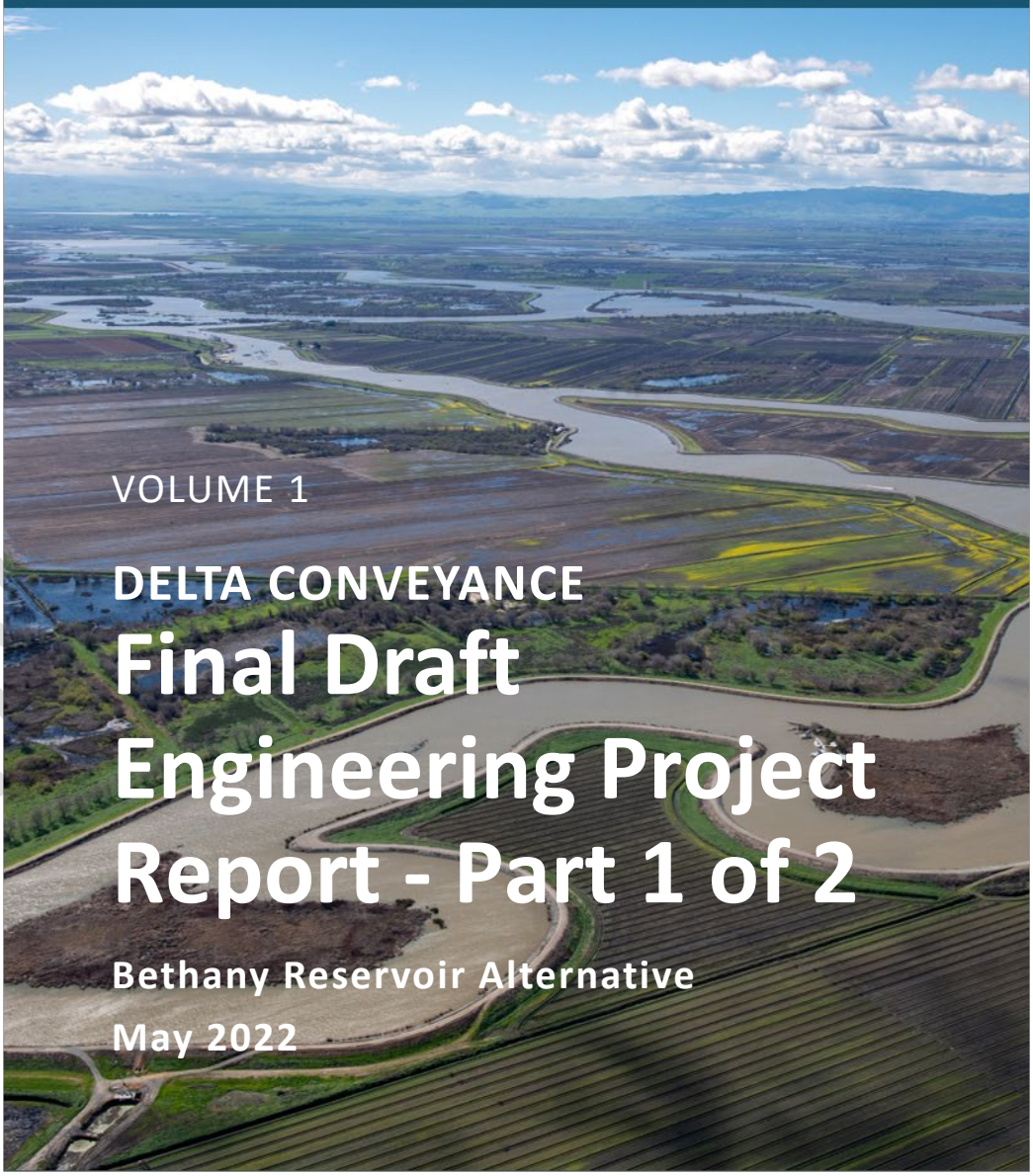
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY



VOLUME 1

DELTA CONVEYANCE

Final Draft Engineering Project Report - Part 1 of 2

Bethany Reservoir Alternative

May 2022

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Delta Conveyance Final Draft Engineering Project Report – Bethany Reservoir Alternative

Project Feature:	Project-wide
Prepared for:	California Department of Water Resources (DWR) / Delta Conveyance Office (DCO)
Prepared by:	Delta Conveyance Design and Construction Authority (DCA)
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The DWR requested the DCA develop conceptual engineering information for key features of the Bethany Reservoir Alternative for consideration by DWR to prepare an Environmental Impact Report (EIR). The evaluation of the Bethany Reservoir Alternative in the DWR EIR would include one project design capacity of 6,000 cubic feet per second (cfs). The DCA Engineering Project Report (EPR) presents the 6,000 cfs project design capacity for the Bethany Reservoir Alternative, as well as for 7,500 cfs, 3,000 cfs, and 4,500 cfs. DWR uses different nomenclature than DCA to describe the various alternatives. This nomenclature is described as follows:

DWR EIR Alternative	EPR Nomenclature
• Alternative 5: Eastern Alignment to Bethany Reservoir with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Bethany Reservoir Alternative using Intakes C-E-3 and C-E-5

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

Document History and Quality Assurance

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

Approval Names and Roles			
Prepared by	**Internal QC review by**	**Consistency review by**	**Approved for submission by**
Karen Askeland/ EDM Environmental Liaison	Phil Ryan / EDM Design Manager	Gwen Buchholz/ DCA Senior Review Consultant	Terry Krause / EDM Project Manager
This interim document is considered preliminary and was prepared under the responsible charge of Philip K. Ryan, California Professional Engineering License C41087.			

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ATTACHMENTS – TECHNICAL MEMORANDA

OTHER VOLUMES

1. Introduction and Background

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

DWR will be completing an environmental assessment of the projects effects consistent with the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA). The DCP, as presented in the Notice of Preparation (NOP) issued by DWR on January 15, 2020 and published in CEQAnet on January 16, 2020 (DWR, 2020a), included two conveyance corridors: the Central Corridor and Eastern Corridor, options, as described in a separate Delta Conveyance Final Draft Engineering Project Report – Central and Eastern Options (referred to in this document as the "C/E EPR") (DCA, 2022).

The NOP was circulated to the public, interest groups, and agencies to receive comments. The comments were summarized in a Scoping Report released by DWR in July 2020 (DWR, 2020b). Some of the comments were related to concerns about construction of facilities near roadways and communities near the existing Clifton Court Forebay. 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 to be located south of Clifton Court Forebay and continue along the Bethany Reservoir Aqueduct to the Bethany Reservoir Discharge Structure along 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."

DWR requested the Delta Conveyance Design and Construction Authority (DCA) to develop conceptual engineering information for key features of the Bethany Reservoir Alternative for consideration by DWR to prepare an Environmental Impact Report (EIR).

The conveyance facility locations described in this document and presented in the attached engineering concept drawings represent the information available as of the date of publication of this EPR. The engineering concept drawings include final site plans, construction phase site plans where locations of features would be substantially different than final site plans, and site ingress and egress layouts.

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

1.1 Project Background

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

The SWP and CVP facilities include reservoirs on the Sacramento and the San Joaquin River systems. Water is conveyed along the river systems to the Sacramento-San Joaquin rivers Delta (Delta), and the water continues to flow through internal Delta channels to the SWP and CVP South Delta pumping facilities with fish screening/collection facilities in the South Delta near the community of Mountain House. Maximum installed pumping capacity of the current SWP and CVP facilities are 10,670 cubic feet per second (cfs) capacity and 4,600 cfs, respectively. However, actual water flow through the pumping facilities is 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 DCP, DWR's underlying purpose is to prepare the SWP for the future. New intakes in the northern Delta will reduce risks to SWP water supplies from sea level rise and Delta levee failures. Multiple intake locations would help minimize conflicts with migrating fisheries resources. Water conveyance from the northern Delta intakes to existing SWP facilities in the southern Delta through a tunnel would protect water supply reliability and minimize land disturbances especially within sensitive Delta communities and ecosystems. To address these and other issues, DWR initiated studies to develop new diversion and conveyance facilities concepts in the Delta to restore and protect the reliability of water deliveries in a cost-effective manner, consistent with the State's Water Resilience Portfolio.

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

- The initial conveyance configuration, the Bay Delta Conveyance Project Pipeline/Tunnel Option (PTO), was documented in the March 10, 2010 Conceptual Engineering Report (CER) (DWR, 2010a) and the subsequent October 2010 Addendum. The original PTO included a 15,000 cfs conveyance facility that consisted of five intakes located along the Sacramento River between Freeport and Walnut Grove, pumping plants at each intake, an intermediate Pumping Plant and intermediate forebay (surface water impoundment) near the intakes, a new forebay near the existing SWP Clifton Court Forebay, and other appurtenant facilities.
- The PTO was later modified to the WaterFix Modified Pipeline Tunnel Option (MPTO) in the 2015 CER when the maximum design flow of the program was reduced from 15,000 cfs to 9,000 cfs (DWR, 2015). Other changes to the PTO at that time included the reduction in the number of screened intakes from five to three, the elimination of the pumping plants at the intakes and the Intermediate Pumping Plant, increasing the size of the north and main

tunnels to provide for gravity flow of the water from the intakes to a new Clifton Court Forebay pumping plant, and placement of the new forebay within the existing footprint of the Clifton Court Forebay. The 2015 CER documented the MPTO facility configuration that was included in the 2016 Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the program (DWR, 2016). DWR issued a Notice of Determination (NOD) in 2017, in accordance with CEQA, to officially adopt the MPTO as the adopted WaterFix project (DWR, 2017).

- The WaterFix project concept was a further modified in 2018 to become the Byron Tract Option (BTO) (DWR, 2018). The main differences between the 2015 WaterFix MPTO and the 2018 WaterFix BTO included moving the new forebay to Byron Tract to become the Byron Tract Forebay (BTF) and eliminating modifications to the Clifton Court Forebay. Certain facility locations at the tunnel shafts were relocated to minimize disturbances to wetlands and sensitive biological resource habitat. DWR issued a Draft Supplemental EIR in July 2018 to present the results of the impact analysis of the BTO.
- In February 2019, California Governor Newsom announced in his State of the State address that he did not "support WaterFix as currently configured" but does "support a single tunnel." On April 29, 2019, Governor Newsom issued Executive Order N-10-19, directing several agencies, including DWR, to (among other things), "inventory and assess… [c]urrent planning to modernize conveyance through the Bay Delta with a new single tunnel project" (DWR, 2020a).
- The Governor's announcement and Executive Order led to DWR's withdrawal of all approvals and environmental compliance documentation associated with California WaterFix. In May of 2019, the WaterFix project approval by DWR was withdrawn and the associated NOD for the WaterFix adopted project was rescinded.

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

In January 2020, DWR launched a new planning effort (DWR, 2020a). The new DCP project included a fresh look at the historical planning information, building on areas of agreement and deviating where new concepts or configurations were identified. As described above, DWR has requested that this EPR be developed to present the conceptual level engineering description of the Bethany Reservoir Alternative. This EPR includes information related to the Bethany Reservoir Alternative conveyance facilities and other facilities to support construction and operations of these facilities.

The EIR will include a Compensatory Mitigation Plan (CMP) and Community Benefits Program. The CMP will identify potential compensatory mitigation options to programmatically address impacts to habitat for special status species, as well as to jurisdictional wetlands and other waters that may result from the conveyance facilities. The compensatory mitigation approach will be based on anticipated mitigation needs for EIR alternatives and will be finalized through regulatory permits and approvals. At this time, the actual design and monitoring methods for the CMP are not known in sufficient detail to allow for detailed layouts. The programmatic

plans will be developed by DWR for inclusion in the EIR. Because the Delta Conveyance Design and Construction Authority (DCA) did not assist with development of the CMP, the EPR does not include discussions of this plan.

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

See TM – Efforts to Minimize Delta Community Effects Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Efforts to Minimize Delta Community Effects (Attachment H of the C/E EPR) for detailed information

The evaluation of the Bethany Reservoir Alternative in the DWR EIR would include one project design capacity alternative for 6,000 cfs. This EPR presents the 6,000 cfs project design capacity for the Bethany Reservoir Alternative in Sections 2 through 6. The 7,500 cfs, 3,000 cfs, and 4,500 cfs project design capacity options are discussed in Section 7. These three project design capacity options are not included in the DWR EIR. DWR uses different nomenclature than this EPR to describe the Bethany Reservoir Alternative. This equivalent nomenclature and the relevant sections of this EPR are described as follows:

DWR EIR Alternative	EPR Nomenclature and EPR Section
• Alternative 5: Eastern Alignment to Bethany Reservoir with a project design capacity of 6,000 cfs and Intakes B and C	• 6,000 cfs project design capacity for the Bethany Reservoir Alternative using Intakes C-E-3 and C-E-5 (Sections 2-6)

1.2 Description of the Bethany Reservoir Alternative

The existing SWP Delta water conveyance facilities, which include Clifton Court Forebay, 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 proposed DCP would construct and operate new conveyance facilities in the Delta that would add to the existing SWP infrastructure.

Under the Bethany Reservoir Alternative, new intake facilities as additional points of diversion would be located in the north Delta along the Sacramento River near the community of Hood; and a tunnel would convey water from the new intakes to facilities in the south Delta south of the Clifton Court Forebay and ultimately to the existing SWP Bethany Reservoir. 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 NOP identified the project design capacity to be 6,000 cfs with the Central Corridor and Eastern Corridor facilities, as described in the C/E EPR. The Bethany Reservoir Alternative for

the 6,000 cfs project design capacity is DWR Environmental Impact Report (EIR) Alternative 5. It would include the same facilities as the Eastern Corridor between the intakes and Lower Roberts Island with minor changes at the Twin Cities Complex, and different facilities from Lower Roberts Island to Bethany Reservoir. The Bethany Reservoir Alternative would include the following 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 fish screens.
- A concrete-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 Clifton Court Forebay.
- 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.

1.2.1 Development of Facilities Plans in the Bethany Reservoir Alternative

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

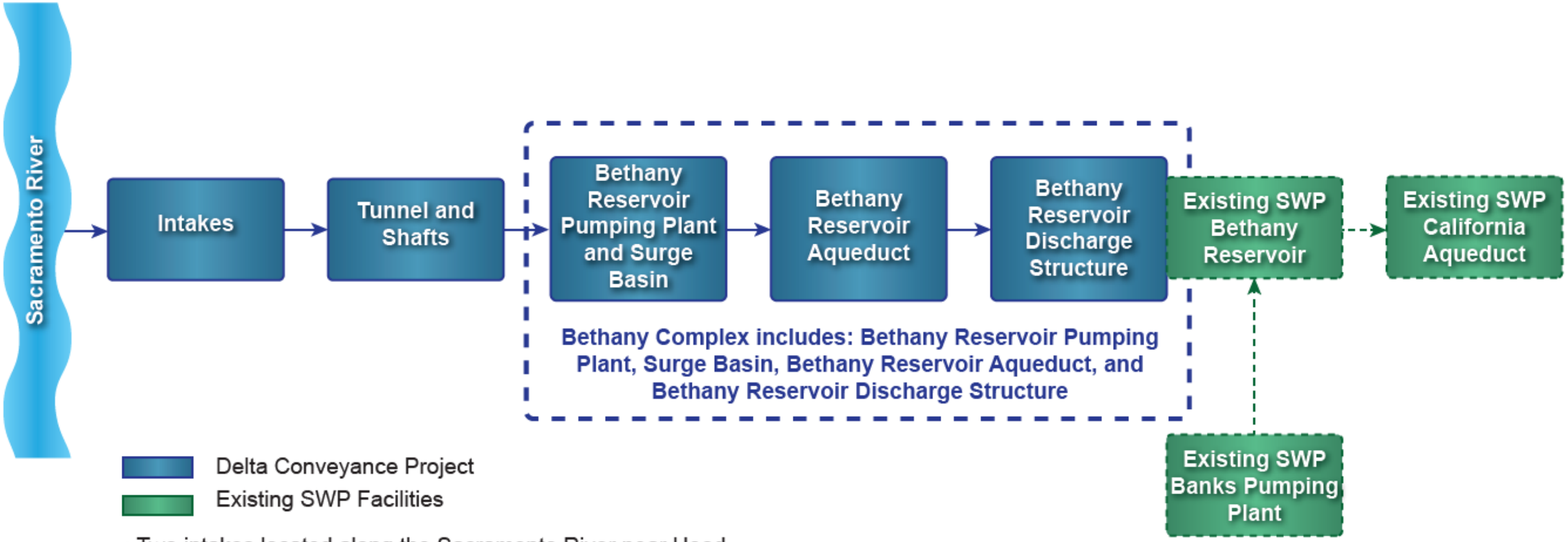
- Minimize construction traffic and associated effects to residents, recreationists, wildlife habitat, and agricultural operations.
- Minimize disturbance to sensitive wildlife and terrestrial and/or aquatic habitat areas.
- Minimize disturbance to existing land uses, including agricultural and residential 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 Section 2.3.4.1 of this EPR and presented in the following TMs in this EPR and the C/E EPR.

- **Intakes Siting Analyses:** Intake Site Identification and Evaluation TM (C/E EPR Attachment A).
- **Tunnel Shaft Siting Analyses:** Shaft Siting Study TM (C/E EPR Attachment B).
- **Bethany Complex Siting Analyses:** Facilities Siting Study – Bethany Reservoir Alternative TM (attached to this EPR).
- **Construction Transportation Route Siting Analyses:**
  - Logistics Strategy – Bethany Reservoir Alternative.
  - Potential Road Access Routes, Logistics Strategy, and Traffic Impact Analysis (Attachment F).
- **Overall Siting Analyses:** Efforts to Minimize Delta Community Effects Supplement – Bethany Reservoir Alternative (attached to this EPR).

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

FIGURE 1. SCHEMATIC OF BETHANY RESERVOIR ALTERNATIVE FACILITIES TO CONVEY WATER FROM INTAKES TO SWP CALIFORNIA AQUEUDCT FOR PROJECT DESIGN CAPACITY OF 6,000 CFS



- Two intakes located along the Sacramento River near Hood
- Water would flow from the intakes into one tunnel and then into 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 2. SUMMARY OF DELTA CONVEYANCE PROJECT SITING ANALYSES FOR INTAKES, TUNNEL SHAFTS AND ALIGNMENTS, SOUTHERN FOREBAY, SOUTH DELTA CONVEYANCE, AND BETHANY COMPLEX

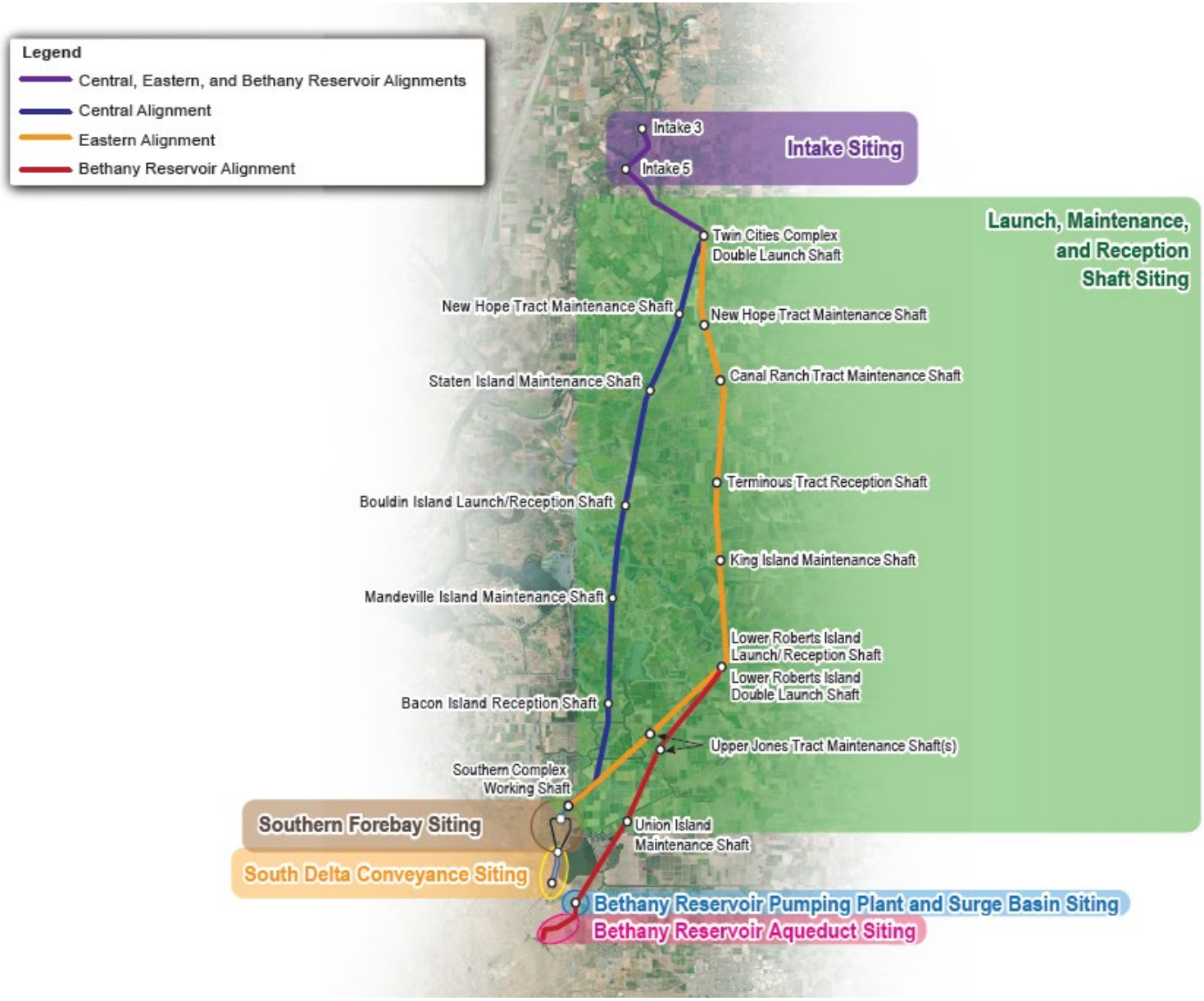
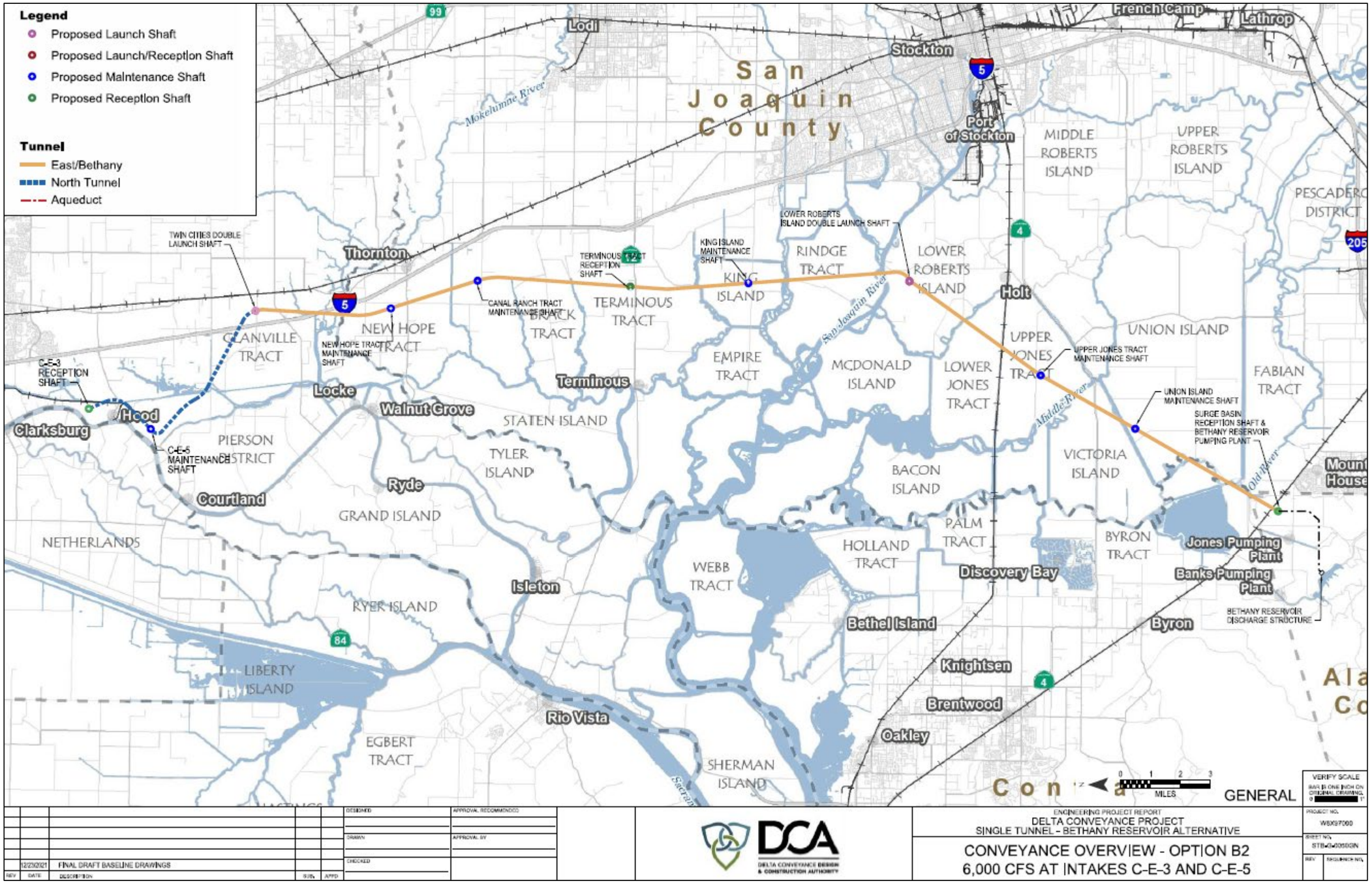


FIGURE 3. BETHANY RESERVOIR ALTERNATIVE FACILITIES LOCATION MAP TO CONVEY WATER FROM INTAKES TO BETHANY COMPLEX FOR PROJECT DESIGN CAPACITY OF 6,000 CFS



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

The Bethany Reservoir Alternative shares facilities in the northern and central areas of the DCP system with the Eastern Corridor option (see C/E EPR) and would include different facilities in the southern area of the DCP system, as summarized below.

- Two intakes along the Sacramento River near the community of Hood would be the same as both the Central and Eastern corridors.
- The Twin Cities Complex would include two tunnel launch shafts in the same manner as the Eastern Corridor.
  - One of the tunnel launch shafts would be used to construct the tunnel to the intakes (Tunnel Reach 1).
  - One of the tunnel launch shafts would be used to construct a tunnel to a reception shaft on Terminous Tract as the first part of the tunnel alignment towards the Bethany Complex in the south Delta (Tunnel Reach 2).
- Lower Roberts Island would include two tunnel launch shafts
  - One of the tunnel launch shaft sites would be used to construct the tunnel to the reception shaft on Terminous Tract (Reach 3).
  - One of the tunnel launch shaft sites would be used to construct the tunnel to the reception shaft at the Surge Basin adjacent to the Bethany Reservoir Pumping Plant at the Bethany Complex (Reach 4).
- 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 between the Bethany Reservoir Pumping Plant and the Bethany Reservoir Discharge Structure, including the following facilities.
    - Aqueduct surge tanks located at the Bethany Reservoir Pumping Plant
    - 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 is presented in Sections 2 through 6, engineering concept drawings, and technical memoranda included in Appendix A and Attachments to this EPR. Please note that all elevations presented in this EPR are relative to North American Vertical Datum of 1988 (NAVD88).

[1] In the EPR, the term "Jones Pumping Plant Penstocks" is used to describe the 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 BETHANY RESERVOIR ALTERNATIVE PHYSICAL CHARACTERISTICS FOR THE 6,000 CFS PROJECT DESIGN CAPACITY

Feature Description	Bethany Reservoir Alternative	Comparison to the Eastern Corridor
Project Design Capacity	• 6,000 cfs	Same as Eastern Corridor
Number of Intakes with Fish Screens	• 2 with cylindrical tee fish screens	Same as Eastern Corridor
Design Flow Capacity of Each Intake	• One Intake at 3,000 cfs (with Reception Shaft) (Intake C-E-3) • One Intake at 3,000 cfs (with Maintenance Shaft) (Intake C-E-5)	Same as Eastern Corridor
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)	• Maximum Capacity – 3,000 cfs between Intake C-E-3 and Intake C-E-5 – 6,000 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 36 feet • Tunnel Outside Diameter: 39 feet • Tunnel Length: 43,081 feet • Number of Tunnel Launch Shafts: 1 • Number of Reception Shafts: 1 • Number of Maintenance Shafts: 1 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 115 (Reach 1) • Maintenance and Reception Shafts Inside Diameter (feet): 83 (aka Intake Outlet Shafts)	Same as Eastern Corridor
Tunnel Reaches between Twin Cities Complex and Bethany Reservoir Pumping Plant Surge Basin	• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Bethany Reservoir Pumping Plant and Surge Basin • Maximum Capacity: 6,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 36 feet • Tunnel Outside Diameter: 39 feet • Tunnel Length: 194,080 feet • Number of Tunnel Launch Shafts: 3 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 5 • 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 Reception Shaft Inside Diameter (feet): 70 • Surge Basin Reception Shaft Inside Diameter (feet): 120	• Reaches 2 and 3 would be same as Eastern Corridor • Reach 4 would be unique to Bethany Reservoir Alternative

Feature Description	Bethany Reservoir Alternative	Comparison to the Eastern Corridor
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 BRPP'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 100 cfs pumps to dewater Surge Basin • One 815-foot by 815-foot Surge Basin with surge overflow capacity	Customized to Bethany Reservoir Alternative
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: 13,000 feet for each pipeline • Tunnels under Jones Penstocks: 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: 3,064 feet for each tunnel, 4 tunnels, tunnel depth varies from approximately 45-50 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	Unique to Bethany Reservoir Alternative

1.2.2 Organization of this Report

The EPR is comprised of the following components.

- **Volume 1 - Summary Report and Technical Memoranda.** The engineering work that describes the design criteria, design assumptions, alternatives analyses, and planned siting and configurations are found in a series of Technical Memoranda (TMs) in the Attachment that were prepared specifically for the Bethany Reservoir Alternative. Many of the Bethany Reservoir Alternative TMs were prepared as supplemental documents to the TMs prepared for the C/E EPR. In addition, many of the items in the Bethany Reservoir Alternative would be identical to items included in the Eastern Corridor which were described in the C/E EPR. Therefore, this summary report includes references to sections and TMs included in the C/E EPR.

  This summary report is intended to highlight the key findings and conclusions of the TMs 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: Major Facility Descriptions of the Bethany Reservoir Alternative for the 6,000 cfs Project design capacity (Intakes, Tunnels and Tunnel Shafts, and Bethany Complex)

- Section 3: Flood Management
- Section 4: Site Development, Site Access, and Logistics
- Section 5: Utilities
- Section 6: Other Systemwide Considerations
- Section 7: Project Design Capacity Options
- Section 8: Fish Screen-Type Options
- Section 9: References

Volume 1 also includes Appendices with quantitative summaries of information from technical memoranda and engineering concept drawings. Appendices A through D provide summaries of quantitative information for the Bethany Reservoir Alternative for the project design capacities of 6,000 cfs, 7,500 cfs, 3,000 cfs, and 4,500 cfs, respectively. Appendices E and F provide preliminary construction and operations and maintenance information for the 6,000 cfs project design capacity needed to develop the EIR air quality and traffic analyses.

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

2. Major Facilities of the Bethany Reservoir Alternative for the 6,000 cfs Project Design Capacity

The facilities described in this section represent the facilities in the DWR EIR Alternative 5, as schematically presented in Figure 2. The major component features of the Bethany Reservoir Alternative include the following facilities which are described in the following sections of this report.

- Intakes at locations Intake C-E-3 and Intake C-E-5.
- Tunnel and Tunnel Shafts.
- Bethany Complex.

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

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

2.1 Intakes

Intake structures allow the diversion of water from the Sacramento River and represent the most upstream facilities of the DCP for the Central and Eastern corridors and the Bethany Reservoir Alternative. Information regarding the intakes for the Bethany Reservoir Alternative would be the same as information presented in Section 2.1, Intakes, of the C/E EPR.

2.2 Tunnels and Tunnel Shafts

2.2.1 Purpose of the Tunnels

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 Bethany Reservoir Alternative 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 2.3, Bethany Complex, 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 2.3, Bethany Complex.

The information related to construction of Tunnel Reaches 1 through 4 include some of the same as information presented in Section 2.2, Tunnels and Tunnel Shafts, of the C/E EPR.

2.2.2 Facility Description

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

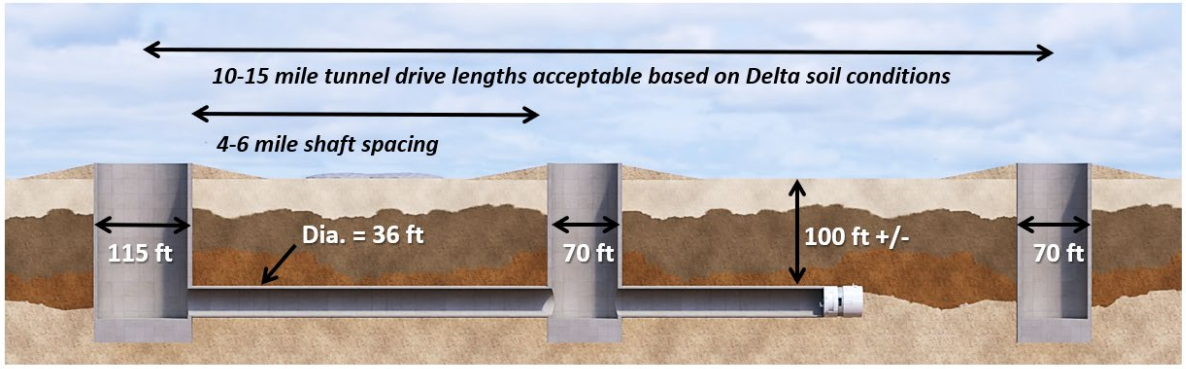
See TM – Tunnel Excavation and Drive Assessment (Attachment B of the C/E EPR) for detailed information

For the DCP, 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 tunneling elevation and to allow assemblage of the entire TBM near the tunnel shaft invert. The tunnel launch shafts would be a significant focal point of tunneling construction activity where the workforce, TBM, and tunnel liner segments would enter the tunnel and where the excavated tunnel material would be transported out of the tunnel. For the purposes of this EPR, the excavated tunnel material is known as Reusable Tunnel Material (RTM). This term is consistent as was used for the Central and Eastern corridors options for which this material would be used to construct some tunnel shaft pads and portions of the Southern Forebay embankment. Under the Bethany Reservoir Alternative, 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 EPR.

The TBM would bore along the tunnel alignment (also known as a “tunnel drive”) to a tunnel reception shaft. The TBM would be disassembled at the bottom of the tunnel reception shaft and the parts would be lifted to the ground surface for removal from the tunnel. TBMs, like all rotating machinery, would require periodic maintenance to maintain acceptable performance. Some routine maintenance procedures on a TBM could be performed from within the tunnel. However, major maintenance events, such as inspection of the cutterhead, would be easier at tunnel maintenance shafts. The tunnel maintenance shaft would 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 tunnel shafts included in the DCP is presented in Figure 4.

FIGURE 4. KEY COMPONENTS WITH GENERAL DIMENSIONS OF A TUNNEL DRIVE WITH TUNNEL LAUNCH, MAINTENANCE, AND RECEPTION SHAFTS



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

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

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

2.2.2.1 Tunnel Shafts for the Bethany Reservoir Alternative

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 DCP 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 TM – Tunnel Excavation and Drive Assessment (Attachment B of the C/E EPR) for detailed information

See TM – Soil Abrasivity Testing Summary (Attachment B of the C/E EPR) for detailed information

See TM – Soil Abrasivity Testing Summary (Attachment B of the C/E EPR) for detailed information

Tunnel Launch Shaft Sites

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

See TM – Shaft Conceptual Design (Attachment B of the C/E EPR) for detailed information

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

See TM – Facilities Siting Study – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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.

See TM – Shaft Siting Study (Attachment B of the C/E EPR) for detailed information

- 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.

Tunnel Maintenance Shaft and Tunnel Reception Shaft Sites

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

See TM – Facilities Siting Study – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Shaft Siting Study (Attachment B of the C/E EPR) for detailed information

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 tunnel shaft locations and tunneling directions are provided in Figure 5 for the Bethany Reservoir Alternative. The tunnel lengths between shafts for the Bethany Reservoir Alternative are summarized in Table 2.

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

FIGURE 5. ORDER OF TUNNEL SHAFTS AND TUNNLEING DIRECTIONS FOR BETHANY RESERVOIR ALTERNATIVE

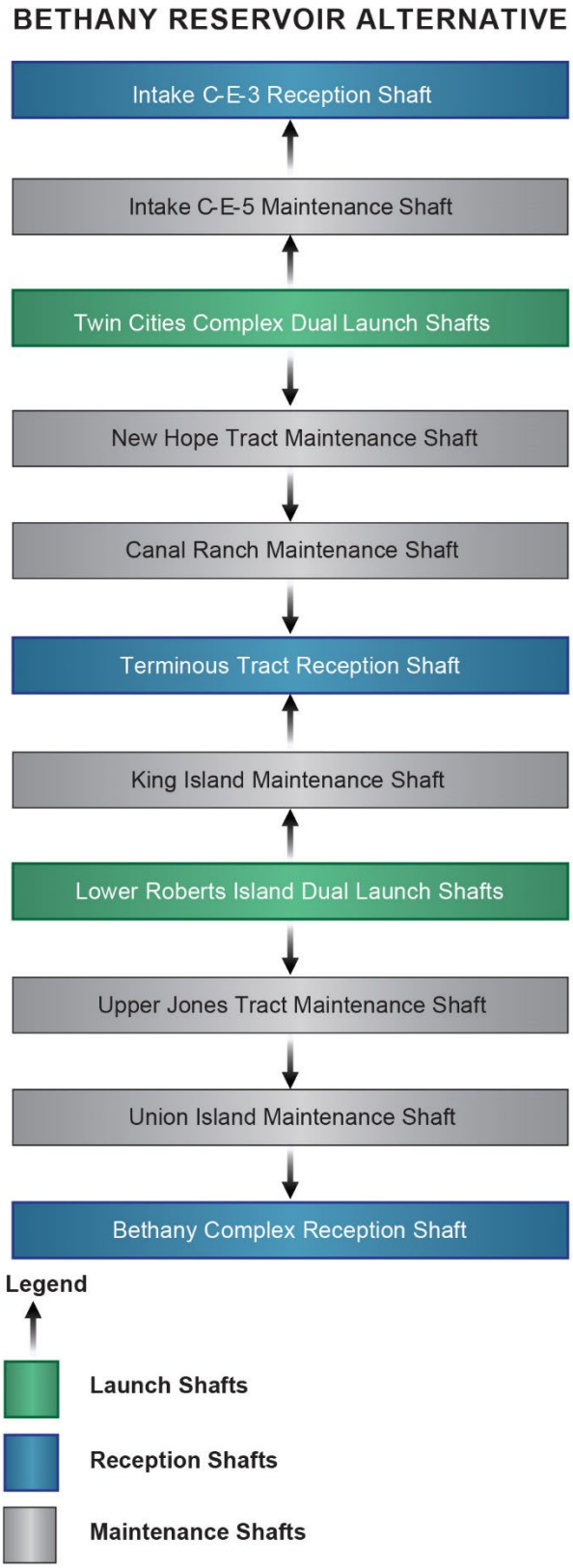


TABLE 2. TUNNEL ALIGNMENT LENGTHS BETWEEN LAUNCH AND RECEPTION SHAFTS ALONG BETHANY RESERVOIR ALTERNATIVE

Reach	Launch Shaft Site	Reception Shaft	Maintenance Shafts	Drive Length (miles)
1	Twin Cities Complex	Intake 3	Intake 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

2.2.3 Considerations for Tunnel Features

The tunnel for the Bethany Reservoir Alternative 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 abrasivity during tunnel boring.

See TM – Capacity Analyses for Preliminary Tunnel Diameter Selection (Attachment B of the C/E EPR) for detailed information

See TM – Hydraulic Analysis of Delta Conveyance Options - Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

2.2.3.1 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 within the tunnel, 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 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).

The hydraulic analysis was also used to identify the bottom elevations (invert) of the tunnels. The invert elevations of the tunnel between the intakes and Twin Cities Complex would range from -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.

2.2.3.2 Tunnel Liner Considerations

The tunnel would be lined with precast concrete segmental liners. The tunnel liner considerations for the Bethany Reservoir Alternative would be the same as described in Section 2.2.3.2 of the C/E EPR.

2.2.3.3 Tunnel Boring Methods

Tunnel boring methods for the Bethany Reservoir Alternative would be the same as discussed in Section 2.2.3.3 of the C/E EPR.

2.2.3.4 Tunnel Launch Shafts

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

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 A. Ground improvements methods considered at the Lower Roberts Island tunnel launch shaft are described in Section 6.3.3, Ground Improvement Methods.

The tunnel launch shaft construction sites would be different for each location based upon ground elevation, adjacent levee height, geological conditions, existing access corridors, and parcel boundaries. The 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 6.8, Table 7. 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 6.8, Construction and Long-term Site Space Requirements. Additional information on tunnel launch shaft construction is provided in Section 2.2.3.4 of the C/E EPR.

See TM – Supplementary Tunnel Information – Bethany Reservoir Alternative (Attachment to this EPR) See TM – Shaft Conceptual Design (Attachment B of the C/E EPR)

See TM – Levee Vulnerability Assessment and Flood Risk Management Supplement – Bethany Reservoir (Attachment to this EPR)

See TM – Levee Vulnerability Assessment (Attachment H of the C/E EPR)

See TM – Flood Risk Management (Attachment H of the C/E EPR)

See TM – Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

2.2.3.5 Tunnel Reception Shafts

The TBM would bore from the tunnel launch shaft to the tunnel reception shaft where the TBM would be 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. During operations, the tunnel reception shafts could be used as an access point for inspection and maintenance.

See TM – Tunnel Excavation and Drive Assessment (Attachment B of the C/E EPR)

See TM – Tunnel Inspection and Maintenance Considerations (Attachment B of the C/E EPR)

See TM – Shaft Conceptual Design (Attachment B of the C/E EPR) for detailed information

The tunnel reception shaft diameter would be based on results from hydraulic analyses as well as the space required to safely allow TBM breakthrough through the concrete walls of the shaft and the disassembly of the TBM for subsequent removal out of the shaft. Tunnel reception shafts 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 shafts 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 2.2.3.4, Tunnel Launch Shafts. Ground improvement would be required at the Terminous Tract tunnel reception shaft, as shown in the engineering concept drawings and described in Section 6.3.3, Ground Improvement Methods.

Soil to construct the tunnel reception shaft pad at Intake C-E-3 would be provided from on-site excavations at the intake site, including soil excavated at the sedimentation basin. Soil to construct the tunnel reception shaft pad at 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.

See TM Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Soil Balance (Attachment H of the C/E EPR) for detailed information

The tunnel reception shaft construction sites would be different for each location based upon ground elevation, adjacent levee height, geological conditions, access roads, and parcel boundaries. The tunnel reception shaft site at Terminous Tract would be the same as described in Section 6.8 of the C/E EPR. Construction and post construction site acreages for the tunnel reception shaft sites are provided in Section 6.8, Table 7.

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.

2.2.3.6 Tunnel Maintenance Shafts

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

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

Soil to construct the tunnel maintenance shaft pad at Intake C-E-5 would be provided from on-site excavations at the intake site, including soil excavated at the sedimentation basin. Soil to construct the tunnel maintenance shaft pads on New Hope Tract, Canal Ranch Tract, and King Island would be provided from on-site excavations and soil 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.

See TM Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Soil Balance (Attachment H of the C/E EPR) for detailed information

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 Bethany Reservoir Alternative tunnel alignment at New Hope Tract, Canal Ranch Tract, and King Island would be the same as described in Section 6.8 of the C/E EPR. Tunnel maintenance shaft sites along the Bethany Reservoir Alternative tunnel alignment include Upper Jones Tract and Union Island. Construction and post construction site acreages for the tunnel maintenance shaft sites are provided in Section 6.8, Table 7. The tunnel maintenance shaft site at Intake C-E-5 would be part of the total intake site acreage, as summarized in Section 6.8 and Appendix A of the C/E EPR.

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.

2.2.4 Reusable Tunnel Material Management

The Bethany Reservoir Alternative 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 2.2.3, 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 3.3.1, 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.

See TM – Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

Significant amounts of soil would be continuously excavated and removed from the tunnel during boring operations. Based on existing data, the soil properties are such that this material would be suitable for use as structural fill 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 Bethany Reservoir Alternative tunnel alignment.

TABLE 3. VOLUME OF WET UNCOMPACTED RTM AT EACH LAUNCH SHAFT SITE OF THE BETHANY RESERVOIR ALTERNATIVE 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 Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative TM. 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 tunnel 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

See TM – Reusable Tunnel Material (Attachment B of the C/E EPR) for detailed information

See TM – Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Bethany Reservoir Pumping Plant Facilities and Site Configuration (Attachment to this EPR) for detailed information

See TM – Tunnel Inspection and Maintenance Considerations (Attachment B of the C/E EPR) for detailed information

refill the areas excavated at each launch site to provide soil for tunnel 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.

2.2.5 Operations and Maintenance of Tunnels

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.

2.3 Bethany Complex

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

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

Figure 6 shows the Bethany Complex temporary and permanent infrastructure layout.

2.3.1 Bethany Reservoir Pumping Plant and Surge Basin

As described previously, the 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.

See TM – Bethany Reservoir Pumping Plant Facilities and Site Configuration (Attachment to this EPR) for detailed information

Figures 6 and 7 shows the permanent infrastructure layout associated with the Bethany Reservoir Pumping Plant and Surge Basin facilities.

2.3.1.1 Surge Basin Reception Shaft and Surge Basin Structure

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 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. During high Sacramento River water surface conditions at the intakes, additional pump control and intake gate management procedures would need to be implemented to maintain water levels in the tunnel below the top of the weir. 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.

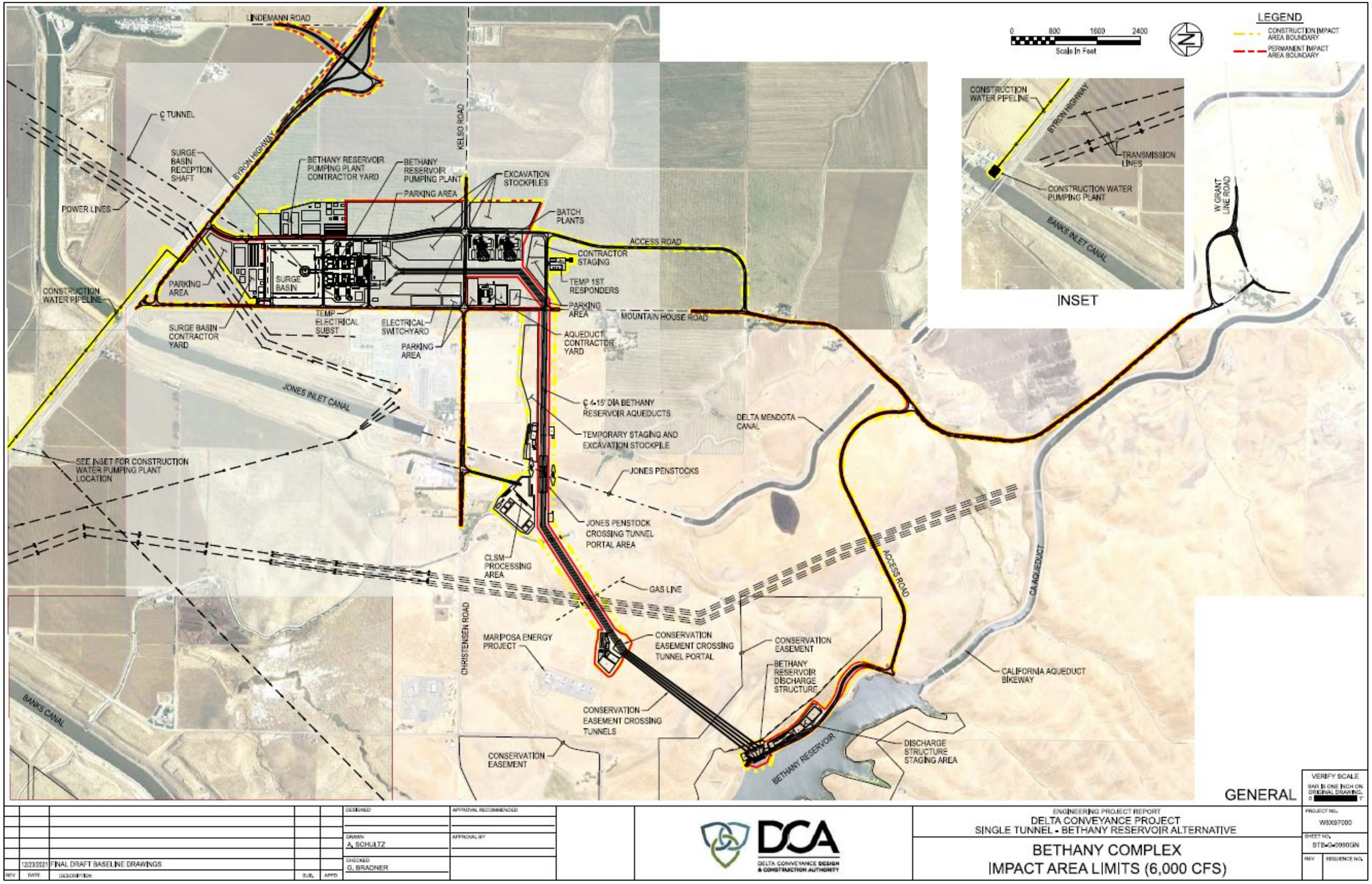
The Surge Basin structure, located above the tunnel and vertical reception shaft, would be an open top, rectangular, below ground-level structure and would be constructed with diaphragm walls and a reinforced concrete floor slab. The top of the Surge Basin would be at existing grade and the bottom elevation (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 gates would be normally closed while the

system is in operation. During a hydraulic transient-surge condition within the main tunnel, water from the tunnel would automatically flow over the circular weir wall and into the Surge Basin. The circular weir wall, with closed gates, would prevent water stored within the Surge Basin from reentering the tunnel. The gates would only be opened to drain the Surge Basin back into the shaft after the surge event was over.

See TM –Bethany Reservoir Pumping Plant Facilities and Site Configuration (Attachment to this EPR) for detailed information

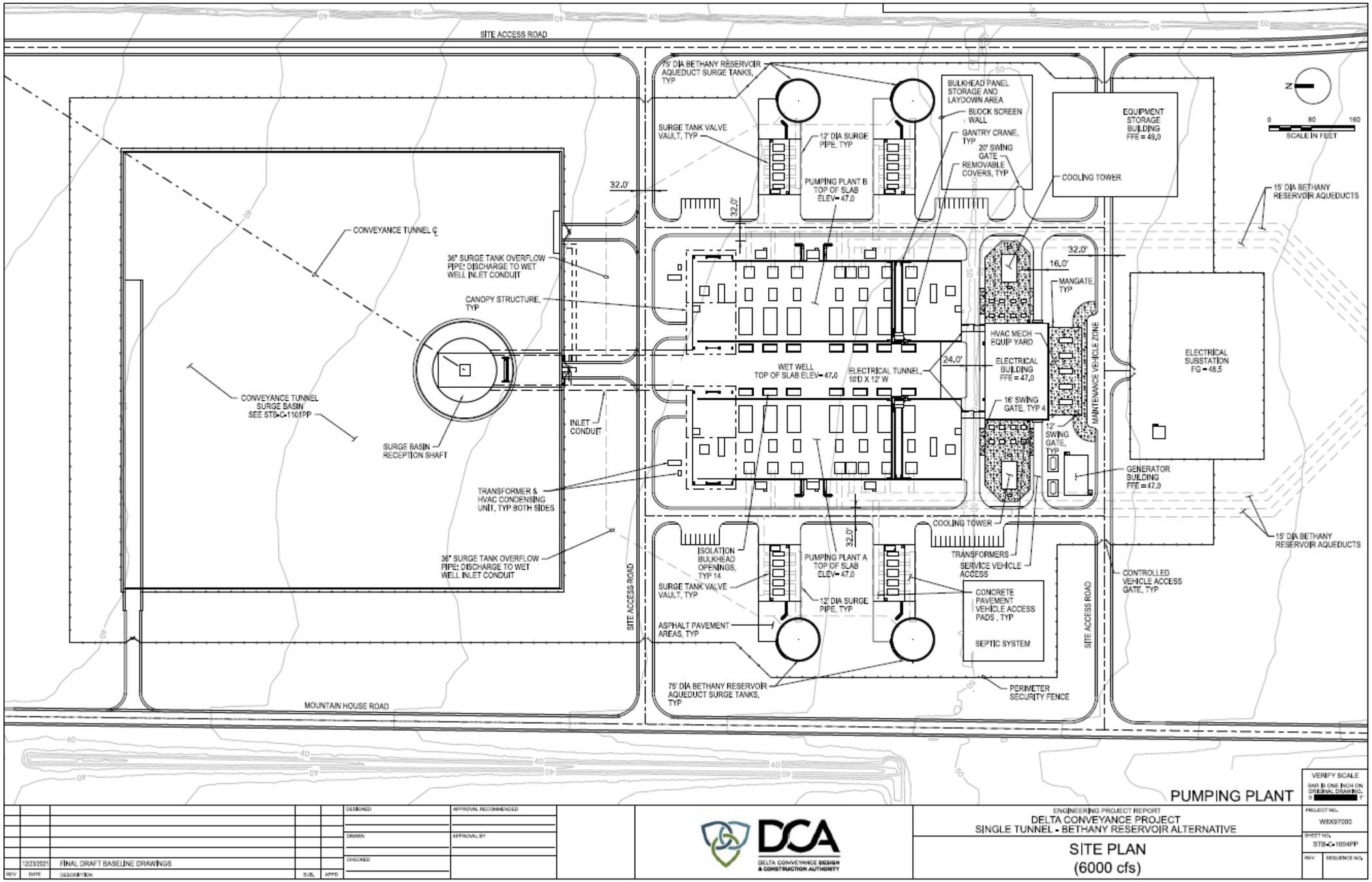
The Surge Basin would include a gantry crane on a bridge structure between the southern edge of the basin and the vertical reception shaft. The top of decking elevation of the bridge would be 46.5 feet and constructed immediately over the top of the covered wet well inlet conduit. The bridge structure 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.

FIGURE 6. BETHANY COMPLEX FACILITIES SITE PLAN WITH CONSTRUCTION AND PERMANENT BOUNDARIES



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

FIGURE 7. BETHANY RESERVOIR PUMPING PLANT FACILITIES: POST-CONSTRUCTION SITE PLAN



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

2.3.1.2 Inlet Wet Well Conduit

See TM –Bethany Reservoir Pumping Plant Facilities and Site Configuration (Attachment to this EPR) for detailed information

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.

2.3.1.3 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 fourteen 500 cfs pumps (including two 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 Appendix A and 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.
- 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-

See TM – Bethany Reservoir Pumping Plant Facilities and Site Configuration (Attachment to this EPR) for detailed information

foot diameter paved helipad without tree coverage to be used only for extreme emergency evacuations.

2.3.1.4 Aqueduct Surge Tanks

The Bethany Reservoir Pumping Plant would lift water into the Bethany Reservoir Aqueduct pipelines that are described in Section 2.3.2, 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 the 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 spill and conveying the water to the Bethany Reservoir Pumping Plant inlet wet well conduit.

See TM – Bethany Reservoir Aqueduct Surge Protection Alternatives – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

2.3.1.5 Bethany Complex Concrete Batch Plants

Concrete batch plants would be included as part of the Bethany Reservoir Pumping Plant and Surge Basin site. These batch plants would provide concrete 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 Bethany Complex from the concrete batch plants in the Stockton area could easily be more than 90 minutes due to travel time along Interstate 5 and Interstate 580/205; and therefore, concrete batch plants would be needed at the Bethany Complex to be compliant with the 90-minute requirement.

See TM – Bethany Reservoir Pumping Plant Facilities and Site Configuration (Attachment to this EPR) for detailed information

The Bethany Complex concrete batch plants would be located near the intersection of Kelso Road and the new Bethany access road east of Mountain House Road. 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.

2.3.2 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. 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 Aqueduct 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.

See TM – Conceptual Development of Aqueduct and Discharge Structure (Attachment to this EPR) for detailed information

2.3.2.1 Open-Trenched Portions of the Bethany Reservoir Aqueduct

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. 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.

2.3.2.2 Tunneled Portions of the Bethany Reservoir Aqueduct

See TM – Conceptual Development of Aqueduct and Discharge Structure (Attachment to this EPR) for detailed information

Tunnels under the Jones penstocks and Bethany Reservoir Conservation Easement would use 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, 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 between tunnel portals under the Jones penstocks and from a tunnel launch portal under 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.

See TM – Supplementary Tunnel Information – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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 70 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.

2.3.3 Bethany Reservoir Discharge Structure

See TM – Conceptual Development of Aqueduct and Discharge Structure (Attachment to this EPR) for detailed information

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 55-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.

2.3.4 Site Selection for the Bethany Complex

An initial desktop study and field reconnaissance was conducted during preparation of the EPR to identify alternative sites for the Bethany Complex.

See TM – Facilities Siting Study – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

2.3.4.1 Bethany Reservoir Pumping Plant and Surge Basin

The Bethany Reservoir Pumping Plant and Surge Basin would generally need to be located to the south of Clifton Court Forebay and north or east of the edge of Bethany Reservoir. The Surge Basin would need to be located where the topography would support a structure with a bottom elevation near elevation 0 to 10 feet. The Bethany Reservoir Pumping Plant and Surge Basin do not have to share a common location, but if separated, the Bethany Reservoir Pumping Plant would need additional surge control features in the wet well area.

The general area considered for siting these facilities, shown in Figure 8, includes multiple canals, high-voltage overhead transmission lines, high-pressure gas pipelines, crude oil pipelines, a major energy facility, the existing SWP Banks and CVP Jones pumping plants and associated canals, highways and roads, a school, and multiple conservation easements. The terrain is relatively flat and close to sea level near the Clifton Court Forebay but rises steadily to the south reaching elevations over 300 feet in some areas near Bethany Reservoir. Most of the land is open space or used for agricultural production.

Potential sites for the Bethany Reservoir Pumping Plant and Surge Basin, as shown in Figure 9, were evaluated with respect to the following goals.

- Acceptable Space and Topography: At least 75 acres of relatively flat terrain and with compatible adjacent topography for conveyance routes to the Bethany Reservoir.
- Key Hydraulic Considerations: The Bethany Reservoir Pumping Plant would need to be located on relatively lower elevation site based on the hydraulic characteristics of the tunnel that would extend from the intakes to Bethany Complex (up to an elevation of 50 to 60 feet). The Surge Basin would benefit from a site that would allow construction below the existing ground surface to avoid the need for construction of above-grade embankments that would be subject to long-term regulatory compliance and inspections.
- Feasible Connection to Bethany Reservoir: The Bethany Reservoir Discharge Structure would need to be located between existing dams that form the rim of the existing reservoir. In addition, conservation easements are present around the northern and eastern rims of the Bethany Reservoir, and connections to existing SWP facilities occur along the northern and southern reservoir shoreline. Therefore, the location of the Bethany Reservoir Pumping Plant would need to accommodate alignments of the Bethany Reservoir Aqueduct to avoid Conservation Easements and inappropriate portions of the reservoir shoreline.
- Tunnel and Shaft Considerations: The tunnel reception site at the Bethany Reservoir Pumping Plant and Surge Basin would need to be within 15 miles of the tunnel launch shaft site on Lower Roberts Island.
- Connection to the Jones Pumping Plant: Considerations for reasonable proximity to the Jones Pumping Plant approach channel if project design capacity of 7,500 cfs was considered (see Section 7, Project Design Capacity Options).

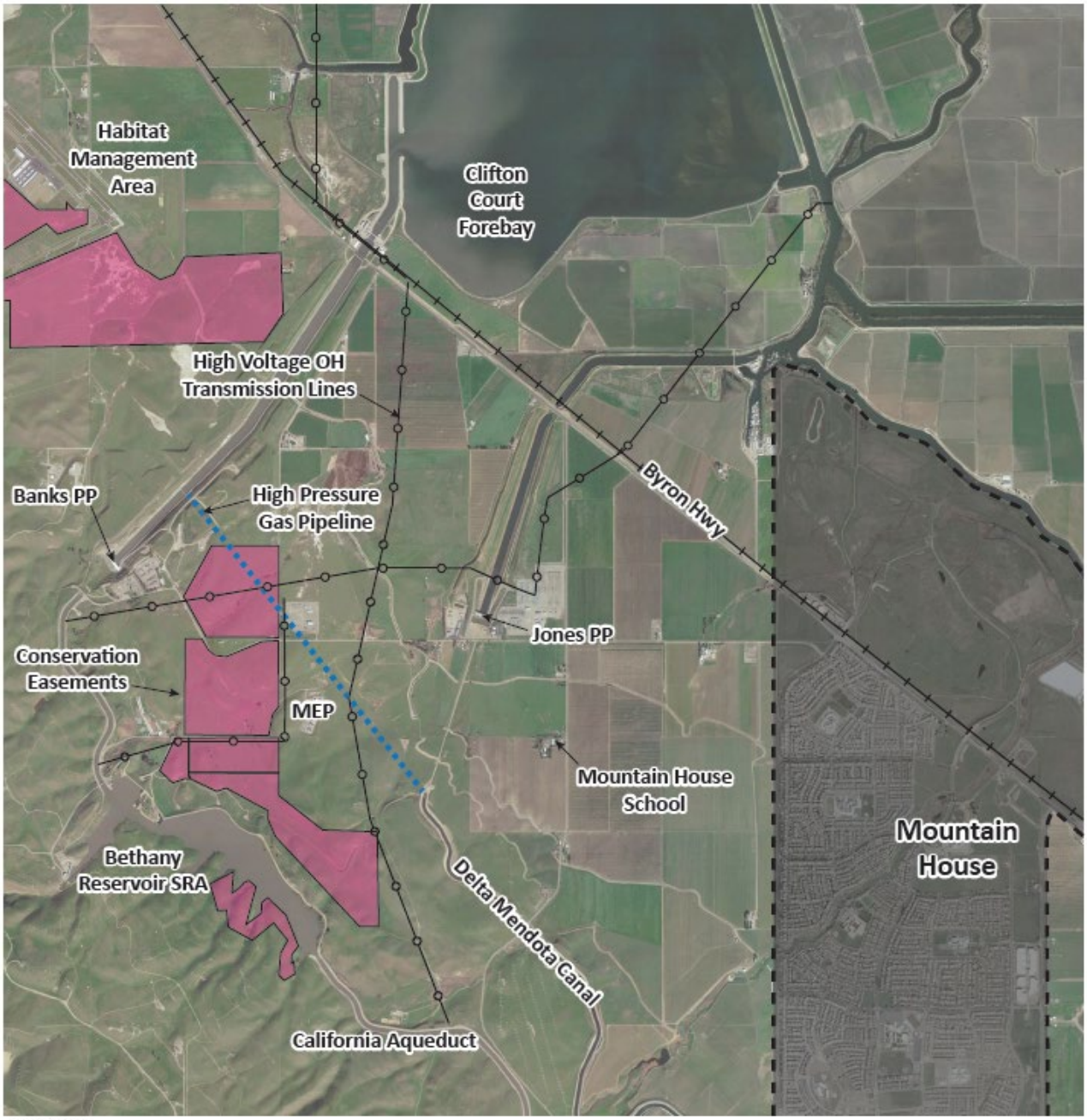
See TM – Facilities Siting Study – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

Each of the potential sites were further evaluated with respect to the following criteria.

- System Operations and Flexibility Considerations.
- Construction Considerations.
- Geotechnical Considerations.
- Property and Land Use.
- Environmental Setting (including habitat conditions).

Several sites were ranked low because of the potential for construction within conservation easements, operations and maintenance complexity (including Surge Basin operations), high site elevations, poor soil conditions and seismic challenges, and poor locations relative to access routes. The four top ranking sites (PS-3, PS-10, PS-11, and PS-12) were evaluated further. Site PS-10 was selected based upon proximity to access routes, avoids crossing the Byron Highway, is at suitable natural ground elevations, not adjacent to lands identified for future development, and is in close proximity to the Jones Pumping Plant approach channel (if needed).

FIGURE 8. POTENTIAL CONSTRAINTS CONSIDERED FOR BETHANY RESERVOIR PUMPING PLANT AND SURGE BASIN SITING ANALYSIS



Legend

Conservation Easements and Conservation Banks

Mountain House Community Future Development Boundary

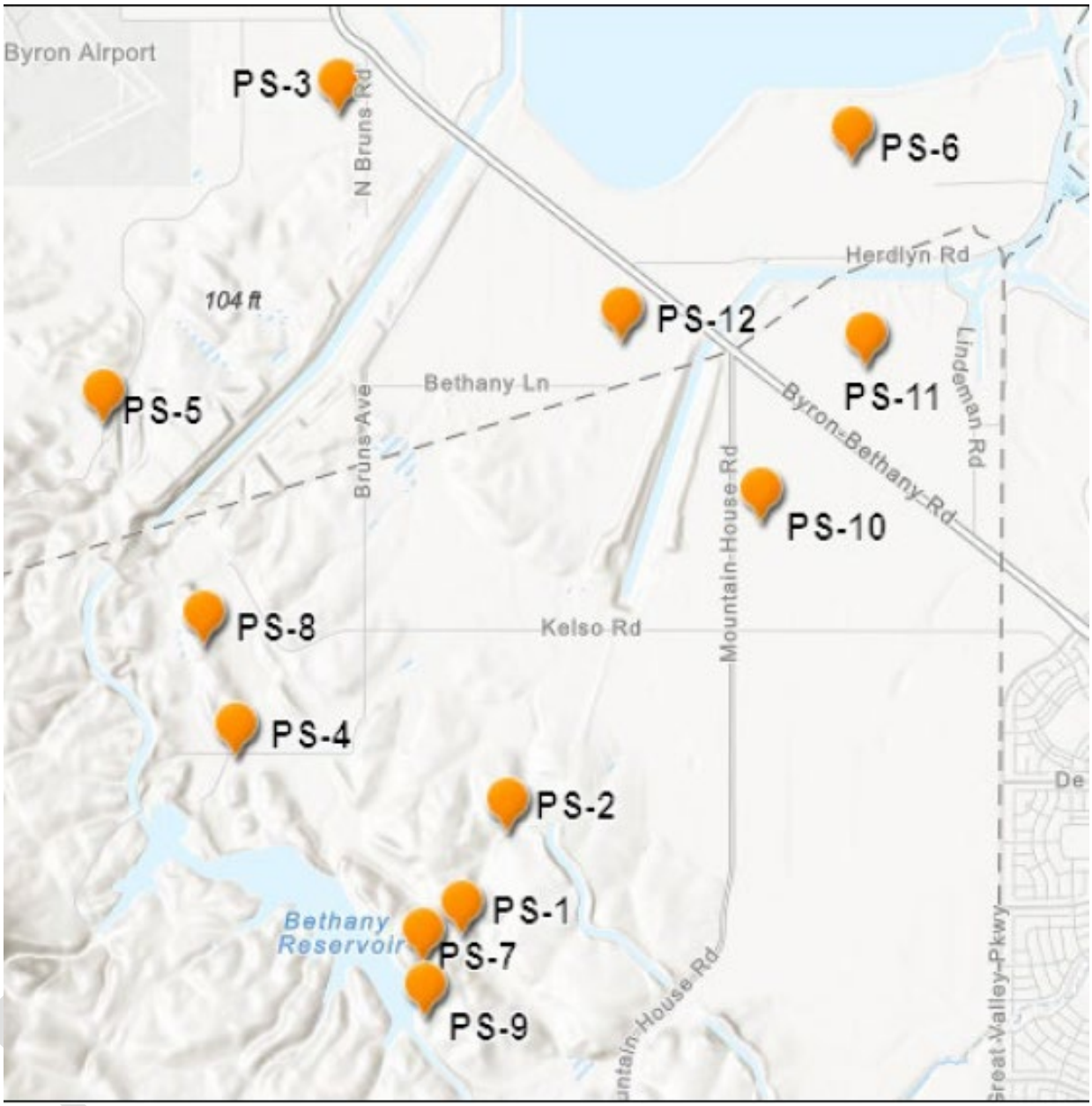
0 2,500 5,000
Approximate scale in feet

North

Notes:

Notes: MEP (Mariposa Energy Project), PP (Pumping Plant) , SRA (State Recreation Area)

FIGURE 9. CANDIDATE LOCATIONS CONSIDERED FOR THE BETHANY RESERVOIR PUMPING PLANT AND SURGE BASIN SITING ANALYSIS



2.3.4.2 Bethany Reservoir Aqueduct

The Bethany Reservoir Aqueduct alignment would be located in the general area shown in Figure 10 which includes multiple canals, Jones penstocks, high-voltage overhead transmission lines, high-pressure gas pipelines, crude oil pipelines, a major energy facility, the existing SWP Banks and CVP Jones pumping plants and associated canals, highways and roads, a school, and multiple conservation easements. The terrain between the Bethany Reservoir Pumping Plant and Bethany Reservoir is characterized by rolling foothills that rise steadily to over elevation 300 feet in areas near Bethany Reservoir with open-space and agricultural production land uses.

Potential alignments for the Bethany Reservoir Aqueduct, as shown in Figure 9, were evaluated with respect to the following goals.

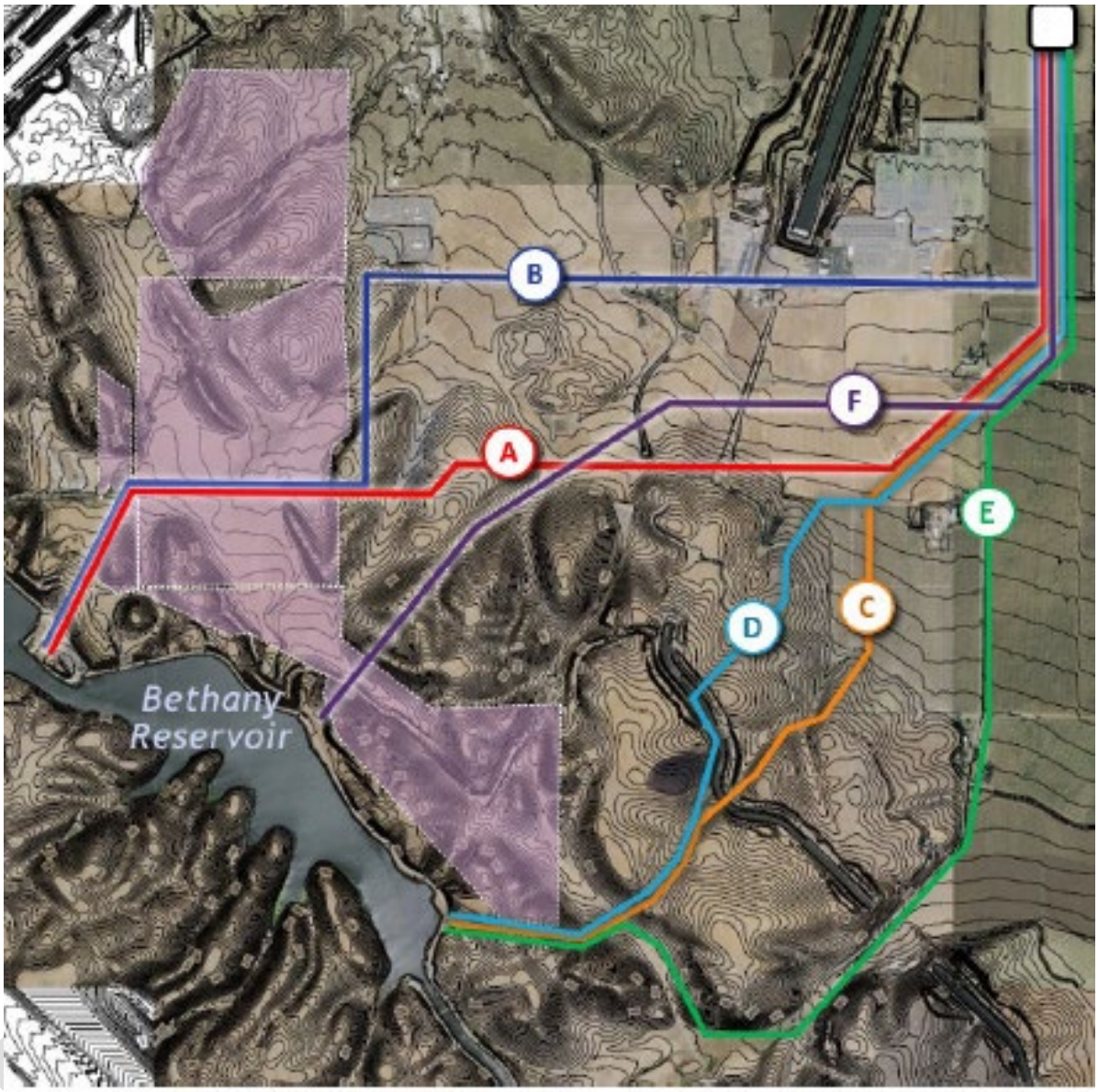
- Shortest Route with Compatible Topography: Compatible topography would avoid or minimize the need for deep excavations or tunnels.
- Avoid Conflicts with Existing Infrastructure: Existing power lines, canals, gas and oil lines, and other infrastructure would need to be avoided to the extent possible or crossed in appropriate locations.
- Maximize Use of Existing Access Roads to Avoid Excess Divisions of Parcels: Use existing roads where possible or select alignments along the edge of parcels.
- Avoid Areas with Sensitive Species or Habitats: Avoid wetlands, vernal pools, and other sensitive habitat areas. Formal surveys were not completed at the time of this evaluation.
- Select Areas to Minimize Crossing of Conservation Easements: Conservation easements are located to the north and east of Bethany Reservoir.

Each of the potential alignments were further evaluated with respect to the following criteria.

- Constructability.
- Topography of Existing Land.
- Operational Complexity (including reservoir water quality based upon discharge locations).
- Property and Land Use.
- Environmental Setting (including habitat conditions).

Although Alignment F would require construction under the Jones penstocks and the Bethany Reservoir Conservation Easement, it was selected since it is characterized by the shortest distance, minimal changes to reservoir water quality discharge location, gradually increasing topography along the alignment, and ability to cross Conservations Easements without surface disruption.

FIGURE 10. CANDIDATE ALIGNMENTS CONSIDERED FOR THE BETHANY RESERVOIR AQUEDUCT SITING ANALYSIS



3. Flood Management

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

3.1 Flood Risk Management Background

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

See TM – Levee Vulnerability Assessment and Flood Risk Management Supplement (Attachment to this EPR) for detailed information

See TM – Levee Vulnerability Assessment (Attachment H of the C/E EPR) for detailed information

See TM – Flood Risk Management (Attachment H of the C/E EPR) for detailed information

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 DCP and determine improvements needed to protect the DCP sites both during and post construction.

The DCP facilities would be designed for long-term operations to be protected from the 200-year flood event with climate change induced hydrology, sea level rise for Year 2100, freeboard criteria, and wind fetch wave run-up. DWR provided the projected water elevations for the 200-year flood event and sea level rise for Year 2100 as documented in the *Preliminary Flood Water Surface Elevations (Not for Construction)* memorandum (DWR, 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 DCP 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 near Clarksburg (Intake C-E-2): 28.2 feet.
- 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.

3.2 Levee Vulnerability 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.

See TM – Levee Vulnerability and Flood Risk Management Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM –Levee Vulnerability Assessment (Attachment H of the C/E EPR) for detailed information

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 to the levee toe (if present) 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 Bethany Reservoir Alternative, including the following criteria.

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

See TM – Levee Vulnerability and Flood Risk Management Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM –Levee Vulnerability Assessment (Attachment H of the C/E EPR) for detailed information

3.3 Flood Risk Management Approach

The flood risk management approach would be the same as described in Section 3.3 of the C/E EPR.

3.3.1 Flood Risk Management Measures

The DCP would include a combination of non-structural and structural flood risk management measures to reduce the risk of flooding during construction and operations, including at tunnel shafts. In this context, non-structural measures could involve temporary facilities or equipment, but such facilities or equipment would not significantly affect the construction footprint or on-site activities. Section 3.3.1 of the C/E EPR includes a general discussion of non-structural and structural flood risk management measures.

See TM – Flood Risk Management (Attachment H of the C/E EPR) for detailed information

See TM – Levee Vulnerability and Flood Risk Management Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

3.3.1.1 Measures to Reduce Flood Risks along Existing Levees

Development of the conceptual design information in support of the EIR included considerations to minimize effects on existing levees. This information is described in Section 3.3.1.1 of the C/E EPR.

See TM – Flood Risk Management (Attachment H of the C/E EPR) for detailed information

3.3.1.2 Measures to Reduce Flood Risks at Intakes

Measures to reduce flood risks at the intakes would be the same as described in Section 3.3.1.2 of the C/E EPR.

See TM – Intake Flood Management (Attachment A of the C/E EPR) for detailed information

3.3.1.3 Measures to Reduce Flood Risks at Tunnel Shafts

As described in Section 2.2.2.1, Tunnel 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 Appendix A and engineering concept drawings for each site.

The levee systems surrounding each Delta island along the Bethany Reservoir Alternative tunnel 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 Public Law 84-99 criteria. Public Law 84-99 criteria were considered an intermediate standard between the Delta Hazard Mitigation Plan and the DWR Bulletin 192-82 criteria.

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 in preparation of this EPR, 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.

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. 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.

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).

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

- **Lower Roberts Island -** 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 Public Law 84-99 Delta-Specific levee design standard (considered by the Federal Emergency Management Agency) and historic levee performance conditions that indicate potential existing vulnerabilities in the levee or foundation. These conditions could create a potentially unacceptable level of risk to the Project. These risks would be reduced through targeted repairs to existing levees to address Public Law 84-99 geometry and historic performance issues during a potential high-water event. Multiple areas have been identified as not meeting the Public Law 84-99 design criteria standards. These areas would primarily require levee widening and crown raises to provide a levee prism and freeboard to meet this design criteria. The Delta-Specific Public Law 84-99 standard provides minimum freeboard and levee geometry requirements based on levee height and the thickness of peat in the levee foundation. Following the Public Law 84-99 standard, the Lower Roberts Island levee would be designed with 1.5 feet of freeboard above the 100-year flood elevation, minimum 16-foot crest width, exterior slopes of 2H:1V exterior slopes, and interior slopes ranging between 3H:1V to 5H:1V depending on levee height and peat thickness. Levee modifications would occur along the Turner Cut eastern levee adjacent to West Neugerbauer Road. All of the modifications would occur on the land-side of the levees, as shown in the engineering 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.

See TM – Flood Risk Management (Attachment H of the C/E EPR) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H of the C/E EPR) for detailed information

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

  To protect the 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.

  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.

See TM – Flood Risk Management (Attachment H of the C/E EPR) for detailed information

See TM - Levee Vulnerability Assessment (Attachment H of the C/E EPR) for detailed information

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

4. Site Development, Site Access, and Logistics

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

See TM – Logistics Strategy – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Potential Road Access Routes (Attachment F of the C/E EPR) for detailed information

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 DCP, including: truck, barge, and rail. All construction sites would require truck access. Barge and rail access were considered exclusively to service major construction sites to reduce 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.

4.1 Roads

Truck access would be required for all construction sites within the DCP. 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).

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

See TM - Preliminary Construction Schedules for Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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

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

See TM - Logistics Strategy – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Logistics Strategy (Attachment F of the C/E EPR) for detailed information

See TM - Potential Road Access Routes (Attachment F of the C/E EPR) for detailed information

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

Design standards for each state or local entity that operates roads and bridges would be followed for all 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.

Major road improvements that will be needed to service construction of the DCP are summarized in Table 4 and included in Appendix A and the engineering concept drawings. Appendix A also includes the number of piles and piers required for new or modified bridges. These roadways would be maintained for transit throughout the construction period.

TABLE 4. MAJOR ROAD IMPROVEMENTS FOR THE BETHANY RESERVOIR ALTERNATIVE

Construction Sites	Description of Major Improvements
Intake Haul Road	• Described in Section 4.1 of the C/E EPR.
Twin Cities Complex	• Widening of 1.0 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	• Described in Section 4.1 of the C/E EPR.
Canal Ranch Tract	• Described in Section 4.1 of the C/E EPR.
Terminous Tract	• Described in Section 4.1 of the C/E EPR.
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
Bethany Reservoir Pumping Plant and Surge Basin	• New interchange at Lindemann Road with Byron Highway realignment and widening and extension 0.5 mile 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 mile paved frontage road along Byron Highway between Lindemann Road and Mountain House Road • New 2.1 mile 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 mile 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

Construction Sites	Description of Major Improvements
	• New 0.6 mile 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
Bethany Reservoir Aqueduct	• Widen 1.23 mile 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 mile 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

4.2 Barge Access

See TM – Barge Transportation Study (Attachment F of the C/E EPR) for detailed information

As discussed in Section 4.2 of the C/E EPR, barge access was considered for sites requiring large volumes of material transport to help ease the load on the local roadways. For the Bethany Reservoir Alternative, these sites included the intakes and the tunnel launch shaft on Lower Roberts Island. Information regarding barge access at the intakes and at the tunnel launch shaft on Lower Roberts Island would be the same as described in Section 4.2 of the C/E EPR.

4.3 Rail Access

See TM – Rail Potential Study (Attachment F of the C/E EPR) for detailed information

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 DCP, the rail facilities would probably use small manifest train facilities. The major railroad would deliver the rail cars to a designated area at the construction site, and the DCP would move the rail cars along on-site railroads within the construction site to specific loading or unloading locations. The DCP would place the 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.

Rail access to Lower Roberts Island would be provided from existing UPRR and Burlington Northern-Santa Fe Railroad tracks located on 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.

4.4 Park and Ride Lots

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

See TM – Logistics Strategy – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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

- Hood-Franklin Park and Ride Lot: along the south side of Hood-Franklin Road immediately east of Interstate 5 to provide parking for employees for the intakes.
- Charter Way Park and Ride Lot: along the south side of Charter Way at the southwest corner of the Interstate 5 overpass to provide parking 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.

4.5 Pre-Cast Tunnel Segmental Liner Facility

See TM – Preliminary Precast Yard Study (Attachment F of the C/E EPR) for detailed information

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 mass produced and transported in sufficient quantity to keep pace with tunneling progress. Information regarding tunnel liner segment manufacturing would be the same as described in Section 4.5 of the C/E EPR.

4.6 Emergency Response Planning

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

available within 2 hours of the travel time from the tunnel entry point when the number people underground totals at least 25 in accordance with the Cal/OSHA requirements.

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

Based on the unique nature of much of the construction activities under the DCP, it is suggested that in general the primary emergency response services be provided by the construction contractors. Therefore, temporary emergency response facilities, equipment, and trained personnel have been included in the plans for the main DCP construction sites (the intakes, tunnel launch shaft sites, and the Bethany Complex) summarized in this EPR, 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.

See TM – Project Emergency Response Plan Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

Additional details regarding emergency response planning are provided in Section 4.6 of the C/E EPR.

5. Utilities

5.1 Purpose

The construction sites for the Bethany Reservoir Alternative 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.

5.2 Electric Power Facilities

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.

See TM – Electrical Power Load and Routing Study - Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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

Methods considered for extending power connections to the DCP facilities are discussed in Section 5.2 of the C/E EPR. However, helicopters would not be used for construction of any transmission towers, or other construction activities for the Bethany Reservoir Alternative.

Discussions with SMUD, WAPA, and PG&E are ongoing as this EPR is being prepared. The current concepts to provide interconnection service and power, either concurrently or eventually, to DCP facilities are presented in the Electrical Power Load and Routing Study TM and briefly summarized in Table 5.

TABLE 5. SUMMARY OF POWER SUPPLY CONNECTIONS FOR BETHANY RESERVOIR ALTERNATIVE

Key Feature	Existing Facilities	Proposed Changes
Intakes	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
Twin Cities Complex	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
New Hope Tract Shaft	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
Canal Ranch Tract	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
Terminous Tract	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
King Island	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.

Key Feature	Existing Facilities	Proposed Changes
Lower Roberts Island	Described in Section 5.2 of the C/E EPR.	• Proposed changes would be similar to those described in Section 5.2 of the C/E EPR. However, the location of the substation would be south of House Road.
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 BRPP 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	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
Hood-Franklin Park and Ride Lot for lights and electric vehicle charging station	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.
Charter Way Park and Ride Lot for lights and electric vehicle charging station	Described in Section 5.2 of the C/E EPR.	• Described in Section 5.2 of the C/E EPR.

5.3 Communications and Supervisory Control and Data Acquisition

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

The existing SWP facilities are largely monitored and controlled through an existing SCADA system and the DCP will need to be integrated into this system to allow for coordinated operations. The communications network for the DCP would connect three major data centers, two intakes, and 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.

See TM – SCADA/ Communications Routing and Basic Design Approach - Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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

- Intakes.
- Tunnel Shafts (launch shafts plus select maintenance or reception shafts, only).
- Bethany Reservoir Pumping Plant.
- Bethany Reservoir Discharge Structure.

Section 5.3 of the C/E EPR provides additional information regarding the SCADA system.

5.4 Water Supplies to Construction Sites

Water supplies in the vicinity of the DCP features are provided by on-site groundwater and/or surface water rights. Information regarding water supplies for the DCP construction sites for the Bethany Reservoir Alternative would be similar to that described in Section 5.4 of the C/E EPR.

5.5 Wastewater Facilities at Construction Sites

Wastewater facilities for most of the DCP construction sites would be provided with portable restrooms. Septic systems would be constructed at the intakes, Twin Cities Complex, 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.

5.6 Potential Crossings with Local Wastewater Facilities at Construction Sites

Wastewater service for structures near the DCP construction sites consist of individual septic systems with septic tanks and leach fields. Information regarding potential conflicts with local wastewater facilities at construction sites would be similar to that described in Section 5.6 of the C/E EPR.

5.7 Potential Crossings with Local Water Facilities at Construction Sites

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

See TM – Summary of Utility Crossings - Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

Information regarding potential crossings with local water facilities at construction sites or along the tunnel alignment would be similar to that described for the Eastern Corridor in Section 5.7 of the C/E EPR. In addition to that described in Section 5.7 of the C/E EPR, the Bethany Reservoir Aqueduct would cross the CVP Jones Pumping Plant discharge aqueducts in a tunnel as described herein and shown on the Engineering Concept Drawings. It would also cross BBID canals, as described in Section 5.8.

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

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

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

See TM – Summary of Utility Crossings - Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

5.9 Potential Crossings with Existing Communication Facilities

Existing communications facilities in the DCP project area are primarily telephone lines co-located on the same poles as overhead electrical power lines. Potential conflicts with existing communication facilities for the Bethany Reservoir Alternative would be similar to that described in Section 5.9 of the C/E EPR.

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

Transmission pipelines are located throughout the Delta to convey natural gas, oil, and fuel between major substations. These pipelines do not serve individual energy users, such as providing natural gas services to a house. Many of the transmission pipelines are located parallel to railroad and highway alignments that are crossed by the tunnel alignment. 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.

6. Other Systemwide Considerations

6.1 Purpose

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

6.2 Hydraulics and Operational Requirements

Hydraulic modeling was completed during preparation of this EPR to determine tunnel diameters and elevations, sizes of the pumps at the Bethany Reservoir Pumping Plant, sizing and configuration of Surge Basin, and sizing of Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure.

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

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

- Hydraulic analysis between the Sacramento River and the Bethany Complex.
- Hydraulic analysis between the Bethany Reservoir Pumping Plant and the delivery point at the Bethany Reservoir Discharge Structure.

The Bethany Reservoir Alternative 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. The model included a detailed hydraulic head loss analysis considering a range of water surface elevations within the tunnel and operational ranges for the Bethany Reservoir Pumping Plant. The evaluation included a hydraulic transient-surge analyses for operation of the tunnel between the intakes and Bethany Complex that could occur 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 the intakes. Under these conditions, surge flows in the tunnel would flow into the Surge Basin through the tunnel reception shaft. The evaluation also included a hydraulic transient-surge analysis for operation

See TM – Capacity Analysis for Preliminary Tunnel Analysis (Attachment B of the C/E EPR) for detailed information

of the Bethany Reservoir Aqueduct if there was a simultaneous shutdown of the Bethany Reservoir Pumping Plant pumps followed by the rapid closure of all pump discharge control valves. In this case, water would flow from the Aqueduct surge tanks located at the Bethany Reservoir Pumping Plant into the Aqueduct pipelines and surge flows would be conveyed into Bethany Reservoir. The Aqueduct pipelines would include air/vacuum valves to reduce pressure in the pipelines.

See TM – Hydraulic Analysis of Delta Conveyance Options – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

Hydraulic characteristics of the upstream system between the Sacramento River intakes and the Bethany Reservoir Pumping Plant would largely be driven by the upstream boundary conditions, including the water surface elevations in the Sacramento River at the intakes and the allowable hydraulic losses in the intakes, along the tunnels, and other appurtenances. The hydraulic analysis was used to size the facilities for different flow rates to meet the upstream and downstream boundary conditions. Hydraulic characteristics of the downstream system between the Bethany Reservoir Pumping Plant and the Bethany Reservoir Discharge Structure would be controlled by the elevations between the pumping plant and the discharge structure.

6.3 Geotechnical and Soil 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.

See TM - Potential Future Field Investigations – Bethany Reservoir Alternative Options (Attachment to this EPR) for detailed information

6.3.1 Seismic Considerations

Conceptual seismic design criteria were developed during the development of the conceptual design information in support of the EIR. 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 DCP including the following facilities.

See TM - Conceptual Level Seismic Design and Geohazard Evaluation Criteria (Attachment H of the C/E EPR) for detailed information

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

guidelines allow flexibility based upon use of the facilities. The seismic loading and performance criteria selected for a facility would be based on 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 DCP.

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

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

See TM - Conceptual Seismic Design and Geohazard Evaluation Criteria (Attachment H of the C/E EPR) for detailed information

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

DWR previously collected preliminary geotechnical exploration data at locations along potential conveyance corridors, including results from soils investigations conducted from 2009 to 2012 while preparing the EIR/EIS for the California WaterFix Project. This effort included conducting soil borings and cone penetrometer tests (CPTs) (DWR, 2010b; DWR, 2013). Additional subsurface data were also obtained from various counties and agencies, including Caltrans and EBMUD.

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

South of the potential Bethany Reservoir Pumping Plant, the geology changes beyond the margins of the historic Delta and consists of colluvium from the coast range. Farther to the south, the aqueduct and the Bethany Reservoir Discharge Structure are 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. The beds of this sedimentary formation generally dip to the northeast at 20 degrees from horizontal.

See TM - Liquefaction and Ground Improvement Analysis for Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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

See TM - Conceptual Seismic Design and Geohazard Evaluation Criteria (Attachment H of the C/E EPR)

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.

See West Tracy Fault Preliminary Displacement Hazard Analysis (Attachment H of the C/E EPR)

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 Clifton Court Forebay area in a large earthquake. Regardless of the potential for surface rupture, accurate characterization of the fault is important as the fault's proximity to project facilities affects design ground motions for use during facility design.

See TM - Potential Future Field Investigations – Bethany Reservoir Alternative Options (Attachment to this EPR)

During the design phase, test trenches (up to approximately 1000 feet long and 20 feet deep) would be excavated along a line running from the southeast of Byron to the southeast of Clifton Court Forebay to further investigate the nature and location of the West Tracy Fault between the town of Byron and the area southeast of Clifton Court Forebay (Latitude 37.8388N / Longitude -121.5934W). 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.

See TM - Potential Future Field Investigations – Bethany Reservoir Alternative Options (Attachment to this EPR) for detailed information

6.3.2 Soil Liquefaction Potential

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

See Liquefaction and Ground Improvement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

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

Preliminary results developed during preparation of this EPR identified that potential liquefaction could occur at several sites unless soil stabilization methods would be included in the construction methods. Liquefaction potential was identified at the intakes and most tunnel shaft sites based on preliminary estimated ground motions, as described in the Liquefaction and Ground Improvements Analysis (Final Draft) attached to this EPR, and the Conceptual Design Phase Seismic Site Response Analysis (Draft) attached to the C/E EPR. 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 numerical modeling and the results of future subsurface exploration and testing.

See Conceptual Design Phase Seismic Site Response Analysis (Draft) (Attachment H of C/E EPR) for detailed information

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 investigations, including the intakes, tunnel shafts, and Bethany Complex facilities.

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

6.3.3 Ground Improvement Methods

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. Ground improvement methods for the Bethany Reservoir Alternative would be the same as described in Section 6.3.3 of the C/E EPR.

See TM – Liquefaction and Ground Improvement Analysis (Attachment H of the C/E EPR) for detailed information

6.3.3.1 Ground Improvement at Intake Sites

Ground improvement methods at the intakes would be the same as described in Section 6.3.3.1 of the C/E EPR.

6.3.3.2 Ground Improvement at Tunnel Shafts

Ground improvement methods at many of the tunnel shafts would be the same as described in Section 6.3.3.2 of the C/E EPR.

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.

See TM – Conceptual Intake Cofferdam Construction (Attachment A of the C/E EPR) for detailed information

6.3.3.3 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.

6.3.4 Dewatering at the Intakes

Information regarding dewatering at the intakes would be the same as described in Section 6.3.4 of the C/E EPR.

See TM – Dewatering Estimates for Intake Facilities and Southern Forebay Emergency Spillway (Attachment H of the C/E EPR) for detailed information

6.4 Earthwork Balance

The DCP 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 DCP 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 DCP construction sites would be obtained from commercially licensed sources.

An inventory was performed for each construction-site to compile fill requirements and soil generation rates and volumes associated with various earthwork activities. The schedule for each activity was applied to the need for and production of soil materials based on the overall project schedule and the duration of the various construction activities. The results of the Earthwork Model were used to identify the structural fill needs at each major construction site utilizing excavated material, including RTM, from the same site (on-site reuse) or imported from other sites with surplus material, as summarized in Table 6.

See TM – Soil Mass Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Soil Balance (Attachment H of the C/E EPR) for detailed information

See TM - Reusable Tunnel Material (Attachment B of the C/E EPR) for detailed information

See TM - Preliminary Construction Schedule for Bethany Reservoir Alternative for detailed information

TABLE 6. SUMMARY OF EARTHWORK MODEL RESULTS FOR SOIL BALANCE

Facility	Structural Fill Balance
Intakes	• Described in Section 6.4 of the C/E EPR
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 Appendix A
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

6.5 Tunneling Through Areas with Oil and Gas Well Fields

See TM – Tunnel Excavation and Drive Assessment (Attachment B of the C/E EPR) for detailed information

See TM - Emergency Response Plan (Attachment F of the C/E EPR) for detailed information

Portions of the tunnel alignment between the intakes and the Bethany Complex would be located in areas with numerous active and abandoned oil and gas wells. Information regarding tunneling though areas with oil and gas well fields for the Bethany Reservoir Alternative would be the same as described in Section 6.5 of the C/E EPR.

6.6 Avoidance of Settlement During Tunneling

See TM – Supplemental Tunnel Information – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Tunneling Effects Assessment (Attachment B of the C/E EPR) for detailed information

Many of the DCP construction sites would be located near existing levees and tunnel alignments would cross under levees, highways, the EBMUD Mokelumne Aqueducts, high-voltage electrical transmission lines, water, sewer, oil, and gas pipelines, and Jones penstocks. The top of the main tunnel structure would cross under most of these surface features at depths of approximately 100 feet below the ground surface. The Bethany Reservoir Aqueduct tunnels would be designed to minimize or eliminate settlement under the Jones penstocks.

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

6.7 Compliance with Environmental Requirements

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

(SWPPP), and dust control plans. Information regarding compliance with these environmental requirements is provided in Section 6.7 of the C/E EPR.

6.8 Construction and Long-term Site Space Requirements

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

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	Described in Section 6.8 of the C/E EPR.		
Intake C-E-3	Described in Section 6.8 of the C/E EPR.		
Lambert Road Concrete Batch Plant	Described in Section 6.8 of the C/E EPR.		
Twin Cities Complex	586	222	364 (agriculture or habitat) 214 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Canal Ranch Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Terminous Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
King Island Shaft Site	Described in Section 6.8 of the C/E EPR.		
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	N/A

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	N/A
Bethany Reservoir Pumping Plant and Surge Basin Site	228	175	53 (agriculture or habitat) 59 (excavated material stockpile planted with native grasses)
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	153	76	75 (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.

N/A = Not Applicable

6.8.1 Post-Construction Site Reclamation

See TM – Post-Construction Land Reclamation Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Post-Construction Land Use Reclamation (Attachment H of the C/E EPR) for detailed information

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 EPR.

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

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

Initial soil treatments would depend on the actual disturbance, but for soils with more than minimal 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.

See TM – Post-Construction Land Reclamation Supplement – Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Post-Construction Land Use Reclamation (Attachment H of the C/E EPR) for detailed information

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 DCP. 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.

6.9 Preliminary Construction Schedule Considerations

Construction scheduling was developed using scheduling software based upon the key features presented in the engineering concept drawings and an assumed number of construction packages. The preliminary construction schedules for the DCP (see Attachment) 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.

See TM – Preliminary Construction Schedule for Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

- **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).

See TM – Preliminary Construction Schedule for Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

See TM – Preliminary Construction Schedule for Bethany Reservoir Alternative (Attachment to this EPR) for detailed information

- **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.

6.10 Preliminary Information for EIR Air Quality and Traffic Analyses

As described in Section 1, this EPR was prepared to provide information to DWR for development of the EIR. A portion of the information needed to develop air quality and traffic analyses in the EIR includes assumptions related to construction 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 E. The assumptions included estimates of travel times for employees and materials deliveries, as discussed in Section 6.10 of the C/E EPR.

Similarly, assumptions associated with operations and maintenance of the DCP facilities were developed to provide information to DWR for the EIR air quality and traffic analyses. These assumptions are included in Appendix F.

7. Project Design Capacity Options

The NOP identified a range of project design capacities from 3,000 cfs to 7,500 cfs to be considered in the EIR (DWR, 2020a). The Bethany Reservoir Alternative with a project design capacity of 6,000 cfs was described in Chapters 2 through 6 of this EPR. Project design capacities for 3,000 cfs, 4,500 cfs, and 7,500 cfs would affect the size of the intake facilities, tunnel diameter and volume of material removed during tunneling operations, sizes of facilities at tunnel launch shaft sites, and sizes of facilities at the Bethany Complex. For the 7,500 cfs project design capacity, additional project features would be included for water deliveries to the CVP Jones Pumping Plant approach channel (Delta-Mendota Canal [DMC]).

The option with a 7,500 cfs project design capacity would include Intake C-E-2 (1,500 cfs), referred to as DWR EIR Intake A, and Intakes C-E-3 and C-E-5 at 3,000 cfs, each. The option with a 3,000 cfs project design capacity would only include Intake C-E-5 at a capacity of 3,000 cfs. The option with a 4,500 cfs project design capacity would include Intake C-E-3 (3,000 cfs) and Intake C-E-5 (1,500 cfs).

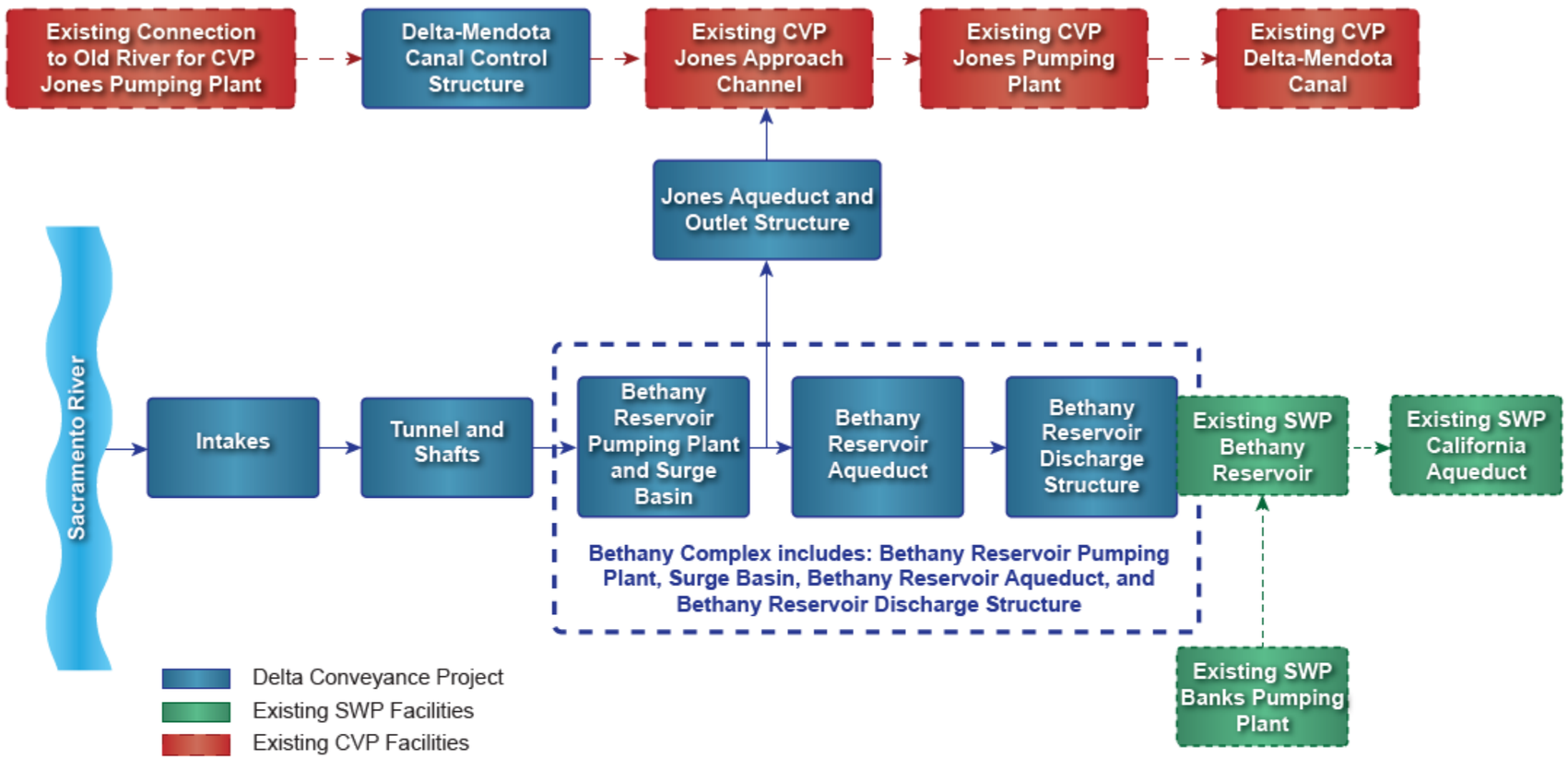
7.1 Project Design Capacity for 7,500 cfs Option

The 7,500 cfs project design capacity option would provide 6,000 cfs to the existing SWP Bethany Reservoir and 1,500 cfs to the existing CVP Jones Pumping Plant approach channel (Figure 10). The facilities described in this section represent potential facilities that are not currently being analyzed in the DWR EIR.

This option would include all of the facilities described in Sections 2 through 6 for the 6,000 cfs project design capacity including the tunnel alignments between Intake C-E-3 and the Bethany Complex. The 7,500 cfs project design capacity would also include one additional intake (Intake C-E-2) with connecting tunnel to Intake C-E-3 and addition of the Jones Canal Aqueduct, Jones Outlet Structure, and DMC Control Structure, as schematically shown in Figures 11 and 12.

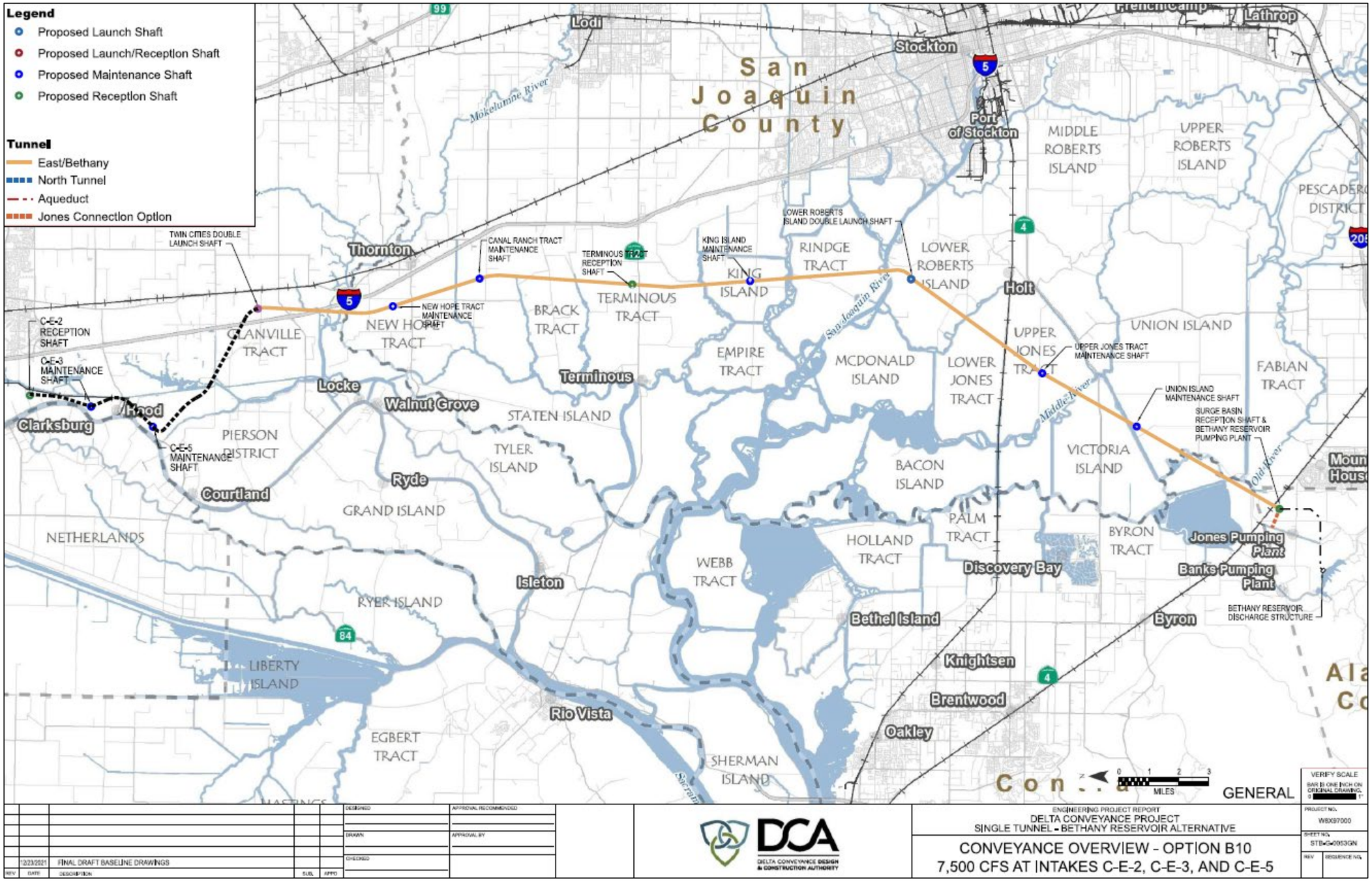
A summary of the physical characteristics is presented in Table 8. Additionally, Table 9 summarizes the construction and post-construction site requirements as well as post-construction site reclamation for the major features. More detailed information about these facilities are presented in the engineering concept drawings and Appendix B of this EPR.

FIGURE 11. SCHEMATIC OF BETHANY RESERVOIR ALTERNATIVE FACILITIES TO CONVEY WATER FROM SACRAMENTO RIVER TO SWP CALIFORNIA AQUEDUCT AND CVP DELTA-MENDOTA CANAL FOR PROJECT DESIGN CAPACITY OF 7,500 CFS



- Three intakes located along the Sacramento River near Hood
- Water would flow from the intakes into one tunnel and then into 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
- Water would be pumped into the Jones Pumping Plant approach channel thorough the Jones Canal Aqueduct and Outlet Structure. The Delta-Mendota Control Structure would be installed in the Delta-Mendota Canal upstream of the new Jones Canal Aqueduct and Outlet Structure to provide "Dual Conveyance" for the CVP
- 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 12. BETHANY RESERVOIR ALTERNATIVE FACILITY LOCATION MAP TO CONVEY WATER FROM INTAKES TO BETHANY COMPLEX FOR PROJECT DESIGN CAPACITY OF 7,500 CFS



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

TABLE 8. SUMMARY OF THE BETHANY RESERVOIR ALTERNATIVE PHYSICAL CHARACTERISTICS FOR THE PROJECT DESIGN CAPACITY OF 7,500 CFS

Feature Description	Bethany Reservoir Alternative
Project Design Capacity	• 7,500 cfs
Number of Intakes with Fish Screens	• 3 with cylindrical tee fish screens
Design Flow Capacity of Each Intake	• One Intake at 1,500 cfs (with Reception Shaft) (Intake C-E-2) • One Intake at 3,000 cfs (with Maintenance Shaft) (Intake C-E-3) • One Intake at 3,000 cfs (with Maintenance Shaft) (Intake C-E-5)
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)	• Maximum Capacity – 1,500 cfs between Intake C-E-2 and Intake C-E-3 – 4,500 cfs between Intake C-E-3 and Intake C-E-5 – 7,500 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 40 feet • Tunnel Outside Diameter: 44 feet • Tunnel Length: 54,202 feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex) • Number of Reception Shafts: 1 (Intake C-E-2) • Number of Maintenance Shafts: 2 (Intakes C-E-3 and C-E-5) • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 120 (Reach 1) • Maintenance and Reception Shafts Inside Diameter (feet): 83 (aka Intake Outlet Shafts)
Tunnel Reaches between Twin Cities Complex and Bethany Reservoir Surge Basin	• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Bethany Reservoir Pumping Plant and Surge Basin • Maximum Capacity: 7,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 40 feet • Tunnel Outside Diameter: 44 feet • Tunnel Length: 194,080 feet • Number of Tunnel Launch Shafts: 3 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 5 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 120 (Reach 2) • Dual Launch Shafts at Lower Roberts Island: Inside Diameter (feet): 120 (Reach 3 and Reach 4) • Maintenance Shafts and Terminous Reception Shaft Inside Diameter (feet):76 • Surge Basin Reception Shaft Inside Diameter (feet): 120
Bethany Reservoir Pumping Plant and Surge Basin	• Eighteen pumps at 500 cfs, each, including three standby pumps (Up to fifteen pumps would operate at any one time for a total of 7,500 cfs capacity) • Four, 75-foot diameter by 20-feet high one-way surge tanks connected to the BRPP's discharge pipelines (one tank connected to each pipeline) • Two Portable 60 cfs Pumps to dewater main tunnel • Five rail-mounted 100 cfs pumps to dewater Surge Basin • One 900-foot by 960-foot Surge Basin with surge overflow capacity

Feature Description	Bethany Reservoir Alternative
Jones Canal Aqueduct, Delta-Mendota Canal Outlet Structure, and Delta-Mendota Canal Control Structure	• Jones Canal Aqueduct – Number of Pipelines: 1 – Pipeline Inside Diameter: 180-inch – Pipeline Outside Diameter: 182.5-inch +/- – Pipeline Length: approximately 3,000 feet • Jones Outlet Structure – Maximum Capacity: 1,500 cfs • Delta-Mendota Canal Control Structure – Maximum Capacity: 4,600 cfs
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	• Maximum Capacity: 6,000 cfs • Number of Pipelines: 4 • Maximum capacity per pipeline: 1,500 cfs • Pipeline Inside Diameter: 180-inch • Pipeline Outside Diameter: 182.5 -inch +/- • Each Pipeline Length: 13,000 feet for each pipeline • Tunnels under Jones Penstock: 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: 3,064 feet for each tunnel, 4 tunnels, tunnel depth varies from approximately 45-50 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

TABLE 9. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 7,500 CFS

Key Feature	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E-2	Described in Section 7.1 of the C/E EPR.		
Intake C-E-3	Described in Section 6.8 of the C/E EPR.		
Intake C-E-5	Described in Section 6.8 of the C/E EPR.		
Lambert Road Concrete Batch Plant	Described in Section 6.8 of the C/E EPR.		
Twin Cities Complex	578	316	262 (agriculture or habitat) 303 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Canal Ranch Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Terminous Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
King Island Shaft Site	Described in Section 6.8 of the C/E EPR.		
Lower Roberts Island Shaft Site	610	356	210 (agriculture or habitat) 245 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	11	11	N/A
Union Island Shaft Site	14	14	N/A

Key Feature	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Bethany Reservoir Pumping Plant and Surge Basin Site	229	177	84 (agriculture or habitat) 69 (excavated material stockpile planted with native grasses)
Jones Canal Aqueduct, Delta-Mendota Canal Outlet Structure, and Delta-Mendota Canal Control Structure	88	57	Included in Pumping Plant/Surge Basin restoration areas above
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	153	76	75 (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.
N/A = Not Applicable

7.1.1 Intakes for Project Design Capacity of 7,500 cfs

Information regarding the intakes for the Bethany Reservoir Alternative 7,500 cfs project design capacity option would be the same as discussed in Section 7.1.1 of the C/E EPR.

7.1.2 Tunnels for Project Design Capacity of 7,500 cfs

The tunnels between the Intakes and the Bethany Complex would be constructed in the same manner as described in Section 2.2, Tunnels and Tunnel Shafts. The tunnel dimensions are summarized in Tables 8 and 9, and quantitative descriptions of the tunnel shaft construction are presented in Appendix B.

7.1.3 Bethany Complex for Project Design Capacity of 7,500 cfs

The Bethany Reservoir Pumping Plant and Surge Basin, Bethany Reservoir Aqueduct, and Bethany Reservoir Discharge Structure would be constructed as described in Section 2.3, Bethany Complex. The Bethany Reservoir Pumping Plant would include additional pumps as compared to the project design capacity of 6,000 cfs, as summarized in Tables 8 and 9, and Appendix B. The Bethany Reservoir Pumping Plant would include a larger electrical building and a larger heating ventilation-air conditioning equipment yard. The Surge Basin would also be larger for the project design capacity of 7,500 cfs as compared to the project design capacity of 6,000 cfs. The Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure would be the same as described in Section 2.3, Bethany Complex.

7.1.4 Jones Canal Aqueduct, Delta-Mendota Canal Outlet Structure, and Delta-Mendota Canal Control Structure for Project Design Capacity of 7,500 cfs

The Jones Canal Aqueduct would be a single 180-inch inside diameter welded steel pipeline and would extend from the Bethany Reservoir Pumping Plant to the Jones Outlet Structure along the Jones Pumping Plant approach channel, as described below and summarized in Tables 8 and 9, and Appendix B. The Jones Outlet Structure would be a baffled concrete drop structure along the eastern bank of the Delta-Mendota Canal between Old River and the Jones Pumping Plant. The Delta-Mendota Canal Control Structure would be constructed in the DMC between the Byron Highway and the Jones Outlet Structure. It would include a series of radial gates to control the flow in the DMC.

See TM – Conceptual Development of Aqueduct and Discharge Structure (Attachment to this EPR) for detailed information

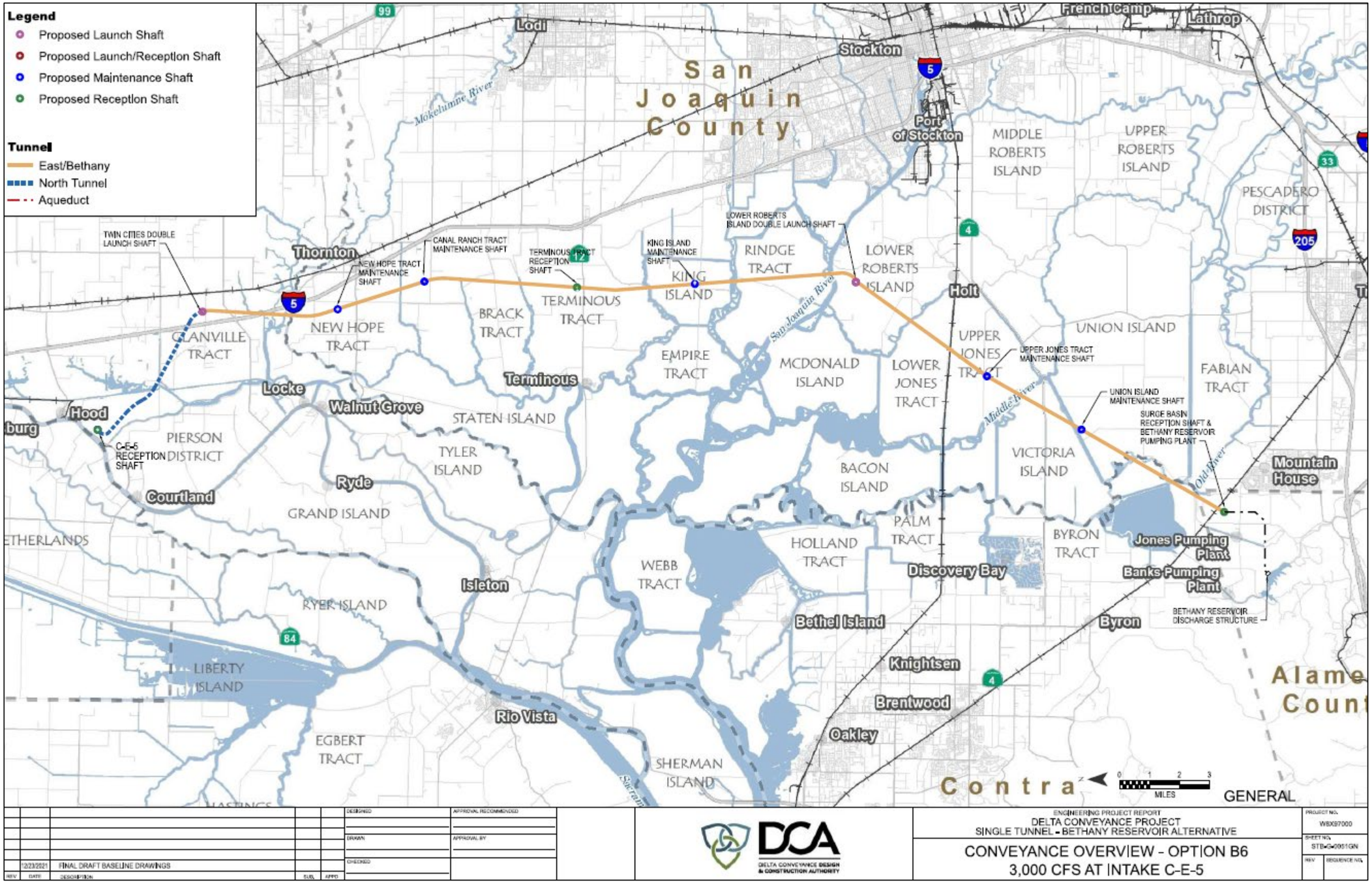
7.2 Project Design Capacity Option for 3,000 cfs

One project design capacity option would provide 3,000 cfs to the existing SWP Bethany Reservoir. The facilities described in this section represent potential facilities that are not currently being analyzed in the DWR EIR.

This option would include all of the facilities described in Sections 2 through 6 for the 6,000 cfs project design capacity except without Intake C-E-3 and the tunnel alignment and intake haul road between Intake C-E-3 and Intake C-E-5. The facilities for this option with a project design capacity of 3,000 cfs are schematically shown in Figures 1 and 13.

Summary of the physical characteristics are presented in Table 10. Additionally, Table 11 summarizes the construction and post-construction site requirements as well as post-construction site reclamation for the major features. More detailed information about these facilities are presented in the engineering concept drawings and Appendix C of this EPR.

FIGURE 13. BETHANY RESERVOIR ALTERNATIVE FACILITY LOCATION MAP TO CONVEY WATER FROM INTAKES TO BETHANY COMPLES FOR PROJECT DESIGN CAPACITY OF 3,000 CFS



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

TABLE 10. SUMMARY OF THE BETHANY RESERVOIR ALTERNATIVE PHYSICAL CHARACTERISTICS FOR THE PROJECT DESIGN CAPACITY OF 3,000 CFS

Feature Description	Bethany Reservoir Alternative
Project Design Capacity	• 3,000 cfs
Number of Intakes with Fish Screens	• 1 with cylindrical tee fish screens
Design Flow Capacity of Each Intake	• One Intake at 3,000 cfs (with Reception Shaft) (Intake C-E-5)
Tunnel Reach 1 (Between Twin Cities Complex and Intakes)	• Maximum Capacity – 3,000 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 26 feet • Tunnel Outside Diameter: 28 feet 4 inches • Tunnel Length: 29,828feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex) • Number of Reception Shafts: 1 (Intake C-E-5) • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 (Reach 1) • Reception Shafts Inside Diameter (feet): 83 (aka Intake Outlet Shaft)
Tunnel Reaches between Twin Cities Complex and Bethany Reservoir Surge Basin	• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Bethany Reservoir Pumping Plant and Surge Basin • Maximum Capacity: 3,000 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 26 feet • Tunnel Outside Diameter: 28 feet 4 inches • Tunnel Length: 194,080 feet • Number of Tunnel Launch Shafts: 3 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 5 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 (Reach 2) • Dual Launch Shafts at Lower Roberts Island: Inside Diameter (feet): 110 (Reach 3 and Reach 4 • Maintenance Shafts and Terminous Reception Shaft Inside Diameter (feet): 53 • Surge Basin Reception Shaft Inside Diameter (feet): 120
Bethany Reservoir Pumping Plant and Surge Basin	• Eight pumps at 500 cfs, each, including two standby pumps (Up to six pumps would operate at any one time for a total of 3,000 cfs capacity) • Two, 75-foot diameter by 20-feet high one-way surge tanks connected to the BRPP's discharge pipelines (one tank connected to each pipeline) • Two Portable 60 cfs Pumps to dewater main tunnel • Four rail-mounted 100 cfs pumps to dewater Surge Basin • Surge Basin with surge overflow capacity

Feature Description	Bethany Reservoir Alternative
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	• Maximum Capacity: 3,000 cfs • Number of Pipelines: 2 • Maximum capacity per pipeline: 1,500 cfs • Pipeline Inside Diameter: 180-inch • Pipeline Outside Diameter: 182.5-inch +/- • Each Pipeline Length: 13,000 feet for each pipeline • Tunnels under Jones Penstock: 200 feet for each tunnel, 2 tunnels, bottom of the tunnel is approximately 50 feet below natural existing ground • Tunnels under Bethany Reservoir Conservation Easement: 3,064 feet for each tunnel, 2 tunnels, tunnel depth varies from approximately 45-50 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, including two riser shafts and two conveyance channels with gates

TABLE 11. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 3,000 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	Described in Section 6.8 of the C/E EPR.		
Lambert Road Concrete Batch Plant	Described in Section 7.2 of the C/E EPR.		
Twin Cities Complex	438	106	332 (agriculture or habitat) 95 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Canal Ranch Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Terminous Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
King Island Shaft Site	Described in Section 6.8 of the C/E EPR.		
Lower Roberts Island Shaft Site	474	208	234 (agriculture or habitat) 93 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	11	11	N/A
Union Island Shaft Site	14	14	N/A
Bethany Reservoir Pumping Plant and Surge Basin Site	228	175	53 (agriculture or habitat) 61 (excavated material stockpile planted with native grasses)
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	145	63	79 (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.
N/A = Not Applicable

7.2.1 Intakes for Project Design Capacity of 3,000 cfs

Information regarding the intakes for the Bethany Reservoir Alternative 3,000 cfs project design capacity option would be the same as discussed in Section 7.2.1 of the C/E EPR.

7.2.2 Tunnels for Project Design Capacity of 3,000 cfs

The tunnels between the Intakes and the Bethany Complex would be constructed in the same manner as described in Section 2.2, Tunnels and Tunnel Shafts. The tunnel dimensions are summarized in Tables 10 and 11, and quantitative descriptions of the tunnel shaft construction are presented in Appendix C.

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

The Bethany Reservoir Pumping Plant and Surge Basin, Bethany Reservoir Aqueduct, and Bethany Reservoir Discharge Structure would be constructed as described in Section 2.3, Bethany Complex. The Bethany Reservoir Pumping Plant would include fewer pumps as compared to the project design capacity of 6,000 cfs, as summarized in Table 9 and Appendix C. The Bethany Reservoir Pumping Plant would include a smaller electrical building and a smaller heating ventilation-air conditioning equipment yard. The Surge Basin and Bethany Reservoir Discharge Structure would also be smaller for the project design capacity of 3,000 cfs as compared to the project design capacity of 6,000 cfs. The Bethany Reservoir Aqueduct would only include two 180-inch welded steel pipelines. The pipelines would be centered on the Aqueduct control line within the permanently disturbed area similar to the configuration for the 6,000 cfs design capacity. These facilities for a project design capacity of 3,000 cfs are summarized in Tables 10 and 11, and Appendix C.

7.3 Project Design Capacity Option for 4,500 cfs

One project design capacity option would provide 4,500 cfs to the existing SWP Bethany Reservoir. The facilities described in this section represent potential facilities that are not currently being analyzed in the DWR EIR.

This option would include all of the facilities described in Sections 2 through 6 for the 6,000 cfs project design capacity, including Intake C-E-3 and Intake C-E-5. The facilities for this option with a project design capacity of 4,500 cfs are schematically shown in Figures 1 and 2.

Summary of the physical characteristics are presented in Table 12. Additionally, Table 13 summarizes the construction and post-construction site requirements as well as post-construction site reclamation for the major features. More detailed information about these facilities are presented in the engineering concept drawings and Appendix D of this EPR.

TABLE 12. SUMMARY OF THE BETHANY RESERVOIR ALTERNATIVE PHYSICAL CHARACTERISTICS FOR THE PROJECT DESIGN CAPACITY OF 4,500 CFS

Feature Description	Bethany Reservoir Alternative
Project Design Capacity	• 4,500 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 1,500 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 – 4,500 cfs between Intake C-E-5 and Twin Cities Complex • Number of Tunnels: 1 • Tunnel Inside Diameter: 31 feet

Feature Description	Bethany Reservoir Alternative
	• Tunnel Outside Diameter: 33 feet 8 inches • Tunnel Length: 43,081 feet • Number of Tunnel Launch Shafts: 1 (Twin Cities Complex) • Number of Reception Shafts: 1 (Intake C-E-3) • Number of Maintenance Shafts: 1 (Intake C-E-5) • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 (Reach 1) • Maintenance and Reception Shafts Inside Diameter (feet): 83 (aka Intake Outlet Shafts)
Tunnel Reaches between Twin Cities Complex and Bethany Reservoir Surge Basin	• Reach 2: Between Twin Cities Complex and Terminous Tract • Reach 3: Between Terminous Tract and Lower Roberts Island • Reach 4: Between Lower Roberts Island and Bethany Reservoir Pumping Plant and Surge Basin • Maximum Capacity: 4,500 cfs • Number of Tunnels: 1 • Tunnel Inside Diameter: 31 feet • Tunnel Outside Diameter: 33 feet 8 inches • Tunnel Length: 194,080 feet • Number of Tunnel Launch Shafts: 3 • Number of Reception Shafts: 2 • Number of Maintenance Shafts: 5 • Dual Launch Shafts at Twin Cities Complex: Inside Diameter (feet): 110 (Reach 2) • Dual Launch Shafts at Lower Roberts Island: Inside Diameter (feet): 110 (Reach 3 and Reach 4) • Maintenance Shafts and Terminous Reception Shaft Inside Diameter (feet): 63 • Surge Basin Reception Shaft Inside Diameter (feet): 120
Bethany Reservoir Pumping Plant and Surge Basin	• Eleven pumps at 500 cfs, each, including two standby pumps (Up to nine pumps would operate at any one time for a total of 4,500 cfs capacity) • Three, 75-foot diameter by 20-feet high one-way surge tanks connected to the BRPP's discharge pipelines (one tank connected to each pipeline) • Two Portable 60 cfs Pumps to dewater main tunnel • Four rail-mounted 100 cfs pumps to dewater Surge Basin • Surge Basin with surge overflow capacity
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	• Maximum Capacity: 4,500 cfs • Number of Pipelines: 3 • Maximum capacity per pipeline: 1,500 cfs • Pipeline Inside Diameter: 180-inch • Pipeline Outside Diameter: 182.5-inch +/- • Each Pipeline Length: 13,000 feet for each pipeline • Tunnels under Jones Penstock: 200 feet for each tunnel, 3 tunnels, bottom of the tunnel is approximately 50 feet below natural existing ground • Tunnels under Bethany Reservoir Conservation Easement: 3,064 feet for each tunnel, 3 tunnels, tunnel depth varies from approximately 45-50 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 including three riser shafts and three conveyance channels with gates.

TABLE 13. SUMMARY OF CONSTRUCTION AND POST-CONSTRUCTION SITE REQUIREMENTS AT MAJOR FEATURES FOR PROJECT DESIGN CAPACITY OF 4,500 CFS

Key Feature	Acreage within Construction Boundary (acres)	Acreage within Post-Construction Boundary (acres)	Acreage Restored for Agriculture or Habitat (acres)
Intake C-E-3	Described in Section 6.8 of the C/E EPR.		
Intake C-E-5	Described in Section 6.8 of the C/E EPR.		
Lambert Road Concrete Batch Plant	Described in Section 6.8 of the C/E EPR.		
Twin Cities Complex	526	166	360 (agriculture or habitat) 157 (RTM stockpile planted with native grasses)
New Hope Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Canal Ranch Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
Terminous Tract Shaft Site	Described in Section 6.8 of the C/E EPR.		
King Island Shaft Site	Described in Section 6.8 of the C/E EPR.		
Lower Roberts Island Shaft Site	553	250	265 (agriculture or habitat) 137 (RTM stockpile planted with native grasses)
Upper Jones Tract Shaft Site	11	11	N/A
Union Island Shaft Site	14	14	N/A
Bethany Reservoir Pumping Plant and Surge Basin Site	228	175	53 (agriculture or habitat) 61 (excavated material stockpile planted with native grasses)
Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure	150	70	77 (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.

N/A = Not Applicable

7.3.1 Intakes for Project Design Capacity of 4,500 cfs

Information regarding the intakes for the Bethany Reservoir Alternative 4,500 cfs project design capacity option would be the same as discussed in Section 7.3.1 of the C/E EPR.

7.3.2 Tunnels for Project Design Capacity of 4,500 cfs

The tunnels between the Intakes and the Bethany Complex would be constructed in the same manner as described in Section 2.2, Tunnels and Tunnel Shafts. The tunnel dimensions are summarized in Tables 12 and 13, and quantitative descriptions of the tunnel shaft construction are presented in Appendix D.

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

The Bethany Reservoir Pumping Plant and Surge Basin, Bethany Reservoir Aqueduct, and Bethany Reservoir Discharge Structure would be constructed as described in Section 2.3, Bethany Complex. The Bethany Reservoir Pumping Plant would include fewer pumps as compared to the project design capacity of 6,000 cfs, as summarized in Table 10 and Appendix D. The Bethany Reservoir Pumping Plant would include a smaller electrical building and a smaller heating ventilation-air conditioning equipment yard. The Surge Basin and Bethany Reservoir Discharge Structure would also be smaller for the project design capacity of 4,500 cfs as compared to the project design capacity of 6,000 cfs. The Bethany Reservoir Aqueduct would only include three 180-inch welded steel pipelines. The pipelines would be centered on the Aqueduct control line within the permanently disturbed area similar to the configuration for the 6,000 cfs design capacity. These facilities for a project design capacity of 4,500 cfs are summarized in Tables 12 and 13, and Appendix D.

8. Fish Screen-Type Options

For information on the fish screen-type options developed, refer to Section 8 of the C/E EPR.

9. References

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10. Appendices

Appendices A through D to this Draft Engineering Project Report provide summaries of quantitative information for the Bethany Reservoir Alternative for the project design capacities of 6,000 cfs, 7,500 cfs, 3,000 cfs, and 4,500 cfs using cylindrical tee fish screens.

Appendix E provides preliminary construction information related to quantities of equipment and vehicle use, employee travel needs, and earthwork quantities for EIR air quality and traffic analyses. Appendix F provides preliminary operations and maintenance information for the EIR air quality and traffic analyses.

The appendices do not include information presented in the Technical Memoranda unless the information is relative to information from the engineering concept drawings. For example, information related to providing connections to electrical supplies is included in the Electrical Power Load and Routing Study Technical Memorandum in the Attachment to this EPR, and information related to SCADA is presented in the SCADA/Communications Route Design Approach – Bethany Reservoir Alternative in the Attachment to this EPR. In a similar manner, all quantifications of excavated soil and Reusable Tunnel Material (RTM) are presented in the Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative Technical Memorandum in the Attachment to this EPR. Therefore, the appendices do not include information related to electric power transmission, SCADA, geotechnical information, soil balance, hydraulic analysis criteria, levee vulnerability, siting analyses, or design and construction methods.

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

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 6,000 cfs with cylindrical tee fish screens. References to the C/E EPR are made for facilities that are the same as those described in the C/E EPR.

This appendix includes the following sections.

- Section 10.1.1 Intakes C-E-3 and C-E-5
  - Described in Section 10.1.1 of the C/E EPR
- Section 10.1.2 Tunnels – Between Intakes and Bethany Complex
  - **Table A1.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for Bethany Reservoir Alternative from Intakes to Bethany Complex for a Project Design Capacity of 6,000 cfs
  - **Table A2.** Construction Conditions and Constructed Facilities Summary for Twin Cities Complex Dual Tunnel Launch Shafts
  - Construction Conditions and Constructed Facilities Summary for New Hope Tract Tunnel Maintenance Shaft are described in Table A11 of the C/E EPR
  - Construction Conditions and Constructed Facilities Summary for Canal Ranch Tract Tunnel Maintenance Shaft are described in Table A12 of the C/E EPR
  - Construction Conditions and Constructed Facilities Summary for Terminous Tract Tunnel Reception Shaft are described in Table A13 of the C/E EPR
  - Construction Conditions and Constructed Facilities Summary for King Island Tunnel Maintenance Shaft are described in Table A14 of the C/E EPR
  - **Table A3.** Construction Conditions and Constructed Facilities Summary for Lower Roberts Island Dual Tunnel Launch Shafts
  - **Table A4.** Construction Conditions and Constructed Facilities Summary for Upper Jones Tract Tunnel Maintenance Shaft
  - **Table A5.** Construction Conditions and Constructed Facilities Summary for Union Island Tunnel Maintenance Shaft
- Section 10.1.3 Bethany Complex
  - **Table A6.** Construction Conditions and Constructed Facilities Summary for Tunnel Reception Shaft at the Surge Basin Site
  - **Table A7.** Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Pumping Plant and Surge Basin

- **Table A8.** Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Aqueduct
- **Table A9.** Construction Conditions and Constructed Facilities Summary for the Bethany Reservoir Discharge Structure

- Section 10.1.4 Access Roads

- **Table A10.** Access Roads to Construction Sites for Project Design Capacity of 6,000 cfs
- **Table A11.** Piles and Piers for Access Roads for Project Design Capacity of 6,000 cfs

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

Information regarding construction conditions and constructed facilities for Intake C-E-3 and C-E-5 would be the same as described in Section 10.1.1 and Table A1 of the C/E EPR.

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 A1. Information for the tunnel shafts between the intakes and the Bethany Complex are presented in Tables A2 through A5. Information related to construction of the tunnel shafts at the intakes are included in Table A1 of the C/E EPR. Information related to construction of the tunnel shafts at the Bethany Complex are included in Table A6.

TABLE A1. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FOR BETHANY RESERVOIR ALTERNATIVE 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	White 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

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
				Jones Pumping Plant Approach Channel
TOTAL TUNNEL LENGTH			**236,600**	

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

Twin Cities Complex

TABLE A2. 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

Items	Quantities
	Two sets, each laydown area = 60-foot wide x 170-foot long
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.
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.

Items	Quantities
	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 [1]	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 [1]	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.
Erosion Control	Most areas of the site would be covered with pavement, RTM, equipment or materials, or buildings. The remaining excavated soil materials would be treated either with water, covers or geotextile fabric, soil binders or chemical soil stabilizer, or mulch. Permanent hydroseeding, fiber rolls, or temporary silt fence would be installed on any slope greater than 2H:1V not including the RTM processing area.

Items	Quantities
Wastewater Facilities during Construction	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be constructed for use during construction. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits. The septic system would be abandoned in accordance with county regulations at the end of construction.
Wastewater Facilities during Operations	Portable restrooms would be hauled to the tunnel shaft site during maintenance activities.
SWPPP Facilities during Construction	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff, wash water, dewatering water flows would be diverted to an on-site treatment plant for on-site reuse and subsequent discharge, if appropriate.
SWPPP Facilities during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to an on-site treatment plant. Treated flows would be discharged to adjacent drainage.
RTM 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:

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

New Hope Tract

Construction conditions and constructed facilities for the New Hope Tract tunnel maintenance shaft would be the same as described in Table A11 of the C/E EPR.

Canal Ranch Tract

Construction conditions and constructed facilities for the Canal Ranch Tract tunnel maintenance shaft would be the same as described in Table A12 of the C/E EPR.

Terminus Tract

Construction conditions and constructed facilities for the Terminous Tract tunnel reception shaft would be the same as described in Table A13 of the C/E EPR.

King Island

Construction conditions and constructed facilities for the King Island tunnel maintenance shaft would be the same as described in Table A14 of the C/E EPR.

Lower Roberts Island

TABLE A3. 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
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

Items	Quantities
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)
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.

Items	Quantities
	Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security during Construction Phase [1]	Approximately 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).
Fencing and Security during Operations Phase [1]	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.
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 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:

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

Upper Jones Tract

TABLE A4. 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.
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

Items	Quantities
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security during Construction Phase [1]	Approximately 2,750 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 [1]	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.
SWPPP Facilities during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

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

Union Island

TABLE A5. 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
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 [1]	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 [1]	Approximately 3,440 feet of 8-foot tall permanent security fencing would be installed. Security cameras would be mounted at key locations and

Items	Quantities
	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.
SWPPP Facilities during Operations Phases	Berms, fiber rolls, silt fences, and other barriers would be constructed around the site to prevent runoff from adjacent lands from entering the site and water from the site leaving the site. Water collected on-site from storm runoff would be diverted to a settling basin with a discharge pipe to an adjacent drainage.
Fire Water Supplies Stored On-site	200,000 gallons to provide up to 1,500 gallons/minute for 2 hours

Notes:

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

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 A6 presents information related to the tunnel reception shaft that would be located at the Surge Basin site. Table A7 presents information for the Bethany Reservoir Pumping Plant and Surge Basin facilities and site. Tables A8 and A9 present information related to the Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure, respectively.

Bethany Reservoir Surge Basin Reception Shaft

TABLE A6. 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).

Items	Quantities
	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.
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.

Bethany Reservoir Pumping Plant and Surge Basin

TABLE A7. 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.

Items	Quantities
	• 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.
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.
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 1,300,000 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 985,000 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 4 separate stockpiles totaling 60 acres.

Items	Quantities
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: 28 acres, 1,345,517 cubic yards, 33 feet tall Location 2: 14 acres, 655,533 cubic yards, 33 feet tall Location 3: 12 acres, 568,193 cubic yards, 33 feet tall Location 4: 6 acres, 307,145 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
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 = 344 feet wide by 186 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)

Items	Quantities
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
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 [1]	Approximately 18,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. 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 [1]	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.
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.

Items	Quantities
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.
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 60 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:

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

Bethany Reservoir Aqueduct

TABLE A8. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR AQUEDUCT FOR PROJECT DESIGN CAPACITY OF 6,000 CFS

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)
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.

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, between the Pumping Plant and STA 185+00 (as included in the engineering concept drawings), the work area west and north of the aqueduct will extend to Mountain House Road and to the BBID canal to provide space for batch plants and other contractor facilities 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 [1]	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 [1]	None, gates at access points along county roads.
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

Items	Quantities
	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
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 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 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
Parking Spaces during Construction (for Redi-Mix trucks)	15 spaces: 15-feet by 40-feet each
Tunnel Launch/Reception Portals at Jones Penstock Crossing (*NOTE: to be backfilled and restored to original grade after construction)	
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

Items	Quantities
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
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 (*NOTE: 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)	
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
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 (*NOTE: 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)	
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

Items	Quantities
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
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: [1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.	

Bethany Reservoir Discharge Structure

TABLE A9. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR DISCHARGE STRUCTURE

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. 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 ***(*NOTE: 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.***	
Contractor's and Owner's Offices	Four buildings, 12-feet wide by 40-feet long, up to 12 feet tall each
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

Items	Quantities
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.
On-site Access Road during Construction	On-site paved access roads with truck tire washes, track-out plates, and/or gravel aprons would be located at all the entrances and exits would be installed throughout the site. Irrigation systems would be installed along many of the access roads to provide water sprays onto excavated soils for dust control.
Fencing and Security during Construction Phase [1]	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 [1]	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.
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:
[1] Fence lengths are approximate and were calculated using the measuring tool in ArcGIS online.

Access Roads

TABLE A10. ACCESS ROADS TO CONSTRUCTION SITES FOR THE BETHANY RESERVOIR ALTERNATIVE

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Access to Intake Haul Road Along Lambert Road	Described in Table A23 of the C/E EPR						
Access to Intake Haul Road Along Hood-Franklin Road	Described in Table A23 of the C/E EPR						
New Intake Haul Road and Access to Intakes C-E-3 And C-E-5	Described in Table A23 of the C/E EPR						
Twin Cities Complex Road Improvements	Dierssen Road	Franklin Boulevard	Interstate 5	18-feet wide: Two 9-foot paved lanes without shoulders	Widen 1-mile paved road	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
	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.	Mid-Construction & End of Construction
Access Road to New Hope Tract Tunnel Maintenance Shaft	Described in Table A23 of the C/E EPR						
Access Road to Canal Ranch Tract Tunnel Maintenance Shaft	Described in Table A23 of the C/E EPR						
Access Road to Terminous Tract Tunnel Reception Shaft	Described in Table A23 of the C/E EPR						
Access Road to King Island Tunnel Maintenance Shaft	Described in Table A23 of the C/E EPR						
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

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
	Burns Cut New Access Road	Lower Roberts Western Yard Track New Access Road	West House Road		New 2.0 miles paved road New Bridge over Burns Cut: 69 feet wide x 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
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		New 1.28 miles paved road New Bridge over Black Slough: New bridge: 32 feet wide x 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		No change	No change	Mid-Construction & End of Construction
	West Fyffe Street	Port of Stockton Expressway	Rough and Ready Access Road		No change	No change	Mid-Construction & End of Construction
Access Road Upper Jones Tract Tunnel Maintenance Shaft	Bacon Island Road	State Route 4	Upper Jones Tract New Access Road	20-foot wide: two 10-foot lanes with no shoulders.	No change	No change	Mid-Construction
	Upper Jones Tract New Access Road	Bacon Island Road	Upper Jones Tract Tunnel Shaft New Access Road		Driveway improvements	Driveway improvements	
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 change	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 change	No change	Before Construction Mid-Construction & End of Construction
Access Road Pumping Plant and Surge Basin (Part of	Lindemann Road Interchange at			Lindemann Road ½ mile new road	New interchange with Byron Highway	Lindemann Road – 32-feet wide: two 12-foot paved	End of Construction

Purpose of Access	Road	Starting Location	Ending Location	Existing Roadway	Action	Modification	Asphalt Overlays
Bethany Complex North Access)	Byron Highway			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	realignment and widening, extension of Lindemann Road New Bridge over Railroad: New bridge: 40 feet wide x 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 x 280 feet long: two 12-foot lanes with 8-foot shoulders.	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.	
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
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex North Access)	Byron Highway Frontage Road	Lindemann Road Interchange	Mountain House Road		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		2.1 miles New Road	36-feet wide: two 12-foot paved lanes with 4-foot and 8-foot shoulders	End of Construction
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex North Access)	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
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex Kelso Road Access)	Kelso Access Road	0.20 miles south of Kelso Road	Kelso Road		0.20 miles New Road	24-feet wide: two 12-foot paved lanes with 4-foot shoulders	

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
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex South Access)	New Mountain House Road and W. Grant Line Road	W. Grant Line Road	Existing Mountain House Road		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
Access Road Pumping Plant and Surge Basin (Part of Bethany Complex South Access)	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
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		0.27 miles new road	32-feet wide: two 12-foot paved lanes with 4-foot shoulders Turn Pockets	End of Construction
Access Road to Bethany Reservoir Discharge Structure (Part of Bethany Complex South Access)	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 A11. 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	Described in Table A24 of the C/E EPR				
Access Road Lower Roberts Island Tunnel Reception Shaft and Launch Shaft	Described in Table A24 of the C/E EPR				
Access Road Lower Roberts Island Tunnel Reception Shaft and Launch Shaft	New bridge over Turner Cut	Turner Cut	New bridge: 32 feet wide x 70 feet long: two 12-foot lanes with 4-foot shoulders.	20 permanent driven piles for bridge 50-feet deep, 16-inch 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
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

APPENDIX B - Summary of Information for the Project Design Capacity of 7,500 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 7,500 cfs with cylindrical tee fish screens. The facilities required for a project design capacity of 7,500 cfs would utilize all of the facilities included for the project design capacity of 6,000 cfs plus an additional intake and facilities to convey water to the Central Valley Project. The higher project design capacity also would result in changes in tunnel diameters and Bethany Reservoir Pumping Plant building sizes, as described in this appendix.

This appendix includes the following sections.

- Section 10.2.1 Intakes C-E-2, C-E-3, and C-E-5
  - Described in Section 10.2.1 of the C/E EPR
- Section 10.2.2 Tunnels – Tunnel between Intakes and Bethany Complex
  - **Table B1.** Tunnel Reach Lengths and Shaft Invert Elevations and Depths for Bethany Reservoir Alternative from Intakes to Bethany Complex for a Project Design Capacity of 7,500 cfs
  - **Table B2.** Summary of Finished Shaft Elevations for a Project Design Capacity of 7,500 cfs
  - **Table B3.** Summary of RTM Storage for Bethany Reservoir Alternative at Twin Cities Complex and Lower Roberts Island for a Project Design Capacity of 7,500 cfs
- Section 10.2.3 Bethany Complex
  - **Table B4.** Construction Conditions and Constructed Facilities Summary of the Bethany Reservoir Pumping Plant and Surge Basin for a Project Design Capacity of 7,500 cfs
  - **Table B5.** Construction Conditions and Constructed Facilities Summary for the Jones Canal Aqueduct and Outlet Structure and the Delta-Mendota Canal Control Structure for a Project Design Capacity of 7,500 cfs

Intakes C-E-2, C-E-3, and C-E-5

Intake facilities to provide a project design capacity of 7,500 cfs would include two intakes with design capacity of 3,000 cfs, each (Intake C-E-3 and Intake C-E-5), and one 1,500 cfs intake (Intake C-E-2).

Information for Intake C-E-3 and Intake C-E-5 would be the same as described in Section 10.1.1 and Table A1 of the C/E EPR.

Information for Intake C-E-2 would be the same as described in Section 10.2.1 and Table B1 of the C/E EPR.

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 7,500 cfs are summarized in Table B1.

Tunnel shaft construction between the intakes and Bethany Complex would be the same as for facilities to provide a project design capacity of 6,000 cfs, as presented in Tables A2 through A5 in Appendix A, Section 10.1.2, unless otherwise indicated below. Information related to construction of the tunnel shaft at Bethany Complex is included in Table A6 in Appendix A, Section 10.1.3. Information related to construction of the tunnel shafts at the intakes is included in Table A1 of the C/E EPR for Intake C-E-3 and Intake C-E-5, and in Table B1 of the C/E EPR for Intake C-E-2.

The finished shaft elevations would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs due to the difference in hydraulic grade line, as discussed in the Hydraulic Analysis of Delta Conveyance Options – Bethany Reservoir Alternative Technical Memorandum in the Attachment to this EPR. The finished shaft elevations are summarized in Table B2.

The RTM volumes at each launch shaft site would be different for a project design capacity of 7,500 cfs as compared to a project design capacity of 6,000 cfs due to the difference in tunnel diameter, as presented in the Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative Technical Memorandum in the Attachment to this EPR. The changes in RTM volumes would also change the RTM storage areas at the tunnel launch shaft sites, as shown in Table B3.

TABLE B1. TUNNEL REACH LENGTHS AND SHAFT INVERT ELEVATIONS AND DEPTHS FOR BETHANY RESERVOIR ALTERNATIVE FROM INTAKES TO BETHANY COMPLEX FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Reception Shaft at Intake C-E-2	-139	144	Not Applicable	Not Applicable
Tunnel Reception Shaft at Intake C-E-3	-140	145	11,100	Drainage
Tunnel Maintenance Shaft at Intake C-E-5	-142	147	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	154	26,900	Hog Slough Sycamore Slough
Tunnel Maintenance Shaft on King Island	-159	147	20,600	White Slough
Tunnel Launch Shafts on Lower Roberts Island	-161	150	29,600	White Slough San Joaquin River
Tunnel Maintenance Shaft on Upper Jones Tract	-164	157	26,900	Whiskey Slough Hayes Slough

Shaft Location	Shaft Invert (Bottom) Elevation (feet)	Shaft Invert Depth from Ground Level (feet)	Tunnel Length from Upstream Shaft (feet)	Stream Crossings Over the Tunnel from Upstream Shaft
Tunnel Maintenance Shaft Site on Union island	-166	160	22,200	Middle River Victoria Canal
Tunnel Reception Shaft Site at the Surge Basin	-169	209	27,500	West Canal Old River
TOTAL TUNNEL LENGTH			**247,700**	
Notes: Values listed are approximate; refer to GIS or Engineering Concept Drawings for more precise values.				

TABLE B2. SUMMARY OF FINISHED SHAFT ELEVATIONS FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Twin Cities Complex Tunnel Launch Shaft Pad	Finished shaft elevation = 31.2 feet
New Hope Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 34 feet
Canal Ranch Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 37 feet
Terminous Tract Tunnel Reception Shaft Pad	Finished shaft elevation = 37.5 feet
King Island Tunnel Maintenance Shaft Pad	Finished shaft elevation = 36 feet
Lower Roberts Island Tunnel Launch Shaft Pad	Finished shaft elevation = 37 feet
Upper Jones Tract Tunnel Maintenance Shaft Pad	Finished shaft elevation = 37.3 feet
Union Island Tunnel Maintenance Shaft Pad	Finished shaft elevation = 41.3 feet

TABLE B3. SUMMARY OF RTM STORAGE FOR BETHANY RESERVOIR ALTERNATIVE AT TWIN CITIES COMPLEX AND LOWER ROBERTS ISLAND FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Twin Cities Complex RTM Temporary Wet Stockpile	Area = 31 acres x 10 feet high
Twin Cities Complex RTM Natural Drying Area	North Stockpile Area = 196 acres by 10 feet high South Stockpile Area = 196 acres by 12 feet high
Twin Cities Treated RTM Storage	Area = 303 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 40 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 303 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Lower Roberts Island RTM Temporary Wet Stockpile	Area = 31 acres x 10 feet high
Lower Roberts Island RTM Natural Drying Area	North Stockpile Area = 196 acres by 9 feet high South Stockpile Area = 196 acres by 14 feet high
Lower Roberts Island Treated RTM Storage	Area = 245 acres by 15 feet high

Items	Quantities
Lower Roberts Island RTM Areas	Approximately 26 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 245 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.

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. The tunnel reception shaft would be similar to the facilities presented in Table A6 in Appendix A, Section 10.1.3.

The Bethany Reservoir Pumping Plant and Surge Basin would be similar to facilities for a project design capacity of 6,000 cfs; however, the facilities sizes would be different as summarized in Table B3. Construction conditions and constructed facilities for the Jones Canal Aqueduct and Outlet Structure and the Delta-Mendota Canal Control Structure are summarized in Table B4.

The Bethany Reservoir Aqueduct and Bethany Reservoir Discharge Structure would be identical to facilities for the project design capacity of 6,000 cfs.

Bethany Reservoir Pumping Plant and Surge Basin

TABLE B4. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR PUMPING PLANT AND SURGE BASIN FOR A PROJECT DESIGN CAPACITY OF 7,500 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 = 900 feet wide x 960 feet long Overflow Shaft: Overflow shaft diameter = 120 feet Overflow weir wall diameter = 232 feet Top of overflow weir wall elevation = 18 feet Eight 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 8-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 1,610 feet long; 5-foot wide by 100-foot deep by 1,080 feet long; and 5 foot wide by 252 foot deep by 770 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 3,720 feet long with two levels of tiebacks.
Foundational Piles	Pumping Plant: Approximately 60 drilled piers would be installed 50 feet deep below the pump discharge isolation gate valve gallery. Surge Basin: Approximately 3,349 drilled piers would be installed 60 feet deep below the surge basin base slab.
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 1,600,000 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 1,280,000 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 4 separate stockpiles totaling 60 acres.

Items	Quantities
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: 28 acres, 1,656,444 cubic yards, 41 feet tall Location 2: 14 acres, 807,016 cubic yards, 41 feet tall Location 3: 12 acres, 699,493 cubic yards, 41 feet tall Location 4: 6 acres, 378,121 cubic yards, 41 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 601 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: • Eighteen pumps at 500 cfs, each, includes three standby pumps Surge Basin: • 5 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 = 140 wide by 180 feet long Top of Structure above Pad = 47 feet Top of Structure Elevation = 86 feet
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 = 350 feet wide by 250 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 Standby Engine Generator Building	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)

Items	Quantities
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 site 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
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	4,287 feet of asphalt paved 32-foot wide roads with gravel shoulders; 520 feet of asphalt paved 24-wide road with no shoulder; 331 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 [1]	Approximately 18,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. 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 [1]	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.
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.

Items	Quantities
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.
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 60 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:

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

Jones Canal Aqueduct and Outlet Structure and the Delta-Mendota Control Structure

TABLE B5. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR JONES CANAL AQUEDUCT AND OUTLET STRUCTURE AND THE DELTA-MENDOTA CONTROL STRUCTURE FOR A PROJECT DESIGN CAPACITY OF 7,500 CFS

Items	Quantities
Conditions and Facilities Along the Overall Aqueduct Corridor	
Aqueduct Construction Area	Single Pipeline from Bethany Reservoir Pumping Plant to Delta-Mendota Canal: • Permanent disturbance – 100 feet wide. • Temporary disturbance – 180 feet wide (details below).
Aqueduct Trench	Single Pipeline from Bethany Reservoir Pumping Plant to Delta-Mendota Canal: Trench would be excavated to a width of 25 feet at the bottom and depths ranging from 25 to 60 feet, 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 flatter per OSHA requirements and to protect workers. Excavated material would be sidecast or hauled to nearby stockpile areas. Pipe would be backfilled to a depth of 1 foot over top of pipe with CLSM, then sidecast or stockpiled excavated trench material placed and compacted on top of the pipe and CLSM to match original ground. 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. Mountain House Road would be restored to original grade and surface conditions per county requirements.
Duration for Concrete Pours for Jones Canal Aqueduct and Outlet Structure and Delta-Mendota Control Structure	Daytime concrete pour would throughout 138 calendar weeks. However, the concrete pours would not occur consistently. The actual concrete pours would occur for 31 weeks over the 138-week period.
On-site Access Roads during Construction	Same as Bethany Reservoir Pumping Plant east of Mountain House Road. Construction would use the permanent access roads plus a temporary bridge over the Delta-Mendota Canal north of the Delta-Mendota Canal Control Structure
Fencing and Security during Construction Phase [1]	Single Pipeline from Bethany Reservoir Pumping Plant to Delta-Mendota Canal: Approximately 5,280 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences.
Fencing and Security during Operations Phase [1]	Single Pipeline from Bethany Reservoir Pumping Plant to Delta-Mendota Canal: Approximately 1,200 feet of 8-foot tall permanent chain link security fencing to enclose the entire backfilled perimeter of the Jones Outlet structure and the Delta-Mendota Canal Control Structure. Signs would be placed on fencing to identify the Delta Conveyance Project and telephone numbers and internet addresses to obtain information.
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, or temporary silt fence would be installed on any slope greater than 2H:1V.
Wastewater Facilities during Construction Phase	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

Items	Quantities
	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	Portable restroom would be hauled to the site during maintenance activities.
SWPPP Facilities during Construction Phase	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.
Excavated Material Stockpiles	Approximately 9acres of the site would be used for a permanent excavated material stockpile for future projects by other agencies that are not identified at this time. The excavated material would be placed in a compacted condition and would be seeded with grasses to control erosion.
Aqueduct between Bethany Reservoir Pumping Plant and Delta-Mendota Canal	
Contractor's and Owner's Offices	Three buildings, each 12-feet wide x 60-feet long x 12 feet in height.
Machine and Maintenance Shop	One building, 50-feet wide x 100-feet long.
Shipping and Receiving	One building, 50-feet wide x 70-feet long x 25 feet in height.
Material Staging and Storage Area	Area 200-feet-wide and 375-feet-long for open storage.
Equipment Storage	Area 150-feet-wide and 300-feet-long for open storage of some equipment and small (secure and weather-proof) enclosures for tools and smaller equipment.
Fueling Area and Hazardous Materials Storage	Area 80-feet-wide and 200-feet-long.
Septic System	0.6 acre area at the north end of the Contractor's yard for the septic tank, leach field, and buffer zones
Temporary Stockpile Management and Dewatering Area	4.7 acre area just south of Jones Outlet Structure and outside the east Delta-Mendota Canal embankment
Delta-Mendota Canal Outlet Structure	
Concrete Baffled Apron Drop Structure	Approximately 165-feet long and 55-feet wide, excluding counterforts and wingwalls.
Contractor's Temporary Facilities	Combined with yard and facilities for adjacent aqueduct construction, with the addition of a large (4.7 acre) dedicated stockpile area for temporary storage of excavated material for this facility.
Delta-Mendota Canal Control Structure	
Stop Logs	Twelve 26-feet wide x 13.5-feet high for isolation of larger radial gates. Four 17-feet wide x 13.5-feet high for isolation of smaller gate. Stop logs would be stored in a 100 foot by 80 foot block wall enclosed storage facility.
Radial Gates	Three 24-feet wide x 37-feet high. One 15-feet wide x 19-feet high.
Contractor's Temporary Facilities	Combined with yard and facilities for adjacent aqueduct construction, with the addition of a large (2,200-foot long x 205-foot wide) dedicated stockpile area for temporary and permanent storage of excavated material for this facility.
Permanent Excavation Stockpile	10.2 acre area (approximately 205 feet wide by 2,200 feet long), 25 feet tall located adjacent to existing excavation spoils on the west side of Jones Inlet Canal. Requires shifting existing farm road westward around perimeter of permanent excavation stockpile.

Notes:

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

Access Roads

Access roads for a project design capacity of 7,500 cfs would be similar to facilities described for project design capacity of 6,000 cfs, as presented in Table A10 in Appendix A, Section 10.1.4. In addition, access would be provided to Intake C-E-2, as described in Appendix B, Section 10.2.6 of the C/E EPR.

Access to the Jones Canal Aqueduct and Outlet Structure and the Delta-Mendota Control Structure would be provided along existing roads, including Mountain House Road and an existing access road to the CVP Jones Pumping Plant.

The required piles and piers for access roads for a project design capacity of 7,500 cfs would be similar to those described in Section 10.1.4 for project design capacity of 6,000 cfs.

APPENDIX C - Summary of Information for the Project Design Capacity of 3,000 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 3,000 cfs with cylindrical tee fish screens. The facilities required for a project design capacity of 3,000 cfs would utilize all of the facilities included for the project design capacity of 6,000 cfs except that there would only be one intake, Intake C-E-5, with a design capacity of 3,000 cfs. The lower project design capacity would result in changes in tunnel diameters and Bethany Complex facilities sizes, as described in this appendix.

This appendix includes the following sections.

- Section 10.3.1 Intake C-E-5
  - Described in Section 10.3.1 of the C/E EPR
- Section 10.3.2 Tunnels – Bethany Reservoir Alternative between Intakes and Bethany Complex
  - **Table C1.** Summary of RTM Storage for Bethany Reservoir Alternative at Twin Cities Complex and Lower Roberts Island for a Project Design Capacity of 3,000 cfs
- Section 10.3.3 Bethany Complex
  - **Table C2.** Construction Conditions and Constructed Facilities Summary of the Bethany Reservoir Pumping Plant and Surge Basin for a Project Design Capacity of 3,000 cfs
  - **Table C3.** Construction Conditions and Constructed Facilities Summary of the Bethany Reservoir Aqueduct for a Project Design Capacity of 3,000 cfs

Intake C-E-5

Intake facilities to provide a project design capacity of 3,000 cfs would include one intake with a design capacity of 3,000 cfs, Intake C-E-5. Information for Intake C-E-5 is presented in Table A1 in Appendix A, Section 10.1.1 of the C/E EPR. Intake C-E-5 would also include the Emergency Response Facilities designated for Intake C-E-3 in Table A.1 in Appendix A, Section 10.1.1 of the C/E EPR.

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 3,000 cfs for the Bethany Reservoir Alternative would be the same as shown for lengths between Intake C-E-5 to the Bethany Complex in Table A1 in Appendix A, Section 10.1.2. However, the tunnel would be based on a 26-foot inside diameter tunnel (approximately 28-foot outside diameter) that would extend between Intake C-E-5 to the Bethany Complex. Tunnel shaft construction would be as presented in Tables A2 through A5 in Appendix A, Section 10.1.2. Information related to construction of the tunnel shafts at Intake C-

E-5 is included in Table A1 in Appendix A, Section 10.1.1 of the C/E EPR. Information related to construction of the tunnel shaft at the Bethany Complex is included in Table A6 in Appendix A, Section 10.1.3.

The RTM volumes at each launch shaft site would be different for a project design capacity of 3,000 cfs as compared to a project design capacity of 6,000 cfs due to the difference in tunnel diameter, as presented in the Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative Technical Memorandum in the Attachment to this EPR. The changes in RTM volumes would also change the RTM storage areas at the tunnel launch shaft sites, as shown in Table C1.

TABLE C1. SUMMARY OF RTM STORAGE FOR BETHANY RESERVOIR ALTERNATIVE AT TWIN CITIES COMPLEX AND LOWER ROBERTS ISLAND FOR A PROJECT DESIGN CAPACITY OF 3,000 CFS

Items	Quantities
Twin Cities Complex RTM Temporary Wet Stockpile	Area = 18 acres x 10 feet high
Twin Cities Complex RTM Natural Drying Area	North Stockpile Area = 129 acres by 3 feet high South Stockpile Area = 129 acres by 6 feet high
Twin Cities Treated RTM Storage	Area = 95 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 40 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 95 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Lower Roberts Island RTM Temporary Wet Stockpile	Area = 18 acres x 10 feet high
Lower Roberts Island RTM Natural Drying Area	North Stockpile Area = 129 acres by 5 feet high South Stockpile Area = 129 acres by 8 feet high
Lower Roberts Island Treated RTM Storage	Area = 93 acres by 15 feet high
Lower Roberts Island RTM Areas	Approximately 26 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 93 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.

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. The tunnel reception shaft would be similar to the facilities presented in Table A6 in Appendix A, Section 10.1.3.

The Bethany Reservoir Pumping Plant for a project design capacity of 3,000 cfs would be similar to a project design capacity of 6,000 cfs with smaller facilities, as summarized in Table C2. The Bethany Reservoir Aqueduct for a project design capacity of 3,000 cfs would be similar to a

project design capacity of 6,000 cfs with only two pipelines and associated tunnels, as summarized in Table C3.

The Bethany Reservoir Discharge Structure for a project design capacity of 3,000 cfs would be sized as described in Tables 10 and 11 of Section 7 and be similar to a project design capacity of 6,000 cfs, as summarized in Table A9 in Appendix A, Section 10.1.3.

Bethany Reservoir Pumping Plant and Surge Basin

TABLE C2. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR PUMPING PLANT AND SURGE BASIN FOR PROJECT DESIGN CAPACITY OF 3,000 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 28 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.
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 1,000,000 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 985,000 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 4 separate stockpiles totaling 62 acres.

Items	Quantities
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: 28 acres, 1,086,894 cubic yards, 27 feet tall Location 2: 14 acres, 529,533 cubic yards, 27 feet tall Location 3: 12 acres, 458,980 cubic yards, 27 feet tall Location 4: 8 acres, 318,268 cubic yards, 27 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 = 243 feet wide by 548 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: • Eight 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 = 80 wide by 180 feet long Top of Structure above Pad = 47 feet Top of Structure Elevation = 86 feet
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 = 2
Electrical Substation on Pumping Plant Pad during Construction and Operation Phases	Area = 344 feet wide by 186 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)

Items	Quantities
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 site 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
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	4,655 feet of asphalt paved 32-foot wide roads with gravel shoulders; 465 feet of asphalt paved 16-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 = 10,365 square feet of paved parking lot
Fencing and Security during Construction [1]	Approximately 18,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. 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 [1]	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.
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 62 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:

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

Bethany Reservoir Aqueduct

TABLE C3. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR AQUEDUCT FOR A PROJECT DESIGN CAPACITY OF 3,000 CFS

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 – 140 feet wide Temporary disturbance – 340 feet wide (details below)
Aqueduct Trench	Approximately 55 feet wide at the bottom, to accommodate 2 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: 7,185 bank cubic yards Conservation Easement Tunnel: 20 foot diameter tunnels with pipelines inside Conservation Easement Tunnel Excavation: 109,812 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.
Duration for Concrete Pours for Bethany Reservoir Aqueduct	Information provided in Table C2 for the Bethany Reservoir Pumping Plant and Surge Basin
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,

Items	Quantities
	as it would fall outside the permanent disturbance area along most of the aqueduct length.
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.
Additional Work Areas	In specific reaches, the available work area will extend beyond the 340-foot width. Specifically, between the Pumping Plant and STA 185+00 (as included in the engineering concept drawings), the work area west and north of the aqueduct will extend to Mountain House Road and to the BBID canal to provide space for batch plants and other contractor facilities and to utilize space otherwise isolated between the canal and the pipeline construction work.
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 [1]	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 [1]	None, gates at access points along county roads.
Lighting Facilities during Construction Phase	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods.
Erosion Control	Most areas of the site would be covered with 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

Items	Quantities
	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
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 for Open Space	Area 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 (1) for Trench CLSM	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 200-feet wide x 350-feet long (1.5 acres) to store up to 15,000 CY of soil up to 7 feet deep.
Cement Storage Silos	Site 50-feet wide x 50-feet long to store 200 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 50,000 gal of water, each tank 21 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
Parking Spaces during Construction (for Redi-Mix trucks)	15 spaces: 15-feet by 40-feet each
Tunnel Launch/Reception Portals at Jones Penstock Crossing (*NOTE: to be backfilled and restored to original grade after construction)	
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

Items	Quantities
	Air Compressor – 20 feet by 20 feet Large Equip and temp tunnel spoils storage area 150 feet wide by 200 feet long
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 (*NOTE: 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)	
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
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 (*NOTE: 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)	
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

Items	Quantities
	Air Compressor – 20 feet by 20 feet
Maintenance Shop	One building, 60-foot wide by 35-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 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:

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

Access Roads

Access roads for a project design capacity of 3,000 cfs would be identical to facilities described for a project design capacity of 6,000 cfs, as presented in Table A10 in Appendix A, Section 10.1.4 without the intake access road between Intake C-E-5 and Intake C-E-3. The required piles and piers for access roads for a project design capacity of 3,000 cfs would be similar to those described in Section 10.1.4 for project design capacity of 6,000 cfs except without the widening of the Hood-Franklin Bridge between Intake C-E-5 and Intake C-E-3

APPENDIX D - Summary of Information for the Project Design Capacity of 4,500 cfs with Cylindrical Tee Fish Screens

This appendix provides quantitative information compiled from the engineering concept drawings related to the project design capacity of 4,500 cfs with cylindrical tee fish screens. The facilities required for a project design capacity of 4,500 cfs would utilize all of the facilities included for the project design capacity of 6,000 cfs except that the design capacity of Intake C-E-5 would be 1,500 cfs. The lower project design capacity would also result in changes in tunnel diameters and Bethany Complex facilities sizes, as described in this appendix.

This appendix includes the following sections.

- Section 10.4.1 Intakes C-E-3 and C-E-5
  - Described in Section 10.4.1 of the C/E EPR
- Section 10.4.2 Tunnels – Bethany Reservoir Alternative between Intakes and Bethany Complex
  - **Table D1.** Summary of RTM Storage for Bethany Reservoir Alternative at Twin Cities Complex and Lower Roberts Island for a Project Design Capacity of 4,500 cfs
- Section 10.4.3 Bethany Complex
  - **Table D2.** Construction Conditions and Constructed Facilities Summary of the Bethany Reservoir Pumping Plant and Surge Basin for a Project Design Capacity of 4,500 cfs
  - **Table D3.** Construction Conditions and Constructed Facilities Summary of the Bethany Reservoir Aqueduct for a Project Design Capacity of 4,500 cfs

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

Intake facilities to provide a project design capacity of 4,500 cfs would include one intake with a design capacity of 3,000 cfs, Intake C-E-3, and one intake with a design capacity of 1,500 cfs, Intake C-E-5.

Information for Intake C-E-3 would be the same as described in Section 10.1.1 and Table A1 of the C/E EPR.

Information for Intake C-E-5 would be the same as described in Section 10.4.1 and Table D1 of the C/E EPR.

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 4,500 cfs for the Bethany Reservoir Alternative would be the same as shown for in Table A1 in Appendix A, Section 10.1.2. However, the tunnel would be based on a 31-foot inside diameter tunnel (approximately 34-foot outside diameter) that would extend between Intake C-E-3 to the Bethany Complex. Tunnel shaft construction would be as

presented in Tables A2 through A5 in Appendix A, Section 10.1.2. Information related to construction of the tunnel shafts at the intakes is included in Table A1 in Appendix A, Section 10.1.1 of the C/E EPR. Information related to construction of the tunnel shaft at the Bethany Complex is included in Table A6 in Appendix A, Section 10.1.3.

The RTM volumes at each tunnel launch shaft site would be different for a project design capacity of 4,500 cfs as compared to a project design capacity of 6,000 cfs due to the difference in tunnel diameter, as presented in the Soil Balance and Reusable Tunnel Material Supplement – Bethany Reservoir Alternative Technical Memorandum in the Attachment to this EPR. The changes in RTM volumes would also change the RTM storage areas at the tunnel launch shaft sites, as shown in Table D1.

TABLE D1. SUMMARY OF RTM STORAGE FOR BETHANY RESESERVOIR ALTERNATIVE AT TWIN CITIES COMPLEX AND LOWER ROBERTS ISLANDFOR A PROJECT DESIGN CAPACITY OF 4,500 CFS

Items	Quantities and Description
Twin Cities Complex RTM Temporary Wet Stockpile	Area = 23 acres x 10 feet high
Twin Cities Complex RTM Natural Drying Area	North Stockpile Area = 168 acres by 5 feet high South Stockpile Area = 168 acres by 8 feet high
Twin Cities Treated RTM Storage	Area = 157 acres x 15 feet high
Twin Cities Complex RTM Areas	Approximately 40 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 157 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.
Lower Roberts Island RTM Temporary Wet Stockpile	Area = 23 acres x 10 feet high
Lower Roberts Island RTM Natural Drying Area	North Stockpile Area = 168 acres by 6 feet high South Stockpile Area = 168 acres by 9 feet high
Lower Roberts Island Treated RTM Storage	Area = 137 acres by 15 feet high
Lower Roberts Island RTM Areas	Approximately 26 acres of excavated areas would be filled with RTM to raise the elevation to existing ground levels. The RTM could require treatment with lime or soil sulfur to provide appropriate soil acidity for future uses for agriculture or habitat. Approximately 137 acres of the site would be used for permanent RTM stockpiles for future projects by other agencies that are not identified at this time. The RTM would be placed in a compacted condition and would be seeded with grasses to control erosion.

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. The tunnel reception shaft would be similar to the facilities presented in Appendix A, Table A6 in Section 10.1.3.

The Bethany Reservoir Pumping Plant for a project design capacity of 4,500 cfs would be similar to a project design capacity of 6,000 cfs with smaller facilities, as summarized in Table D2. The

Bethany Reservoir Aqueduct for a project design capacity of 4,500 cfs would be similar to a project design capacity of 6,000 cfs with only three pipelines and associated tunnels, as summarized in Table D3.

The Bethany Reservoir Discharge Structure for a project design capacity of 4,500 cfs would be sized as described in Table 13 of Section 7 and be similar to a project design capacity of 6,000 cfs, as summarized in Table A9 in Appendix A, Section 10.1.3.

Bethany Reservoir Pumping Plant and Surge Basin

TABLE D2. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR PUMPING PLANT AND SURGE BASIN FOR A PROJECT DESIGN CAPACITY OF 4,500 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 = 1,165 foot wide x 1,169 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 1,562 feet long; 5-foot wide by 100-foot deep by 1,440 feet long; and 5 foot wide by 252 foot deep by 400 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 32 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.
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 1,200,000 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 985,000 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 4 separate stockpiles totaling 62 acres.

Items	Quantities
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: 28 acres, 1,219,078 cubic yards, 30 feet tall Location 2: 14 acres, 593,932 cubic yards, 30 feet tall Location 3: 12 acres, 514,800 cubic yards, 30 feet tall Location 4: 8 acres, 356,975 cubic yards, 30 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 = 243 feet wide by 683 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: Eleven 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 = 108 wide by 180 feet long Top of Structure above Pad = 47 feet Top of Structure Elevation = 86 feet
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 = 3
Electrical Substation on Pumping Plant Pad during Construction and Operation Phases	Area = 344 feet wide by 186 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)

Items	Quantities
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
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	4,920 feet of asphalt paved 32-foot wide roads with gravel shoulders; 520 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 = 10,450 square feet of paved parking lot
Fencing and Security during Construction [1]	Approximately 18,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. 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 [1]	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.
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.

Items	Quantities
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.
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 62 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:

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

Bethany Reservoir Aqueduct

TABLE D3. CONSTRUCTION CONDITIONS AND CONSTRUCTED FACILITIES SUMMARY FOR THE BETHANY RESERVOIR AQUEDUCT FOR PROJECT DESIGN CAPACITY OF 4,500 CFS

Items	Quantities
Conditions and Facilities Along the Overall Aqueduct Corridor	

Items	Quantities
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 – 170 feet wide Temporary disturbance – 370 feet wide (details below)
Aqueduct Trench	Approximately 85 feet wide at the bottom, to accommodate 3 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: 10,778 bank cubic yards Conservation Easement Tunnel: 20 foot diameter tunnels with pipelines inside Conservation Easement Tunnel Excavation: 164,717 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.
Duration for Concrete Pours for Bethany Reservoir Aqueduct	Information provided in Table D2 for the Bethany Reservoir Pumping Plant and Surge Basin
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.

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.
Additional Work Areas	In specific reaches, the available work area will extend beyond the 370-foot width. Specifically, between the Pumping Plant and STA 185+00 (as included in the engineering concept drawings), the work area west and north of the aqueduct will extend to Mountain House Road and to the BBID canal to provide space for batch plants and other contractor facilities and to utilize space otherwise isolated between the canal and the pipeline construction work.
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 [1]	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 [1]	None, gates at access points along county roads.
Lighting Facilities during Construction Phase	Lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods.
Erosion Control	Most areas of the site would be covered with 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.

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	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
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 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 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 300 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 75,000 gal of water, each tank 25 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
Parking Spaces during Construction (for Redi-Mix trucks)	15 spaces: 15-feet by 40-feet each
Tunnel Launch/Reception Portals at Jones Penstock Crossing (*NOTE: to be backfilled and restored to original grade after construction)	
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

Items	Quantities
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
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 ***(*NOTE: 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)***	
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
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 ***(*NOTE: 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)***	
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

Items	Quantities
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
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:

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

Access Roads

Access roads for a project design capacity of 4,500 cfs would be the same as facilities described for a project design capacity of 6,000 cfs, as presented in Table A10 in Appendix A, Section 10.1.4. The required piles and piers for access roads for a project design capacity of 4,500 cfs would be similar to those described in Section 10.1.4 for project design capacity of 6,000 cfs.