

Items	Quantities
Tunnel Shaft	Shaft Depth during construction = 174 feet Shaft Depth during operations = 191 feet
Shaft Ventilation Fan Housing	Two sets, each with an area = 30-foot wide x 20-foot long, 30 feet tall
Tunnel Liner Segment Storage	Two sets, each with an 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	Two sets, each building = 70-foot wide x 125-foot long, up to 12 feet tall Two sets, each laydown Area = 60-foot wide x 170-foot long
Diaphragm Wall/Trench Slurry Plant	Two sets, 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	Two sets, each with an area for Slurry/Grout Mixing Plant = 35-foot wide by 55-foot long Two sets, each with silos for fly ash, cement, chemical additives, and bentonite = Three 30-feet high and 16-foot diameter silos (six total silos)
RTM Temporary Wet Stockpile	Area = 27 acres and 10 feet high
RTM Natural Drying Area	North Stockpile Area = 196 acres by 7 feet high South Stockpile Area = 196 acres by 11 feet high
Emergency Response Facilities during Construction	The facilities would include two ambulances because there are two launch shafts. Each 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	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	Two sets of two buildings, 100-foot wide x 50-foot long, up to 20 feet tall each (four buildings total)

Items	Quantities
Steel Fabrication Area and Miscellaneous Steel Storage Buildings	Two sets of two buildings, 70-foot wide x 35-foot long, up to 20 feet tall each (four buildings total)
Maintenance Shop	Two shops (one for each shaft), each 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 90 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 66 weeks over the 90-week period.
Parking Spaces during Construction	Two sets of parking spaces, each with 60 spaces: 10-foot by 20-foot parking spaces
Standby Engine Generator during Construction (2 each)	Power supplies would be connected to the tunnel launch shaft site at two new substations, one per launch shaft, spanning 135-feet wide by 62-feet long. The power demands would be about 20,000 kVA for each TBM, for a site total of about 59,000 kVA including supporting equipment and facilities. An additional 230-kV distribution substation would be located within a 186-foot wide x 344-foot long fenced area on the south side of Mountain House Road.
Standby Engine Generators during Operations	None. Portable generators would be mobilized, if needed. Size would depend on activity. Frequency expected to be multiple years between uses.
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[a]	Approximately 23,500 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. 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
Fencing and Security during Operations Phase[a]	Approximately 25,000 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, 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 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.

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 an on-site treatment plant. Treated flows would be discharged to adjacent drainage.
RTM Areas	Approximately 26 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. Approximately 189 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 could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat if the overlying RTM stockpile was off-hauled for other uses at a later date. 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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.7 Upper Jones Tract

Table A9. Quantifications of Construction Conditions and Constructed Facilities Summary for 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 35 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 Maintenance Shaft Pad	Top of shaft pad = 20 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 = 35 feet Finished shaft elevation = 37 feet
Tunnel Shaft	Shaft Depth during construction = 177 feet Shaft Depth during operations = 201 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 32 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 12 weeks over the 32-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[a]	Approximately 2,750 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[a]	Approximately 2,750 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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.1.8 Union Island

Table A10. Quantifications of Construction Conditions and Constructed Facilities Summary for union 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 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 = 18 feet above ground Top of shaft pad elevation = 12 feet Top of shaft pad length = 235 feet Top of shaft pad width = 200 feet Depth of ground improvement = 45 feet Finished shaft elevation = 39 feet
Tunnel Shaft	Shaft Depth during construction = 178 feet Shaft Depth during operations = 205 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 32 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 12 weeks over the 32-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[a]	Approximately 3,440 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[a]	Approximately 3,440 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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.2 Bethany Complex

The Bethany Complex includes the tunnel reception shaft at the Surge Basin, the Bethany Reservoir Pumping Plant and Surge Basin facilities, Bethany Reservoir Aqueduct, and Bethany Reservoir Discharge Structure.

Table A11 presents information related to the tunnel reception shaft that would be located at the Surge Basin site. Table A12 presents information for the Bethany Reservoir Pumping Plant and Surge Basin facilities and site. Tables A13 and A14 present information related to the Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure, respectively.

1.1.2.1 Bethany Reservoir Surge Basin Reception Shaft

Table A11. Quantifications of Construction Conditions and Constructed Facilities Summary for Bethany Reservoir Surge Basin 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 the pour.
Tunnel Reception Shaft	Shaft Depth during construction = 209 feet (depth from existing ground surface prior to excavation or fill) Shaft Depth during operations = 199 feet
Shaft Ventilation Fan Housing	Area = 30-foot wide x 20-foot long, up to 30 feet tall
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 by 40-foot long steel fabrication area
Maintenance Shop - Working Shaft and Southern Forebay Inlet Structural Tunnel Launch Shaft, at each site	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
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces
On-site Access Road during Construction	Construction access would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
Fencing and Security during Construction Phase	Fencing and security would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
Fencing and Security during Operations Phase	Fencing and security would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
Lighting Facilities during Construction and Operation Phases	Lighting facilities would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
Erosion Control	Erosion control would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.

Items	Quantities
Wastewater Facilities during Construction	Wastewater facilities would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
Wastewater Facilities during Operations	Wastewater facilities would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
SWPPP Facilities during Construction and Operations	SWPPP Facilities would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.
Fire Water Supplies Stored On-site	Fire water supplies would be part of the overall facilities at the Bethany Reservoir Pumping Plant and Surge Basin as described in Table A7.

1.1.2.2 Bethany Reservoir Pumping Plant and Surge Basin

Table A12. Quantifications of Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Pumping Plant and Surge Basin for Project Design Capacity of 6,000 cfs

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), unless otherwise noted.
Pumping Plant Construction Sequence	• Construct reinforced concrete perimeter diaphragm walls and interior diaphragm columns for the pumping plant dry pits and center wet well structures, and wet well inlet conduit. • Install dewatering system within area inside diaphragm walls. • Construct roof slab and beams over pumping plant dry pit and wet well structures. • Perform top-down excavation below roof slab and below and between intermediate floor levels within the structures. Transport excavated material to stockpiles. • Each intermediate floor will be connected to the diaphragm walls and columns. • Construct foundation slab. • Construct all interior concrete elements • Install mechanical equipment and piping • Excavate and dewater for construction of the reinforced concrete mechanical room which includes gate valve gallery. Ground water cutoff structures to be determined during preliminary design. • Install drilled piers for support of the mechanical room. • Construct base slab, perimeter walls and all interior elements. • Remove diaphragm wall sections between the mechanical room and pumping plant dry pit structures. • Construct roof slab over the gate valve gallery.

Items	Quantities
Surge Basin Construction Sequence	• Construct diaphragm walls for reception shaft from existing grade. • Excavate interior of shaft. Transport excess excavation to stockpiles. Construct tremie slab at base of shaft, shaft lining and build frame for openings. • Construct diaphragm walls for inlet conduit walls (in conjunction with construction of pumping plant diaphragm walls), and center wall for inlet conduit bulkhead gate panels. Install drilled tie-down shafts for base slab of inlet conduit with reinforcing steel only be installed in the lower portion of the shaft for connection to the inlet conduit base slab. • Construct roof slab for inlet conduit (in conjunction with roof slab for pumping plant). • Construct diaphragm walls for surge basin concurrent with excavation of inlet conduit (and pumping plant). Only the upper portion of the diaphragm wall for the perimeter of the surge basin will have reinforcing steel while the lower portion will be unreinforced and will primarily be used for seepage cutoff during construction. • Install dewatering system within the area inside the surge basin, from existing grade. • Perform top-down excavation within the surge basin concurrent with the inlet conduit excavation. For the surge basin, install tiebacks as excavation progresses. Degrade unreinforced portion of drilled inlet conduit base slab drilled tie-down shafts as inlet conduit excavation progresses. Transport excess excavation to stockpiles. • Form and construct vertical wall on inlet conduit to connect roof slabs and complete surge basin perimeter • Install surge basin drilled tie-down shafts for uplift resistance from bottom of surge basin excavation (El. 2 ft). • Remove shaft wall to connect shaft with inlet conduit. • Remove upper portions of the diaphragm walls for the shaft and inlet conduit walls within the surge basin footprint. • Construct surge basin floor slab to El. 7 ft. • Construct permanent access ramp for surge basin. • Partially construct overflow weir wall, bridge, rail-mounted pump system, and bulkhead gates. • Retrieve TBM. • Finish construction of overflow weir wall, bridge, rail-mounted pump system, and bulkhead gates.
Ground Improvement	Ground improvement is not anticipated at the Bethany complex site.
Pumping Plant Dimensions and Description of Site Features	Top of Pumping Plant Ground Elevation = 46.5 feet Top of Pumping Plant Slab Elevation = 47.0 feet Pumping Plant Pad Site = 1,166 foot wide x 1,260 feet long

Items	Quantities
Surge Basin Dimensions and Description of Site Features	Surge Basin: Top of Surge Basin Ground Elevation = 40 to 46.5 feet (varies) Top of Base Concrete Slab Elevation = 7 feet Surge Basin Size = 815 feet wide x 815 feet long Overflow Shaft: Overflow shaft diameter = 120 feet Overflow weir wall diameter = 180 feet Top of overflow weir wall elevation = 18 feet Six 5 foot by 5 foot vertical sluice gates within the perimeter of the overflow weir will allow stored water from a surge event to drain into the overflow shaft. The overflow shaft will connect to the Bethany Reservoir Pumping Plant via the inlet conduit located on the southern wall of the overflow shaft. A double row of isolation bulkhead gates will exist along the southern wall of the surge basin to isolate the Bethany Reservoir Pumping Plant from the upstream portion of the conveyance system. A removable hatch will be installed in the roof of the inlet conduit downstream of the bulkhead gates for discharge into the Bethany Reservoir Pumping Plant during tunnel dewatering. A dedicated 7-foot diameter discharge pipe conveys discharge from the rail-mounted pumps into the Bethany Reservoir Pumping Plant inlet conduit. An inspection and maintenance access bridge will be constructed over the inlet conduit and the overflow shaft. A gantry crane on the bridge will also allow for installation and removal of the bulkhead gates and other maintenance.
Diaphragm Walls	Pumping Plant: Approximately 6 foot wide by 252 foot deep by 1,438 feet long; 5-foot wide by 100-foot deep by 1,750 feet long; and 5 foot wide by 252 foot deep by 630 feet long diaphragm walls. Wet Well Inlet Conduit: Approximately 6 foot wide by 252 foot deep by 800 feet long; and 5 foot wide by 100 foot deep by 160 foot long diaphragm wall columns below foundation. Surge Basin: Approximately 3 foot wide by 137 foot deep by 3,260 feet long with two levels of tiebacks.
Foundational Piles	Pumping Plant: Approximately 53 drilled piers would be installed 50 feet deep below the pump discharge isolation gate valve gallery. Surge Basin: Approximately 2,530 drilled piers would be installed 60 feet deep below the surge basin base slab.

Items	Quantities
Earthwork	Pumping Plant: The total excavation volume for the Bethany Reservoir Pumping Plant dry pits, wet well, valve pit, mechanical/electrical pit, surge tank valve vaults, and ancillary site grading total approximately 1,270,298 cubic yards of excavation. 7,000 cubic yards will be needed as fill associated with site grading. Surge Basin: The total excavation volume of the surge basin is approximately 1,171,060 cubic yards. An access ramp will be constructed with an MSE wall with free draining backfill and drainage stone behind the wall. Excavated soil will be placed in permanent stockpiles located immediately to the east and south of the Bethany Reservoir Pumping Plant in up to 5 (five) separate stockpiles totaling approximately 70 acres.
Excess Excavation Stockpiles	Excess excavated material from all portions of the Bethany Complex would be stockpiled at 4 stockpile locations within the Bethany Reservoir Pumping Plant and Surge Basin portion of the Bethany Complex, as described below. A five percent buffer for sloping sides and perimeter access roads was used to estimate the height of each stockpile. Location 1: 12 acres, 450,185 cubic yards, 33 feet tall Location 2: 12.75 acres, 586,660 cubic yards, 33 feet tall Location 3: 8.5 acres, 261,335 cubic yards, 33 feet tall Location 4: 30.75 acres, 307,145 cubic yards, 33 feet tall Location 5: 5.8 acres, 180,072 cubic yards, 33 feet tall The stockpiles are located immediately to the east and south of the Bethany Reservoir Pumping Plant. Each stockpile area would be cleared, grubbed, and stripped of topsoil before stockpiling. Topsoil from these locations, plus excess topsoil from other portions of the Complex, would be respread over the completed stockpiles upon completion. The stockpiles would be hydroseeded upon completion.
Pumping Plant	Area of Structure = 412 feet wide by 503 feet long Top of slab of wet well, wet well inlet conduit and pumping plant dry pit pump bays = 47.0 feet Top of canopy structures on the north end of each pumping plant dry pit above Pad = 74.5 feet, resulting in a top of structure elevation = 121.5 feet
Pumps	Pumping Plant: • Fourteen pumps at 500 cfs, each, includes two standby pumps Surge Basin: • 4 rail-mounted pumps at 100 cfs, each, for dewatering surge basin • 2 vertical submersible pumps at 60 cfs each, for dewatering main tunnel
Electrical Building on Pumping Plant Pad	Area of Structure = 180 wide by 117 feet long Top of Structure above Pad = 47 feet Top of Structure Elevation = 86 feet

Items	Quantities
Equipment Storage Building on Pumping Plant Pad	Area of Structure = 195 wide x 235 feet long Top of Structure above Pad = 49 feet Top of Structure Elevation = 98 feet
Surge Tanks for Aqueduct to Bethany Reservoir Discharge Structure	Area of Tank = 75-foot diameter by 20 feet high Top of Tank Structural Pad = 47 feet Top of Tank Elevation = 67 feet Total Number of Tanks = 4
Electrical Substation on Pumping Plant Pad during Construction and Operation Phases	Area = 400 feet wide by 400 feet long, within a separately fenced area.
Standby Engine Generator Building	Area of Structure = 45 feet by 75 feet long Top of Structure above Pad = 21 feet Top of Structure Elevation = 68 feet Electrical Generator = 30 kilowatts with less than 50 brake horsepower
Fuel Tank for SEG	Diesel Fuel Tank (elevated) within a containment area
Rail Mounted Gantry Cranes	Pumping Plant: 150 feet wide by 59 feet high; located over each pumping plant dry pit bay (total of two cranes) Surge Basin: 60 feet wide by 59 feet high; located over surge basin bridge deck (total of one crane)
Construction Contractor Working Area not located on Pumping Plant Pad	Concrete Forms and Rebar Storage Area = 120 feet wide by 400 feet long Warehouse = 80 feet wide by 100 feet long, up to 25 feet tall Other Storage Area = 200 feet wide by 350 feet long (includes area to collect runoff) Laydown Area = 100 feet wide by 200 feet long Contractor's and Owner's Offices Area = 90 feet wide by 100 feet long, up to 12 feet tall Equipment Storage Area = 200 feet wide by 350 feet long, up to 20 feet tall Maintenance Shop Area = 90 feet wide by 120 feet long, up to 25 feet tall Parking Spaces Area = 200 feet wide by 400 feet long Construction Crew Facilities Area = 100 feet wide by 200 feet long
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 All tanks inside fully contained fueling areas

Items	Quantities
Duration for Concrete Pours for Bethany Reservoir Pumping Plant and Surge Basin, and Bethany Reservoir Aqueduct	Daytime concrete pour would throughout 518 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 430 weeks over the 518-week period.
On-site Access Roads during Construction	On-site paved and unpaved access roads. Truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils and unpaved roads for dust control.
On-Site Access Roads during Operation Phase	4,054 feet of asphalt paved 32-foot wide roads with gravel shoulders; 540 feet of asphalt paved 24-wide road with no shoulder; 349 feet of asphalt paved 16-foot wide road with no shoulder.
On-Site Parking at Pumping Plant during Construction Phase	Area = 80,000 square feet of graveled parking lot located within Construction Contractor Working Area
On-Site Parking at Pumping Plant during Operation Phase	Area = 16,254 square feet of paved parking lot
Fencing and Security during Construction[a]	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. 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 Operation Phase[a]	During operations, approximately 14,000 feet of at least 8-foot tall chain link security fencing would be installed around the permanent Pumping Plant and Surge Basin site including fencing for the permanent electrical substation Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information. Site security would include video surveillance at all entrance gates with key pad and card readers. Visitor access would need to be prearranged.
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, 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.
Emergency Response Facilities	The facilities would include an 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.
Wastewater Facilities during Construction	Restrooms, including sinks, showers, and toilets, would be provided. Wastewater would flow to a septic system would be required for the operations staff at the Bethany Reservoir Pumping Plant and Surge Basin. The Pumping Plant would include restrooms, showers, and sinks and wastewater treatment and disposal facilities. The septic tank and leach field would be designed and constructed in accordance with the Alameda County Onsite Wastewater Treatment System Manual June 2018. The septic tank and leach field would be constructed on-site at the Pumping Plant 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.
Wastewater Facilities during Operations	The Pumping Plant would include permanent restrooms, showers, and sinks and wastewater treatment and disposal facilities to serve operations staff of the Pumping Plant, Surge Basin, and distribution system. The septic tank and leach field would be designed and constructed in accordance with the Alameda County Onsite Wastewater Treatment System Manual June 2018. The septic tank and leach field would be constructed adjacent to the final pumping plant on the Pumping Plant site. The site is located on compacted soil material. 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 avoid too rapid an application rate. 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 of 100 feet away from any contained waterbody and 150 feet away from a wall, including the well installed for drinking water, toilets, and shower water.

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 as reuse and subsequent discharge, if appropriate.
SWPPP Facilities during Operations	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.
Excavated Material Stockpiles	Approximately 70 acres of the site would be used for permanent excavated material 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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

1.1.2.3 Bethany Reservoir Aqueduct

Table A13. Quantifications of Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Aqueduct for Project Design Capacity of 6,000 cfs

Location	Items	Quantities
Conditions and Facilities Along the Overall Aqueduct Corridor	Construction Period	Most construction would occur year-round except as follows: • Construction of the two crossings of BBID's canals would occur between November and February (outside the irrigation season), or as otherwise noted below
	Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average), except as follows: • Construction work to establish a bypass for traffic on Mountain House Road, and to remove the bypass after completion of pipeline work under Mountain House Road, will occur during nighttime hours, or as otherwise noted below
	Aqueduct Construction Area (excluding tunneled reaches)	Permanent disturbance – 200 feet wide Temporary disturbance – 400 feet wide (details below)

Location	Items	Quantities
	Aqueduct Trench	Approximately 115 feet wide at the bottom, to accommodate 4 pipes 180-inches in diameter and 30 feet on center. Trench would be excavated to a depth of about 0.7 times pipe diameter (0.7D), plus 1 foot for pipe bedding and another 1 foot or more for trench stabilization material, where needed. Trench side slopes would be 1:1 or as required for OSHA conformance and safety of workers. Excavated material would be sidecast. Some would be moved to CLSM processing area. Pipe would be backfilled to 0.7D with CLSM, then sidecast excavated trench material placed and compacted on top of the pipe and CLSM to a depth of 0.7D across the entire trench, then backfilled to finished grade with sidecast material or material brought in from other excavations in the Bethany Complex. Backfill side slopes above existing grade would be at 4:1. A 24-foot width on top of the compacted material would be surfaced with 6 inches of gravel to serve as a permanent patrol road along the aqueduct.
	Work Areas Adjacent to Trench	On each side of the excavated trench, an area 20 feet in width would be set aside as a temporary work area for equipment to install pipe and backfill materials. The area would be cleared and grubbed prior to construction but would not be surfaced, and would ultimately be at least partially covered by the backfill over the pipe and CLSM.
	Tunneled Portions of Aqueduct	Jones Penstock Tunnel: 20 foot diameter tunnels with pipelines inside Jones Penstock Tunnel Excavation: 14,370 bank cubic yards Conservation Easement Tunnel: 20 foot diameter tunnels with pipelines inside Conservation Easement Tunnel Excavation: 219,623 bank cubic yards
	Staging Area for Pipe and Excavation Material	Adjacent to the 20-foot-wide work area described above, an 80-foot-wide strip would be allocated on each side of the trench to serve as a staging area, primarily for temporary storage of excavated material and pipe segments not yet installed in the trench. The area would be cleared and grubbed prior to construction, but would not be surfaced. Following construction, it would be reseeded and restored to original condition, as most of it would fall outside the permanent disturbance area along the aqueduct length.
	Temporary Access Roads within Aqueduct Corridor	Adjacent to the 80-foot-wide staging area, a 20-foot wide strip would be allocated on each side of the trench to serve as a temporary access road for construction travel along the aqueduct corridor. The area would be cleared and grubbed prior to construction and would be surfaced with gravel. Following construction, gravel would be removed and it would be reseeded and restored to original condition, as it would fall outside the permanent disturbance area along most of the aqueduct length.

Location	Items	Quantities
	Permanent Access Roads within Aqueduct Corridor	A gravel access road would be constructed as part of final grading for long-term access to the aqueduct corridor. The road would be located on top of the aqueduct, approximately at the centerline of the pipes. The road would begin at the Bethany Reservoir Pumping Plant and terminate at the north portal for the Conservation Easement tunnel so it would not extend across the Conservation Easement. Small scale vector control would be addressed with measures such as insect repellent wipes, yellow jacket catchers, and rodent traps near unpaved areas.
	Additional Work Areas	In specific reaches, the available work area will extend beyond the 400-foot width. Specifically, approximately STA 115+00 to 140+00(as included in the engineering concept drawings), the work area west and north of the aqueduct will extend to Mountain House Road west to Kelso Road on both the north and south side of the BBID Canal 70 to provide space for soil stockpiling and other contractor operations and to utilize space otherwise isolated between the canal and the pipeline construction work.
	Duration for Concrete Pours for Bethany Reservoir Aqueduct	Information provided in Table A7 for the Bethany Reservoir Pumping Plant and Surge Basin
	On-site Access Roads 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[a]	Approximately 19,000 feet of at least 8-foot tall chain link security fence would be installed around the multiple work sites described herein, 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[a]	None, gates at access points along county roads.

Location	Items	Quantities
	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. 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 gravel, 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 Phase	Restroom facilities for the Aqueduct Contractors Main Yard would be provided by the Bethany Reservoir Pumping Plant and Surge Basin site. Portable restrooms would be placed on-site at the CLSM Processing Area.
	Wastewater Facilities during Operations Phase	Portable restrooms would be hauled to the site during maintenance activities.
	SWPPP Facilities during Construction Phase	For any portions of the Aqueduct alignment that are adjacent to (or tributary to) existing water courses, 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	1,000,000 gallons to provide up to 4,500 gallons/minute for 4 hours.
Main Yard	Contractor’s Offices	Three buildings, each 12-feet wide by 40-feet long, up to 12 feet tall
	Owner’s Office	One building, 12-feet wide by 40-feet long, up to 12 feet tall

Location	Items	Quantities
	Health and Safety Station	One building, 20-feet wide by 60-feet long, up to 12 feet tall
	Machine and Maintenance Shop	One building, 35-feet wide by 40-feet long, up to 25 feet tall
	General Tool and Equipment Storage	Area 50-feet-wide and 100-feet-long for open storage of some equipment and small (secure and weather-proof) enclosures up to 11 feet tall for tools and smaller equipment
	Water Tanks	Area 20-feet-wide and 40-feet-long for one or multiple water tanks for construction or cleaning purposes
	Air Compressor	Area 20-feet-wide and 20-feet-long for air compressor
	Miscellaneous Material Storage – Open Space	Area approximately 200-feet-wide and 200-feet-long for open storage of miscellaneous construction materials (rebar, shoring, concrete forms, etc.)
	Fuel Storage	Area 20-feet-wide and 30-feet-long for fuel tank(s) and filling of construction vehicles and equipment
	Generator	Area 10-feet-wide and 40-feet-long for generator.
	Parking Spaces during Construction	30 spaces: 10-feet by 20-feet each
CLSM Processing Area	Batch Plants (2) for Trench CLSM	Two immediately adjacent plants on same site, each approximately 100-feet wide by 100-feet long by 50-75 feet in height.
	Contractor’s Office	One building, 12-feet wide by 40-feet long, up to 12 feet tall
	Owner’s Office	Temporary 12 by 20 foot trailer, up to 10 feet tall
	Soil Storage Area for CLSM production	Site 300-feet wide x 400-feet long (2.75 acres) to store up to 30,000 CY of soil up to 7 feet deep.
	Cement Storage Silos	Site 50-feet wide x 100-feet long to store 400 tons of cement; silos will be 50-75 feet in height.
	Water Storage Tanks (2) for CLSM production	Two tanks to store a total of 100,000 gal of water, each tank 30 feet in diameter and 10 feet tall, mounted on 8-foot tall platforms.
	Miscellaneous Material Storage – Steel Building	One building, 50-feet wide by 100-feet long, up to 20 feet tall
	Conveying and Loading Equipment Area	100-feet by 100-feet long

Location	Items	Quantities
	Runoff Containment and Surface Water Treatment	Small containment area and temporary water treatment facility
	Parking Spaces during Construction (for Redi-Mix trucks)	15 spaces: 15-feet by 40-feet each
Tunnel Launch/Reception Portals at Jones Penstock Crossing [b]	Construction Hours	Tunneling and tunnel spoils 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 materials deliveries – could occur at night due to traffic congestion.
	Shaft Ventilation Fan Housing	Area = 20-feet wide by 30-feet long, up to 30 feet tall
	Contractor's and Owner's Offices	Two buildings, 12-feet wide by 40-feet long, up to 12 feet tall, each.
	Crew Facilities	One building, 24-feet wide by 40-feet long, up to 12 feet tall
	Miscellaneous Storage Areas and Buildings	Health and Safety and Quality 20 feet wide by 60 feet long, up to 12 feet tall Grout Material Storage 100 feet by 100 feet Ground Support Storage Area – 50 feet wide by 100 feet long General Tool and Small Equipment Storage – 50 feet wide by 100 feet long Water tanks – 20 foot diameter by 40 feet long Air Compressor – 20 feet by 20 feet Large Equip and temp tunnel spoils storage area 150 feet wide by 200 feet long

Location	Items	Quantities
	Maintenance Shop	One building, 35-foot wide by 40-foot long, up to 25 feet tall
	Parking Spaces during Construction	40 spaces: 10-foot by 20-foot parking spaces
	Standby Engine Generator during Construction	One generator loaded on trailers, 10-foot wide by 30-foot long, each Isolated fuel tank, 8-foot diameter tank by 25-foot long installed on a 20-foot by 30-foot concrete pad
Tunnel Launch Portal at Conservation Easement Crossing [c]	Construction Hours	Tunneling and tunnel spoils 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 materials deliveries – could occur at night due to traffic congestion.
	Shaft Ventilation Fan Housing	Area = 30-feet wide by 20-feet long, up to 30 feet tall
	Contractor's and Owner's Offices	4 buildings, 12-feet wide by 40-feet long, up to 12 feet tall each.
	Miscellaneous Storage Areas and Buildings	Crew Facilities (Dry house) – 24 feet wide by 40 feet long, up to 12 feet tall Health and Safety and Quality – 20 feet wide by 60 feet long, up to 12 feet tall Grout Material Storage – 100 feet by 100 feet Ground Support Storage Area – 50 feet wide by 100 feet long General Tool and Small Equip Storage – 50 feet wide by 100 feet long Water tanks – 20 foot diameter by 40 feet long Air Compressor – 20 feet by 20 feet Large Equipment and temp tunnel spoils storage area 150 feet wide by 200 feet long
	Maintenance Shop	One building, 60-feet wide by 35-feet long, up to 25 feet tall

Location	Items	Quantities
	Parking Spaces during Construction	72 spaces: 10-foot by 20-foot parking spaces
	Standby Engine Generator during Construction	One generator loaded on trailers, 10-foot wide by 30-foot long, each Isolated fuel tank, 8-foot diameter tank by 25-foot long installed on a 20-foot by 30-foot concrete pad
Tunnel Reception Shafts at Conservation Easement Crossing [d]	Construction Hours	Placement of concrete for each tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.
	Tunnel Shaft	Shaft Depth during construction = 112 feet. Shaft Depth during operations = 112 feet.
	Shaft Ventilation Fan Housing	Area = 30-feet wide by 20-feet long per shaft, up to 30 feet tall
	Contractor's and Owner's Offices	Two buildings, 12-feet wide by 60-feet long, up to 12 feet tall each
	Equipment Storage and Ventilation Equipment Storage Buildings	Two buildings, 100-feet wide by 50-feet long, up to 30 feet tall each
	Miscellaneous Buildings and Areas	Eight buildings: Crew Facilities 100 feet wide by 30 feet long, up to 12 feet tall Health and Safety and Quality 20 feet wide by 60 feet long, up to 12 feet tall Grout Material Storage 100 feet by 100 feet 100-foot wide by 50-foot long Ground support storage area. General Tool Equipment Storage – 100 feet by 50 feet. Large Equip and temp tunnel spoils storage area 150 feet wide by 200 feet long Water tank – 20 foot diameter by 40 feet long Air Compressor – 20 feet by 20 feet
	Maintenance Shop	One building, 60-foot wide by 35-foot long, up to 25 feet tall

Location	Items	Quantities
	Parking Spaces during Construction	40 spaces: 10-foot by 20-foot parking spaces
	Standby Engine Generator during Construction	One generator loaded on trailer, 10-foot wide by 30-foot long Isolated fuel tank, 8-foot diameter tank by 25-foot long installed on a 20-foot x 30-foot concrete pad

Notes:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

[b] To be backfilled and restored to original grade after construction

[c] launch portal to be restored to original grade after construction; area adjacent to portal graded for buildings, offices, and other temporary facilities to remain as graded

[d] Contractor's temporary facilities listed below at this site will be co-located with facilities to construct the discharge structure. However, it is expected that the facilities below will require less space and generally be in place and in most cases removed before many of the facilities for the discharge structure are moved onsite. Area graded for contractor's facilities not anticipated to be backfilled and restored to original conditions after construction

1.1.2.4 Bethany Reservoir Discharge Structure

Table A14. Quantifications of Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Discharge Structure

Location	Items	Quantities
Conditions and Facilities Along the Overall Bethany Reservoir Discharge Structure	Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average), unless otherwise noted. Dewatering operation between cofferdam and construction area will be conducted 24-hours a day, 7 days a week until structure is formed, poured, and backfilled and riprap is placed.
	Construction Period	Construction would occur year-round.
Contractor's and Owner's Offices, Material and Equipment Storage, Fuel, Water Supply and Treatment, Power Supply, and Parking [b]	Contractor's and Owner's Offices	Four buildings, 12-feet wide by 40-feet long, up to 12 feet tall each

Location	Items	Quantities
	Miscellaneous Buildings and Areas	Staging and laydown areas—area graded along reservoir access road adjacent to structure as shown on the Engineering Concept Drawings. The original grades would not be reestablished for this area. Dry house – 24 feet by 40 feet, up to 12 feet tall Health and safety and quality – 20 feet by 60 feet, up to 12 feet tall Construction material storage – 100 feet by 250 feet Excavated material storage – 100 feet by 250 feet General tool equipment storage – 30 feet by 70 feet Fuel storage and containment – 20 feet x 30 feet Construction and dust suppression water storage – 25 feet diameter by 40 feet tall Concrete washdown – 50 feet by 100 feet Contaminant area – 35 feet by 50 feet Air Compressor – 20 feet by 20 feet
	Parking Spaces during Construction	20 spaces: 10-foot by 20-foot parking spaces
	Standby Engine Generator	During construction, one standby engine generator loaded on trailer, 10-foot wide x 40-foot long During operations, one standby engine generator for backup power
	Duration for Concrete Pours for Bethany Reservoir Discharge Structure	Daytime concrete pour would throughout 70 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 70 weeks over the 70-week period.

Location	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[a]	During construction, approximately 5,000 feet of at least 8-foot tall chain link security fence would be installed 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.
	Fencing and Security during Operations Phase[a]	During operations, approximately 1,000 feet of 8-foot tall permanent chain link security fencing would be installed to enclose the entire backfilled perimeter of the structure, including the permanent stoplog storage area but excluding the bridge crossing. Signs would be placed on fencing to identify the Delta Conveyance Project and telephone numbers and internet addresses to obtain information. Site security would include video surveillance at all entrance gates with key pad and card readers. Visitor access would need to be prearranged.
	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.

Location	Items	Quantities
	Wastewater Facilities during Construction	Portable restrooms would be placed on-site.
	Wastewater Facilities during Operations	Portable restroom would be hauled to the 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:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

[b] Contractor's temporary facilities listed below at this site would be co-located with facilities to excavate the aqueduct conservation easement tunnel shafts. However, it is expected that the facilities below would require more space and many would not be needed until after temporary facilities for the shafts are moved offsite.

1.1.3 Access Roads

Table A15. Access Roads to Construction Sites for the Project

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access to Intake Haul Road Along Lambert Road	Franklin Boulevard	Concrete Batch Plant Driveway	Lambert Road	Not Applicable	No changes, asphalt overlay only	Not Applicable	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	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
	Hood-Franklin Road	East of Interstate 5	Intake Haul Road	Not Applicable	No changes, asphalt overlay only	Not Applicable	Mid-Construction & End of Construction
New Intake Haul Road and Access to Intakes C-E-3 And C-E-5	Intake Haul Road	Lambert Road	Intake C-E-5 Access Road	Not Applicable	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

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	Intake Haul Road	Intake C-E-5 Access Road	Hood-Franklin Road	Not Applicable	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	Not Applicable	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	Not Applicable	Asphalt overlay following realignment of highway	Not Applicable	Mid-Construction following realignment of highway at intakes
Twin Cities Complex Road Improvements	Dierssen Road	Franklin Boulevard	Interstate 5	18-feet wide: Two 9-foot paved lanes without shoulders	Widen 0.8-mile paved road; asphalt overlay extends an additional 0.2 miles	24-feet wide: two 12-foot paved lanes with 4-foot wide shoulders.	Mid-Construction & End of Construction
	Franklin Boulevard	.22 miles north of Dierssen Road	.25 miles south of Dierssen Road	32-feet wide: Two 12-foot paved lanes with 4-foot shoulders	Widen 0.48 miles paved road	Widen to 48 feet: four 12-foot paved through/turn 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
	Twin Cities Road	0.83 miles west of Franklin Boulevard	0.17 miles east of Franklin Boulevard	22-feet wide: Two 10-foot paved lanes with 1-foot shoulders	Widen 1-mile paved road	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders and a 44-foot wide portion with three 12-foot paved lanes (including left-turn merge lane) with 4-foot wide shoulders.	Mid-Construction & End of Construction
Access Road to New Hope Tract Tunnel Maintenance Shaft	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	West Pelletier Road	West of Interstate 5	Canal Ranch Tract Tunnel Shaft	20-foot wide: two 10-foot lanes with no shoulders.	No changes, asphalt overlay only	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.	No changes, asphalt overlay only	New pavement and striping	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road to Terminous Tract Tunnel Reception Shaft	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. State Route 12 westbound and eastbound are separated by a K-rail.	New paved acceleration and deacceleration lanes located on the westbound side of State Route 12.	New paved acceleration and deacceleration lanes	Not Applicable
Access Road to King Island Tunnel Maintenance Shaft	West Eight Mile Road	Regatta Lane	King Island Tunnel Shaft	24-foot wide: two 10-foot lanes with no shoulders.	No changes, asphalt overlay only	No change	Pre-Construction
Access Road Lower Roberts Island Tunnel Double Launch Shaft	Rough and Ready Access Road	West Fyffe Street	Lower Roberts Western Yard Track New Access Road	Gravel Road	Construct 1.12 miles paved road.	24-foot wide: two 12-foot paved lanes with no shoulders.	Mid-Construction & End of Construction
	Burns Cut New Access Road	Lower Roberts Western Yard Track New Access Road	West House Road	Not Applicable	New 2.0 miles paved road New Bridge over Burns Cut: 69 feet wide by 268 feet long: two 12-foot lanes with 4-foot shoulders and room for rail spur.	24-foot wide: two 12-foot paved lanes with no shoulders. Construction Easement: 75 feet wide	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road Lower Roberts Island Tunnel Double Launch Shaft	West House Road	Burns Cut New Access Road	Lower Roberts New Access Road	16-foot wide: two 8-foot lanes with no shoulders.	Widen 1.18 miles paved road	24-foot wide: two 12-foot paved lanes with no shoulders.	Mid-Construction & End of Construction
	Lower Roberts New Access Road	West House Road	0.44 miles west of North Holt Road	Not Applicable	New 1.28 miles paved road New Bridge over Black Slough: New bridge: 32 feet wide by 70 feet long: two 12-foot lanes with 4-foot shoulders.	24-foot wide: two 12-foot paved lanes with no shoulders.	Mid-Construction & End of Construction
	Port of Stockton Expressway	State Route 4	West Fyffe Street	Not Applicable	No changes, asphalt overlay only	No change	Mid-Construction & End of Construction
	West Fyffe Street	Port of Stockton Expressway	Rough and Ready Access Road	Not Applicable	No changes, asphalt overlay only	No change	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road Upper Jones Tract Tunnel Maintenance Shaft	Bacon Island Road	State Route 4	Upper Jones Tract New Access Road	20-foot wide: two 10-foot lanes with no shoulders.	No changes, asphalt overlay only	No change	Mid-Construction
	Upper Jones Tract New Access Road	Bacon Island Road	Upper Jones Tract Tunnel Shaft New Access Road	Not Applicable	Driveway improvements	Driveway improvements	Not Applicable
Access Road Union Island Tunnel Maintenance Shaft	Clifton Court Road	S. Tracy Boulevard	Bonetti Road	20-foot wide: two 10-foot lanes with no shoulders.	No changes, asphalt overlay only	No change	Before Construction Mid-Construction & End of Construction
	Bonetti Road	Clifton Court Road	Union Island Tunnel Maintenance Shaft	20-foot wide: two 10-foot lanes with no shoulders.	No changes, asphalt overlay only	No change	Before Construction Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex North Access)	Lindemann Road Interchange at Byron Highway	Not Applicable	Not Applicable	Lindemann Road ½ mile new road Byron Highway – 1 mile on new alignment SB on and off ramps .55 miles new ramps NB on and off ramps .58 miles new ramps	New interchange with Byron Highway realignment and widening, extension of Lindemann Road New Bridge over Railroad: New bridge: 40 feet wide by 130 feet long: two 12-foot lanes with 8-foot shoulders. New Bridge over realigned Byron Highway and Future Byron Highway Widening: New bridge: 40 feet wide by 280 feet long: two 12-foot lanes with 8-foot shoulders.	Lindemann Road – 32-feet wide: two 12-foot paved lanes with 4-foot shoulders Byron Highway 66-feet wide: four 12-foot paved lanes with 8-foot shoulders Interchange Ramps 24-feet wide: one 12-foot lane with 4-foot inside and 8-foot outside shoulders.	End of Construction
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex North Access)	Byron Highway	Lindemann Road Interchange at Byron Highway	Great Valley Parkway	Paved Road	Widen 0.5 miles	32-feet wide: two 12-foot paved lanes with 4-foot wide shoulders.	End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	Byron Highway Frontage Road	Lindemann Road Interchange	Mountain House Road	Not Applicable	1.2 miles New Road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders	End of Construction
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex North Access)	Surge Basin Shaft Access Road	Byron Highway Frontage Road	Mountain House Road	Not Applicable	2.1 miles New Road	36-feet wide: two 12-foot paved lanes with 4-foot and 8-foot shoulders	End of Construction
	Mountain House Road	Byron Highway	Connector Road	26 – feet wide: two 11-foot lanes with 2-foot paved shoulders	Widen 1.34 miles of paved Road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders	Mid-Construction & End of Construction
	New temporary access road to first responders' site	Access road from Mountain House Road	Temporary first responders' site	Not Applicable	0.1 miles New Road	24-feet wide: two 12-foot paved lanes with 4-foot shoulders	Not Applicable
	Kelso Access Road	0.20 miles south of Kelso Road	Kelso Road	Not Applicable	0.20 miles New Road	24-feet wide: two 12-foot paved lanes with 4-foot shoulders	Not Applicable

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex South Access)	W. Grant Line Road	0.14 miles west of Mountain House Road	Mountain House Road	26 – feet wide: two 11-foot lanes with 2-foot paved shoulders	Widen for merge lane	0.14 miles widening for merge lane	Mid-Construction & End of Construction
	New Mountain House Road and W. Grant Line Road	W. Grant Line Road	Existing Mountain House Road	Not Applicable	0.6 miles New Road including a new roundabout at W. Grant Line Road New Bridge over Swale: New bridge: 40 feet wide x 150 feet long: two 12-foot lanes with 4-foot shoulders.	32-feet wide: two 12-foot paved lanes with 4-foot shoulders; widen at roundabout	Mid-Construction & End of Construction
	Mountain House Road	New Mountain House Road	0.18 miles north of Surge Basin Shaft Access Road	26 – feet wide: two 11-foot lanes with 2-foot paved shoulders	Widen 2.20 miles of paved road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders	Mid-Construction & End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access Road Pipeline Construction Staging Area (Part of Bethany Complex Kelso Road Access)	Kelso Road	0.14 mile east of Mountain House Road	New Access Road Pipeline Construction Staging Area	22-feet wide; two 11-foot lanes with no shoulder	Widen 1.23 miles of paved road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders Turn Pockets	End of Construction
Access Road Pipeline Construction (Part of Bethany Complex South Access)	Connector Road	Mountain House Road	Surge Basin Shaft Access Road	Not Applicable	0.27 miles new road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders Turn Pockets	End of Construction
	Bethany Reservoir Access Road (CA Aqueduct Bikeway)	Mountain House Road	Bethany Reservoir Discharge Structure	Paved Road	Widen 0.6 miles of paved road 1.2 miles new road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders	End of Construction

Table A16. 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	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 Lower Roberts Island Tunnel Double 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
Lindemann Interchange Access Road to Bethany Complex	New Bridge across Re-aligned Byron Highway	Re-aligned Bryon Highway	New 280 -foot long and 40-foot wide bridge over Re-aligned Byron Highway (two 12-foot lanes with 8-foot wide shoulders)	36 Driven Piles 40-feet deep	Install 6 piles/day
Lindemann Interchange Access Road to Bethany Complex	New Bridge across UPRR Track	UPRR Track	New 130-foot long and 40-foot wide bridge over UPRR tracks (two 12-foot lanes with 8-foot wide shoulders)	24 Driven Piles 40’ deep	Install 6 piles/day

Purpose of Access	Bridge	Crossing	Modification	Piles/Piers	Installation Notes
Mountain House Road Bypass	New Bridge Over Swale	Swale	New bridge over channel: New bridge: 40 feet wide x 150 feet long: two 12-foot lanes with 4-foot shoulders.	30 permanent piles for bridge 10 CIDH abutment piles – 16” diameter 30 feet deep 20 CIDH bent piles – 16” diameter, 30’ deep	Install 5 piles/day

1.1.4 Lambert Road Concrete Batch Plant

Table A17. Quantifications of Construction Conditions and Constructed Facilities Summary for Lambert Road Concrete Batch Plant

Items	Quantities
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average). During placement of concrete for tremie slab – construction would be continuous until concrete pour is completed, as noted on the previous tables for individual features.
Ground Improvement	No ground improvement would be required for construction of the batch plant
Batch Plants (2)	Two immediately adjacent plants on same site, each approximately 500-feet wide by 500-feet long by 50-75 feet in height with bulk cement storage silos; portable cement silo; batch trailer; reclaimed water system; an admix area that would include a pump house, admixture storage tanks, and secondary containment barriers; an aggregate storage area consisting of common aggregate stockpiles; 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 dust collectors for the batcher, silo, and truck mixer 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.
Parking Spaces during Construction	36 spaces: 10-foot by 20-foot parking spaces and parking spaces for the concrete trucks
On-site Access Road during Construction	On-site paved access driveway with truck tire washes, track-out plates, and/or gravel aprons would be located at the entrance and exit. Water systems would be installed for the dust control facilities.

Items	Quantities
Fencing and Security during Construction Phase[a]	Approximately 3,600 feet of at least 8-foot-tall chain link security fence around the work site. 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 site access management and site surveillance during operational hours. 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).
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.
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	Portable restrooms would be placed on-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 for on-site reuse and subsequent discharge, if appropriate.

Notes:

[a] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

Attachment 2
Proposed Interconnection Facilities – Contra Costa Water District

Attachment 2. Proposed Interconnection Facilities – Contra Costa Water District

2.1 Introduction

The purpose of this document is to present a narrative summary and description of the proposed Interconnection Facilities for the Contra Costa Water District (CCWD). The document outlines the basis of schematic design and lists some of the assumptions used for the conceptual development of the Interconnection Facilities along with schematic design sketches.

2.1.1 Background

DWR and CCWD previously entered into a settlement agreement on March 24, 2016, where, unique to CCWD and DWR, the settlement agreement addressed disagreements related to CCWD's potential adverse water quality and water supply effects from the Bay Delta Conservation Plan/ California WaterFix Project. While the California WaterFix Project approvals were withdrawn in 2019, there remained some question as to the applicability of the 2016 agreement on future project proposals, including the DCP. As the EIR was being prepared, DWR requested that the DCA conduct a preliminary analysis of a potential new interconnection facility as part of the Bethany Reservoir Alignment. This interconnection would allow water to be conveyed from the proposed Union Island tunnel maintenance shaft through a pump station, a raw water conveyance pipeline, and Interconnection valve into the existing CCWD existing Middle River Pipeline (also known as the Victoria Island Pipeline). The proposed facilities would divert and convey up to 150 cfs of water managed by CCWD under existing water rights, Central Valley Project contracts, or water transfer or sales agreements. The raw water to be supplied to CCWD through this interconnection would be diverted from the Sacramento River at the DCP intakes with fish screens in the north Delta and can, therefore, be combined with CCWD water diverted at the existing Middle River Intake that includes fish screens.

For the basis of schematic design described in this summary, the proposed pump station and connecting pipelines were sized to deliver three maximum firm design flow capacity options, including 150, 100 and 50 cfs. The maximum firm design flow capacity associated with each option would be established with all pumps in operation (i.e., no standby pumps would be included).

The Interconnection Facilities would consist of an Interconnection Pump Station with water intake from the Union Island tunnel maintenance shaft on the main DCP tunnel, and a new 1.6-mile conveyance pipeline that would extend from the pump station and connect to the existing CCWD Victoria Island Pipeline just downstream of the CCWD's existing Middle River Intake and Pumping Plant. An isolation valve would be provided on the new conveyance pipeline at the connection to the existing Victoria Island Pipeline. Pumped flow from the new Interconnection Pump Station would convey raw water from the DCP's proposed Union Island shaft to CCWD's existing Transfer Pumping Station through the new conveyance pipeline and subsequently though CCWD's existing Victoria Island and Old River Pipelines. During periods when CCWD's existing Middle River and Old River Pumping Plants are in simultaneous operation with the proposed Interconnection Pump Station, a maximum combined pumped flow of up to 250 cfs could be conveyed through the Victoria Island Pipeline and a maximum combined flow of up to 320 cfs could be conveyed through the Old River Pipeline. The proposed Interconnection Pump

Station and conveyance pipeline route along with existing CCWD infrastructure and the proposed DCP infrastructure are shown in Figure A-2: 1.

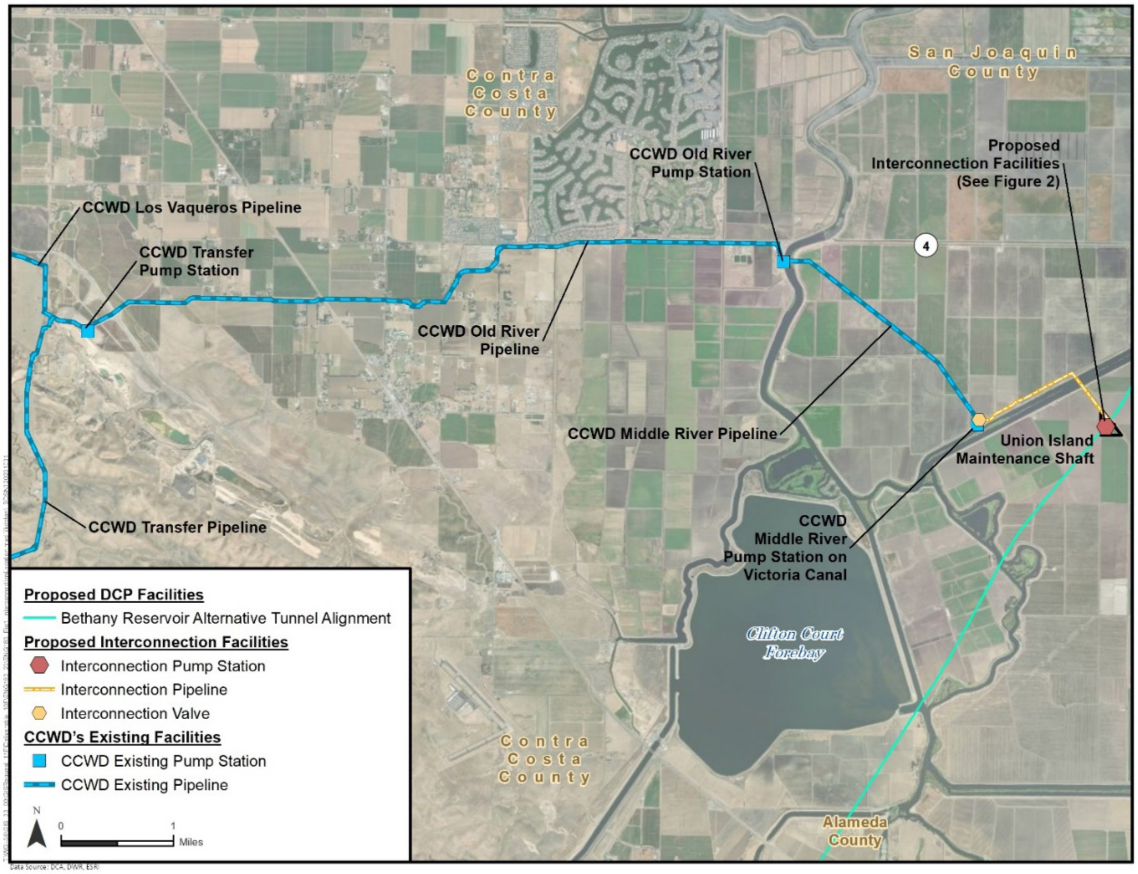


Figure A-2: 1. Location of Interconnection Facilities relative to existing CCWD and DCP Facilities

Figure A-2: 2 shows the details of the Interconnection Facilities that include the Interconnection Pump Station, Interconnection Pipeline, and Interconnection Valve. While not shown in Figure 2, it is assumed that the Interconnection pipeline would have a permanent easement of 70 feet with an additional 30 feet of temporary construction easement for a total 100 foot wide construction limits along the length of the pipeline. The crossing of the Victoria Canal would be trenchless. A map depicting the footprint disturbance areas is provided in Exhibit A-2: A.

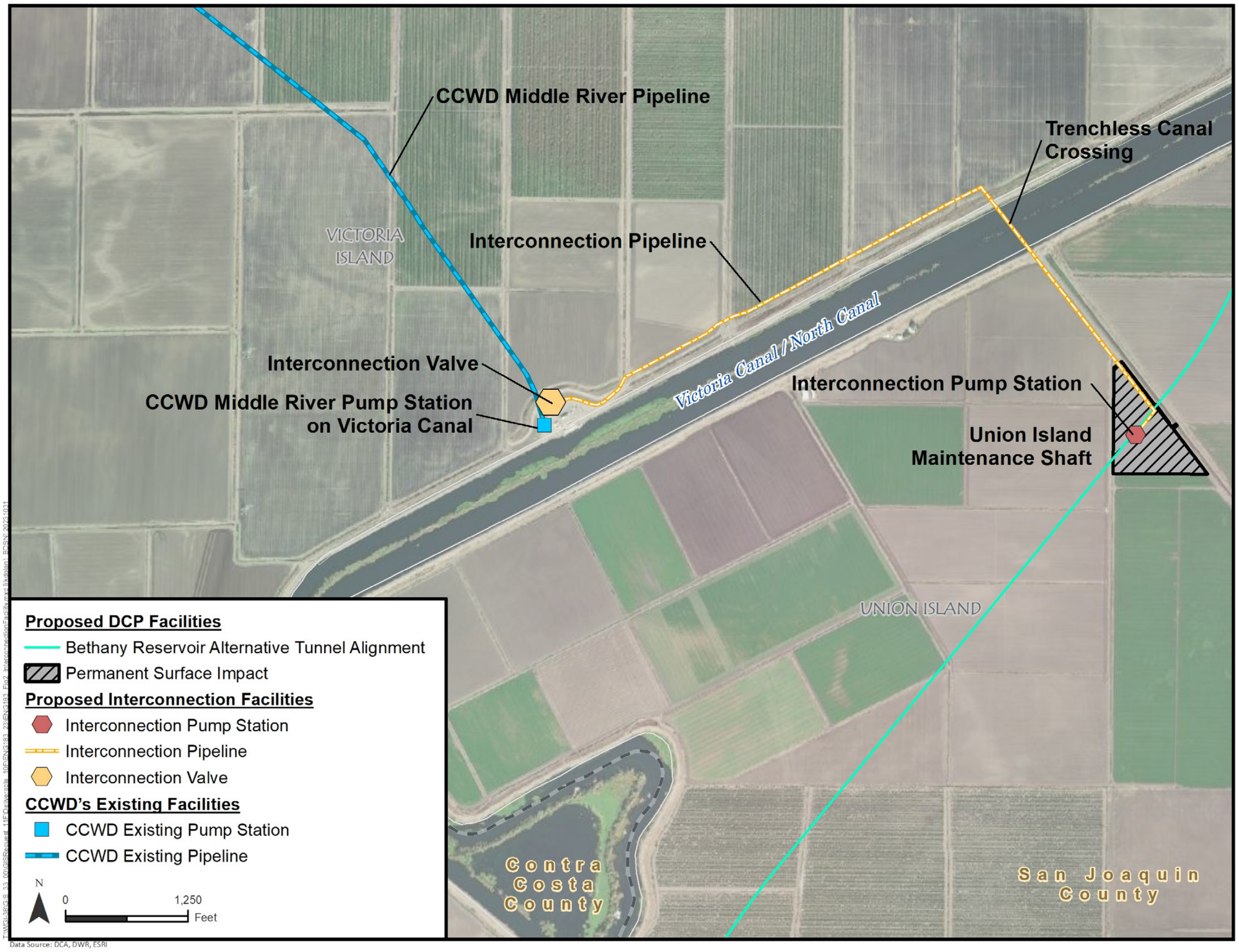


Figure A-2: 2. Interconnection Facilities including Interconnection Pump Station, Interconnection Pipeline, and Interconnection Valve

2.1.1.1 Basis for Schematic Design

The schematic design for the proposed Interconnection Pump Station would be based on utilizing submersible vertical turbine pumps, suspended within casings installed within the DCP's proposed Union Island Maintenance Shaft. Identically sized pumps (all duty with no standby) operating in parallel would be used. Each pump would have a rated capacity of 25 cfs per pump at the maximum total dynamic head condition. Each pump would be connected to a variable speed drive (VFD) to facilitate effective operation for the design flow and system head conditions and the wide variation of water level within the DCP tunnel shaft system. Each pump would discharge through a separate vertical discharge pipe and would be connected to its own dedicated flowmeter, pump control valve and discharge isolation valve. Each parallel pump discharge pipe would be 24-inch diameter and connected to a proposed buried pipeline that would then be interconnected to CCWD's existing Transfer Pumping Station system via connection to the Victoria Island Pipeline and Old River Pipeline as shown in Figure A-2: 1. A hydro-pneumatic surge tank system would be connected to the proposed buried pipeline near the discharge header of the pump station to protect against damage from hydraulic transient-surge conditions. Isolation butterfly valves within buried vaults would be included at the point of interconnection to CCWD's existing Victoria Island Pipeline and at the buried conveyance pipeline at the proposed pump station site.

Maximum pump discharge pressures were estimated assuming the maximum firm design flow capacity for each design flow option (150, 100 and 50 cfs) would be conveyed through the Interconnection Pipeline and existing conveyance system using a maximum hydraulic gradeline elevation (HGL) boundary condition of 226.0 feet, which was assumed at CCWD's existing Transfer Pumping Station. The hydraulic analysis assumed a Hazen-Williams coefficient of friction "C" value of 118 and minor loss coefficients used for the pipeline headloss calculations which are consistent with friction values used in existing calculations conducted by CCWD for the existing CCWD pipelines. Preliminary pipeline headloss analyses included additional conveyance flows in the existing CCWD pipelines that would be pumped at the existing CCWD pumping facilities when additional flow could be combined with flows pumped from the proposed interconnecting pump station. Maximum combined flow capacities used to determine the maximum pipeline headloss conditions were limited to the maximum design flow capacity established by CCWD for their existing pipelines. Maximum design flow conditions assumed a combined flow of up to 250 cfs through the Victoria Island Pipeline and a combined flow of up to 320 cfs through the Old River Pipeline.

The following sections describe the schematic-level configuration of the Interconnection Facilities including the pump station, pipeline, and Interconnection Valve for each design flow option.

2.1.2 Interconnection Facilities

Interconnection Facility configurations were developed for each of the design flow options (150, 100 and 50 cfs). The Interconnection Facilities include three primary components that include the Interconnection Pump Station, the Interconnection Pipeline, and the Interconnection Valve that provides isolation for connection to the existing Victoria Island Pipeline.

2.1.2.1 Interconnection Pump Station

The Interconnection Pump Station would be at the Union Island tunnel maintenance shaft, and as such, it is assumed that project activities related to construction of the maintenance shaft would need to be complete prior to starting work on the Interconnection Pump Station. Tunnel boring activities within Reach 4 would also be completed prior to installation of pump station equipment because the submersible pumps would be suspended in the shaft along with facilities located on the shaft pad. Therefore, there would be limited excavation and disturbance related to the Interconnection Pump Station at the Union Island shaft site. The pump station would also include a new electrical building adjacent to the pump station. Haul routes for delivering construction related supplies would primarily utilize Clifton Court Road and Bonetti Road, which are the same routes expected for construction of the Union Island tunnel maintenance shaft site.

The schematic design for the Interconnection Pump Station would be based on utilizing submersible vertical turbine pumps, suspended within casings installed inside the proposed Union Island tunnel maintenance shaft. Each pump would be connected to a VFD to facilitate effective operation for the design flow range and the predicted water level variation within the DCP tunnel system. Each pump would discharge through a separate vertical 24-inch diameter discharge pipe and be connected to its own dedicated flowmeter, pump control valve and discharge isolation valve that would be located within a buried vault adjacent to the proposed Union Island Maintenance shaft. Each 24-inch diameter parallel pump discharge pipe would be connected to a proposed buried Interconnection Pipeline that would be routed to and connected to the existing CCWD Victoria Island Pipeline immediately downstream of the CCWD's existing Middle River Intake and Pumping Plant as previously shown in Figure A-2: 2. Table A-2: 1 summarizes the number of submersible pumps, rated flow at the maximum total dynamic head condition and rated motor horsepower required per pump for each design flow option.

Table A-2: 1. Number of Duty Pumps and Corresponding Rated Conditions

Maximum Project Design Flow Capacity (cfs)	Number of Duty Pumps Required	Total Dynamic Head Condition (feet)	Rated Motor Horsepower per Pump (HP)
50	2	453	1,750
100	4	455	1,750
150	6	451	1,750

A hydro-pneumatic surge tank system, located at the shaft site, would be connected to the proposed Interconnection Pipeline to protect the pipeline from damage due to hydraulic transient-surge conditions created by operation of the Interconnection Pump Station. Isolation butterfly valves within buried vaults would be included at the pump discharge valve and meter vault within the proposed Union Island Shaft site and at the Interconnection Pipeline's point of connection to the existing CCWD Victoria Island Pipeline.

The proposed pump station would include a separate electrical building which would be located adjacent to the proposed Union Island shaft and would house the electrical switchgear, VFDs, controls, and an air compressor system for the hydro-pneumatic surge tank(s). Electrical transformers and related equipment yard for permanent power supply would be located next to the electrical building. It is assumed that the power supply would be a new connection to the existing WAPA overhead line running adjacent to the existing CCWD Middle River Intake and Pumping Plant.

Schematic drawings for the Interconnection Pump Station are provided in Exhibit B. The drawings illustrate the overall plan view of the interconnecting pump station facilities located on the raised pad at the Union Island shaft, plan view of the flowmeter and isolation valve vault, and typical section view of the pump and connecting discharge piping for each design flow option.

The construction features of the Interconnection Pump Station are summarized as follows:

Pumping Facility:

- Includes new submersible vertical turbine pumps (all duty pumps with no standby) installed within the proposed Union Island shaft. Pumps would be of identical size and construction each with a rated capacity of 25 cfs. Number of pumps required for each design flow capacity option would be as indicated in Table A-2: 1. Based on preliminary evaluation of system hydraulics, each pump would be equipped with submersible motors. Motor rated horsepower for each design flow option would be as shown in Table A-2: 1. All pumps would be connected to VFDs located within the proposed electrical building (refer to schematic drawings). Each pump would be installed within a suspended well casing pipe (about 36-inch diameter, installed within the shaft). Well casings would be supported by the 90-degree discharge head assemblies mounted on top of the Union Island Shaft as shown on the schematic drawings. Pumps would draw water from the wet well at the invert of its well casing pipe at the approximate elevation of -75.00 feet. The well casings would also serve as shrouds for cooling the submersible pump motors when in operation. A structural steel support system would be required to stabilize the well casings within the shaft. Pumps would be arranged as shown in the schematic drawings. Each pump discharge head assembly would include a combination air and vacuum relief valve for the annular space between the well casing and the column discharge pipe and another combination air release and vacuum valve (designed for use with vertical turbine pumps) for each 24-inch discharge pipe (typical each pump). Discharge heads would be mounted on a foundation on the shaft cover. The foundation would include a sole plate and embedded anchor bolts. Discharge heads would be removable for removing/installing each well pump.

Pump Discharge Valves and Meters:

- A pump discharge valve and meter vault would be located adjacent to the Union Island shaft as shown on the schematic drawings. The vault would be buried with an exposed concrete cover. The vault cover would include removable panels to access valves, piping and meters below. The vault would include a ventilation system, lighting and receptacles for operations and maintenance. Access to the vault interior would be through hatches in the vault cover, ladders to a grated platform, and ladders from the platform to the finished floor between each parallel piping train (as shown in the schematic drawings).
- Flowmeters and valves within the vault for each pump discharge assembly:
  - Silent check valves or Cla-Valve style globe type pressure sustaining pump control valves, 24-inch in size, diaphragm actuated pressure sustaining type, with solenoid operated pilot control system, would be selected during future design phases of the proposed project.
  - 24-inch magnetic flowmeters. Meters would be rated for the required pressure and flow rates.
  - Rubber seated isolation butterfly valves with electric motor actuator would be located downstream of the meter and pump check valves.
  - Combination air-release and vacuum valves (as needed and described above).
  - Pipe support systems would be steel saddle type supports with concrete piers located as shown on the schematic drawings.
  - Dismantling joints would be provided in each piping assembly to facilitate installation and removal of components.

Hydro-pneumatic Surge Tank and Valves:

- Above ground hydro-pneumatic surge tank with ring girder supports (size and configuration as shown on schematic drawings). Size shown is approximate and would be confirmed during the design phase.
- Surge Tank isolation butterfly valve with manual actuator located above ground for isolating the hydro-pneumatic tank from the Interconnection Pipeline.
  - A skid-mounted duplex air compressor (25 HP each compressor) with air receiver tank and control panel for hydro-pneumatic surge tank operation would be located inside the electrical building.

Electrical Building:

- A new electrical building would be located adjacent to the Union Island shaft as shown on the schematic drawings. The electrical building was estimated to be block wall construction with mansard type roof. The building would have double door access with removable transom on the east side of the building for moving the electrical equipment into and out of the building. An additional door would be included on the west side of the building to access the HVAC equipment yard. The interior space of the electrical building would be cooled by direct expansion (DX) air handlers located along the exterior of the building. The number of DX air handler units (duty plus standby) for each pump station design flow option is shown on the schematic drawings. A block screening wall would be included around the HVAC mechanical equipment yard with exterior door access for maintenance.

Electrical Features:

- Medium voltage (4160 V, low side) power supply transformers included for each of the pump station's design flow options:
  - two, 10 MVA transformers for the 150 cfs design flow option
  - two, 7.5 MVA transformers for the 100 cfs design flow option
  - two, 3.75 MVA transformers for the 50 cfs design flow option
  - two, low voltage transformers (750 kVA) would be included for all design flow options.
- A new electrical power drop from the existing WAPA transmission line feeding CCWD's Middle River Intake and Pumping Plant would be required for permanent power supply for the proposed Interconnection Pump Station.
- Electrical and mechanical equipment would include:
  - 1,750 horsepower (HP) VFDs:
    - six, VFDs for the 150 cfs design flow option
    - four, VFDs for the 100 cfs design flow option
    - two, VFDs for the 50 cfs design flow option
  - Skid mounted duplex air compressor (25 HP each compressor) with air receiver tank and control panel for hydro-pneumatic surge tank operation.
  - 4160 V switchgear.
  - 480 V motor control center (MCC) and 220/110V low voltage power panel(s).
  - PLC cabinet with control station.
  - Communications cabinet.

Communications:

- A communications cabinet would be located within the Electrical Building. Additional direction would be required during detailed design to determine how CCWD would like to accomplish communications with their operations.

2.1.2.2 Interconnection Pipeline

The Interconnection Pipeline route would leave the Union Island Tunnel Maintenance Shaft site and proceed generally north on Bonetti Road and cross under the Victoria Canal. After the undercrossing, the pipeline would turn in a generally west direction and proceed along farm roads outside the toe of the levee road to the connection point with the Victoria Island Pipeline at a location just north of the Middle River Intake and Pumping Plant. The connection to the Victoria Island Pipeline would be on the discharge side (immediately downstream) of the Middle River Pumping Plant and an interconnection isolation valve would be provided on the Interconnection Pipeline prior to connecting to the existing pipeline.

A total of 7,500 feet of pipeline construction to the north and south of Victoria Canal would be completed through open cut and backfill methods. It is assumed the pipeline would be buried at least 5 feet below surface elevation.

Approximately 900 linear feet of pipeline beneath Victoria Canal would be constructed using trenchless microtunneling techniques (similar to pipejack excavation) and would be accomplished with a microtunneling boring machine (MTBM). Microtunneling activities would be completed by lowering the MTBM into a shaft or excavation at the launch site to the desired depth below ground surface, prior to tunneling beneath Victoria Canal. The MTBM may require use of small volumes of bentonite slurry to lubricate the MTBM. There would be a launch and retrieval shaft (or excavation) site located on either side of Victoria Canal. These sites would be approximately 35 feet by 50 feet and would occur within the proposed 100 foot construction limit. The top of the pipeline under Victoria Canal would be at least 12 feet below the bottom of Victoria Canal and the tunnel launch and retrieval shafts would be located approximately 40 feet below ground surface outside of the canal banks.

Typical construction means and methods would ensure stability of the tunnel and Victoria Canal during tunneling. These construction means and methods include regularly monitoring pressure in the tunnel, monitoring the Victoria Canal during tunneling. If bentonite slurry is used, the viscosity and pressure would be controlled to avoid breakout, Also, slurry controls would trigger alarms so there is a quick shut off provision in the unlikely event of substantial pressure changes. Microtunneling would take approximately 4 weeks and require nighttime construction activities because the tunneling would be continuous since it would be difficult to restart the boring machine after being shut down due to the geological conditions. To maintain stability of the tunnel at the face of the microtunneling boring machine and to avoid “freezing” of the microtunneling boring machine, the tunneling activities must occur for 24 hours per day and 7 days a week for approximately two or three weeks. Major activities would occur between sunrise to sunset. Between sunset to sunrise, the tunnel boring machine would continue to be operated and pipeline segments would be mounted within the tunneling shaft on Union Island and removed soil material would be placed near the portal for subsequent transport to the Union Island tunnel shaft during the daytime hours. Noise and light shields would be placed around the activities at the shaft site. Downcast lights would be used at the shaft site during construction. In addition, a dark colored tent (e.g., dark blue or black), or other barrier, would be placed around the shaft to minimize light distribution during nighttime construction.

Excavated materials from microtunnel construction, launch and retrieval shafts, and remaining soils from cut and backfill methods would be reused onsite or taken to the Union Island tunnel shaft to be incorporated into the shaft pad.

Dewatering may be required during construction of the pipeline. This water would be collected, treated and reused onsite, using the same facilities as those for the Union Island Shaft site or discharged in Union Island or Victoria Island drains. Volumes of dewatering water have not been determined at this time. Geotechnical investigations would be completed prior to construction to determine the dewatering requirements and estimated volumes.

Access for the construction of the pipeline on Union Island and the Victoria Canal undercrossing would utilize Clifton Court Road and Bonetti Road, identical to access to the main tunnel shaft. Access for the pipeline located to the north of Victoria Canal would use Old Highway 4 and State Route 4 and other existing roads, per CCWD agreements with Victoria Island Farms. This includes limited access by trucks with three or more axles to State Route 4 either across the Old River Bridge or Middle River Bridge.

Table A-2: 2 summarizes approximate selected sizes of the Interconnection Pipeline for each project design flow option.

Table A-2: 2. Interconnection Pipeline Nominal Diameters

Maximum Project Design Flow Capacity (cfs)	Conveyance Pipeline Nominal Diameter (in)
150	66
100	54
50	42

The construction features of the Interconnection Pipeline is summarized as follows:

Interconnection Pipeline:

- Interconnection pipeline consisting of new 1.6-mile welded steel pipe and fittings in accordance with AWWA C200, sized as described in Table 2 for each design flow option.
- Welded steel pipe and fittings connecting the above ground hydro-pneumatic surge tank to the new conveyance pipeline at the Interconnection Pump Station site.
- Interconnection pipeline would be isolated at each end with isolation valves located in the pump discharge valve and meter vault and then at the other end with a buried valve vault at the connection to the CCWD Victoria Island Pipeline, referred to as the Interconnection Valve.
- Pipeline appurtenance facilities such as air valves, blow offs, and access manways would be included with the pipeline. The location of these appurtenances would be determined during design based on the profile and special crossing requirements of the pipeline.
- Major feature crossings for Interconnection Pipeline include:
  - Victoria Canal (trenchless crossing assumed)
  - Irrigation and drainage pipelines on the north side of Victoria Canal (assumed that restoration would be provided but special crossing construction would not be required)

2.1.2.3 Interconnection Valve

The Interconnection Valve would be located in a buried vault on the Interconnection Pipeline just prior to connecting to the Victoria Island Pipeline. The valve would be electrically actuated and located in a buried concrete vault with exposed concrete top deck. Access to the vault interior would be through hatches in the vault top deck with ladders to the floor level. The top deck would also include a removable equipment cover such that the valve could be removed for maintenance or replacement.

The construction features of the Interconnection Valve is summarized as follows:

Interconnection Pipeline Isolation Valves:

- Butterfly valve with electric motor actuators located within the buried Interconnection Valve vault, sized to match the Interconnection Pipeline as shown in Table 2 for each design flow option. A dismantling joint would be provided in the vault to allow removal of the valve for maintenance.

- Length, width and depth of the cast in place buried Interconnection valve vault would be approximately 11.5-feet x 15.5-feet x 12.0-feet.

2.1.2.4 Delta Conveyance Project Construction Features

The following facility features would be assumed to be part of the DCP, as described in this CER.

- Land acquisition for Interconnection Pump Station at the Union Island shaft site.
- Off-site DCP environmental mitigation for Interconnection Pump Station
- DCP main tunnel and shaft
- Parking area at the Union Island shaft site.
- Site clearing and grubbing at the Union Island shaft site.
- Site grading for Union Island shaft and all associated perimeter drainage and desilting basin.
- Site restoration not directly related to finish grading of Interconnection Pump Station project components.
- Gravel road and gravel surface at the Union Island shaft site.
- 100’ x 150’ maintenance staging area at the Union Island shaft site.
- Pads for generator, fuel containment, and trailers at the Union Island shaft site.
- Area reserved for maintenance activities and office trailers at the Union Island shaft site.
- 40’ x 40’ concrete pad for mobile crane located on the raised pad next to the Union Island shaft.
- Site fencing and gates at the Union Island shaft site.
- Removal of all temporary facilities associated with the main tunnel and Union Island shaft construction.

2.1.3 Estimated Construction Duration

2.1.3.1 Estimated Construction Duration

An estimated construction duration was developed to better understand how the interrelation of the Interconnection Facilities might align with the overall construction of the DCP. The overall construction duration for the Interconnection Facilities is shown in Figure A-2: 3 and the minimum time required for construction is approximately 18 months for project design capacities ranging from 50 to 150 cfs.

Activity	Duration (Wks)
Site operations	76
Mobilization and site Prep	8
Building and Vault Construction	16
Pipeline construction	25
Mechanical and Electrical installation	31
Launch & reception shafts	9
Pipejack excavation	5
Commissioning and testing	12
Final site work	6
Restoration	6

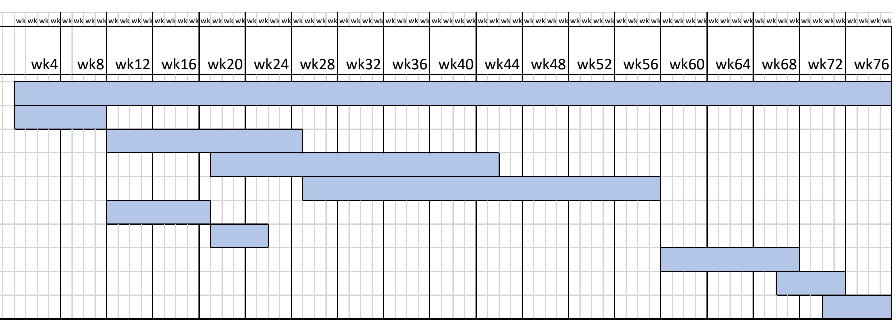


Figure A-2: 3. Estimated Construction Duration

Prior to construction of the interconnection facility, DWR would secure fee title or permanent easements and necessary permits. It is anticipated that in addition to the permanent 70-foot easement for the interconnection pipeline a temporary construction easement of 30 feet would be needed, for a total potential area of temporary of disturbance of 100 feet wide along the pipeline during construction. Once construction is complete, all temporarily disturbed areas would be restored to pre-project conditions.

Since the Interconnection Pump Station would be located on top of the Union Island tunnel maintenance shaft, it is assumed that the construction of this shaft would need to be complete and the TBM, including trailing gear, in Reach 4 would need to have passed through this maintenance shaft prior to starting work on the Interconnection Pump Station. After the maintenance shaft is constructed, the submersible pumps would be installed inside of the maintenance shaft and other facilities would be located on the shaft pad surrounding the shaft. The pumps would need to be installed after the liners were installed in the Union Island shaft. It is expected that only a small amount of work would be required in the main tunnel itself since the submersible pumps would be installed above the crown of the tunnel. Consequently, some coordination with the ongoing use of the tunnel to support tunnel construction would be required. The tunneling contractor may also need to retain limited access to the Union Island tunnel maintenance shaft for emergency access and ventilation provisions. Suitable partitions/barriers would be needed to limit interference between the construction of the Interconnection Pump Station and the Reach 4 tunnel. Work on the Interconnection Pipeline and Interconnection Valve could be completed at any time but construction sequencing and scheduling will likely have to be coordinated between multiple contractors. The overall conclusion of estimating the construction duration for the Interconnection Facilities suggests that it is feasible to assume construction of the Interconnection Facilities could be completed and overlap the end of the Reach 4 tunnel construction and still provide enough time for startup testing and commissioning such that the Interconnection Facilities could be brought online concurrently with the operation of the DCP.

2.1.4 Quantities

Quantities supporting the EIR air quality impact assessment are shown for the for the 150 cfs project design capacity in Tables A-2: 3, A-2: 4, and A-2: 5.

Table A-2: 3. CCWD Interconnection Facility Quantities

Item	Unit	150 cfs Project Design Capacity
Submersible Pump and Assembly	Horsepower	10,500
Pump Control Equipment	Pipe Diameter/Number of Pumps	396
Pump Control Vault	Bank Cubic Yards	999
Electrical Building	Square Feet	2775
Electrical Equipment	Square Feet	2775
Power Supply Distribution	Linear Feet	8448
Power Supply Transformers	Kilovolt-Amps	21500
Electrical Building HVAC Units	Each	3

Item	Unit	150 cfs Project Design Capacity
Pipeline along Roads	Linear Feet	2430
Pipeline along Fields and Tracks	Linear Feet	5122
Tie-in Connection/Vaults	Pipe Diameter/Number of Vaults	132
Tie-in Connection/Valves	Pipe Diameter/Number of Valves	132
Surge Tanks and Air Equipment	Pipe Diameter/Number of Surge Tanks	66
Trenchless Canal Crossing	Linear Feet	896.4

Table A-2: 4. CCWD Interconnection Facility Construction On-Road Equipment for 150 cfs

Phase	Working Days	Start date	End Date	Equipment Category	Equipment/Vehicle	Hours/ day	Total Hours
Mobilization and Site Preparation	40	Week 1	Week 9	Off-Highway Truck	Truck, Flatbed, 4T, Hwy	21.6	866
Building and Vault Construction	80	Week 9	Week 25	Dumpers	CAT 730 30T,23 CY Articulated End Dump	1.9	153
Pipeline Construction	125	Week 18	Week 42	Dumpers	Truck, End Dump, 10-13cy, Hwy	6.5	811
Launch & Reception Shafts	45	Week 9	Week 18	Dumpers	Truck, End Dump, 10-13cy, Hwy	5.0	224
Pipejack Excavation	25	Week 18	Week 23	Off-Highway Truck	Trucking	4.6	115
Final Site Work	30	Week 67	Week 73	Off-Highway Truck	Truck, Flatbed, 4T, Hwy	11.0	330
				Dumpers	Truck & Bottom Dump, 25cy, 30T	9.4	283
					Truck, End Dump, 10-13cy, Hwy	11.0	329
Restoration	30	Week 70	Week 76	Dumpers	Cat 6 mgal w/ CAT 725 Tractor, 320hp	1.0	30

Table A-2: 5. CCWD Interconnection Facility Construction Offroad Equipment for 150 cfs

Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
Mobilization and Site Preparation	40	Week 10	Week 9	Off-Highway Tractor	Farm Tractor, All Wheel Drive, 115HP	21.6	866
				Rubber Tired Loaders	CAT LOADER/HOE 416 E	21.6	866
Building and Vault Construction	80	Week 9	Week 25	Excavator	CAT 329F Excavator, 2.02 CY, 239HP	0.6	51
				Crawler Tractor	CAT D6T LGPDozer w winch	0.6	51
					CAT D3K2 LGP, Dozer	0.1	10
				Grader	CAT 14 M	0.2	13
				Rollers	Compactor, Trench Roller, Vib 32"w	0.9	71
					CAT CS-64, Roller, 13.3 tn, 131HP	0.1	10
				Rubber Tired Loaders	Case 590 SupN Loader/Hoe, 110 hp	0.2	13
					CAT 950 K Wheel Loader	2.0	163
				Off-Highway Truck	Conc Pump, Trlr Mtd, 100 cy/hr, 181hp	1.9	155

Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
				Crane	Grove RT Crane 55T, 247 hp	8.6	690
					Manitowoc MLC165 182T, 275' Boom, 310HP	3.2	255
				Skid Loaders	Bobcat S630 Skid Steer Loader	1.4	109
				Generator	Portable, 100 Kw, Diesel 158hp	1.9	155
					Portable, 20 Kw, Diesel, 36HP	1.3	102
				Air Compressor	Air Compressor 185 cfm	1.6	127
					Air Compressor 900 cfm	1.9	155
					Air Compressor 375 cfm	1.3	102
				Pumps	Water Pump, 4" Diesel, Submersible	0.6	51
				Plate Compactors	Compactor, Plate, 22"w x 35"	0.9	71
				Welder	400A Diesel Welder, Trailer Mounted	3.2	257
				Other Construction Equipment	Pile Vibro Driver/Extractor V20B	1.3	102

Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
					Bidwell Bridge Deck Screed-Finish, 65 HP	1.8	140
Pipeline Construction	125	Week 18	Week 42	Excavator	CAT 329F Excavator, 2.02 CY, 239HP	4.1	511
				Crawler Tractor	CAT D3K2 LGP, Dozer	2.4	300
				Rollers	Compactor, Trench Roller, Vib 32"w	0.6	75
				Rubber Tired Loaders	Case 590 SupN Loader/Hoe, 110 hp	0.6	75
					CAT LOADER/HOE 416 E	6.6	829
					CAT 950 K Wheel Loader	2.4	300
				Crane	Grove RT Crane 55T, 247 hp	44.1	5,518
					Manitowoc MLC165 182T, 275' Boom, 310HP	30.0	3,745
				Generator	Portable, 100 Kw, Diesel 158hp	1.2	150
					Portable, 45 Kw, Diesel 85hp	57.1	7,141
					Light Plant, 4 lite, 1000w, Tower/Mast	44.1	5,512

Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
				Air Compressor	Air Compressor 185 cfm	6.0	745
				Plate Compactors	Compactor, Plate, 22"w x 35"	3.0	375
Mechanical and Electrical Installation	155	Week 25	Week 55	Crawler Tractor	CAT D3K2 LGP, Dozer	2.3	350
				Rubber Tired Loaders	CAT LOADER/HOE 416 E	9.0	1,400
				Crane	Grove RT Crane 55T, 247 hp	10.0	1,548
					Manitowoc MLC165 182T, 275' Boom, 310HP	4.5	690
				Generator	Portable, 45 Kw, Diesel 85hp	7.2	1,119
					Light Plant, 4 lite, 1000w, Tower/Mast	5.5	858
				Air Compressor	Air Compressor 185 cfm	4.5	690
				Forklifts	Fork Lift, 8000LB, RT, 4x4	4.2	650
Launch & Reception Shafts	45	Week 9	Week 18	Rubber Tired Loaders	Case 590 SupN Loader/Hoe, 110 hp	2.5	112
				Off-Highway Truck	Conc Pump, Trk Mtd, 117 cy/hr, 210hp	1.3	58

Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
				Crane	Grove RT Crane 55T, 247 hp	9.3	417
					Manitowoc MLC165 182T, 275' Boom, 310HP	14.3	645
				Skid Loaders	Bobcat S630 Skid Steer Loader	1.2	56
				Generator	Portable, 100 Kw, Diesel 158hp	2.6	117
					Portable, 20 Kw, Diesel, 36HP	6.7	300
				Air Compressor	Air Compressor 185 cfm	2.5	112
					Air Compressor 900 cfm	5.2	233
				Pumps	Water Pump, 4" Diesel, Submersible	0.5	22
				Welder	400A Diesel Welder, Trailer Mounted	9.3	417
				Other Construction Equipment	Pile Vibro Driver/Extractor V20B	6.7	300
Pipejack Excavation	25	Week 18	Week 23	Rubber Tired Loaders	Case 590 SupN Loader/Hoe, 110 hp	0.8	20
					CAT 980 FEL 8 CY	4.6	115
				Crane	Hydraulic Crane 9 Ton	6.0	150

Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
Final Site Work	30	Week 67	Week 73	Generator	Generator Set 500 KW	3.6	91
					150 KW Diesel Generator	5.4	136
				Air Compressor	1600 CFM Compressor Diesel	0.4	10
				Welder	Electric Welder 400 AMP	7.3	182
				Grader	CAT 14 M	3.1	94
				Rollers	CAT CS-64, Roller, 13.3 tn, 131HP	3.1	94
					Asphalt Rolller, 2 Drum 15tnx84", 137hp	1.4	41
					Asphalt Roller, 17.6 Tn Pneumatic,133hp	1.4	41
				Rubber Tired Loaders	Case 590 SupN Loader/Hoe, 110 hp	43.9	1,316
					CAT LOADER/HOE 416 E	30.2	907
					CAT 950 K Wheel Loader	43.9	1,316
					CAT 962 K Wheel Loader	3.1	94
				Skid Loaders	Bobcat S630 Skid Steer Loader	57.7	1,732
				Pumps	Water Pump, 4" Diesel, Submersible	0.6	19
				Plate Compactors	Compactor, Plate, 22"w x 35"	21.9	658
				Paver	Asphalt Paver, 10-19 Ft Wide, Cat 225 HP	1.4	41

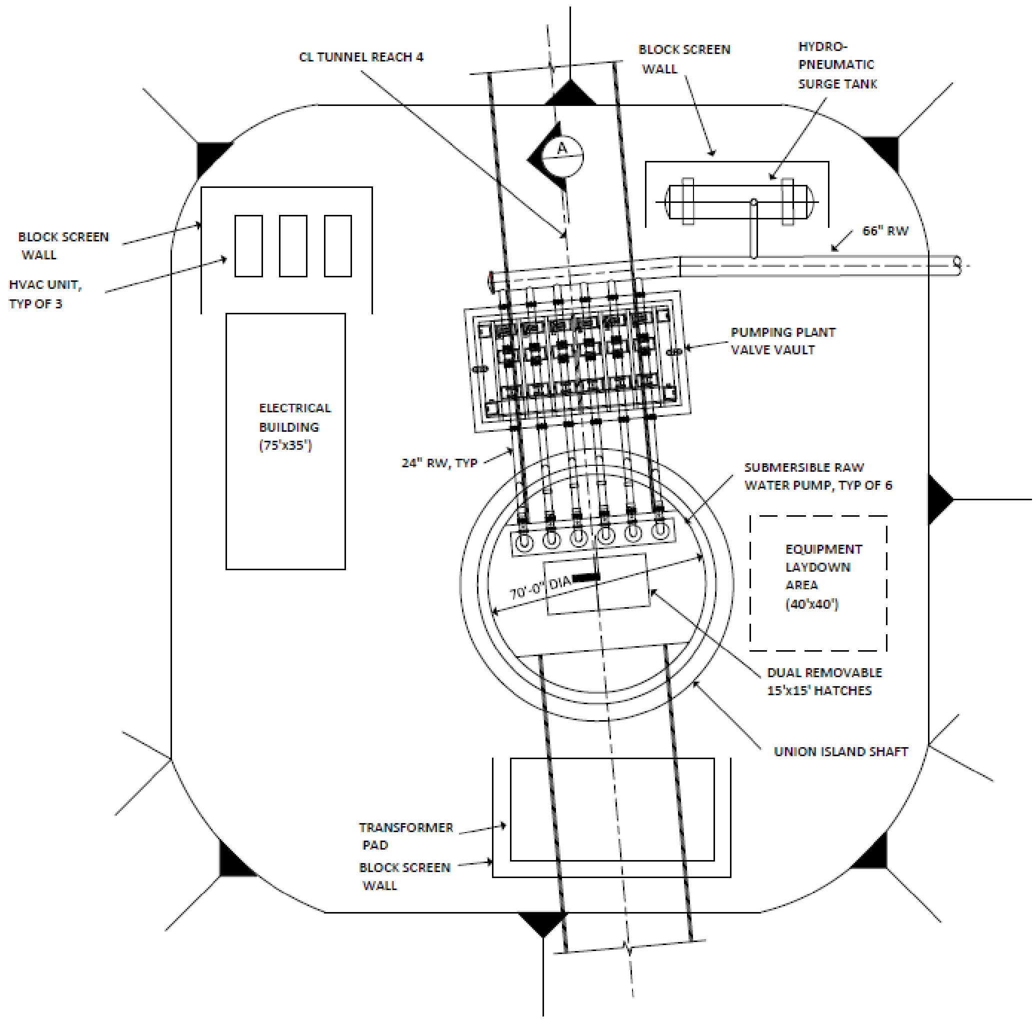
Phase	Working Days	Start Date	End Date	Equipment Category	Equipment/ Vehicle	Hours/ day	Total Hours
Restoration	30	Week 70	Week 76	Off-Highway Tractor	Farm Tractor, All Wheel Drive, 115HP	0.2	7
					Farm Tractor, All Wheel Drive, 285 HP	1.4	43
				Crawler Tractor	CAT D6T LGPDozer w winch	1.2	35
					CAT D9T, Dozer w ripper	1.2	35
				Grader	CAT Grader 12H	0.6	17
				Rubber Tired Loaders	CAT 966 M Wheel Loader	0.3	9

Source: DCA, DWR, CCWD, ESRI Basemap Aerial Imagery

Draft example map for discussion purposes only.
This map is a scaled representation of the GIS data
and only shows major facilities. (November 2023)

Exhibit A: Proposed Interconnection Facilities and
Delta Conveyance Project Facilities

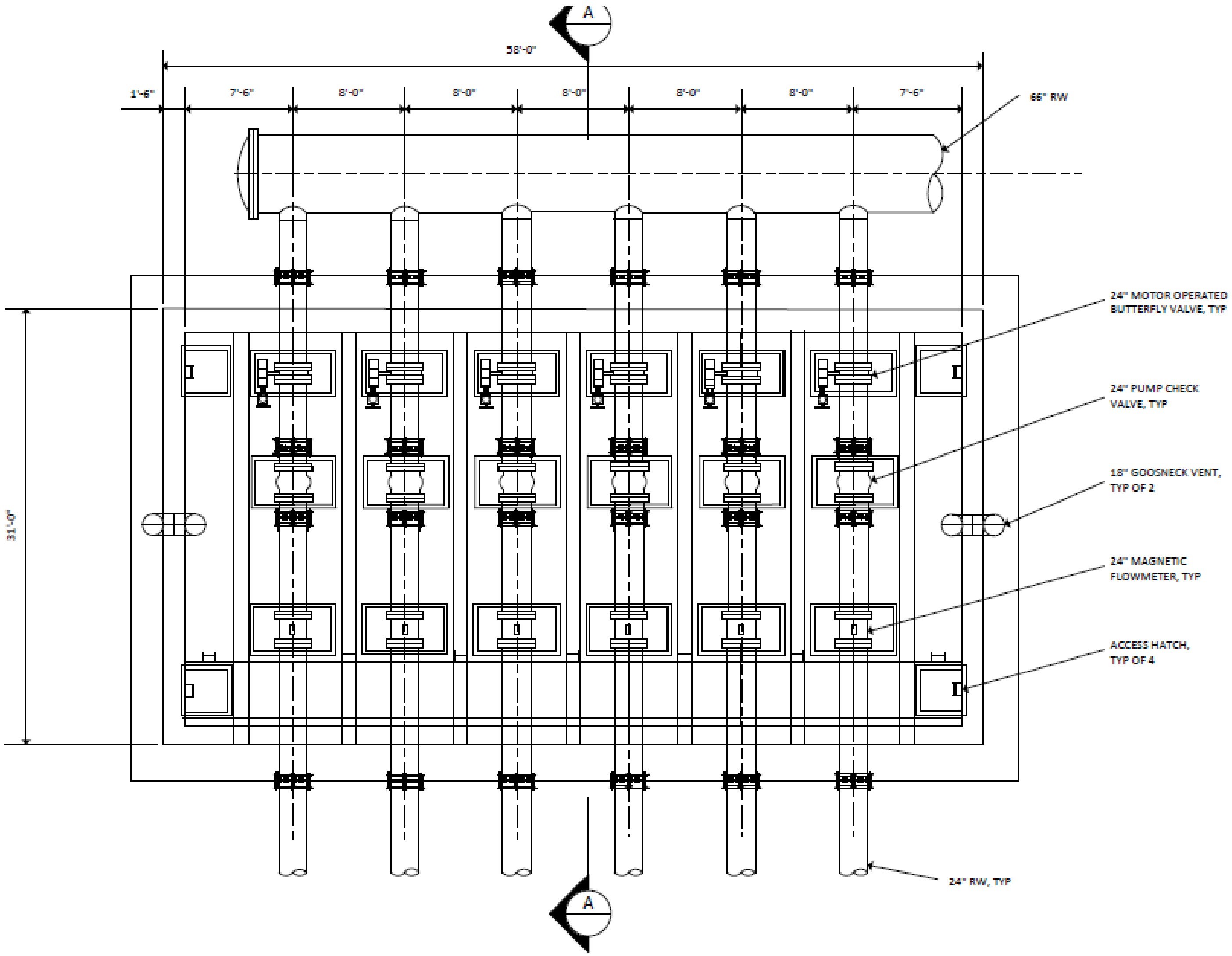
Exhibit A-2: A: Proposed Interconnection Facilities and Delta Conveyance Project Facilities



Alternative U1 – Union Island Shaft Pumping Plant Overall Plan
Design Flow Capacity 150 cfs
Approximate Scale: 1" = 32'-0"

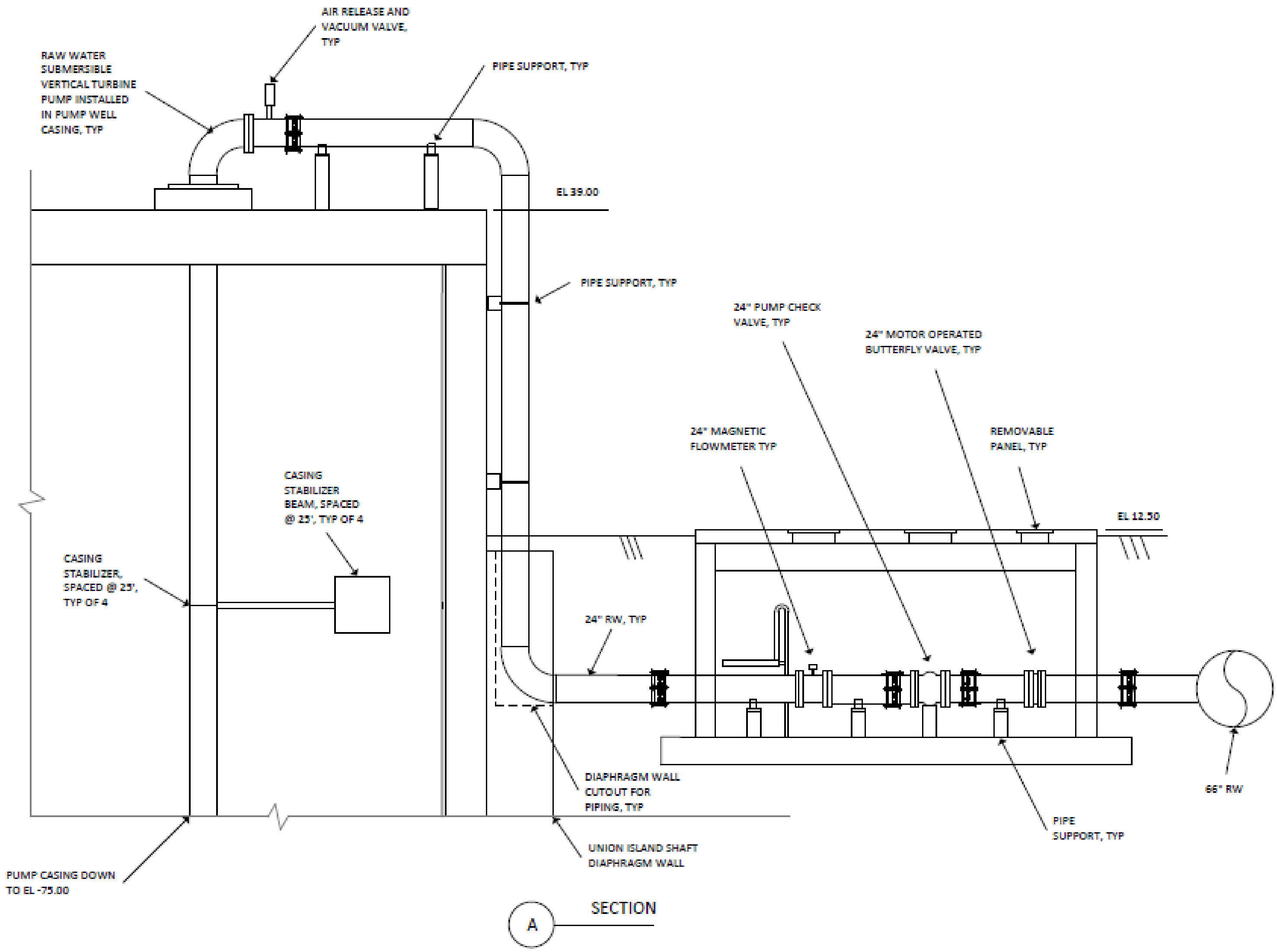
Figure U1-1

Exhibit A-2: B: Union Island Interconnection Pump Station Schematic Drawings



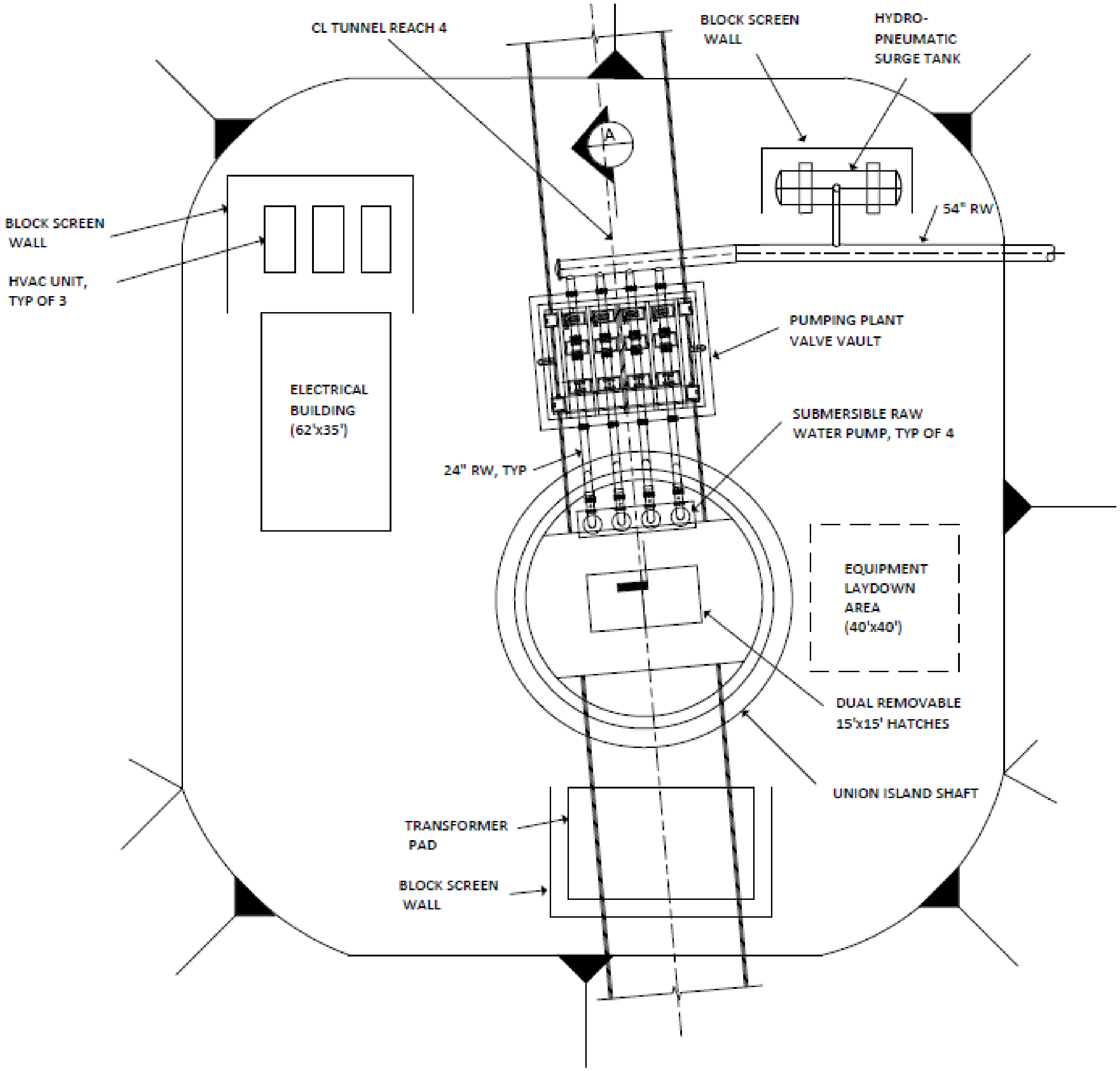
Alternative U1 – Union Island Shaft Pumping Plant Valve Vault Plan
Design Flow Capacity 150 cfs
Approximate Scale: 1" = 32'-0"

Figure U1-2



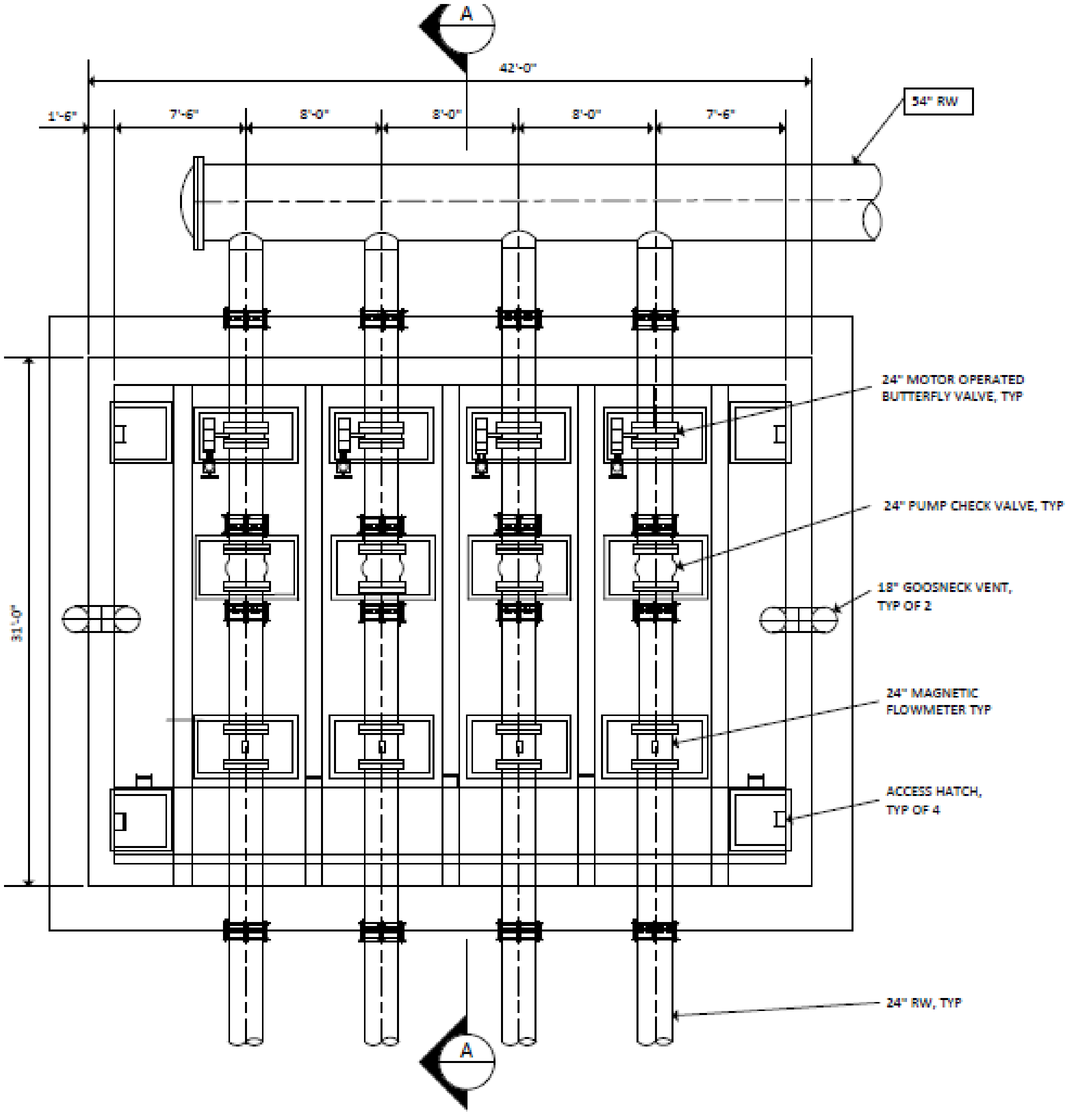
Alternative U1 – Union Island Shaft Pumping Plant Typical Section
Design Flow Capacity 150 cfs
Approximate Scale: 1/8" = 1'-0"

Figure U1-3



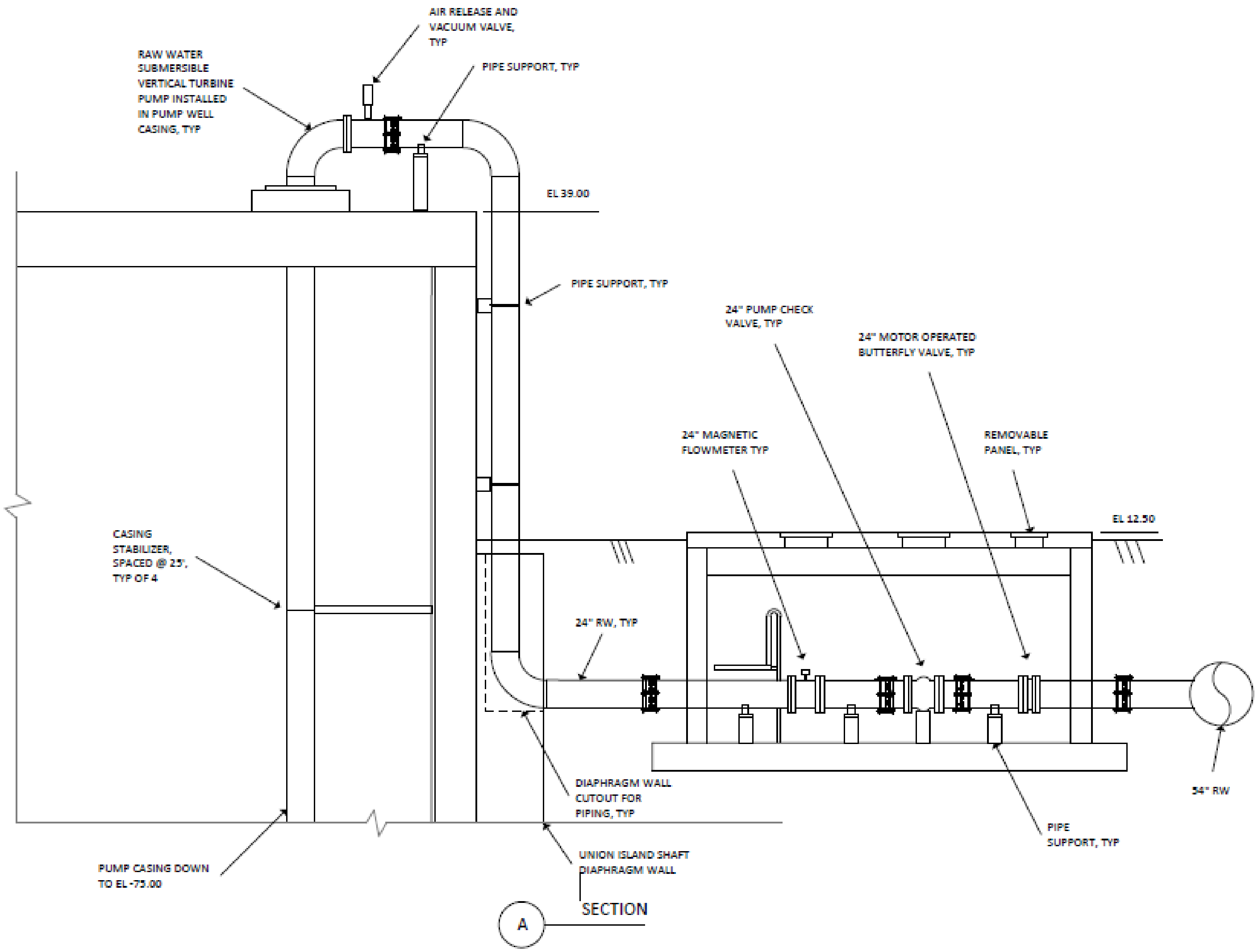
Alternative U1 – Union Island Shaft Pumping Plant Overall Plan
Design Flow = 100 cfs
Approximate Scale: 1" = 32'-0"

Figure U1-4



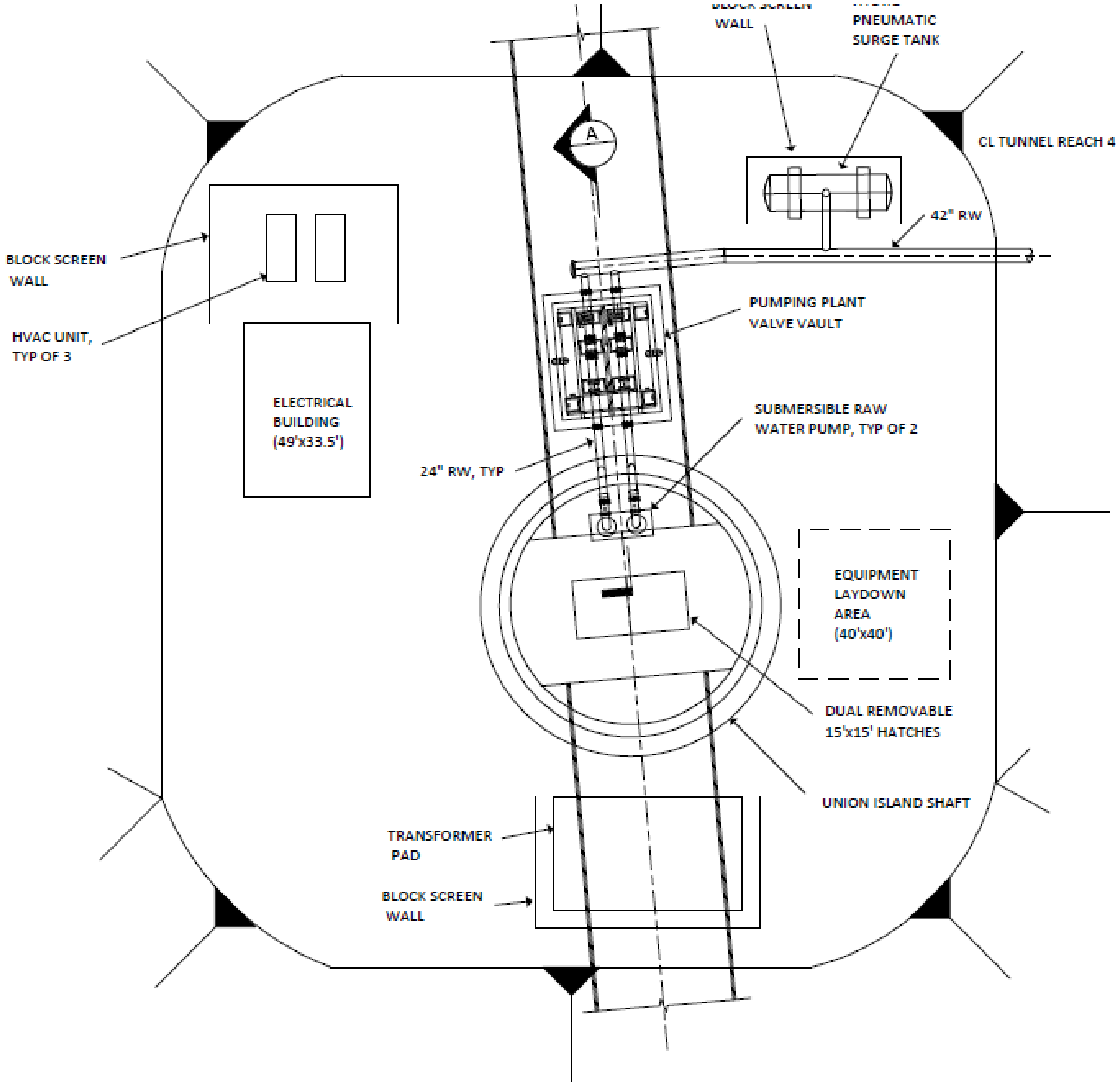
Alternative U1 – Union Island Shaft Pumping Plant Valve Vault Plan
Design Flow = 100 cfs
Approximate Scale: 1/8" = 1'-0"

Figure U1-5



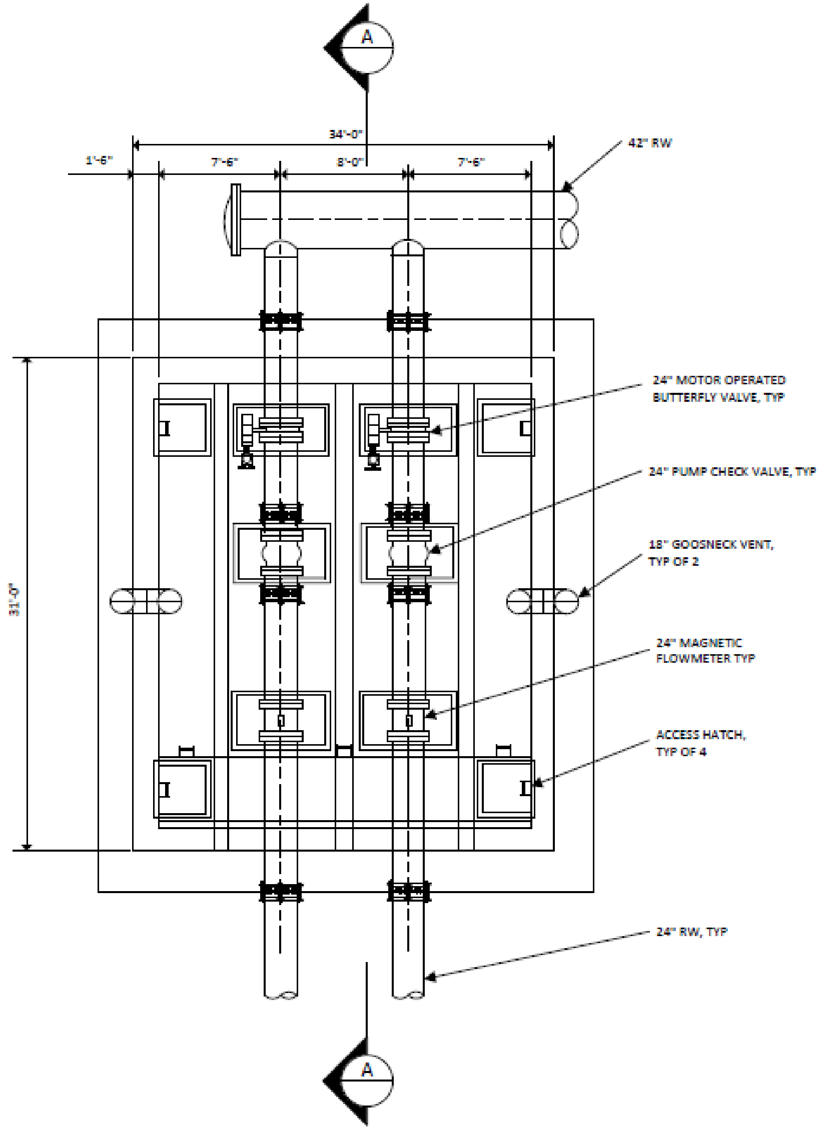
Alternative U1 – Union Island Shaft Pumping Plant Typical Section
Design Flow = 100 cfs
Approximate Scale: 1/8" = 1'-0"

Figure U1-6



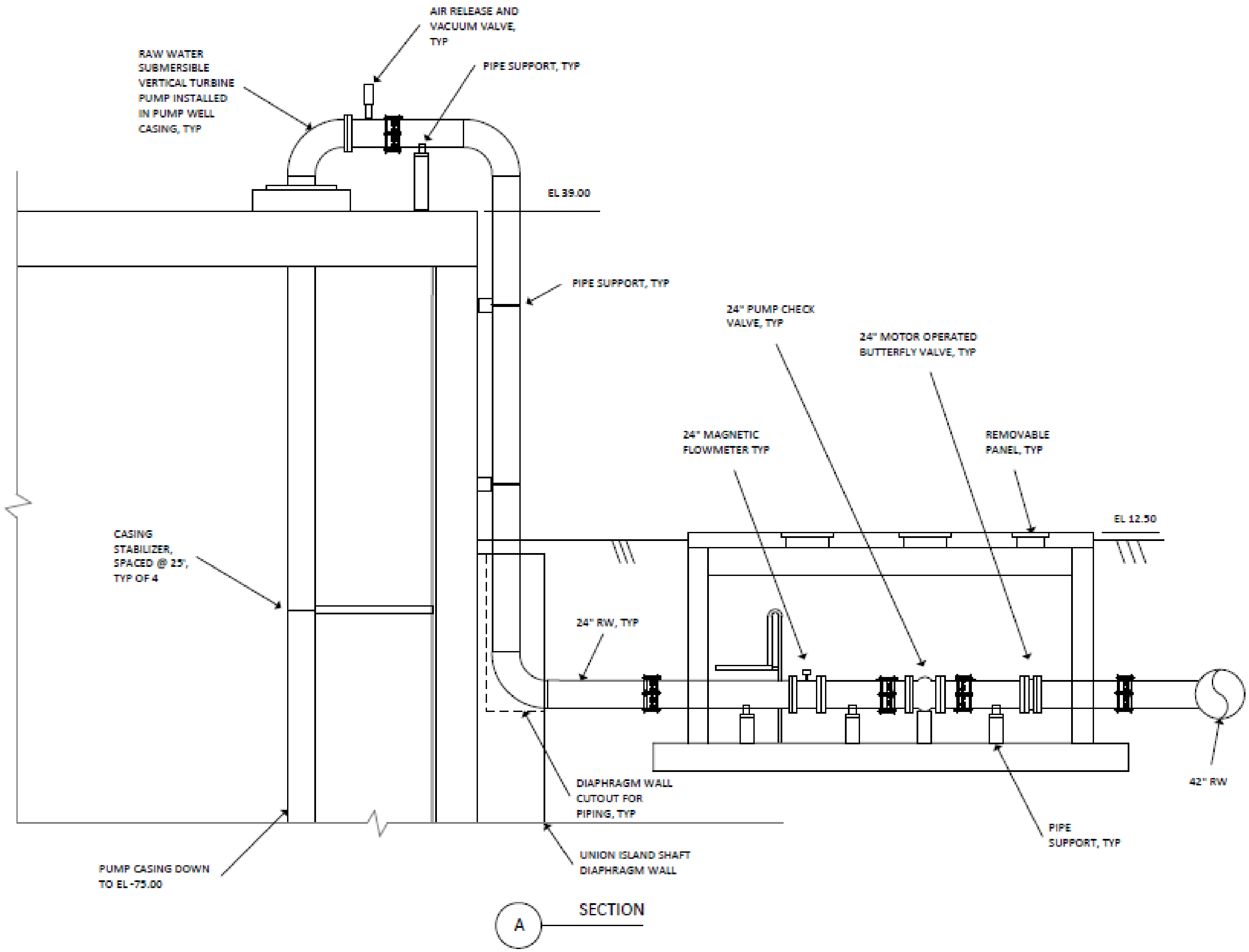
Alternative U1 – Union Island Shaft Pumping Plant Overall Plan
Design Flow = 50 cfs
Approximate Scale: 1" = 32'-0"

Figure U1-7



Alternative U-1 Union Island Pumping Plant Valve Vault Plan
Design Flow = 50 cfs
Approximate Scale: 1/8" = 1'-0"

Figure U1-8



Alternative U1 – Union Island Shaft Pumping Plant Valve Vault Plan
Design Flow = 50 cfs
Approximate Scale: 1/8" = 1'-0"

Figure U1-9