Appendix B12. North Delta Intake Facilities Configuration, Construction, and Operations (Final Draft)

1. Introduction and Purpose

This Technical Memorandum (TM) includes an overview of the proposed North Delta intakes for the Delta Conveyance Project (Project). Information related to the configuration of the intakes, construction considerations and sequencing, general operations phase concepts, and information specific to each intake site, size, and screen type are included. This information, along with other Intake documentation provided as part of the Concept Engineering Report (CER) prepared for the Project (CER Appendix B11 *Intake Flood Management*) form the engineering basis for analysis in the Project Environmental Impact Report (EIR) prepared by DWR.

For the most part, figures are not provided in this TM. Refer to the engineering concept drawings included with the Project CER for drawings supporting the information in this TM.

1.1 Organization

- Introduction and Purpose
- Overview of Intakes
- Intake Configuration
- Overview of Intake Construction Activities
- Intake Operations and Maintenance
- Intake Specific Information
- References
- Figures

2. Overview of Intakes

2.1 Intake Locations

The Project includes two intakes along the east bank of the Sacramento River between the communities of Clarksburg and Courtland. The intakes are the Project's point of diversion along the river and include provisions for protecting aquatic species, managing suspended sediment, and controlling flow for conveyance downstream into the Project tunnels. The intakes were sited along the river as described in the CER Appendix B6 *Intake Site Identification and Evaluation*. The selected intake sites include the following:

- Intake C-E-3—centrally located, on east bank of river just north of Hood
- Intake C-E-5—most downstream, on east bank of river south of Hood and north of Courtland and Randall Island

The diversion capacity of the individual intakes, described in additional detail below, would be 3,000 cubic feet per second (cfs) based on the overall Project capacity of 6,000 cfs. Sizing information regarding the individual intakes at 3,000 cfs is described in CER Appendix B7 *Intake Screen Sizing – North Delta Intakes*.

2.2 Intake Features

The intakes would include an on-bank intake structure located in the Sacramento River with state-of-the-art fish screens to reduce the potential of impingement and/or entrainment of aquatic resources through the intakes. Other components include conveyance pipes or conduits from the intake structure to a sedimentation basin, a sedimentation basin to remove sediment from the diverted water (divided into two sections by a turbidity curtain), sediment drying lagoons to reduce the water content of dredged sediment before it is hauled offsite, control gates to regulate flows into and through the intake facility, and a tunnel shaft to provide an inlet to the Project tunnel system.

The intake sites would also include new flood control levees, power supply substation, electrical and control buildings, standby engine generators and fuel tanks, fueling station, office and equipment storage, water and wastewater facilities, communications/supervisory control and data acquisition (SCADA) facilities, security features, fencing and signage, emergency response facilities during construction, and other ancillary facilities. Refer to the engineering concept drawings included as part of the EPRs for additional information.

2.3 Key Intake Design Considerations

The intake structures would be on-bank diversion structures with state-of-the-art cylindrical tee fish screen systems. Key features of the intakes would include an intake structure with the fish screens in the river along the east bank, a sedimentation basin to allow large sediment to be captured and removed from the diverted flow stream before entering the Project tunnel system, flow control features to manage diversion flows, levee embankments to provide flood protection and contain the intake system, and a variety of appurtenant features.

The Project intake system design, construction, and operations would be subject to compliance with a variety of regulatory requirements and other considerations including, but not limited to, criteria developed by the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (DFW), United States army Corps of Engineers (USACE), State Water Resources Control Board (SWRCB), Central Valley Flood Protection Board (CVFPB), State Lands Commission, Caltrans, and U.S. Coast Guard.

Fish screen design criteria must comply with the 2018 draft NMFS Anadromous Salmonid Passage Design Guidelines, as well as requirements of the USFWS and CDFW. The USFWS and CDFW require a design approach velocity of 0.2 feet per second (fps) to protect Delta Smelt and other juvenile Delta fish species. The NMFS 2018 guidelines require a design approach velocity of 0.33 fps to protect salmonids. Further, the NMFS 2018 guidelines also require a slower approach velocity to mitigate for the inability to accommodate sweeping velocities under tidal conditions, which would be applicable to the proposed intake screens for the Project. Although not specifically stated in the NMWS Guidelines, the lower velocity criteria have generally been accepted to match the USFWS and CDFW approach velocity of 0.2 fps for projects in the Delta. The more stringent of the various criteria control the design; most notably, the USFWS and CDFW approach velocity requirement would control the sizing of the intake structures.

Intakes would be designed to operate at full design flow capacity for the range of river water levels from the low level that is exceeded 99 percent of the time to the high level defined by the elevation of the 200-year flood flow stage, including the effect of year 2100 sea level rise (SLR) and climate change hydrology, plus 3 feet of freeboard. The lower end of the range was defined by the DCA (CER Appendix B2 *River Hydrologic Criteria for Intake Sizing*) and is considered conservative since full diversions at minimum water levels would be rare. However, conceptual design for this condition is considered appropriate for the Project planning phase. Operational criteria have not been finalized and the relationship of the intake design water surface elevation to low river levels would be re-evaluated during final design relative to the need to operate at these very low levels. The high end of the range is a design parameter defined by DWR and directed for application to all Project facilities (DWR, 2020).

Sedimentation basins would be designed to capture sand sized and larger particles at the full design flow capacity. Refer to the CER Appendix B8 *Intakes River Sediment Analysis - North Delta Intakes* for additional information.

Since the intake structures would be constructed along and through the existing flood control levees, all associated work would be subject to USACE and CVFPB requirements. All levees providing flood control at the sites during or after the work, plus related structures, would be designed and constructed in accordance with levee design and construction requirements of the USACE and the CVFPB. Those requirements would require that detailed engineering analysis be conducted using site specific hydrologic and geotechnical information. The analyses would establish the levee configuration, including construction sequencing, minimum crest width, stable slide slopes, foundation requirements, slurry cutoff wall requirements, levee fill material and zoning requirements, and other details. Refer to the CER Appendix B11 for additional information.

2.4 General Operational Concept

At each intake, diverted water would flow from the Sacramento River through the fish screen system on the intake structure, then through a pipe or conduit system equipped with flow meters and control gates to regulate the flow through the screens. The piping or conduits would extend landward and discharge the diverted water into a sedimentation basin.

Diverted water would contain sediment suspended in the river water. Once the diverted water enters the sedimentation basin, sand and larger silt sediment particles would settle while smaller silt and clay particles would be carried into the tunnel. Tunnel velocity would be sufficient to transport these smaller particles to the Bethany Reservoir.

About once a year, sediment that is captured in the sedimentation basin would be dredged from the basin, dried in the sediment drying lagoons, and disposed of off-site for beneficial use at a permitted disposal location, such as landfill cover or restored tidal wetlands.

In addition to the gates controlling the pipes discharging to the sedimentation basin as described above, a flow control structure equipped with radial gates would be provided at the back of the sedimentation basin. This structure would hold the water in the basin on its upstream side at a constant water level relative to the river level and simultaneously discharge the diverted flow downstream into the tunnel inlet. The gates and the flow control structure could also be used for isolation of the tunnel system for flood control or during tunnel maintenance.

3. Intake Configuration

This section provides a summary of the intake design flow capacity requirements and detailed descriptions of the various components that make up the Project intakes.

3.1 Description of Intake Facilities

3.1.1 Intake Site Access

A new haul road would be provided along the westerly toe of the old railroad embankment east of the proposed intake sites. The haul road would eliminate the need for construction traffic to travel through the main portion of the Town of Hood and on State Route (SR) 160. All access for construction, plus most operations phase access, would use the haul road to enter the intake sites. Refer to the CER Appendix E1 *Logistics Strategy* for additional information.

3.1.2 Intake Structure and Conveyance to the Sedimentation Basin

A concrete intake structure would be constructed along the riverbank for each intake. The front wall (river side) of the structure would be positioned about 100 feet into the river from the river side crest of the flood control levee at each site. SR 160 is also located on top of the levee at each site. The position of the front wall of the intake structure would allow the bottom of the intake screens to be at least 4 feet above the river bottom at each location. The intake structure would be a concrete structure with fish screens installed along the front wall as described below. Behind the front wall, the structure includes a dry well that houses flow control gates, flow meters, and piping that extends further landward to the sedimentation basin located on the land side of the structure. Each fish screen has a dedicated pipe with control gates and a flow meter that extends to the sedimentation basin.

The tops of each intake structure would be set at an elevation equal to, or greater than, the 200-year flood flow stage, including the effect of year 2100 sea level rise (SLR) and climate change hydrology, plus 3 feet of freeboard. The structures would be designed to allow large vehicles (HS-20 tractor trailer rigs) to drive onto the roof deck. Various safety rails and other minor features would also be included.

A gantry crane would be provided on the top of each structure to facilitate the removal and replacement of fish screen units for cleaning and related operations and maintenance (O&M) activities.

3.1.3 Flood Control Levees and State Route 160

The intakes would be located along the existing flood control levee, which includes SR 160 constructed on the top of the levee. The levee was constructed as part of the Sacramento River Flood Control Project (SRFCP) established by the USACE to provide flood management for surrounding lands. Levees constructed as part of the SRFCP are typically referred to as Project Levees. The levees at the intake sites are Project Levees and are considered “jurisdictional”, which requires approval by the USACE and CVFPB prior to any modification or replacement. Given the Project Levee status of the existing levees, flood control functions, including compliance with all USACE and CVFPB criteria, would need to be maintained continuously during construction of any modifications or new levee sections. Accordingly, new temporary and permanent levees included with the work would also be considered Project Levees once they are accepted by the USACE and CVFPB.

On the water side of the levees at each intake site, the levees are overlain with riprap and vegetation. On the land side, the levee is primarily covered with dirt, gravel, trees, shrubs, and/or weeds and grasses. SR 160 is a two-lane roadway with varying widths of unpaved shoulder areas. In the vicinity of the intake sites, SR 160 has been designated as a Scenic Highway by Sacramento County and the State of California.

3.1.3.1 Temporary Levee

The new intake structures and conveyance features would be constructed in the existing Project Levee prism. Since the existing Project Levee would be impacted by construction of the new facilities, a temporary levee would be required at the intake sites to allow the intake facilities to be constructed along the river while maintaining continuous flood protection equivalent to, or better than, the protection provided by the existing levee. The temporary levee would be a fully functional USACE Project Levee and would facilitate the construction sequencing of the permanent levee around the perimeter of the intake sedimentation basin and intake outlet channel. The temporary levee would divide the construction work site into two main work areas; the river side and the land side. The temporary levee would have the same design characteristics of the permanent levee. Refer to construction phase information presented in Section 4 for additional information regarding the temporary levee.

3.1.3.2 State Route 160 Relocation

State Route 160 is located on the top of the existing Project Levee at each site and must be temporarily relocated to allow construction of the intakes. The temporary levee described above would also serve as the temporary location of SR 160.

Several alignment alternatives were considered for relocating SR 160, and are listed below:

1) SR 160 relocated to a temporary setback levee a few hundred feet behind the existing levee
2) SR 160 relocated around the back of both Intakes C-E-2 and 3 and individually around the back of Intake C-E-5
3) SR 160 relocated individually around the back of each intake

All alignment alternatives require a dedicated road constructed to Caltrans highway standards. Alignments 2 and 3 would result in a substantially larger footprint and more land removed from agricultural land use to accommodate design curves and sight distances. Also, these alignments would require an elevated embankment to be above the 100-year flood level, which is only a few feet lower than the existing levee. At the location behind the intake sites, these embankments would make uninterrupted flood protection at the sites more complex and considerably more costly due to longer flood protection levees. On the other hand, Alignment 1 could be accomplished with minimal additional footprint and the flood protection aspects of the relocation would be smaller and more compatible with the completed system.

Alignments 2 and 3 would require that all construction traffic on the new haul road cross the relocated highway to gain access to the work site. For Alignment 1, only the river side work site traffic would cross the relocated highway.

Finally, SR 160 is a State and County Scenic Highway and Alignments 2 and 3 would result in the relocation of the roadway to a location much further from the river, a longer driving time through the construction sites, and closer to the Stone Lakes Refuge.

Given the additional impacts and complexity associated with Alignments 2 and 3, Alignment 1 was selected for the configuration of the relocation of SR 160.

SR 160 would temporarily be relocated about 200 feet further from the river than its existing location. The Project assumes that it would eventually need to be reestablished as close as possible to its original location due to its status as a Scenic Highway. Therefore, a permanent SR 160 alignment was also developed as close to the intake structure as possible. The permanent alignment would facilitate proper curve radii to allow access between SR 160 and the top of the intake structure. The centerline of the permanent alignment would be atop a widened embankment section about 20-50 feet further inland from the existing highway centerline, depending on the intake site.

SR 160 would be established in its temporary location for the majority of the construction phase. During that time, the permanent location of SR 160, relatively close to its original location as noted above, would be established on completed fill areas behind the intake structure. During a later phase of construction, this fill area and permanent roadway would be completed and traffic on SR 160 would be reestablished in the permanent location. After that time, and after the permanent flood control levee is in place, the temporary portion of the fill and the temporary SR 160 improvements would be removed.

The location of both the permanent and temporary portions of SR 160 are shown in the engineering concept drawings. Refer to construction phase information presented below for additional information regarding the sequencing of the temporary and permanent SR 160 roadway.

3.1.3.3 Permanent Levee

A permanent Project Levee would be constructed as part of the Project. The permanent levee would include the portions of the intake embankments that form the perimeter of the sedimentation basin and the outlet channel, plus the transitions to the existing levee upstream and downstream of the site. The perimeter embankment was selected as the permanent levee to facilitate monitoring and inspection of this critical flood control feature.

Once completed, the permanent levee would extend from the existing levee beneath State Route 160 starting on the upstream side of the intake site. It would follow the new and slightly relocated State Route 160 until it reaches the upstream (north) sedimentation basin embankment. At that point, the sedimentation basin embankment would serve as the permanent levee and extend around the full perimeter of the intake facility sedimentation basin and outlet channel. At the point where the downstream sedimentation basin embankment (south) returns toward the river and intersects with the slightly relocated final location of SR 160, the permanent levee would follow the new SR 160 alignment to its interconnection with the existing levee and highway at the downstream limit of the intake site.

The temporary levee and temporary SR 160 would not remain in place as part of the permanent Project Levee. The configuration portrayed in the engineering concept drawings includes the following levee features:

- Top of all levees would be equal to or greater than the 200 year flood flow stage, including the effect of year 2100 SLR, plus 3 feet of freeboard. Note that the temporary levee may be somewhat lower to account for its temporary status and lower SLR during the construction phase.
- Slurry cutoff wall would be provided beneath all levees and extend beneath the flow control structure described below. The top of the cutoff wall, or a fine-grained levee core within the levee fill section, would be constructed to the maximum flood water level elevation, as shown on the engineering concept drawings.
- Levee side slopes of three horizontal feet for every one vertical foot (3H:1V) for both the interior and exterior slopes would be used. The side slopes may be revised after further analysis.
- A minimum crest width of 20 feet is required by the USACE and CVFPB. However, due to the presence of electrical equipment at the intake sites, the levee crest would also need to meet

California Fire Code (CBSC, 2016), which would require at least 20-foot-wide roads and 4-foot shoulders (total 28 feet wide). For the conceptual layout shown on the engineering concept drawings, a two-lane road, 12 feet width for each, plus 8-foot shoulders (total 40 feet wide) was selected to provide adequate turning radii for construction, O&M, and emergency vehicles on the jurisdiction levee. This width may be reduced during later design phases.

- Ground improvement would be provided beneath levee embankments to provide stability relative to settlement of the fill material and to protect the levee from liquefaction of subsurface material in a seismic event.
- An inspection trench would be provided beneath levee foundations on the water side of the crest during construction in accordance with Title 23, Division 1 of the California Code of Regulations, which defines the CVFPB regulations and authorities.
- Minimal work would be included in the levee prism (area within projection of side slopes downward beneath finished embankments) below constructed grade; limited to drilled piers, cutoff wall, ground improvement, dewatering wells, and the tunnel shaft.
- Slope protection, including rock, articulated mats, and vegetation, as applicable, to minimize slope erosion would be provided. Vegetation would be expected to be used only on the outside slope.

3.1.3.4 Finished Levee

During construction, after the temporary levee was in place, the permanent levee would be constructed around the intake area to at least the minimum section and height required to accomplish uninterrupted flood control as a Project Levee. During a later phase of construction, after the tunnel shaft is completed and SR 160 has been replaced in its permanent location, the fill material used for the tunnel shaft pad and the temporary levee (with temporary SR 160 relocation) would be removed and the fill materials would be placed along the permanent levee. This fill would be used to widen the levee for the electrical facilities, equipment storage, roads, and other miscellaneous fills. Therefore, the finished levee section would be widened in some locations beyond the minimum Project Levee width requirements for flood control and access, as described above.

3.1.3.5 Intake Structure Training Walls

The concrete intake structures would extend up to about 100 feet into the river, depending on river stage. Sheet pile training walls would extend in an arc reaching back from the river side face of the structure to the finished grade along the levee side slope both upstream and downstream of the intake structure. The training walls would transition flows from the existing river embankment and levee to the face of the structure. The training walls would provide improved river hydraulics and facilitate vehicular access between the operating deck of the intake and the permanent location of SR 160. Each training wall would extend at a continuous radius of about 150-200 feet from the structure toward the limits of the Project Levee. These walls will remain in place after construction as a permanent structure and would be installed to approximately finished grade (approximately the same top elevation as the adjacent permanent levee). Detailed dimensions of these walls are shown on the engineering concept drawings. Depending on agency requirements, the flutes (vertical grooves) along the face of the sheet pile walls may be sealed, filled, or screened for use as fish refugia.

3.1.4 Fish Screen Facilities

The fish screens that would be provided on the intakes would be part of an overall system that includes the screens, guide rails for installing them on the face of the structure, solid panels, flow baffles, and a screen cleaning system.

3.1.4.1 Cylindrical Tee Screen System

The cylindrical tee fish screen units would be stainless steel metal fabrications conforming to the dimensions shown on the engineering concept drawings. The screen units would consist of two fish screen cylinders installed on either side of a manifold feeding an outlet to form a “tee” configuration. The two sides of the tee would include fish screen cylinders that feed diverted flow into the branch outlet of the tee. The cylinders and outlet all would intersect at the manifold section.

The screen cylinders would be comprised of fish screen material on the outside and include an interior cylindrical baffle assembly for porosity control. The perforated baffle system within the cylindrical structure and immediately behind the fish screen would promote uniform approach velocity up to and through the cylindrical screen. The end of the cylinders would be sealed with a solid plate. The solid plate would be conically shaped to promote smooth flow for the most upstream and most downstream screen unit.

Slotted fish screen material would be fabricated from 1.75 millimeter wide wedge wire, similar to a well screen. The screen material would include 1.75 millimeter gaps between individual wedge wires to provide about 50 percent open area, which easily complies with regulatory requirements of a minimum 27 percent open area. The screen cylinders would rotate in both directions for cleaning using a submersible motor driver for each side. The manifold and outlet portions of each unit would be fixed. Stationary replaceable brushes would be installed on the exterior and the interior of the screen cylinders and apply cleaning action against the screen cylinder when it rotates. The brush screen cleaners would help remove debris and avoid biofouling.

The screen outlet and manifold would be fabricated from solid stainless steel plate. The outlet would be attached to a mounting panel constructed from a heavy duty stainless steel tube framing. This panel would have a solid stainless steel covering outside of the screen outlet. The mounting panel would be used to slide the screen units up and down in guide rails installed flush with the face of the concrete intake structure. The mounting panel would include ultrahigh molecular weight polyethylene (UHMWPE) runners along each side of the vertical frame edge to facilitate installation in the guide rails as well as to allow custom fit adjustment in the field. The screen units and mounting panels would be fabricated to a high straightness and dimensional tolerances for the frame and the screen cylinders. Frame straightness would provide no gaps larger than 1/16 inch around the edges in the guide rails and at the interfaces with the bottom sill or solid panels above.

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

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

Water would flow from the Sacramento River through the cylindrical tee-style fish screens, then through a piping system with flow meter and control gates to regulate the flow through each screen. The system would include a dedicated piping train behind each screen. Control gates in structures along each piping train would use flow meter feedback to control the flow rate through each screen. The piping would extend landward from the structure and discharge the water into the sedimentation basin. The flow velocity would be high enough in the piping system to transport sediment suspended in the diverted flow into the sedimentation basin.

Each intake structure would include multiple tee screen units, each with dedicated 60-inch diameter piping and valve assemblies and each rated for a diversion capacity of 100 cfs. Each screen and piping assembly is an independent unit from other screen and piping assemblies and includes its own screen cleaning brushes, pipe, flow meter, and control gates, all leading to a common sedimentation basin. This subdivision of the system into individual screen assembly units would facilitate better diversion flow control along the length of the intake structure. Consolidation of two or three screens into a common discharge pipe and flow control system may also achieve the desired control and would be considered during design.

3.1.5 Debris Fender and Log Boom

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

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

A log boom with 18- to 24-inch diameter pipe piles to guide its position would be installed immediately in front of the entire length of fish screens along the face of the structure. On the upstream end, the log boom would tie into and extend off the end of the debris fender. The log boom would encourage near surface and floating material to flow downriver past the screen area. The “logs” would be pontoon style coated and sealed steel pipes. The log boom would be connected to its guiding pipe piles such that it would go up and down with the changing river level.

Log boom piles will be installed during the last in-river work window during the construction phase for each intake. Each pile would take about an hour to drive into place, including rigging time. This work would be coordinated with the excavation of river bottom soil material along the face of the intake structure and the placement of riprap over the excavated area. It is expected that the piles would be driven using equipment mobilized on the top deck of the completed intake structure. However, it is possible that barge mounted pile driving equipment could be used.

Existing geotechnical information suggests that all log boom piles could be vibrated into place without the need for any impact pile driving. However, practically speaking, there may be some unsuspected higher density soil strata that could require some amount of impact driving for these piles. Table 3.1.5.1 summarizes the number of piles at each intake and a conservative estimate of the impact pile driving assumed to be required.

Table 3.1.5.1. Log Boom Pile Driving Information

Intake	Number of Log Boom Piles	Strikes Per Pile	Impact Driving Time per Pile (minutes)	Total Impact Driving Time per Intake (minutes/ hours)
C-E-3	32	504	10.08	323/5.4
C-E-5	32	66	1.32	42/<1

Notes

[1] Quantities include upstream fender piles.

[2] Impact driving time assumed about 3 feet of pile depth for impact driving at Intake C-E-5 and 12 feet at Intake C-E-3.

[3] 50 strikes/minute was assumed for impact pile driving.

3.1.6 Flow Control Structure and Outlet Channel

A flow control structure (FCS) using radial gates would be provided at the back of the sedimentation basin. On the upstream side (basin side) of the structure, the FCS would hold the water in the basin at a constant water level relative to the river level (about 18 to 24 inched below river level) and simultaneously allow the diverted flow through the structure into the outlet channel on the downstream side. The flow discharged past the FCS would flow through the intake outlet channel and into the tunnel via the intake outlet shaft (tunnel inlet) and be conveyed through the tunnel to the facilities in the South Delta.

The FCS would be a concrete structure with several large radial gates. While it is not expected to be a jurisdictional structure, it would have the same top elevation as the permanent levee and be installed to operate integrally with the permanent jurisdictional levee. It would also be used to isolate the tunnel system during flood or tunnel maintenance events. The FCS, including the radial gates, would be designed in full conformance with DWR and USACE requirements, including the following criteria.

- USACE ETL 1110-2-584 Manual for Design of Hydraulic Steel Structures
- USACE EM 1110-2-2702 Manual for Design of Spillway Tainter Gates

The flow control structure would be constructed over a seepage cutoff wall constructed integral with the ground improvement and intake cutoff wall systems beneath the permanent levee system. The structure would be designed to isolate flow when the upstream water surface in the sedimentation basin is at the 200-year flood flow stage, including the effect of year 2100 SLR, and no water surface is present on the downstream side. Construction details regarding foundations, ground improvement, seepage control, and hydraulic thrust on the structure would be developed during final design.

The outlet channel would be designed to convey the intake design capacity into the tunnel system at the low design river water surface elevations. Due to turbulence downstream of the radial gates and higher velocity flow at low river levels, the channel would be concrete lined between the FCS and the tunnel inlet shaft. Provisions to accommodate the expected variations in water surface in the channel, including considerations for armoring, uplift, and other related features would be developed during final design.

3.1.7 Sedimentation Basin and Drying Lagoons

A large sedimentation basin would be provided immediately downstream of the intake structure and associated conveyance pipes or box conduits. The sedimentation basin would be sized to capture all sand sized and larger particles suspended in the diverted flows. Depending on the diversion rate and distribution of sediment in the water column, some silt sized particles would also be captured.

The sedimentation basin would be divided into two cells, as shown on the engineering concept drawings, using a sediment curtain. The curtain would allow one side of the basin to be dredged while the other side remains in service.

The sedimentation basins would be dredged about once every year and the dredged slurry would be discharged into four on-site drying lagoons. The lagoons would be used as part of a process to dry the sediment enough to minimize dust formation and facilitate disposal at a licensed off-site disposal location.

The sedimentation basins would be lined on both the bottom and side slopes. Side slope lining would be provided to prevent erosion and facilitate maintenance. The bottom lining would provide a hard surface to indicate the bottom was reached during dredging. Linings would be porous and are expected to be riprap or articulated concrete mats.

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

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

The sedimentation basins would include an underdrain system connected to dewatering sumps that would operate in conjunction with a series of dewatering wells. The underdrain system would be used to help provide a stable basin bottom for maintenance access, but the dewatering wells would be the primary feature used to dewater the basins. These features would be located completely within the basin and would be expected to mostly avoid the Project Levee prism. They have not been included in the conceptual design at this time and would be developed during detailed design after more site-specific hydrogeologic data is available for the sites. They would be operated with portable pumps and in conjunctions with dewatering wells in the event the sedimentation basins need to be dewatered during the operations phase of the Project.

Drying lagoons would be provided to facilitate the separation of settled sediment from dredged slurry and allow the sediment to be disposed of off-site. The lagoons would be concrete lined and include underdrains, decant/outlet structures, return flow pumping structures, and minor piping. The drying lagoons would be constructed over a ground improvement grid similar to the grid beneath the levees and embankments at the sites. Also, given the site elevations relative to river water surfaces, the proximity to the river, and possible porous soil strata at the intake sites, lagoon design would consider the effects of artesian groundwater pressure carried by soil strata to act on the bottom lining of the lagoons. Based upon the results of future field investigations, applicable ground improvement, grading criteria, and design features would be developed for the drying lagoon design to minimize groundwater entering through the lagoon floor to avoid lagoon buoyancy issues and high water levels that could overtop the lagoon levees.

Refer to the CER Appendix B8 for additional details about the sediment management concepts for the Project.

3.1.8 Power and Supervisory Control and Data Acquisition (SCADA) Facilities

The intake facilities would be supplied electrical power from a new underground 69 kilovolt (kV) transmission line installed in the haul road accessing the intake sites. The new transmission line would connect to a facility substation located on the top of the levee embankment adjacent to the outlet channel. Power would be distributed from the substation at 4160 volts (V) to two electrical buildings, one adjacent to the substation and one on the river side of the sedimentation basins. Both buildings would be located on top of the widened levee or fill section at, or above, the required levee height. The electrical building near the substation would serve loads near the FCS, outlet channel, and support buildings and the electrical building at the sedimentation basin would serve loads at the intake structure. Each electrical building would have a secondary transformer to further reduce the voltage for utilization by the equipment served from that building. It would include applicable containment for transformer oil and safety walls. Power would be distributed around the site using buried conductors.

Each electrical building would include a one-megawatt standby engine generator (SEG) with a 1528 horsepower engine and propane fuel tanks. The power supply ties to the SEG would include an automatic transfer switch to ensure key equipment could operate as needed in the event of a power failure. The generators and fuel tanks would be located adjacent to and outside the buildings, but inside the facility security fence, and surrounded by a CMU wall.

Refer to the CER Appendix H2 *Electrical Power Load and Routing Study* for additional details about the intake power supply.

Instrumentation and remote-controlled actuators and starters would be distributed around the site at applicable equipment and monitoring locations. Data would be concentrated at the two electrical buildings where control and communications equipment would be provided to facilitate on-site and remote control. The communications equipment would transmit data signals throughout the Project network using fiber optic cables extending to off-site connection points.

Refer to the CER Appendix H3 *SCADA/Communications Routing and Basic Design Approach* for additional details about overall Project SCADA and communications connections for the intakes.

3.1.9 Intake Support Features

In addition to the electrical substation and electrical buildings described above, the intakes would also include the following support features:

3.1.9.1 Vehicle Storage Facility

A vehicle storage facility would be included at Intake C-E-3. The vehicle storage building would be the location where O&M equipment specific to the intakes would be stored and maintained. The facility is expected to house the dredge, a forklift, a pressure washer, a work barge (pontoon style flatbed boat), and a mobile crane. A large pickup truck and other equipment may also be stored at the facility or may be deployed from other existing DWR O&M facilities to support specific activities. In addition to vehicle storage, the building would include a warehouse area for storing spare parts and smaller tools and equipment, an office area, a lunch/break room, and a restroom and small locker room with a shower. The vehicle storage facility would be about 4000 square feet and about 20 feet tall. It would be located near original grade on the westerly (landward) side of the outlet channel and drying lagoons. This facility may be used as the emergency response station during construction.

3.1.9.2 Office

A small office would be provided at each intake. At Intake C-E-3, it would be included in the vehicle storage facility. The office would be used to facilitate O&M activities such as sediment management and screen cleaning, and equipment checks and routine maintenance. The office would be small (less than 1000 - square feet) and include an office area, small tools and equipment storage, a lunch/break room, and a restroom and small locker room with a shower. The office would be located near original grade on the westerly (landward) side of the outlet channel and drying lagoons.

3.1.9.3 Fuel Station

Each intake would include a fuel storage and refilling station for equipment used during O&M activities. This would be a block wall enclosure with an above ground fuel tank and fuel pump and filling station. The entire area, fuel storage and filling area, would include proper containment for the full stored fuel volume. The fuel tank would store fuel primarily during times it is needed for ongoing O&M activities. The fuel station would be located in the vicinity of the vehicle storage facility or office, near original grade on the westerly (landward) side of the outlet channel and drying lagoons.

3.1.9.4 Stoplog and Gate Storage

An area enclosed by a block wall would be located on the top of the levee embankment adjacent to the outlet channel for storage of a flatbed trailer plus a variety of stoplog gates, spare fish screen panels, and other O&M or spare components that can be stored outside. Shade structures would be provided inside the enclosure for some features. The enclosure is expected to be about 80 feet wide by 120 feet long and include 12 foot high block walls.

3.1.10 Other Site Features

Other features at the intake sites would include the following:

3.1.10.1 Utilities

A sanitary leachfield designed per Sacramento County standards would be provided to support the restroom and showers in the office or vehicle storage building. One or more of the water wells used on the site during construction would be used as the water supply for the office or vehicle storage building. Suitable well head treatment would be provided as needed to facilitate a safe water supply.

3.1.10.2 Fencing and Security

The entire permanent facility site would be fenced in accordance with DWR standards for the areas both on the land side and on the river side of SR 160. All locations for access into the sites would include automatic gates with access control features such as keypads and card readers. Gates would be located for access from SR 160 on both the upstream and downstream side of the intake structure on the river side. On the land side, gates would be provided at the main O&M entrance on the westerly side of the sites where the haul road access is located, plus at two locations along SR 160 as needed to access the top of the levees opposite the river side access gates.

All buildings would also include access control features at entry doors.

The intake sites and all structures and access gates would include surveillance cameras and other security and safety monitoring features (e.g., entry alarms, fire alarms, etc.), both inside and outside, as applicable. Surveillance information would be transmitted to off-site DWR operations centers and to emergency responders via the communications system, as applicable.

3.1.10.3 Roads and Work Areas

The following on-site permanent roads would be paved, 20-foot minimum width, plus at least 4-foot gravel shoulders:

- Main entry from haul road at back of site
- Intake structure top deck access roads from SR 160
- Top of levee/embankment access roads
- Ramps to top of levee/embankment from original ground at back of site

The following on-site permanent roads would also be paved or otherwise hard surfaced (details regarding width to be developed during design):

- Access ramps to deploy dredge into sedimentation basin
- Access ramps to deploy equipment into drying lagoons
- Access ramp into outlet channel

The following roads would be gravel surfaced, 20-foot minimum width, plus at least 4-foot shoulder areas on each side (details to be developed during design):

- Electrical building access on river side of sedimentation basin
- Patrol road along base of levee/embankments at original grade
- Drying lagoon perimeter roads

Gravel surfaced work areas:

- Two permanent on-site work areas, each at original grade adjacent to the backside of the sediment drying lagoons for staging sediment drying and disposal operations

3.1.10.4 Landscaping

A specific landscaping plan has not been conceptually developed for the intakes. However, suitable space would exist to facilitate landscaping on both sides of SR 160 as it passes through the site on the fill area between the intake structure and sedimentation basins. Space for landscaping would also be available around the remaining three sides of the perimeter of the site on the land side of SR 160. Landscaping could also be provided around the vehicle storage or office buildings.

Other than erosion protective grasses, no landscaping would be placed on temporary or permanent Project Levee embankments. Depending on the final levee section locations, it may be possible to place some landscaping behind the training walls on the upstream and downstream side of the intakes on the river side of SR 160 and along the strip between SR 160 and the sedimentation basins.

4. Overview of Intake Construction Activities

Since the intakes would be located along the existing Project Levee and SR 160, flood control and highway traffic must be maintained continuously during construction of any modifications. Accordingly, the conceptual construction information has been developed in consideration of three primary phases of construction, as summarized below:

- Phase 1—period where the existing Project Levee would provide flood protection and the existing location of SR 160 would convey traffic
- Phase 2—period where the temporary Project Levee would provide flood protection and the temporary location of SR 160 would convey traffic
- Phase3—period where the permanent Project Levee would provide flood protection and the permanent location of SR 160 would convey traffic

The information in this section describes the sequence of construction as well as construction concepts for the main intake facilities.

4.1 Construction Sequence

Construction of the intakes would include a predetermined sequence of work to accomplish the work of the three phases of construction according to the following major priorities:

- Complete site preparation with minimum interruption of adjacent land uses
- Maintain flood protection equal to or better than that offered by the existing Project Levee
- Maintain traffic on SR 160
- Comply with work windows for fisheries protection in the Sacramento River
- Minimize the transfer of fill materials to or from the site
- Construct the work to meet the Delta Conveyance Project fundamental purposes and design standards

Phase 1 of the construction sequence would include preparing the site and building a new temporary Project Levee east of the existing Project Levee and rerouting SR 160 onto this levee to provide:

- a river side workspace for the intake structure,
- a land side workspace for sedimentation basin and permanent Project Levee construction,
- flood control for all land side operations and existing properties.

Phase 2 would follow construction of the new temporary Project Levee and relocated highway. Phase 2 work would be conducted on both the land side and on the river side of the new temporary levee.

Completion of the work would be conducted during Phase 3 which would take place once the temporary levee and SR 160 features are no longer needed.

A sequential listing of key construction activities for a typical intake facility, shown by construction phases defined above, is provided in Table 4.1.1. These activities are also illustrated on the sketches in Figures 4.1.1 through 4.1.9 (attached separately at the end of this TM). Phase 2 work activities are designated by “river side” or “land side” in Section 4.1.1, as applicable. The time frames and overlap characteristics of each of the activities would depend upon the logic included in a detailed construction schedule for each intake site. Note that all activities are not included, but Section 4.1.1 and Figures 4.1.1 through 4.1.9 (attached at the end) are intended to show the sequence of major activities involved in constructing the intakes.

4.1.1 Phase 1 Activities

Initial Site Move-in and Preparation (Figure 4.1.1)

- Site move-in and preparation, including environmental controls
- Install cutoff walls 1a, 1b and 3
- Install ground improvement under temporary levee/SR 160 fill
- Install initial dewatering system inside area enclosed by cutoff walls and dewater borrow area

Temporary Levee and SR 160 Relocation (Figure 4.1.2)

- Construct new levee/SR 160 fill using fill from borrow area
- Construct temporary SR 160
- Relocate traffic to temporary SR 160

4.1.2 Phase 2 Activities

Cutoff Walls and Landside Dewatering (Figure 4.1.3)

- Degrade existing levee, as needed (river side)
- Install cutoff walls (2 and 4) and ground improvement in river side fill (river side) and under remainder of levee (land side)
- Extend cutoff walls 1b to deep mechanically mixed (DMM) back wall of cofferdam location (river side)

Cofferdam, Training Wall, and Drilled Piers (Figure 4.1.4)

- Construct trestle (river side)
- Place sheet pile (cofferdam and training walls) (river side)
- Construct DMM back wall of cofferdam, tie into cutoff walls 1b (river side)
- Set up cofferdam dewatering WTP (river side)
- Install cofferdam back wall tie-backs and internal supports/excavate cofferdam/partial dewatering (river side)
- Place drilled pier starter casings/install drilled piers (river side)

Complete Cofferdam and Initial Intake Structure (Figure 4.1.5)

- Place tremie seal (river side)
- Dewater cofferdam (river side)
- Pour mud slab (river side)
- Clean/cut top of pier casings and expose rebar (river side)

- Build floor slab (river side)
- Build walls and roof deck, including gate chambers and required mechanical/electrical (river side)

Intake Structure and River Side Backfill (Figure 4.1.6)

- Remove trestle (river side)
- De-tension DMM wall tie-backs (river side)
- Backfill between cofferdam and structure (except the water side) and behind training walls (river side)
- Backfill degraded levee and permanent road pad area (river side)

Tunnel Shaft (Figure 4.1.7)

- Construct fill for tunnel shaft pad (land side)
- Construct tunnel shaft (land side)
- TBM passes through site or is recovered from shaft, depending on intake site (land side)
- Demolish upper portion of shaft and remove associated pad fill (land side)

Permanent Project Levee and SR 160 (Figure 4.1.8)

- Activate dewatering system for sedimentation basin excavation (land side)
- Construct remainder of Project Levee and drying lagoon earthwork (land side)
- Construct radial gate flow control structure; tie into Cutoff Wall 4 and ground improvement grid (land side)
- Construct permanent SR 160 (river side)
- Re-establish SR 160 traffic on permanent alignment (river side)

4.1.3 Phase 3 Activities

Complete Intake Facility (Figure 4.1.9)

- Remove fill from temporary Highway 160 area and complete land side fills
- Bore intake discharge pipes into sedimentation basin from intake structure
- Install outlet structures on intake discharge pipes in sedimentation basin
- Construct outlet channel lining
- Install sedimentation basin bottom and side slope revetment
- Install drying lagoon lining and structures; tie into ground improvement grid
- Stop dewatering sedimentation basin area
- Construct substation and electrical buildings
- Construct other support structures
- Install fish screen panels
- Complete miscellaneous civil/structural/mechanical work at structures
- Complete electrical/I&C interconnects and site electrification
- Install log boom piles and log boom
- Conduct minor river dredging (mechanical type) and install riprap around structure
- Pave roads, install fencing and landscaping, complete minor site work
- Conduct final testing and commissioning

- Clean up and demobilize
- Restore disturbed lands

Note: The listing in this table provides a general sequential order to help illustrate sequence of the overall intake facility work; however, many activities are not included in the listing, and many would occur concurrently.

4.2 Construction Concepts for the Main Intake Facilities

4.2.1 Work Areas

Work areas would be needed for all elements of the proposed construction. Sufficient space would be required adjacent to the Project sites to allow contractors to manage and conduct a wide variety of activities. These activities would include, but not be limited to the following:

- field offices
- parking
- power supplies
- bus loading/unloading zones for employees transported from the offsite employee parking location
- road networks to traverse the site
- water and wastewater management and treatment
- vehicle and equipment maintenance and storage
- storehouses for various supplies and parts
- general access and staging around and adjacent to work components
- topsoil and excavated material management
- mixing plants and other support facilities for the various aspects of the work
- staging and erection areas for the materials and equipment needed for the work

A general site plan showing the expected distribution of construction phase support areas is included in the engineering concept drawings.

In the case of the intakes, space is also required for the temporary Project Levee and the SR 160 relocation.

Each intake construction site would include some combination of required processing operations, including slurry mixing and management facilities, soil mixing and staging facilities, and cement storage. These facilities would be erected on the site when needed and demobilized after they are no longer needed. For example, the slurry mixing and management facilities would be needed to support slurry cutoff wall construction early during the work, while an excavation processing area would be used later in the work when the sediment basins would be constructed. Concrete batch plants would be established on the east side of Interstate 5, near the intersection of Franklin Boulevard and Lambert Road, to provide concrete for intake construction. Applicable concrete truck wash-out areas would be provided at the intake sites.

All site facilities, including soil and concrete processing facilities and all materials storage, would be established with suitable grading and best practices to minimize surface water and local area impacts. Also, all storage and processing areas would be properly contained, as required, for environmental and regulatory compliance.

No significant metal fabrication is expected to take place at the intake sites. Fabricated metals used in the work would mostly be fabricated off-site and delivered to the site for installation. Some minor welding, fastening, and erection of metal components, such as sheet pile pairs, cofferdam supports, reinforcing steel, fish screen cleaning assemblies, piping, and radial gates, would be conducted at the site. This work would be expected to be conducted within the general processing and laydown areas shown on the engineering concept drawings, and in some cases, at the specific location where it would be incorporated into the work.

Conceptual estimates indicate that work area requirements outside of the permanent footprint would be a minimum of about 100-110 acres for intakes with design capacity of 3,000 cfs and about 80-90 for those with design capacity of 1,500 cfs. Actual work areas included in the conceptual layout of the facilities are presented in Section 6 and are often slightly larger than the minimum required acreage to account for site specific conditions and the use actual parcel boundaries to define the sites. Actual parcel boundaries were considered since land use for those properties would likely be permanently impacted, whether or not they were actively part of the work areas. More specific work area limits would be developed as part of design.

4.2.2 Site Preparation

4.2.2.1 Environmental Assessment and Remediation

Appropriate environmental site assessments and related explorations would be conducted prior to work at the intake sites to define and locate potential contamination, contamination sources, and related features. Applicable remediation, or related efforts, would either be completed before site preparation work was initiated or incorporated into the early site preparation activities. Such remediation, or related efforts, are currently unknown, so no specific description of those activities are included in this TM.

4.2.2.2 Clearing and Grubbing

Clearing is the activity to remove vegetation, debris, rubbish, and other obstructions on the ground surface. Grubbing is the activity of removing below ground materials, including tree stumps (including all roots at least 2-inches in diameter), buried debris and rubbish, rocks larger than 2-inches in diameter, and concrete and asphalt concrete.

Prior to clearing and grubbing, any vegetation or areas that would be protected during construction would be fenced to prevent construction activities in those areas. These protected areas would be identified on design plan sheets. Structures (e.g., houses and barns) and appurtenant structures, including septic tanks, leach fields, and fuel tanks, would be removed. If appropriate, wood from the structures, asphalt, and other materials would be hauled to licensed locations for recycling. Vegetation would be chipped and either spread over excavated areas to minimize erosion or hauled to a licensed landfill to be included in the compostable fill. Rocks removed from the soil also would be stockpiled to be placed at specific excavated areas to minimize erosion. Topsoil would be removed for about 0.5 to 1 foot below existing ground surface and stockpiled on-site in a protected area for placement following construction. The stockpiled topsoil would be covered or treated to minimize water and/or wind erosion of the stockpiled soil. Other materials would be hauled to a licensed landfill that would accept each type of material.

The construction activities, including potential remediation described above, would be required to follow California Division of Industrial Safety, Department of Toxic Substances Control, and SWRCB for removal of specific waste materials including asbestos, polychlorinated biphenyl, explosives, materials in septic systems, or other potentially hazardous materials. Removal of underground or elevated fuel tanks would include soil and groundwater sampling and laboratory tests, removal of electrical cables and piping, and removal of residual tank contents. All equipment would be hauled in an appropriate manner to a licensed disposal site.

4.2.2.3 Utility Relocation

The existing infrastructure and buildings at the intake sites are currently served by overhead power and telephone services that traverse the sites. None of the sites are served by community water or wastewater services. Overhead power and telephone utilities would require relocation at the intake sites to maintain service to surrounding properties. Relocations are shown on the engineering concept drawings.

Agricultural parcels, including those at the intake sites, generally include agricultural and/or stormwater drains, plus irrigation diversions and ditches, and some pumping facilities. Many of the agricultural drains were constructed as subsurface drains and are not identified on publicly available records and cannot be located without access to the properties. Similarly, the pumping facilities, irrigation diversions and ditch network cannot be fully evaluated without access to the properties. If the pumping facilities, diversions, ditches, and drains only serve the parcels acquired for construction, the pumping facilities, diversions, ditches, drains would not be maintained during construction unless used to support the construction facilities, which is expected to be the case for the pumping facilities and diversions. If the pumping facilities, diversions, ditches, and drains serve adjacent properties, modifications to these features would occur to preserve this service as part of site preparation, prior to construction. During the design phase, field work would be completed to identify locations of agricultural pumping facilities, diversions, ditches, and drains and define the function and character of these features.

4.2.2.4 Site Security and Lighting

Security fencing would be installed to protect the construction site and help prevent the public from entering the construction site. Access would be provided through secure control gates and security fencing that would be at least 8 feet high. Signs would be placed on the fencing to identify the Delta Conveyance Project construction activities, telephone numbers and internet addresses to obtain additional information, and applicable warnings. Construction sites and structures, including entrance gates, would have video surveillance. Security personnel would be used on the sites 24 hours per day.

When roadway construction would occur on SR 160, signage would be placed along nearby major roadways to inform residents, visitors, truck traffic, and emergency services traffic. These activities would be coordinated with local emergency services providers, county transportation agencies, and Caltrans.

Artificial outdoor lighting would be limited to specific work activities plus basic safety and security requirements, and to the extent feasible, shielded to direct light only downwards towards objects requiring illumination to minimize halo and spillover effects outside of the property boundaries. Wherever possible, the lights would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells and motion detectors. 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. Lighting would normally not be used unless work is specifically being conducted where lighting is required, or motion detection activates such lighting.

4.2.2.5 Navigation Safety

Prior to in-river construction of the cofferdams, piles, log booms, and the use of barges to place riprap, in-water work areas would be indicated by buoys, signage, or other effective means to warn boaters of their presence and access restrictions. Warning devices and signage (e.g., "boats keep out" or "no wake zone" labeled buoys) would be in compliance with the U.S. Coast Guard Private Aid to Navigation requirements (U.S. Coast Guard 2012) and would be effective at all times, including non-daylight hours and periods of dense fog. Artificial outdoor lighting on the buoys and signage would be limited to basic safety and security requirements and shielded to direct light only downwards towards objects requiring illumination to minimize halo and spillover effects outside of the property boundaries.

Notifications to commercial and leisure boating community of proposed barge operations in the waterways would be conducted, including posting notices at Delta marinas, public launch ramps, and applicable websites. This information would provide details regarding construction site location(s), construction schedules, and identification of speed-restricted zones extending about 200 to 500 feet upstream and downstream of river construction areas to maintain worker and navigation safety. Since the river would be at least 400 feet wide at the intake locations during both construction and operation conditions, non-Project river traffic would not be significantly impacted and would be able to easily pass the work sites.

Temporary public use of the shoreline within the designated construction area would be prohibited during the construction phase. Signage and fencing would be provided to warn the public and exclude pedestrian access along the shoreline and riverbank during the work.

4.2.3 Temporary Project Levee Construction and Relocation of SR 160

After site preparation, Phase 1 construction sequence activities required to support the construction of the temporary Project Levee and the relocation of SR 160 would be conducted.

These activities begin with the construction of slurry cutoff walls and ground improvement features on the land side of the existing Project Levee. Slurry cutoff wall and ground improvement feature construction is described in Section 4.2.7, below.

Slurry cutoff walls would be constructed under the full length of the temporary levee and also extend into the land side work area to surround the borrow areas for excavating materials from the sedimentation basin area that would be used to construct the levee. The cutoff wall could be constructed beneath the entire permanent levee at this time depending upon site conditions determined during design and/or construction. Similarly, the ground improvement grid would be constructed beneath the temporary levee footprint area. Refer to the construction sequencing drawings (Figures 4.1.1 through 4.1.3) for additional information.

Once the slurry cutoff wall and the ground improvement grid were in place for the temporary levee and borrow area, a dewatering system(s) would be installed and activated. Then, the earthwork would be conducted to construct the temporary levee from materials excavated from the borrow area. Refer to Section 4.2.5, below, for additional levee construction information.

Once the temporary Project levee was in place and accepted by the agencies, the temporary relocation of SR 160 would be constructed on top of the temporary Project Levee. Once complete, traffic would be moved onto the temporary SR 160 location.

After both the temporary levee and SR 160 relocation are complete and functional, work would commence on both the river side and land side of the temporary levee and highway.

4.2.4 River Side Activities

After the construction of the temporary Project Levee during Phase 1 of the construction sequence defined above, work would be conducted on both the river side and land side of the temporary levee. Most of this work would be included in Phase 2 of the construction sequence where the temporary levee was in place and serving as the Project Levee. Once the temporary levee was in place and accepted by the agencies, the section of the existing Project Levee replaced by the temporary levee would no longer be used and would be partially removed and regraded to form a working platform for construction of the intake structure. A trestle would be installed on temporary piers along the water side of the existing levee, and a cofferdam consisting of sheet piles (for the front walls) and a deep mechanically mixed (DMM) back wall would be constructed partially in the river from the trestle. The cofferdam and trestle would support construction of the concrete intake structure. Work in the river would be confined to the summer season to protect fisheries resources and minimize the potential for adverse flood impacts. It is assumed that the sheet pile portion of the cofferdam would be constructed within about a 5-month period from June through October. The specific time period would be subject to discussions with the regulatory agencies.

As noted, the front, side, and intermediate walls of the cofferdam, plus the training walls, would be constructed using sheet piles and would be constructed during the summer season. Once the sheet pile walls were installed, a steel-reinforced cement DMM wall supported by rows of grouted tiebacks would be constructed to make up the rigid back wall of the cofferdam to support the flexible front wall and provide seepage cutoff between the river and the adjacent land (refer to the CER Appendix B10 *Conceptual Intake Cofferdam Construction*).

After the back wall of the cofferdam was installed, the ground between the back wall and the previously improved ground beneath the temporary Levee area would be improved using a grid of cement DMM walls. The walls would also serve as ground support to permit the installation of the discharge pipes or box conduits and would be spaced to avoid conflicts with the planned tieback anchors.

Once the cofferdam sheet piles and DMM wall seal off the river from the area within the cofferdam, a fish rescue operation would be conducted as described below. Then, construction would continue in wet conditions behind the front wall to complete the cofferdam, install drilled piers, and place the concrete tremie seal[1] prior to removal of water from the cofferdam area. The cofferdam wouldn't be completely watertight, so any opening larger than the fish screen openings of 1.75 mm would be required to be closed. Because of this, the water inside the cofferdam would be considered "fish free" after the fish rescue operation is completed.

Once the cofferdam is in place, the inside would be excavated to the intake structure tremie seal subgrade using a sequence of excavation, ground anchoring, and internal brace installation. After excavation, foundation piers would be installed within the flooded cofferdam from the trestle using steel casing to contain the pier drilling operations within the flooded cofferdam, Finally, a concrete

[1] Tremie concrete: Concrete placed in an underwater condition by moving concrete by gravity through a vertical pipe to the area to be covered by concrete. Tremie concrete requires a continuous flow of concrete to place the concrete in a manner that minimizes mixing with water and disturbance to concrete already placed and the surrounding soils. For this application, the concrete tremie seal would be up to several feet thick and would be poured within the cofferdam and around drilled pier casings.

tremie seal would be poured in the bottom of the cofferdam, around the cased piers, to minimize the flow of ground water into the cofferdam and to create a working surface. After the tremie[1] seal is installed, all aspects of the intake structure, including structural concrete and mechanical and electrical features would be constructed outside the river and within the area protected by the cofferdam.

It is anticipated that impact pile driving would not be required for the work conducted on the river side of the work once the sheet pile portion of the cofferdam was completed. Following dewatering, construction would continue in dry conditions until the intake structure would be complete.

Concurrent with cofferdam and intake structure construction, a slurry cutoff wall and ground improvement would be constructed either in, or along a portion of the land side toe of, the existing levee (but still on the river side of the temporary levee). This slurry cutoff wall would extend upstream and downstream along the length of the new levee and road section beyond the cofferdam DMM walls. This cutoff wall would eventually be beneath the permanent location of SR 160 and would become part of the permanent Project Levee outside the limits of the new intake structure and sedimentation basin embankments.

Following ground improvement, construction of a portion of the intake structure to provide suitable support to the DMM wall, the area behind the intake structure would be filled to the permanent levee height. After the permanent Project Levee is completed on the land side and accepted by the agencies, SR 160 would be moved to its new permanent location behind the intake structure, Phase 2 would be complete, and the temporary levee could be removed as an initial Phase 3 activity.

4.2.5 Land Side and Levee Construction

All flood control levees constructed at the site would be constructed as Project Levees in accordance with levee design and construction requirements of the USACE and the CVFPB.

Levees would be constructed over previously installed slurry cutoff walls and ground improvement. Fill meeting the engineering design and regulatory requirements would be placed and compacted in lifts to achieve the desired levee configuration. It is expected that site soils are available that meet the requirements for the levee fill. If suitable soils are not found at the site, site soils would be improved, or suitable material would be imported to the site. The specific fill requirements would depend on the engineering analyses conducted for the site and would be developed in detail for final design and USACE levee permit acquisition activities.

Levees would be structurally connected to, or transitioned to, adjacent existing Project Levees by properly configuring the slurry walls and ground improvement beneath the levees at these transition sites as well as using applicable levee fill materials. Then, the new Project Levee would be compacted against the existing or previously placed levee in lifts keyed into the older Project Levees in a stepped configuration.

On the land side of the temporary Project Levee, slurry cutoff walls and areas with ground improvement would be constructed within the foundation footprint of the permanent Project Levee embankment that would go around the perimeter of the sedimentation basin and outlet channel. Once completed, this perimeter embankment would become the permanent Project Levee at the site.

After the permanent Project Levee is in place, work would include constructing the tunnel shaft, the radial gate flow control structure, sedimentation basin, sediment drying lagoons, and completing other grading and appurtenant structures. Also, as described above, after the permanent Project Levee is in place, the temporary Project Levee would be removed once SR 160 is moved to the final location behind the intake structure.

The radial gate flow control structure would be constructed at the downstream end of the sedimentation basin over, and incorporated into, a slurry cutoff wall and a ground improvement grid. In addition to sedimentation basin water level control, the radial gate structure would be used to isolate the tunnel system during high flood events. The portion of the radial gate structure abutting into the embankment would be completed as part of Phase 2. The remainder of the structure would probably be completed as part of Phase 2, but could also be completed during Phase 3.

4.2.6 Intake Earthwork

To the extent possible, all fill material for the intakes would be provided from the on-site excavations, primarily from the sedimentation basin. At this time, it is assumed that only specialty fill material would be imported, such as fine-grained materials for levee cores, gravel and drain rock for miscellaneous uses, concrete, and asphalt for paved areas. Dewatering will be required for all excavations deeper than approximately 5 feet below grade. In order to reduce the anticipated dewatering flows, perimeter cutoff walls planned for seepage control of the permanent Project Levee will be installed prior to any deep excavation. The engineering concept drawings include site plans illustrating the extent of earthwork for Phases 1 through 3.

To help illustrate the sequence of earthwork at the site, earthwork would be divided into the three construction phases as follows:

- **Phase 1: Construction of the temporary Project Levee and roadbed for State Route 160.** This phase would use material excavated from the sedimentation basin on the land side of the temporary levee. If needed, fine-grained material for the levee core would be imported from commercially licensed sources. The existing Project Levee would not be modified throughout Phase 1.
- **Phase 2: Minor excavation on the river side and construction of the permanent Project Levee around the perimeter of the sedimentation basin and outlet channel on the land side, including the tunnel shaft pad.** This phase would include modification to the existing Project Levee, the excavation of the cofferdam on the river side, and construction of the permanent Project Levee fills on the land side. Land side levees would be constructed using material excavated from the sedimentation basin on the land side of the temporary levee. If needed, fine-grained material for the levee core would be imported from commercially licensed sources. On the river side, construction of levee transitions and fills for the permanent SR 160 roadbed would be constructed.
- **Phase 3: All earthwork required to complete the levee work, including removal of the temporary Project Levee.** Phase 3 would include removing the temporary Project Levee and placing this fill where needed to complete wider levee sections and portions of the drying lagoons. Phase 3 may generate an excess quantity of material that would be available for other on-site fill requirements at the intakes. Any remaining excess material would be placed around the site to avoid exporting the soil.

Detailed summaries of earthwork quantities for each intake site, type, and size, are included in Section 6.

4.2.7 Ground Improvement and Cutoff Walls

Due to the ground conditions beneath the intake site, liquefaction and associated surface settling could occur during seismic events. Therefore, ground improvement would be constructed to provide stability for embankments and facilities at the site. Drilled pier foundations would also be utilized under the major structures, including the intake structure, the flow control structure, and possibly portions of the box conduits. Following additional site-specific geotechnical analyses, ground improvement requirements can be more accurately defined.

A grid of cement DMM ground improvement walls would be constructed using specialty equipment that mixes cement with existing in-situ soil in a wall panel configuration to strengthen the ground for supporting overlying structures and embankments and containing and enhancing the cyclic shear resistance of the soils to liquefaction. This work would extend under all areas of embankments and some structures. The ground improvement grid would include millions of cubic yards of mixed wall sections and hundreds of thousands of tons of cement would be required to be mixed with site soils, depending on the actual site conditions, which would be determined during design. The individual walls would be approximately 30 inches in width and would extend below the depth considered compressible and/or liquefiable.

For the back wall of the cofferdam, structural reinforcing steel, likely wide flange steel beams, would be vibrated into a DMM wall panel, before it hardens, to provide the structural rigidity required for the cofferdam. The cofferdam DMM wall panel would be similar to the ground improvement grid, but thicker, potentially deeper, and include reinforcing, as described above.

A deep soil-cement-bentonite perimeter wall (cutoff wall) would be included in the DMM wall grid beneath the Project Levee and some structures and would also work in combination with the back DMM wall of the cofferdam and serve as cutoff walls and to isolate the sedimentation basins from the local groundwater. The groundwater is relatively shallow near the intake site. For example, the Piezometer DCN4-PZ-001, installed by DWR and located 40 feet from the levee toe south of Hood, reported a depth to water of 3.5 feet below ground surface (Elevation 11.6 feet) in January of 2013.

When the cutoff wall material sets, it provides a barrier that reduces seepage of groundwater. During construction this would limit the effects of dewatering mostly to the area inside the slurry wall and therefore reduces the amount of water that would be pumped to maintain a dry work site. After construction, the cutoff wall reduces groundwater seepage into or out of the sedimentation basin and enables future dewatering to occur when the basin needs to be drained for maintenance purposes.

At the intakes, cutoff walls beneath the levees and a structural cutoff wall installed using DMM at the back of the intake structure cofferdam would cut off groundwater movement and protect adjacent groundwater levels and quality, facilitate the dewatering of the sedimentation basin and piping or box conduits, and to provide Project Levee cutoffs, where applicable. The cutoff walls would reduce groundwater and river water seepage into the excavation and would minimize exfiltration of diverted water into the surrounding groundwater. The structural cutoff wall is described below as part of the cofferdam. The slurry cutoff walls would consist of soil, bentonite and cement slurry and would be installed at the following locations.

- Along the alignment of the temporary Project Levee under the relocated footprint of SR 160.
- Along, or immediately adjacent to, the alignment of the land side toe of the existing levee beneath the final permanent location of SR 160 upstream and downstream of the permanent Project Levee

locations (i.e. approach areas from the existing levee into the site). The cofferdam DMM cutoff wall would provide the cutoff between these upstream and downstream transitions.

- Along the alignment of the new permanent Project Levee surrounding the sedimentation basin and outlet channel.

The cutoff walls would transition to the existing Project Levee along, or immediately adjacent to, SR 160 at the edges of the disturbed area to facilitate future extension by others.

Cutoff walls would be constructed in trenches and serve to minimize groundwater from entering or exiting a site. The trenches, generally 1.5 to 6 feet wide and up to 130 feet deep, would be filled with a mixture of excavated soil, bentonite, and/or cement and can be excavated using long-reach excavators, clam shell buckets, or cutter suction equipment, depending on depth. The cutoff walls could also be constructed using mix-in-place techniques, such as DMM methods which simultaneous injects bentonite or cement and mixes it into the soil to form a homogenous block of low permeability (and high strength if desired) soil.

To install the cutoff walls, a set of horizontal guide beams or walls are often constructed, then excavation occurs between the guide walls using a hydromill trench cutter, cutter mixing unit, clamshell bucket, or hydrofraise (a cutter that uses suction to transport the excavated soil and slurry, sends it to the surface for processing) often mounted on a crawler crane. As the excavation continues, the slurry supports the trench walls. It is also possible to install cutoff walls using long-reach excavators and a process of trench-side mixing of soil and bentonite to construct cutoff walls of moderate depth.

To install structural diaphragm walls for the outlet shafts connecting to the tunnels, reinforcement bars and cages are placed in the slurry, followed by tremie placement of concrete which causes the slurry to rise. The risen slurry would be removed and cleaned prior to reuse. These operations could be required to continue over a 24-hour period.

In addition to the trench cutters, soil mixers, and excavators, the equipment at the construction site for installation of DMM and cutoff walls could include slurry mixers, bentonite and cement storage tanks, or mixed slurry tanks or lined basins, and slurry separation equipment. The slurry storage tanks or basins must be of adequate size to submerge the slurry pump and support separation operations. Due to the size of the site, the slurry equipment, including the mixing tanks, separation plant, and storage tanks may be moved around the site to maintain proximity to the actual work site.

Concrete batching would be the only operation that could be conducted off-site and hauled to the shaft diaphragm wall construction location.

The slurry material (including cement slurry for DMM walls) would be prepared in the mixing tanks and pumped to the active excavation at the slurry wall or to the DMM downhole mixing equipment. For open trench cutoff walls, soil cuttings would be mixed with bentonite and possible cement to create the cutoff wall backfill and discharged into the active excavation area. Slurry displaced by the mixed backfill would be pumped from the excavation to the separation plant where the bentonite would be reclaimed and returned to the excavation until the excavation would be completed.

4.2.8 Cofferdam, Training Wall, Drilled Pier, and Riprap Construction

A cofferdam with sheet pile front, interior, and side walls, and a DMM back wall, with internal bracing and ground anchors, would be installed to isolate the intake structure construction area from the river.

The contractor would install the cofferdam sheet piles and DMM wall for the full perimeter of the intake structure at a predetermined distance from the permanent back structure walls (about 0 to 5 feet).

The intake training walls would also require sheet pile installation, generally during the same construction operation as the cofferdam. The walls would extend above the river level per the design for the training wall and to a contractor-selected height for the cofferdam (normally above typical flood levels, but somewhat lower than the top of structure). The sheet piles would include “Z” shape sheet pile pairs. Bracing would be provided inside the cofferdam between the sheet pile walls and the DMM wall. Ground anchors, likely consisting of grouted tiebacks, would serve to add support for earth loads to the back DMM wall of the cofferdam.

The cofferdam would remain in place for the full duration of construction of the intake structure. The DMM back wall, sheet pile side walls, and the front wall sheet piles below the floor of the intake structure would remain in place permanently. The sheet pile training walls would also remain in place after construction as a permanent structure and would be installed to approximately finished grade. Grouted tieback anchors for the DMM wall would be de-tensioned, but would remain in place. Detailed dimensions of these walls are shown on the engineering concept drawings. If required, the flutes (vertical grooves) along the face of the sheet pile training wall would be sealed, filled, or screened after they are installed. This would be an in-river activity and would be completed during the summer months.

Construction of the cofferdam and training wall sheet pile system would be conducted from a trestle installed adjacent to the structure on the land side. It is understood that the cofferdam could also be constructed from barges; however, this is not part of the Project description. Access onto the trestle would be from the existing degraded SR 160 embankment. The trestle would be a pier supported structure with a heavy-duty timber top deck. It would be installed as part of Phase 2 efforts after the temporary levee was in place, SR 160 was relocated, and the existing Project Levee was degraded. The trestle would be fully removed at the conclusion of its use in the work.

Equipment and materials required to construct the DMM back wall would include a wall panel cutter, a crane for installation of the reinforcing steel, slurry mixing tanks, storage tanks for bentonite and cement, and storage for reinforcing steel, likely consisting of wide flange steel beams. Short sheet pile starter walls may be required if the river water level is above the ground surface at the wall location and to contain the slurry and cement. All equipment and working area, including the mixing tanks, storage tanks, and reinforcing steel laydown areas would be on or adjacent to the work trestle and could be moved along the length of the intake structure to maintain proximity to the actual work site.

The wall excavator would construct a panel about 8 feet long to the full depth of the wall. That excavation would be filled with bentonite slurry mixed with the native soil to keep the excavated area from collapsing. After it is fully excavated to full depth and cement is introduced to the full soil-bentonite column, reinforcing steel reinforcement is placed in the panel. Wall panels are placed in an alternating (every other one) pattern. Once the initially constructed panels achieved suitable strength, the intermediate panels (between initial panels) would be placed and the excavation for this panels would overlap into the previous placed panels to provide a continuous wall. Bentonite to support and facilitate the excavations and cement would be prepared in mixing tanks and pumped to the active excavation at the wall cutter. The small amount of excess soil removed from excavation would be reused on site as fill material.

For the front walls, there are two methods typical for installing sheet piles, the traditional impact hammer approach or the vibratory approach. The impact hammer approach would be challenging for areas close to residential properties due to the constant noise created by the hammer. The use of noise walls and acoustic shrouds would reduce the noise, as practical. However, noise walls would be difficult to install on the water side and residences across the river may be affected by noise. The use of a vibrating pile head installer would also be expected to be a viable option for the construction of most sheet pile portions of the cofferdam and the foundation piles. Noise is also an issue for vibratory installation, but is typically lower than the impact hammered installation. Some amount of impact hammer driving would be expected to be required to accomplish the sheet pile installation as defined in the CER Appendix B10. The decision to resort to use of impact driving may be the result of clogged interlocks between sheets, delays in vibratory installation that result in “set-up”, or encountering dense or very hard soils or gravels.

During design, a test pile driving program would be established to determine more definitively what types of pile driving can be used to accomplish the work and what noise reduction methodologies could reduce the noise impacts. The test pile driving program would involve driving about 10-20 sheet pile pairs matching the proposed design to the design tip depth using both vibratory and impact hammer methods. Preferably, the piles would be driven on the water side of SR 160 from a barge. However, after additional explorations, it may be possible to conduct some of the testing on the land side of the existing levee into a soil profile expected to be representative of the river side conditions. Noise reduction methods would be developed in advance, tested during the installation, and monitored for effectiveness. The piles would be removed after the test.

During installation of the cofferdam and training wall pile system, one or more bubble curtains may be provided inside the cofferdam or in the river adjacent to the structure to minimize the effects of pile driving vibration on fish. If used, one or more air pipelines would be laid along the cofferdam or river bottom and a continuous curtain of bubbles would rise through the water column. Additional vibration control curtains could also be included along the cofferdam once the front row is installed. Pile driving vibration control features and requirements would be evaluated in greater detail as part of design development to meet regulatory requirements.

The portions of the cofferdam and training walls that enclose submerged portions of the riverbank would be installed during the summer pile driving season as established to minimize impact to fish. The full duration for installation of the cofferdam and training wall sheet pile system would be about 5 months. Only the DMM wall portion of the cofferdam behind the enclosed area, or interior walls that can be driven solely by vibratory methods, would be installed outside of the fish protection window.

At the completion of the portion of the cofferdam that encloses river water, a fish rescue operation would be conducted to remove trapped fish from the enclosed area. For the fish rescue operation, the contractor would install all the cofferdam required to isolate the intake structure construction area from the Sacramento River, except for one or two sheet panels on the downstream, river side, corner. Qualified fisheries biologists with experience in fish capture and handling would direct fish toward the opening utilizing screens, non-closing seines, nets, or other appropriate methods. While the fish are being directed to the opening, the contractor would be on site with the remaining cofferdam sheet panel(s)and staged to place the sheets at the direction of the biologists once the fish have been removed from the construction area.

If possible, the steel sheet piles and the DMM wall would be designed to key into an underlying low permeability soil layer, when present, for seepage cutoff. The enclosed area within the cofferdam would be excavated to the level of the structural and tremie seal subgrade using clam shell or long-reach backhoes after ground improvement (if needed), but before installation of foundation piers, and placement of the tremie seal. Internal bracing and multiple rows of grouted tiebacks would be installed inside the cofferdam as it is excavated and partially dewatered. Once the cofferdam is fully excavated but still full of water, a reinforced concrete drilled pier foundation would be installed to resist the lateral structural loads that would ultimately act on the intake structure. Drilled pier design would be in general accordance with Federal Highway Administration (FHWA) design procedures. Lateral load design is expected to be the controlling factor. Lateral foundation deflections would be limited to less than 1 inch. The 1-inch threshold of movement would be for a non-seismic case and would occur gradually as the height of the fill behind the structure was increased to the finished level. Drilled pier foundation installation would include several concurrent drill rigs and be expected to take about a year. This would be initiated concurrent to cofferdam installation in areas where the cofferdam was already complete.

After completion of the foundation pier system, a tremie concrete seal would be placed around the piers within the entire enclosed area of the cofferdam. The thickness of the tremie concrete would be commensurate with the design uplift pressure and the uplift capacity of the drilled piers. A 5-foot-thick slab has been accounted for in the engineering concept drawings. Once the tremie slab cured sufficiently, dewatering of the cofferdam would then proceed to allow other construction activities to be carried out in the dry. Temporary uplift forces acting on the tremie slab would be resisted by the drilled pier foundation and possibly by continuous pumping of water from beneath the seal slab inside the cofferdam. All water removed from the cofferdam would be treated to meet permit requirements prior to on-site reuse or discharge back into the river. Once the water is removed, the top of the tremie seal would be cleaned and a more level concrete slab about 1 foot thick (mud slab or working slab) would be placed to level out the work area at the bottom of the cofferdam.

Near the end of construction, after completion of the intake structure, divers or mechanized cutting machines would be utilized to cut away the river facing sheet pile cofferdam wall to an elevation just below the screen sill, as shown on the engineering concept drawings. This action would expose the intake structure face to the river. Removal of the cofferdam would occur during a 3-month period concurrent with placement of the log boom which would be followed by placement of riprap around the structure interface with the river bank and bottom (see below), all completed during the summer fish protection period.

During the last summer fish protection period, rip rap would be placed from approximately the riverbed toe of the existing embankment up to the top of the concrete-filled sheet pile at the front sill (front porch) of the intake. This riprap layer would be expected to be about 40 to 60 feet wide, and would be reconsidered following completion of detailed two-dimensional modeling supporting final design. Along the training wall sections, riprap would be installed up to the training walls. Riprap would extend a short distance (about 100-200 feet, depending upon the results of modeling efforts) upstream and downstream of the structure to prevent scour, and to transition and smooth out the variable topography along the face and ends of the intake. A minor amount of mechanical (clam shell) or hydraulic dredging would be used to excavate and prepare the subgrade for riprap placement. Riprap design would be dependent on two-dimensional river modeling, which would be conducted as part of the design and permitting process. Placement of riprap would occur from a barge during about a 1 to 2 month period at each intake. Dredged material would be placed on a small barge and disposed of at a permitted off-site location. Dredging and placement of riprap would occur during periods of time approved by the regulatory agencies.

Foundation drilled piers would also be used to support portions of the box conduits and related gate chambers as well as the radial gate control structures. However, those foundation elements would not be within the cofferdam and would be constructed within normal excavation supports, where necessary.

4.2.9 Barging

Barging is only planned for intake construction as part of the placement of riprap described above. Initially, a barge with a clamshell excavator would be mobilized up the Sacramento River. This excavator would be used to excavate the river bottom for riprap placement and to place the riprap in the excavated area.

An empty excavated material barge would be mobilized to the intake site, the clamshell would fill it with excavated material and the barge would depart back down the river to an approved licensed disposal site. After disposing of the excavated material, the barge would return to the intake until the work was completed. Alternately, there may be a second barge used while one barge is transporting and disposing of the materials the second barge would be loaded with excavated materials at the intake site. The total number of barge trips would not change, but the use of a second barge may make the work more efficient and help complete it somewhat faster.

After excavation at a given location, riprap would be placed from a riprap barge that would be mobilize up the river to the work site. Once the riprap on the barge was placed, the barge would return with another load until all the required riprap is placed.

It is anticipated that one round trip would be required for the clamshell and several each for riprap and excavated material transport per intake facility. In addition, two round trips would be required for barges to install the log boom piles and log boom. Round trips for barging at each intake are summarized in Table 4.2.9.1 for the cylindrical tee screen configuration. Depending on how the work is staged, the most barge traffic would be two trips upstream and two trips downstream per day. Also, it would be expected that the work would be sequentially staggered by at least one year for each intake, so total round trips would increase by the number of intakes, but the daily traffic would not. These values would be reconsidered following completion of two-dimensional modeling supporting future permitting and design phase efforts.

Table 4.2.9.1. Number of Round Trips for Barges at Project Intakes

Activity/Intake	Intake C-E-3	Intake C-E-5
Transport Log Boom and Support Pile Installation	2	2
Transport Clamshell Excavator	1	1
Transport Excavated/Dredged Material	28	19
Transport Riprap	16	12
Total Roundtrips	**47**	**34**

Note: Estimated quantities of excavated material and riprap to be transported by barge are included in Section 6, as applicable.

4.2.10 Concrete Construction

Concrete would be the primary construction material for the following intake components, as described below:

- Intake Structure: including drilled piers, tremie seal, mud slab, floor slab, interior and exterior walls, and the roof deck
- Box Conduits or Discharge Pipes: including the box conduits, reinforced concrete discharge pipes (cylinder type), the control and isolation gate chambers, and the outlet structures

- Radial Gate Flow Control Structure: including drilled piers, channel lining, floor slab, walls, and the access bridge deck
- Outlet Channel: including channel lining
- Tunnel Shaft: Including the diaphragm wall panels, tremie seal, floor slab, and the finished inside surface
- Buildings: Including the floor slabs for all buildings
- Gate and Screen Storage Enclosure: including a partial floor slab

Other Project-site batched cementitious products, similar to concrete, would also be used at the site, as follows:

- Drying Lagoons: Shotcrete side walls and roller compacted concrete basin bottoms
- Buildings: Grout for concrete masonry unit (CMU) wall cells, if used
- Gate and Screen Storage Enclosure: Grout for CMU wall cells

Concrete, grout, and shotcrete would be produced at the Lambert Batch Plant complex adjacent to Interstate 5 and hauled to the site using ready mix trucks. Ready mix trucks would access the site using the new haul road. They would be greeted at the entrance to the site by a representative of the construction contractor to check tickets and provide the driver with specific routing instructions through the site using paved and gravel surfaced on-site roads to the applicable structure for discharge. These roads would generally extend down the westerly side of the permanent intake site to access the intake structure. Access to other structures would vary depending on the location of the structure. For concrete loads that would cross SR 160 to access the intake structure, a traffic light or traffic control with flaggers, would be provided at a single controlled crossing location. All roads used for concrete delivery would be actively treated to avoid dust generation.

An on-site concrete truck washdown area about 200 feet by 200 feet would be provided to allow concrete trucks to wash down after discharging the loads, but before returning to the batch plant. Wash water would be collected and treated for reuse or disposal and waste concrete would be collected and disposed of at a permitted solid waste facility.

Concrete pours for tremie seals require 24 hours placement in order to achieve a seal. Concrete would be poured 24 hours a day for about 8 to 14 days to accomplish the seal for the intake structure and about 3 days for the tunnel shaft. The tremie concrete volume would be about 16,000 cubic yards for the intake structure and delivered at a rate of about 5 to 10 loads per hour, depending on the number of crews used. Full cutoff lighting with light containment shielding would be used to minimize nighttime light pollution. Backup beepers on ready mix trucks would be disabled in favor of dedicated backup monitors to help reduce noise. Concrete pumping equipment will be shrouded for noise.

The only cementitious product that would be produced on site would be roller compacted concrete (RCC) for the lining of the sediment drying lagoons. A pug mill would be set up in the staging and processing area, probably in the same location as some of the slurry mixing facility (which would no longer be active). Cement would be stored in silos at the sites. Also, soil or aggregate would also be stockpiled at the site. Cement storage would be filtered to avoid dust transmission during filling and discharge to the pug mill. Aggregate or soil would be kept wet or otherwise covered to control dust. The pug mill would be housed inside a temporary enclosure with suitable filtration to control dust transmission. Aggregate or soil, water, and cement would be fed into the pug mill for mixing. The pug mill would discharge concrete to either ready mix or end dump trucks for transport to the lagoon areas.

The material would be discharged and compacted onto the bottom of the basins in lifts until the desired thickness is achieved. The material may also be tied to the ground improvement grid to help reduce uplift. About 30,000 to 40,000 cubic yards of RCC would be expected to be placed over a 3 to 4 month period for the lagoons. This work would be late in Phase 3 in accordance with construction sequencing.

4.2.11 Fish Screen Systems

Fish screens would be installed on the face of the intake structure using previously installed guide rails.

The front wall of the intake structure would be constructed with a blockout area left in the initial wall pour that would be about a foot wide and the full height of the guide rail slot. Then the precision straight guide rails would be carefully positioned and firmly supported in place in the blockout area. After the guiderail placement accuracy and straightness is verified, concrete would then be poured in the blockout area to lock the rails in place and complete the installation.

Later, the fish screen and solid panels would simply be lowered into place within the guide rails from the top of the structure. This method would be the same as would be used during operations to remove and replace the panels or retrieve them to the top of the structure for cleaning.

4.2.12 Other Discipline Work

Most of the other construction phase activities would include conventional construction means and methods as required to complete the various trades and disciplines and provide a functional facility, as follows:

- **Civil/Site Work:** Complete all grading, drainage, and roadway work.
- **Architectural:** Complete architectural aspects of the intake buildings and install landscaping, as applicable.
- **Mechanical:** Install and test all piping, valves, gates, pumps, plumbing, fire protection, and other equipment.
- **Electrical and I&C:** Install and test all ductbanks, raceways, wiring, devices, instruments, control and communication equipment, and appurtenant features.

All of the other discipline work in expected to be completed within the work areas at the various features and structure described herein.

Once the work is completed, all Project features would be commissioned such that they operate as intended and within their expected performance parameters.

4.2.13 Construction Power Supply

Power would be required at the intake site during construction. A temporary substation would be required until the permanent substation is constructed during Phase 3. Power would be distributed as needed around the work areas using buried cables. Engine generators would also be used to support work at the site where it would be impractical for a semi-permanent connection to the substation. Power for testing and commissioning would be supplied through the permanent substation. Refer to the CER Appendix H2 for details related to construction phase power supply at the intakes.

4.2.14 Other Construction Provisions

4.2.14.1 Spill Prevention and Control and Hazardous Materials Management Plan Compliance

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

- Spill prevention kits in proximity where hazardous materials would be used (e.g., crew trucks and other logical locations)
- Hazardous materials handling plan training to properly implement all reasonable means when working in or near any waterway
- For fueling of stationary equipment at the construction sites, containments would be provided to the degree that any spill would not enter the channel or damage wetland or riparian vegetation

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

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

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

4.2.14.2 Stormwater Pollution Prevention Plan Compliance

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

- Preventing off-site runoff from entering the construction site by surrounding the construction site with berms, fiber rolls, silt fences, or other barriers with interior drainage ditches to divert flows towards the SWPPP sump and treatment facility, prevent runoff from flowing into adjacent water bodies, and retain sediment on the construction site.
- Temporary erosion control measures (e.g. silt fencing, straw bale barriers, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrances) for all disturbed areas.
- Site specific structural and operational BMPs to prevent and control impacts on runoff water quality, measures to be implemented before each storm event, inspecting and maintaining BMPs, and monitoring of runoff quality by visual and/or analytical means. For the larger project sites with many acres of disturbed area during construction (e.g. intakes), this would be anticipated to include the employment of on-site pump and treat systems and the utilization of portable treatment and storage tanks.
- Monitoring and providing appropriate treatment to all on-site water flows prior to reuse or discharge.
- Ensuring no disturbed surfaces would be left without erosion control measures in place during the winter and spring months.
- Implementing and monitoring post-construction erosion control measures (including silt fencing, straw bale barriers, fiber rolls, hydraulic mulch/seeding, and vegetative plantings) to ensure minimization of water quality and associated impacts.

4.2.14.3 Dust Control

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

Typical dust sources on the construction site would include:

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

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

Excavation areas would be sufficiently stabilized prior to backfilling or construction completion to reduce dust re-entrainment in the air column with water application, geotextile fabric, permanent linings, or mulch. Water could be applied to the excavated areas to reduce potential fugitive dust. Water application would be provided by a combination of irrigation piping with spray nozzles and water trucks. The water trucks could haul 3,500 to 10,000 gallons with side and rear spray nozzles that can spray water over a 10 to 25-foot wide area.

4.2.14.4 Post-Construction Land Restoration

The near-surface native soil within the temporary construction areas at the intakes could be compacted from construction equipment, consolidated beneath material stockpiles, or have properties less suitable for agriculture or habitat restoration due to construction activities. Land restoration efforts would be employed to restore the soil quality and condition, to the extent practical, in these construction areas. Refer to the CER Appendix I1 *Post-Construction Land Reclamation* for addition information.

5. Intake Operations and Maintenance

Operations of the intakes would require specific flow control operations as well as O&M for fish screens, sediment management facilities, gate systems, permanent power supplies, and other miscellaneous features.

5.1 Flow Control Operations

Flow control operations would be conducted to operate the intakes in compliance with Project diversion requirements related to river conditions determined as part of the Project permitting process. The diversion requirement limitations are not described in this TM, but the application of these requirements would be expected to simply result in operational commands that establish and change the allowable diversion flow rates at the intakes. These allowable rates would vary by season, tidal cycle, and other considerations. As such, the key operational requirements at the intake would be to establish a diversion flow rate and modify it over time as well as start and stop diversions. Allowable diversion flow rates would be expected to require the intakes to occasionally operate across their full design flow capacity during a single tidal cycle, so reasonable flow control reaction times are necessary.

There are two main flow control features at the intakes. These include the radial gate FCS at the back of the sedimentation basins and the flow control gates at the intake structure behind each fish screen, or group of fish screens (depending on screen type).

- The FCS would operate automatically to maintain the water level in the sedimentation basin at a predetermined differential level below the level of the river measured at the front of the intake structure. This level differential is expected to be about 1 to 2 feet, but would need to be determined during commissioning and actual practice.
- The flow control gates at the intake structure behind the fish screens (screen gates) would modulate in response to flow meters on the discharge pipes or box conduits. Such modulation would adjust the flow to convey the currently allowed diversion flow from the river into the sedimentation basin.

As the allowable diversion flow rate increases, the screen gate system would let more flow into the sedimentation basin and the FCS would open a little to allow more flow into the tunnel system to prevent the basin level from rising; thereby maintaining the differential level. Conversely, as the allowable diversion flow rate is decreased, the screen gates would allow less flow into the sedimentation basins and the FCS would close a little to allow less flow out of the basin and prevent the level from dropping. As the allowable flow goes to zero, the screen gates would be fully closed.

If the river level drops while the allowable diversion flow rate is zero, the FCS would adjust the basin level to the setpoint differential by releasing water into the tunnel system. If the river level increases while the allowable diversion flow rate is zero, the FCS gates would initially remain closed and the basin would refill once the screen gates are allowed to open and divert water, eventually catching up to the differential, and operations would continue as described above. This flow control arrangement allows the intake facilities to react quickly to changes in both allowable diversion flow rate and river level. Conceptual hydraulic modeling suggests that the intake flow control system would react faster than the long tunnel and pumping system. Therefore, diversion flow rate changes of about 1,000 cfs per intake per 15 minutes appear achievable and reasonable. Experience with the system during commissioning and operations may suggest modifications to this flow ramp rate.

5.2 Fish Screen Related Maintenance

Cylindrical tee fish screen systems would be maintained on a regular basis to preserve functionality, including manual cleaning of screens plus solid panels; sediment buildup reduction; screen panel inspection; screen cleaning system inspection and adjustment; and emergency sediment dredging.

5.2.1 Manual Cleaning of Screens, Solid Panels, and Baffles

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

5.2.1.1 Cylindrical Tee Screens

The upper solid panel would be retrieved to the top of the structure, inspected, secured in place, and cleaned with the high-pressure spray, front and back. The solid panel would be lowered into the center guide slot immediately behind the tee screen. The process would be repeated for each solid panel. Since the solid panels are placed in the slot just behind the screens, they create a solid barrier preventing fish from being drawn into the structure. By conducting the work during low water level periods, or by using spare solid panels, the river level would never be higher than the panels in either the front or center guide slot, whichever is higher.

After all the solid panels are cleaned and temporarily placed in the guide slot behind the screen, the fish screen would be pulled up and thoroughly cleaned and inspected in a similar manner. The baffle inside the cylindrical fish screen would be cleaned when the screen is cleaned. Cleaning personnel would likely enter the screen units to clean the baffle plates and screen interior. Additional access and safety precautions would be required.

After cleaning is complete, the fish screen would be replaced in its original position and the solid panels would be returned to their original positions above the screen panel in reverse order. The cylindrical tee screen units would require a lifting apparatus and possibly a larger crane or boom truck would be used for the screen units versus the solid panels.

5.2.2 Log Boom and Debris Fender Maintenance

The debris fender at the upstream end of the log boom and the log boom itself require maintenance to prevent corrosion and related deterioration. Also, periodically debris may collect on the fender or boom, especially after, or during, storm runoff. Corrosion protection would be accomplished by removing portions of the fender or boom from the water, either onto a floating work platform or onto land. Spare fender or boom sections would be used to maintain continuous functionality of the system. Once removed, coatings would be repaired or reapplied and hardware would be changed if broken or in poor condition. Also, broken log boom supports and guides would be repaired in a similar manner. Debris would be removed by personnel working from work boats with hoists and, if needed, divers. Debris removal staff would use hand and power tools to facilitate removal.

5.2.3 Sediment Buildup Reduction

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

5.2.4 Baffle Plate Adjustment

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

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

5.2.5 Screen Panel Inspection

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

5.2.6 Screen Cleaner Inspection and Adjustment

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

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

A full set of spare parts would be maintained on site for either screen cleaner system, so repairs and time-sensitive maintenance could be made at any time.

5.2.7 Emergency Sediment Dredging

Emergency sediment dredging would not be anticipated to be required based on existing information and bathymetric surveys of the river at the intake locations over the past decade. As sediment accumulates on the “front porch” in front of the screen, the sediment would be jetted into the river. This process would be effective for normal sedimentation expected in the river and would be conducted routinely, so sediment quantities being jetted would be very small and only result in de minimis turbidity increases. However, if anomalous sediment transport resulted in excessive river shoaling deposits in the intake area, emergency dredging would be conducted in front of the intake structure to allow the intakes to effectively divert flow and provide aquatic species protection. Emergency dredging would only be conducted on a case-by-case basis and would involve hydraulic dredging or clam shell excavation of sediment from the river bottom and loading the dredged material into barges for off-site disposal at a permitted site.

5.3 Sediment Management Facilities

5.3.1 Sedimentation Basin

The sedimentation basin would operate passively and sediment would settle to the bottom of the basin during flow diversions. A turbidity curtain would be provided in the sedimentation basin so that about half of the basin could be taken out of service and dredged without causing excessive turbidity to impact flows in the other half of the basin that would ultimately enter the tunnel.

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

The suction dredge would be maneuvered around the sedimentation basin until manual soundings demonstrate that the accumulated sediment has been removed. The dredging operation would be coordinated with the operation of the drying lagoons to maximize dredging and drying efficiency. Once the dredging operation on one side of the sedimentation basin turbidity curtain was completed, the dredge would be moved to the other side and the process repeated. If excess sediment builds up before the summer dredging season, the dredge would be mobilized earlier in the year and used to fill one or more of the four drying lagoons in order to make room for additional sediment in the basin.

Depending on the season, the presence of regulated fish species in the river, and the Project diversion requirements, the operating portion of the intake would potentially be operated up to 0.33 fps approach velocity during dredging to preserve most of the intake diversion capacity.

Dredging equipment would require maintenance on an annual basis.

Refer to the CER Appendix B8 for additional information regarding sediment accumulation and dredging.

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

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

During an extreme flood event, the CVFPB could require that the intake screen structure gates and the FCS radial gates be closed as an additional safety precaution.

5.3.2 Sediment Drying Lagoons

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

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

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

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

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

Refer to the CER Appendix B8 for additional information regarding drying lagoon operations and estimated dredging and drying duration for each intake.

Other sediment drying lagoon maintenance would include periodic cleaning of the underdrains using conventional agricultural drain cleaning equipment. Replacement of the underdrains and the gravel envelope surrounding the lines would be required on an infrequent basis, possibly every five to ten years or more.

Return flow pumping equipment, adjustable weir gates, and mixing and loading equipment would require typical mechanical equipment maintenance on an annual basis. Minor debris collection would be conducted on a continuous basis.

Depending on the final design configuration of the lagoons, they may need to be filled with water to help counteract buoyancy during high surface or ground water events.

5.4 Gate Systems

Control and isolation gates would either be fixed radial gates, sluice gates, or stop log gates. Control gates would be radial gates or fixed sluice gates. Some control gates would be dual purpose and used for isolation.

5.4.1 Isolation Gates

Isolation gates, typically in the form of stop logs gates or fixed sluice gates, are provided to allow all key intake features to be isolated for O&M as follows:

- **Cylindrical Tee Screen Intake Structure and Discharge Pipes:** A fixed sluice gate and stop log gates would provide isolation of the river side of the structure and the discharge pipes and fixed sluice gates would isolate the opposite side of the structure and the discharge pipes from the sedimentation basins. Isolation and dewatering of the piping system would be required to conduct flow meter O&M or to rehabilitate the piping system. Double isolation is provided since workers may be inside the pipes and would not have provisions for immediate egress in the event of an emergency.
- **Flow Control Structure:** Stop logs gates would provide isolation of both sides of each gate bay at the FCS. Isolation and dewatering would be required to maintain or rehabilitate the radial gates. Single isolation is provided for the gate bays since workers would have provisions for immediate egress in the event of an emergency. The combination of one stop log gate and one closed radial gate would also provide double isolation for worker safety in the tunnel system downstream.

All other intake features would be isolated using a combination of the features described above for the intake structure and FCS.

5.4.2 Gate O&M

5.4.2.1 Stop Log Gates

Stop log gate O&M would include replacing seals and repairing coatings. These activities would be conducted when the gates where removed. Also, the stop log gate guide rails would be cleaned periodically to facilitate easy deployment of the gates and effective sealing of flow.

5.4.2.2 Fixed Sluice Gates

Fixed sluice gate O&M would include lubrication and actuator maintenance, adjusting seating, and repairing coatings and cathodic protection. Typically, these activities would be conducted when the gates where in service. However, the sluice gates would have to be removed to recoat key parts or replace gates. A spare gate would be installed in the place of gate being repaired or replaced. After the repair, the gate would become the spare for the next gate O&M activity requiring gate replacement.

5.4.2.3 Radial Gates

Radial gate O&M would include lubrication and hoist and cable maintenance, adjusting seating, replacing seals, and repairing coatings and cathodic protection. Simple activities, especially for parts above the water level, would be conducted when the gates where in service. However, the radial gates would have to be isolated and possibly removed for some activities and to recoat key parts or replace gates. Gates would be repaired while the gate bay was isolated and spare gates would not be provided.

5.5 Power Supply

Power would be required at the intake site during operation to power electric items at the site. O&M requirements would include period testing of electrical gear and cables. Also, the SEGs at the site would be operated and performance tested once per month to ensure they are ready for automatic transfer and standby operation at any time.

Refer to the CER Appendix H2 for additional information regarding power supplies to the intakes.

5.6 Other Features

Equipment and facilities for other features included at the intakes would require typical cleaning, surface restoration, lubrication, performance checkouts, recoating, component repair and replacement, periodic testing and adjustment, and other routine maintenance on an annual basis. Vegetation management, minor erosion repairs, and minor debris collection would be conducted on a continuous basis.

6. Intake-Specific Information

This section summarized data specific to individual intake facilities. It arranged by:

- Section 6.1: Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens
- Section 6.2: Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

6.1 Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

6.1.1 Site Locations and Preconstruction Conditions

Intake C-E-3 site would be located along the Sacramento River and State Route 160 to north of the community of Hood. The construction site and post-construction site would extend on both sides of State Route 160 which is located on top of the existing Project Levee. On the river side of State Route 160, the site extends to the Sacramento River. On the land side of State Route 160, the site extends to the west side of an abandoned railroad embankment. No changes or construction activities would occur on the abandoned railroad embankment located to the east of the site. General locations of the intake facilities on the post-construction site are presented in the engineering concept drawings and summarized below.

- Total Size of Construction Site – approximately 242 acres
- Total Size of Post-Construction Site – approximately 123 acres

- Size of Construction Site on west side of State Route 160 – approximately 8 acres
- Size of Construction Site on east side of State Route 160 – approximately 234 acres
- Size of Post-Construction Site on west side of State Route 160 – approximately 6 acres
- Size of Post-Construction Site on east side of State Route 160 – approximately 118 acres
- Existing Levee Dimensions under State Route 160
  - Top of levee elevation: Approximately 30 feet
  - Width of levee crest: 30 feet
  - Width of levee from river side to land side toe: 152 to 190 feet along construction site
  - Toe of levee on river side elevation: -20 to -35 feet along construction site
  - Toe of levee on land side elevation: approximately 15 feet
- Main Roadway Access to Construction Site: State Route 160 approximately 0.04 miles north of Hood-Franklin Road. State Route 160 is a two-lane road with varying widths of unpaved shoulder areas. State Route 160 would not be used as an access road during construction.
- Elevation of the site: Ranges from 3 to 15 feet, see engineering concept drawings for more details
- Current Land Use: Agricultural land with orchards (primarily apples, pears, cherries) and vineyards; and some non-agricultural vegetation
- Number of Structures within Construction Site: Two residential structures and two storage structures
- Number of Commercial Buildings within Construction Site: None
- Recreational uses near site: Unofficial fishing and river access occur along State Route 160
- Distance to closest community: 0.4 miles to Hood
- Distance to closes schools: 2.3 miles to Clarksburg Middle School, Delta Elementary Charter, and Delta High in Clarksburg
- Distance to closest emergency responder: 0.5 miles to Courtland Fire Protection District Station 92 in Hood
- Distance to closest railroad: 3.2 miles to Union Pacific Railroad (UPRR) located to the east of Interstate 5
- Distance to closest airport: 4.2 miles to Borges-Clarksburg Airport and 6.9 miles to Franklin Boulevard

The site sizes presented are approximate and the GIS should be used for exact areas. The levee centerline was used to calculate the areas east and west of State Route 160.

Information is this section is provided for the location of the intake structure in the river that has been adjusted to account for water surface level impact compliance.

6.1.2 Earthwork

6.1.2.1 Main Works

As described in Section 4, the intake construction would occur in phases. Table 6.1.2.1 shows the quantities of landside earthwork quantities at Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens in accordance with the three phases described above.

To reduce the impact on importing or exporting fill or excavated material, a semi-balanced cut/fill approach would be undertaken by adjusting the sedimentation basin size to enable most fill to be provided on site.

Table 6.1.2.1 Landside Earthwork Quantity Summary for Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

Phase (Construction Activity)	Cut (cubic yards)	Fill[c] (cubic yards)	Net Balance (cubic yards)
Stripping (1 ft, to be permanently stockpiled in earthwork management area shown on the drawings)	**149,345**	**0**	**149,345**
Phase 1 Earthwork Borrow from Sedimentation Basin work area	376,641	Not Applicable	Not Applicable
Phase 1 Earthwork State Route 160 (temporary relocation and ramps)	0	387,147	Not Applicable
Phase 1 Earthwork Total[a]	**376,641**	**387,147**	**-10,506**
Remaining Earthwork from PH-1	-10,506	Not Applicable	Not Applicable
Phase 2 Earthwork State Route 160 (final)	14	163,419	Not Applicable
Phase 2 Earthwork Levee	0	368,163	Not Applicable
Phase 2 Earthwork Removal State Route 160 (North Flank)	50,426	Not Applicable	Not Applicable
Phase 2 Earthwork Removal State Route 160 (South Flank)	72,632	Not Applicable	Not Applicable
Phase 2 Earthwork Borrow from Sedimentation Basin work area	535,749	Not Applicable	Not Applicable
Phase 2 Earthwork Shaft Work Area (minimum, temporary)	0	125,640	Not Applicable
Phase 2 Earthwork Total[b]	**648,316**	**657,222**	**-8,906**
Remaining Earthwork from PH-1	-8,906	Not Applicable	Not Applicable
Phase 3 Earthwork Entire Site (remaining)	528,861	424,418	Not Applicable

Phase (Construction Activity)	Cut (cubic yards)	Fill[c] (cubic yards)	Net Balance (cubic yards)
Phase 3 Earthwork Gate Structure Fill	Not Applicable	18,451	Not Applicable
Phase 3 Earthwork Total	**519,955**	**442,869**	**77,087**

Notes

[a] Up to about 25,000 cy of this material could be imported fine grained material for Phase 1.

[b] Up to about 30,000 cy of this material could be imported fine grained material for Phase 2.

[c] These values do not include bulking or compaction factors.

Only minimal excavated material would be stored on site to balance the cut and fill operations, especially during wet weather. Maximum stored material height would not exceed elevation 30, which is the finished levee and embankment heights.

6.1.2.2 River Side Works

Table 6.1.2.2 summarizes the river side earthwork.

Table 6.1.2.2 River Side Earthwork Quantity Summary for Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

Items	Quantities
Excavation from within Cofferdam	Approximately 135,000 cubic yards would be excavated from inside the cofferdam (including installation of piers and the DMM wall). About 116,000 cubic yards of this material would be excavated from below the normal river elevation of 6.0 feet (median annual elevation). The excavation elevations, not including piers and the DMM wall, would be expected to reach about -26 feet to -31 feet within the cofferdam.
Excavation in front of Cofferdam	Approximately 13,300 cubic yards would be excavated from in front and around the intake structure on the river side. About 8,600 cubic yards of riprap would be placed at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep.
Net excavation, fill, and river displacement at the Intake below normal river water level	Net excavation = 37,300cubic yards, including backfill and concrete placement at the Intake Structure Total Excavation = 129,400 cubic yards Total Fill = 92,100 cubic yards Structure Interior Displacement (not a flooded structure) = 36,500 cubic yards Net River Volume Increase = 800 cubic yards

6.1.3 Piles and Piers

Table 6.1.3.1 provides the estimated pile, drilled pier, and DMM wall quantities and preliminary estimated top and bottom elevations based on NAVD88 datum to be installed in-water. Depending on water level, all of the sheet piles, drilled piers, and DMM wall could be installed where the ground surface is below the river water surface. However, following placement of the front row of the cofferdam and training wall piles, the cofferdam would separate the work area from the river, and the remaining pile, pier, and DMM wall installation would no longer be in the river.

Table 6.1.3.1 Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

Intake Number	Length of cofferdam and training wall sheet pile system (feet)	Approximate number of piles ("Z" sheet pairs)	Preliminary cofferdam sheet pile tip elevations (ft)	Length of cofferdam DMM wall system (feet)	Preliminary DMM wall bottom elevation	Approximate number of drilled piers within cofferdam	Preliminary drilled pier tip elevation
C-E-3	1,928	420 (includes 343 in front row of cofferdam and training walls)	-60	714	-100	1,215	-100

Table 6.1.3.2 provides the estimated pile and drilled pier quantities and preliminary estimated tip elevations based on NAVD88 datum to be installed on-land.

Table 6.1.3.2 Preliminary Estimated Pile and Drilled Pier Information for On-land Work for Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

Facilities	Approximate number of drilled piers	Approximate number of sheet piles (king piles ± "Z" sheet pairs)	Preliminary drilled pier tip elevation
Radial Gate Control Structure	400	Not Applicable	-100
Other Miscellaneous Excavations	Not Applicable	200 to 400	-60

At this time, the number of sheet piles that would require impact hammer pile driving is a preliminary estimate and the objective is to maximize vibratory driving methods prior to using impact driving methods. The potential soils at Intake C-E-3 site include lean clay and loose to medium sand in the top 18 feet of soils and underlain by very stiff to hard lean clay, fat clays with dense to very dense silt, sand, and gravel.

6.1.4 Overall Construction Conditions

Table 6.1.4 summarizes the overall construction conditions and dimensions of features at Intake C-E-3—3,000 cfs with Cylindrical Tee Screens.

Table 6.1.4 Construction Conditions and Constructed Facilities Summary for Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

Items	Quantities
Total Size of Construction Site [1]	242 acres
Total Size of Post-Construction Site [1]	123 acres

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. Connection of relocated State Route 160 onto temporary levee and permanent levee: at night if allowed by Caltrans Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour.
Temporary Levee and State Route 160 Levee Dimensions	Length of Temporary Levee = 4,250 feet along the centerline Top elevation of Temporary Levee = approximately 30 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 23 feet) with sea level rise for 2040 and 3 feet of freeboard Width of Top of Temporary Levee = 60 feet including State Route 160 Width of Bottom of Temporary Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus shoulders and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Temporary Levee	The temporary levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee would only be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would extend to an elevation -24 feet (this elevation is just above the nearby portions of the river bottom)
Permanent Levee and State Route 160 Dimensions (State Route 160 would be relocated to a fill pad between the intake structure and the sedimentation basin)	Length of Permanent Levee = 7,600 feet along the centerline Top elevation of Permanent Levee = 30.3 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 27.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020) Width of Top of Permanent Levee = 60 feet including State Route 160 Width of Bottom of Permanent Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus deceleration and turning lanes for intake site access, shoulders, and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.

Items	Quantities
Construction Methods of Permanent Levee	The permanent levee embankment would be constructed around the sedimentation basin and the outlet channel. The levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee placement would be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would be within the excavation footprint for the sedimentation basin and would extend to elevation -20 feet (this elevation is just above the nearby portions of the river bottom) Native grass would be planted on the non-water side of the levee. Erosion protection would be placed on the interior side of the sediment basin embankment, as described below. The inside of the levee would be protected from erosion as described above. The outside of the embankment would be planted with native grass.
Ground Improvement	Ground improvement would be installed under the levees and facilities embankments. The quantity of improved ground would be approximately 1.5 to 2.0 million cubic yards of mixed wall sections and approximately 250,000 to 350,000 tons of cement.
Cofferdam	Length = 2942 feet (including sheet piles and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Intake Structure Length	Length = 1574 feet along river including training walls Length = 964 feet along river for concrete structure only
Intake Structure Elevation	Top elevation = 30.3 feet which would be about 55 to 65 feet above river bottom Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 10 feet River elevation at this location = -25 to -30 feet
Intake Structure Floor Elevation	Floor elevation would be at the bottom of screen panel = -16 feet Concrete front slab elevation = -17 feet
Fish Screen Elevation	Elevation at the bottom of the fish screen = -13 feet
Gantry Crane on top of Intake Structure	Width = 35-feet Top elevation = 70 feet (40 feet above Intake Structure)
Cylindrical Tee Screen Assembly	Number of Fish Screen Units = 30 Each unit: 8 feet in diameter and 30 feet long, including fish screen and manifold assembly, and mounted on the face of the structure Each unit includes internal and external fixed brush cleaning system Each unit would extend about 12 feet from the intake structure into the river Complete assembly includes 60-inch diameter piping and control gates from the screen unit to the sedimentation basin

Items	Quantities
Portable Fish Screen Pressure Washer (not mounted on Intake Structure)	Trailer mounted rig to maneuver equipment for pressure washing screens would be approximately 6 feet tall, 6 feet wide, and 8 feet long. A standard pickup truck would tow this rig.
Portable Mobile Crane (not mounted on Intake Structure)	Mobile crane to load and unload intake features would be approximately 15 feet tall, 20 feet wide, and 400 feet long. A 100-foot-long boom would be extended from the main crane. Standard tractor trailer rig with a flat-bed trailer would be used to transport panels to and from the intake.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep for a total of approximately 8,600 cubic yards of riprap, or 16 barge round trips (assuming 1 barge with a capacity of 1000 tons). About 13,300 cubic yards of excavated material would be dredged from the river outside the cofferdam to support intake construction and riprap placement. This material would be transported to an existing and properly permitted off-site disposal area using 28 barge round trips. An additional 3 barge round trips would be required to support riprap placement, dredging, and log boom installation. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard.
Sedimentation Basin Dimensions	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1300 feet long and 650 feet wide at top of the embankment. Top elevation of embankment = 30.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of Project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 27 feet Each cell would be 990 feet long and 500 feet wide at bottom of the embankment. Bottom elevation = -18 feet
Sedimentation Basin Side Slopes	Side slopes would be 3H:1V Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sediment Basin Radial Gate Flow Control Structure at the junction with the Outlet Structure and tunnel inlet	Four Large Radial Gates: 30 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 30.3 feet Bottom elevation of Flow Control Structure = - 8.8 feet

Items	Quantities
Outlet Channel from Flow Control Structure to tunnel inlet	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 146 feet wide Top elevation of embankment = 30.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of Project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 8.8 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Sediment Drying Lagoons Dimensions	Four sediment drying lagoons Each lagoon would be approximately 146 feet wide and 350 long at the bottom of the embankment. Each lagoon would be approximately 15 to 18 feet deep and contain an average of 10 to 12 feet of water. Embankment slopes would be 1H:1V. Side slopes and bottom would be concrete lined to facilitate removal of dried sediment and prevent uplift. Sediment depth approximately 1 foot distributed over the floor of the lagoon during operations.
Sediment Drying Lagoons Outlet Structure (to convey water from the lagoons to a pump that to return any water to the Sediment Basin)	Each lagoon would have an outlet structure: approximate 15 feet wide by 15 feet tall. Top elevation at the top of lagoon embankment. Bottom elevation 20 to 25 feet below top elevation.
On-site Electrical Substations – during Construction and Operation Phases	An electrical substation would be established near the haul road entrance to the work site at the eastern boundary of the intake site. The substation would include switches, transformers, and related electrical gear housed within a 75 foot wide by 125 foot long enclosure with a separate safety and security fence. The substation would also be within the fenced secure total construction site area. After construction of the embankment, this substation would be relocated to the top of the embankment as shown on the engineering concept drawings. Smaller transformers less than 10 feet wide by 10 feet long would be positioned at several locations around the site. The transformers would have suitable containment, if required, and would be within the fenced secure total construction site area and additional security would not be needed.
Standby Engine Generator/Fuel Tank – during Construction and Operation Phases	A 1 megawatt standby engine generator with a 1528 horsepower engine would be used primarily to supply the office complex and possibly to recharge electrical equipment during construction. The standby engine generator would be installed inside a fenced area of about 30 feet by 30 feet, including both the generator and the fuel tank. The fuel would be provided by a diesel tank with suitable containment or a propane tank stored above ground. After construction of the embankment, the standby engine generator would be replaced with new permanent generators at locations on the top of the embankment as described above and as shown on the engineering concept drawings. The permanent standby engine generators would provide energy to operate the valves and gates, including the ability to stop diversions at the intake structure.

Items	Quantities
Appurtenant Structures Dimensions – during Construction Phase	Office trailers, showers/washrooms, a canteen and common area, and a bus shelter would be installed to serve the construction workers and other on-site personnel. Most of these buildings would be 15-feet tall or less (one story). An emergency services building would be about 30 feet tall. Other buildings for warehousing for materials and temporary work enclosures would be less than 20 feet tall.
Appurtenant Structures Dimensions – during Operations Phase	One of the construction buildings would be used for indoor storage of portable equipment and vehicles used for maintenance of all intakes during operations.
On-Site Access Roads – during Construction Phase	Approximately 2.5 miles of roads would be constructed within the intake site. Most of the interior roads would be covered with gravel, gravel over geotextile material, or paved depending upon the amount of vehicle use envisioned. Roads leading to the access road would be paved, including roads at the main office buildings and bus shelter.
On-Site Access Roads – during Operations Phase	Towards the end of construction, about 8,900 feet of paved permanent access roads would be installed. Access to the intake site would occur from State Route 160 and from an access/haul road located to the west of the abandoned railroad embankment that would be installed during construction. These access roads would be 24-foot wide paved roads. Several internal access roads would be constructed around the base of the outlet shaft area, along the top of the embankments, and on ramps up the side of the embankments. These roads would receive substantial vehicle use, and therefore, would also be 24-foot wide paved roads. Approximately 6,500 feet of 20-foot wide gravel roads would be constructed around the sediment drying lagoons, along the length of the sedimentation basin parallel to State Route 160, and to provide access along the sediment loading areas.
On-Site Parking and Construction Materials and Vehicle Staging Areas – during Construction Phase	An area approximately 100 feet wide by 200 feet long would be provided near the office complex for employee parking. Several small parking areas would be located near the office buildings and laydown areas to support vehicles for special tools and deliveries. An area approximately 200 feet wide by 200 feet long would be provided a bus that would transport employees from the park and ride lots near Interstate 5. Approximately 30 acres would be used for construction material staging and equipment management, including 15 acres for vehicle and equipment storage and maintenance. Areas used for equipment maintenance would use gravel surfaces, and areas used for vehicle and equipment storage would use unpaved surfaces. Areas with containment structures would be used for refueling and maintenance using grease, oils, or other similar chemical compounds.
On-Site Parking – during Operations Phase	An area approximately 50 feet wide by 100 feet long would be provided for operations and maintenance workers and vehicle storage. Two areas located to the east of the sediment drying lagoons, approximately 3.5 acres, each, would be used to stage loading of the dried sediment into trucks for disposal.

Items	Quantities
Fencing and Security – during Construction Phase [2]	Approximately 20,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include 24-hours site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations and security personnel would be in contact using cell phones or short wave radio.
Fencing and Security – during Operations Phase [2]	Approximately 10,000 feet of 8-foot tall permanent chain link security fencing to enclose both the river side and land side of the facility along State Route 160. Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information.
Lighting Facilities – during Construction and Operations Phases	Lights on land would be downcast, cut-off type fixtures with non-glare finishes, and controlled by photocells and motion detectors. Lights would provide good color with natural light qualities with minimum intensity with adequate strength for security, safety, and personnel access. The lights would comply with the Illuminating Engineering Society industry standards for light source and luminaire measurements and testing methods. Lights along the waterway would be for safety and navigational purposes only.
Electrical Facilities – during Construction and Operations Phases	The overhead electrical supplies on-site would be moved throughout the construction phase.
Emergency Response Facilities to serve Intakes C-E-3 and C-E-5 during Construction Phase	The facilities would include an emergency services building, ambulance with two sets of full-time staff during work hours (up to 7 people), a rescue boat, and a fire truck with a full-time crew (approximately five people covering each construction shift). During construction, the emergency response facility would be located in the building that would ultimately be used for General Maintenance and Storage during operations. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.
Wastewater Facilities – during Construction and Operations Phases	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic system would be maintained during long-term operations. The septic tank and leach field would be located near the eastern boundary of the intake but outside of the ground improvement areas. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site at the intake site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits.

Items	Quantities
SWPPP Facilities – during Construction	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.
Land Restoration	Approximately 119 acres would be restored. These lands would be located on the areas used during construction for material/equipment laydown and staging, material stockpiles, slurry batch plant, retention ponds, parking areas, bus drop-off/pick-up, access roads, and facilities/trailers for owners, contractors, and crew.

Notes:

[1] Site sizes are approximate; exact area should be obtained from the GIS. Total area excludes access road modifications.

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

6.1.5 Operations Phase Conditions

This subsection describes operational considerations for fish screen system, sedimentation basin, sediment drying lagoon maintenance, and the permanent power supply, as summarized in Table 6.1.5.

Table 6.1.5. Operations Conditions for Intake C-E-3 – 3,000 cfs with Cylindrical Tee Screens

Items	Quantities
Fish Screen Maintenance	Fish screen cleaner brushes would be inspected and replaced annually, as needed. Fish screen rotation drive motors, 2 per unit, would be inspected annually and replaced if needed. The expected life of the motor is more than 10 years. Bushing areas between the rotating screen cylinder and the manifold would be inspected annually and repaired or replaced as needed. About every 3 to 6 months, the fish screen would be brought to the top of the structure for inspection and cleaning using the high pressure washer, if warranted.
Dredging Barges Within the Sedimentation Basin	A portable dredge would be used to remove the sediment from the sedimentation basin. It would be about 30 to 40 feet long and about 8 to 12 feet wide. The dredging operation would take place during the summer months. Each sediment drying lagoon would be pumped full of sediment about once every 4 to 8 days and would contain about 1800 cubic yards. The process would be repeated until the entire sediment volume collected since the previous dredging operations was removed from the sedimentation basin.
Sediment Drying Lagoons	Sediment from the drying lagoons would be removed and hauled to an offsite licensed facility for disposal. The volume and frequency of sediment removal would be dependent upon the volume and flow rate of water diverted at the intake.

6.2 Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

Information is this section is provided for the location of the intake structure in the river that has been adjusted to account for water surface level impact compliance.

6.2.1 Site Locations and Preconstruction Conditions

Intake C-E-5 site would be located about 1.5 miles south of the community of Hood along State Route 160. The construction site and post-construction site would extend on both sides of State Route 160 which is located on top of the existing Project Levee. On the river side of State Route 160, the site extends to the Sacramento River. On the land side of State Route 160, the site extends to the west side of an abandoned railroad embankment. No changes or construction activities would occur on the abandoned railroad embankment located to the east of the site. General locations of the intake facilities on the post-construction site are presented in the engineering concept drawings.

- Total Size of Construction Site – approximately 239 acres
- Total Size of Post-Construction Site – approximately 109 acres
- Size of Construction Site on west side of State Route 160 – approximately 9 acres
- Size of Construction Site on east side of State Route 160 – approximately 230 acres
- Size of Post-Construction Site on west side of State Route 160 – approximately 7 acres
- Size of Post-Construction Site on east side of State Route 160 – approximately 103 acres
- Existing Levee Dimensions under State Route 160
  - Top of levee elevation: 29 to 30 feet
  - Width of levee crest: 30 feet
  - Width of levee from river side toe to land side toe: 180 to 195 feet along construction site
  - Toe of levee on river side elevation: -15 to -18 feet along construction site
  - Toe of levee on land side elevation: approximately 14 feet
- Main Roadway Access to Construction Site - State Route 160 approximately 0.5 miles north of Lambert Road. State Route 160 is a two-lane road with some larger paved areas for passing and varying widths of unpaved shoulder areas. State Route 160 would not be used as an access road during construction.
- Elevation of the site - Ranges from 4 to 14 feet, see engineering concept drawings for more details
- Current Land Use - Agricultural land with row crops, orchards (primarily almonds, pears, cherries) and vineyards; and some non-agricultural vegetation
- Number of Structures within Construction Site - 2 residential structures and 10 storage or support structures
- Number of Commercial Buildings within Construction Site – None
- Recreational uses near site - Unofficial fishing and river access occur along State Route 160
- Distance to closest community – 1.4 miles to Hood
- Distance to closest schools - 2 miles to River Delta Community Day School in Courtland
- Distance to closest emergency responder - 1.5 miles to Courtland Fire Protection District Station 92 in Hood
- Distance to closest railroad – 4 miles to Franklin Boulevard
- Distance to closest airport – 6 miles to Borges-Franklin Boulevard

The site sizes presented are approximate and the GIS should be used for exact areas. The levee centerline was used to calculate the areas east and west of State Route 160.

6.2.2 Earthwork

6.2.2.1 Main Works

As described in Section 4, the intake construction would occur in phases. Table 6.2.2.1 shows the quantities of landside earthwork quantities at Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens in accordance with the three phases described above.

To reduce the impact on importing or exporting fill or excavated material, a semi-balanced cut/fill approach would be undertaken by adjusting the sedimentation basin size to enable most fill to be provided on site.

Table 6.2.2.1 Earthwork Quantity Summary for Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

Phase (Construction Activity)	Cut (cubic yards)	Fill[c] (cubic yards)	Net Balance (cubic yards)
Stripping (1 ft, to be permanently stockpiled in earthwork management area shown on the drawings)	**128,377**	**0**	**128,377**
Phase 1 Earthwork Borrow from Basins	322,901	0	Not Applicable
Phase 1 Earthwork State Route 160 (temp relocation and ramps)	0	318,749	Not Applicable
Phase 1 Earthwork Total[a]	**322,901**	**318,749**	**4,151**
Remaining Earthwork from PH-1	4,151	0	Not Applicable
Phase 2 Earthwork State Route 160 (final)	0	148,520	Not Applicable
Phase 2 Earthwork Levee	0	267,022	Not Applicable
Phase 2 Earthwork Removal State Route 160 (North Flank)	46,528	0	Not Applicable
Phase 2 Earthwork Removal State Route 160 (South Flank)	68,088	0	Not Applicable
Phase 2 Earthwork Borrow from Basins	429,544	0	Not Applicable
Phase 2 Earthwork Shaft Work Area (minimum, temporary)	0	120,608	Not Applicable
Phase 2 Earthwork Total[b]	**548,310**	**536,150**	**12,161**
Remaining Earthwork from PH-1	12,161	0	Not Applicable

Phase (Construction Activity)	Cut (cubic yards)	Fill[c] (cubic yards)	Net Balance (cubic yards)
Phase 3 Earthwork Entire Site (remaining)	545,790	356,168	Not Applicable
Phase 3 Earthwork Gate Structure Fill	0	17,493	Not Applicable
Phase 3 Earthwork Total	**557,951**	**373,660**	**184,290**

Notes

[a] Up to about 25,000 cy of this material could be imported fine grained material for Phase 1.

[b] Up to about 30,000 cy of this material could be imported fine grained material for Phase 2.

[c] These values do not include bulking or compaction factors.

Only minimal excavated material would be stored on site to balance the cut and fill operations, especially during wet weather. Maximum stored material height would not exceed elevation 30, which is the finished levee and embankment heights.

6.2.2.2 River Side Works

Table 6.2.2.2 summarizes the river side earthwork.

Table 6.2.2.2 River Side Earthwork Quantity Summary for Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

Items	Quantities
Excavation from within Cofferdam	Approximately 123,600 cubic yards would be excavated from inside the cofferdam (including installation of piers and DMM wall). About 114,600 cubic yards of this material would be excavated from below the normal river elevation of 5.9 feet (median annual elevation). The excavation elevations, not including piers and DMM wall, would be expected to reach about -26 feet to -31 feet within the cofferdam. See Table 6.2.3.1 for details about piers.
Excavation in front of Cofferdam	Approximately 8,700 cubic yards would be excavated from in front and around the intake structure on the river side. About 6,800 cubic yards of riprap would be placed at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep.
Net excavation, fill, and river volume displacement at the Intake below normal river water level	Net excavation = 32,500 cubic yards, including backfill and concrete placement at the Intake Structure Total Excavation = 123,300 cubic yards Total Fill = 90,800 cubic yards Structure Interior Displacement (not a flooded structure) = 35,700 cubic yards Net River Volume Displacement = 3,300 cubic yards

6.2.3 Piles and Piers

Table 6.2.3.1 provides the estimated pile, drilled pier, and DMM wall quantities and preliminary estimated top and bottom elevations based on NAVD88 datum to be installed in-water. Depending on water level, all of the sheet piles, drilled piers, and DMM wall could be installed where the ground surface is below the river water surface. However, following placement of the front row of the cofferdam and training wall piles, the cofferdam would separate the work area from the river, and the remaining pile, pier, and DMM wall installation would no longer be in the river.

Table 6.2.3.1 Preliminary Estimated Pile, Drilled Pier, and DMM Wall Information for In-water Work for Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

Intake Number	Length of cofferdam and training wall sheet pile system (feet)	Approximate number of piles ("Z" sheet pairs)	Preliminary cofferdam sheet pile tip elevations (ft)	Length of cofferdam DMM wall system (feet)	Preliminary DMM wall bottom elevation	Approximate number of drilled piers within cofferdam	Preliminary drilled pier tip elevation
C-E-5	1,883	410 (includes 332 in front row of cofferdam and training walls)	-55	714	-100	1,215	-100

Table 6.2.3.2 provides the estimated pile and drilled pier quantities and preliminary estimated tip elevations based on NAVD88 datum to be installed on-land.

Table 6.2.3.2 Preliminary Estimated Pile and Drilled Pier Information for On-land Work for Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

Facilities	Approximate number of drilled piers	Approximate number of sheet piles (king piles ± "Z" sheet pairs)	Preliminary drilled pier tip elevation
Radial Gate Control Structure	400	Not Applicable	-100
Other Miscellaneous Excavations	Not Applicable	200 to 400	-60

At this time, the number of sheet piles that would require impact hammer pile driving is a preliminary estimate and the objective is to maximize vibratory driving methods prior to using impact driving methods. The potential soils at Intake C-E-5 site include soft lean clay and loose to medium sand in the top 36 feet of soils and underlain by very stiff to hard lean clay, fat clays, and medium to very dense sands.

6.2.4 Overall Construction Conditions

Table 6.2.4 summarizes the overall construction conditions and dimensions of features at Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens.

Table 6.2.4 Construction Conditions and Constructed Facilities Summary for Intake C-E-5 – 3,000 cfs with Cylindrical Tee Screens

Items	Quantities
Total Size of Construction Site [1]	239 acres
Total Size of Post-Construction Site [1]	109 acres
Construction Hours	Most construction would occur 5-days/week from sunrise to sunset (assumed to be approximately 10 hours on average), unless otherwise noted. Connection of relocated State Route 160 onto temporary levee and permanent levee: at night if allowed by Caltrans Placement of concrete for tremie slab – construction continuous until concrete pour is completed, approximately 3 days per pour
Temporary Levee and State Route 160 Levee Dimensions	Length of Temporary Levee = 4,200 feet along the centerline Top elevation of Temporary Levee = approximately 29 feet (18 to 20 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 100-year flood elevation (approximately 22 feet) with sea level rise for 2040 and 3 feet of freeboard Width of Top of Temporary Levee = 60 feet including State Route 160 Width of Bottom of Temporary Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus shoulders and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.
Construction Methods of Temporary Levee (See Table 6.2.2.1 for excavated soil volumes)	The temporary levee would be placed on improved ground extending beneath the entire foot print of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee would only be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would extend to an elevation -20 feet (this elevation is just above the nearby portions of the river bottom)
Permanent Levee and State Route 160 Dimensions (State Route 160 would be relocated to a fill pad between the intake structure and the sedimentation basin)	Length of Permanent Levee = 6,200 feet along the centerline Top elevation of Permanent Levee = 29.3 feet (20 to 23 feet above toe of temporary levee fill). Note: top elevation similar to existing levee and higher than 200-year flood elevation (approximately 26.3 feet) with sea level rise for 2100 and 3 feet of freeboard (DWR, 2020) Width of Top of Permanent Levee = 60 feet including State Route 160 Width of Bottom of Permanent Levee = 175 to 200 feet at the toe Embankments would be 3H:1V State Route 160 would have two 12-foot wide lanes plus deceleration and turning lanes for intake site access, shoulders, and clear space for visibility on a curve. The road would be designed and paved in accordance with Caltrans requirements for a state highway.

Items	Quantities
Construction Methods of Permanent Levee (See Table 6.2.2.1 for excavated soil volumes)	The permanent levee embankment would be constructed around the sedimentation basin and the outlet channel. The levee would be placed on improved ground extending beneath the entire footprint of the fill. Up to 5 feet of topsoil would be removed prior to ground improvement and the new levee would be placed on that subgrade. The excavation for the levee placement would be about 1 foot below existing grade at the site, except for an inspection trench which would extend about 6 feet below existing grade. Excavations for borrow material adjacent to the new levee would be within the excavation footprint for the sedimentation basin and would extend to elevation -20 feet (this elevation is just above the nearby portions of the river bottom) Native grass would be planted on the non-water side of the levee. Erosion protection would be placed on the interior side of the sediment basin embankment, as described below. The inside of the levee would be protected from erosion as described above. The outside of the embankment would be planted with native grass.
Ground Improvement	Ground improvement would be installed under the levees and facilities embankments. The quantity of improved ground would be approximately 1.5 to 2.0 million cubic yards of mixed wall sections and approximately 250,000 to 350,000 tons of cement.
Cofferdam	Length = 2897 feet (including sheet piles and DMM wall) Elevation at the top of Cofferdam = about 20 feet Coordinate with U.S. Coast Guard to appropriately install buoys or signage to warn boaters, and notify the commercial and leisure boating community, including posting notices at Delta marinas and public launch ramps.
Intake Structure Length	Length = 1528 feet along river including training walls Length = 964 feet along river for concrete structure only
Intake Structure Elevation	Top elevation = 29.3 feet which would be about 41 to 51 feet above river bottom Approximately the same as the top of the new levee Ground elevation at landside of levee toe = 11.3 feet River elevation at this location = -15 to -22 feet
Intake Structure Floor Elevation	Floor elevation would be at the bottom of screen panel = -16 feet Concrete front slab elevation = -17 feet
Fish Screen Elevation	Elevation at the bottom of the fish screen = -13 feet
Gantry Crane on top of Intake Structure	Width = 35-feet Top elevation = 69 feet (40 feet above Intake Structure)
Cylindrical Tee Screen Assembly	Number of Fish Screen Units = 30 Each unit: 8 feet in diameter and 30 feet long, including fish screen and manifold assembly, and mounted on the face of the structure Each unit includes internal and external fixed brush cleaning system Each unit would extend about 12 feet from the intake structure into the river Complete assembly includes 60-inch diameter piping and control gates from the screen unit to the sedimentation basin

Items	Quantities
Portable Fish Screen Pressure Washer (not mounted on Intake Structure)	Trailer mounted rig to maneuver equipment for pressure washing screens would be approximately 6 feet tall, 6 feet wide, and 8 feet long. A standard pickup truck would tow this rig.
Portable Mobile Crane (not mounted on Intake Structure)	Mobile crane to load and unload intake features would be approximately 15 feet tall, 20 feet wide, and 400 feet long. A 100-foot long boom would be extended from the main crane. Standard tractor trailer rig with a flat-bed trailer would be used to transport panels to and from the intake.
Post-construction completion of Intake Structure including use of barges to install riprap and safety equipment	Riprap would be placed by barge at the end of construction for scour control along the interface between the intake structure and existing levees and river bottom. Depending on site conditions, the riprap would extend about 40 to 60 feet in front of the intake structure and about 3 feet deep for a total of approximately 6,800 cubic yards of riprap, or 12 barge round trips (assuming 1 barge with a capacity of 1000 tons). About 8,700 cubic yards of excavated material would be dredged from the river outside the cofferdam to support intake construction and riprap placement. This material would be transported to an existing and properly permitted off-site disposal area using 19 barge round trips. An additional 3 barge round trips would be required to support riprap placement, dredging, and log boom installation. Log booms, buoys, signage, and basic security and safety downcast lights would be installed near the intake structure. Notification would be provided to U.S. Coast Guard.
Sedimentation Basin Dimensions	The basin would be divided into two cells divided by a turbidity curtain. Each cell would be 1300 feet long and 645 feet wide at top of the embankment. Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of Project development. Overall height is not expected to vary by more than a few feet. Water Surface Elevation would vary from 3 to 26 feet Each cell would be 990 feet long and 495 feet wide at bottom of the embankment. Bottom elevation = -18 feet
Sedimentation Basin Side Slopes	Side slopes would be 3H:1V Interior side slopes would be protected with small rock or articulated concrete mats to minimize erosion and spalling.
Sediment Basin Radial Gate Flow Control Structure at the junction with the Outlet Structure and tunnel inlet	Four Large Radial Gates: 30 feet wide and 40 feet tall, each One Small Radial Gate: 15 feet wide and 8 feet tall Top elevation of Flow Control Structure = 29.3 feet Bottom elevation of Flow Control Structure = - 9 feet

Items	Quantities
Outlet Channel from Flow Control Structure to tunnel inlet	Top and inside of embankment: 750 feet long and 375 feet wide Bottom and inside of embankment: 750 feet long and 146 feet wide Top elevation of embankment = 29.3 feet; top elevation of levee around outlet channel is subject to verification to be consistent with hydraulic analyses conducted during later phases of Project development. Overall height is not expected to vary by more than a few feet. Bottom elevation of embankment = - 9 feet Sides slopes of embankment based on 3H:1V Interior side slopes would be concrete lined to prevent scour from turbulence downstream of the gates.
Sediment Drying Lagoons Dimensions	Four sediment drying lagoons Each lagoon would be approximately 146 feet wide and 350 long at the bottom of the embankment. Each lagoon would be approximately 15 to 18 feet deep and contain an average of 10 to 12 feet of water. Embankment slopes would be 1H:1V. Side slopes and bottom would be concrete lined to facilitate removal of dried sediment and prevent uplift. Sediment depth approximately 1 foot distributed over the floor of the lagoon during operations.
Sediment Drying Lagoons Outlet Structure (to convey water from the lagoons to a pump that to return any water to the Sediment Basin)	Each lagoon would have an outlet structure: approximate 15 feet wide by 15 feet tall. Top elevation at the top of lagoon embankment. Bottom elevation 20 to 25 feet below top elevation.
On-site Electrical Substations – during Construction and Operation Phases	Same as Intake C-E-5 – 3,000 cfs with Vertical Flat Plate Screens.
Standby Engine Generator/Fuel Tank – during Construction and Operation Phases	Same as Intake C-E-5 – 3,000 cfs with Vertical Flat Plate Screens.
Appurtenant Structures Dimensions – during Construction Phase	Office trailers, showers/washrooms, a canteen and common area, and a bus shelter would be installed to serve the construction workers and other on-site personnel. Most of these buildings would be 15-feet tall or less (one story). Other buildings for warehousing for materials and temporary work enclosures would be less than 20 feet tall.
Appurtenant Structures Dimensions – during Operations Phase	One of the construction buildings would be used for indoor storage of portable equipment and vehicles used for maintenance of all intakes during operations.

Items	Quantities
On-Site Access Roads – during Construction Phase	Approximately 2.5 miles of roads would be constructed within the intake site. Most of the interior roads would be covered with gravel, gravel over geotextile material, or paved depending upon the amount of vehicle use envisioned. Roads leading to the access road would be paved, including roads at the main office buildings and bus shelter.
On-Site Access Roads – during Operations Phase	Towards the end of construction, about 8,300 feet of paved permanent access roads would be installed. Access to the intake site would occur from State Route 160 and from an access/haul road located to the west of the abandoned railroad embankment that would be installed during construction. These access roads would be 24-foot wide paved roads. Several internal access roads would be constructed around the base of the outlet shaft area, along the top of the embankments, and on ramps up the side of the embankments. These roads would receive substantial vehicle use, and therefore, would also be 24-foot wide paved roads. Approximately 6,500 feet of 20-foot wide gravel roads would be constructed around the sediment drying lagoons, along the length of the sedimentation basin parallel to State Route 160, and to provide access along the sediment loading areas.
On-Site Parking and Construction Materials and Vehicle Staging Areas – during Construction Phase	An area approximately 100 feet wide by 200 feet long would be provided near the office complex for employee parking. Several small parking areas would be located near the office buildings and laydown areas to support vehicles for special tools and deliveries. An area approximately 200 feet wide by 200 feet long would be provided a bus that would transport employees from the park and ride lots near Interstate 5. Approximately 30 acres would be used for construction material staging and equipment management, including 15 acres for vehicle and equipment storage and maintenance. Areas used for equipment maintenance would use gravel surfaces, and areas used for vehicle and equipment storage would use unpaved surfaces. Areas with containment structures would be used for refueling and maintenance using grease, oils, or other similar chemical compounds.
On-Site Parking – during Operations Phase	An area approximately 50 feet wide by 100 feet long would be provided for operations and maintenance workers and vehicle storage. Two areas located to the east of the sediment drying lagoons, approximately 3.5 acres, each, would be used to stage loading of the dried sediment into trucks for disposal.
Fencing and Security – during Construction Phase [2]	Approximately 20,500 feet of at least 8-foot tall chain link security fence around the work site and some minor interior security fences. Signs would be placed on fencing to identify the Delta Conveyance Project construction activities and telephone numbers and internet addresses to obtain information. Construction site security would include 24-hours site access management and site surveillance. Security personnel would be onsite with regular inspection rounds. Cameras would also be used at key locations and security personnel would be in contact using cell phones or short wave radio.
Fencing and Security – during Operations Phase [2]	Approximately 9,600 feet of 8-foot tall permanent chain link security fencing to enclose both the river side and land side of the facility along State Route 160. Signs would be placed on fencing to identify the Delta Conveyance Project activities and telephone numbers and internet addresses to obtain information.

Items	Quantities
Lighting Facilities – during Construction and 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 and motion detectors. 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.
Electrical Facilities – during Construction and Operation Phases	The overhead electrical supplies on-site would be moved throughout the construction phase.
Emergency Response Facilities to serve Intakes during Construction Phase	If Intake C-E-5 is included in the Project without Intake C-E-3, Emergency Response Facilities would be located at Intake C-E-5, otherwise at Intake C-E-3. The facilities would include an emergency services building, ambulance with two sets of full-time staff during work hours (up to 7 people), a rescue boat, and a fire truck with a full-time crew (approximately five people covering each construction shift). During construction, the emergency response facility would be located in the building that would ultimately be used for General Maintenance and Storage during operations. Space for a 60-foot diameter paved helipad without tree coverage would only be used for emergency evacuations.
Wastewater Facilities – during Construction and Operations Phases	A septic tank and leach field would be constructed to treat wastewater flow from the restrooms, including sinks, showers, and toilets. The septic tank and leach field would be located near the eastern boundary of the intake but outside of the ground improvement areas. The septic system would be designed and constructed in accordance with the Sacramento County Onsite Wastewater Treatment System Guidance Manual. The septic tank and leach field would be constructed on-site at the intake site which could include soils characterized by low permeability and high groundwater. It is anticipated that the peak daily flow would be 500 gallons/day. The septic tank would be a 2,000 gallon concrete tank. The leach field would be sized based upon 0.2 gallons/day per square feet to reduce application rates in lower permeable soils. The leach field would include fourteen 90-foot long and 2-foot wide trenches with a dosing chamber to equally disperse septic tank effluent in all trenches. Each trench would be separated by 6 feet between outside walls of the trenches. The septic tank and leach field would be sited in accordance with setback limits.
SWPPP Facilities – during Construction	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 for on-site reuse or subsequent discharge, if appropriate.

Items	Quantities
Land Restoration	Approximately 130 acres would be restored. These lands would be located on the areas used during construction for material/equipment laydown and staging, material stockpiles, slurry batch plant, retention ponds, parking areas, bus drop-off/pick-up, access roads, and facilities/trailers for owners, contractors, and crew.

Notes:

[1] Site sizes are approximate; exact area should be obtained from the GIS. Total area excludes access road modifications.

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

6.2.5 Operations Phase Conditions

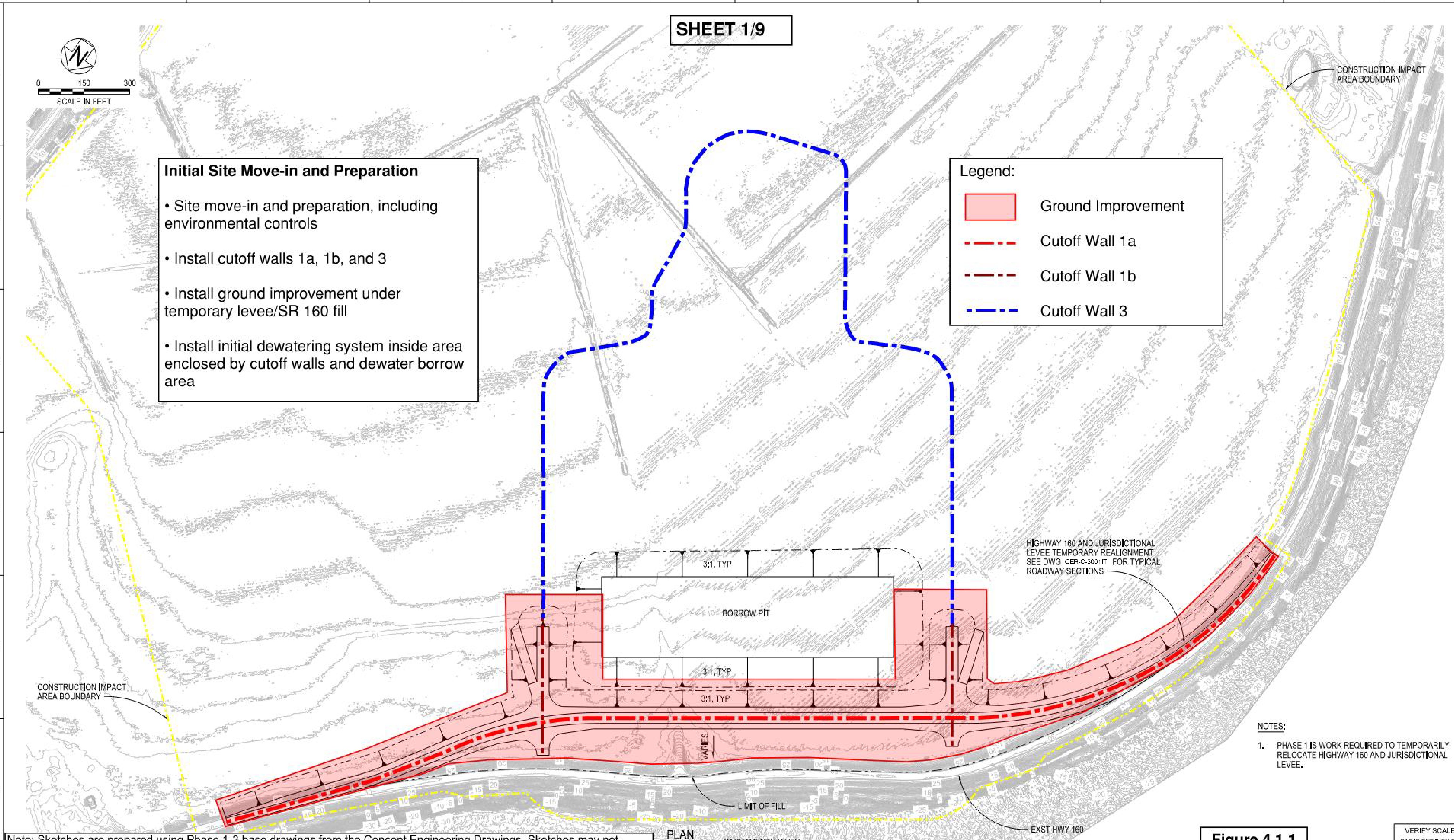
Operations of Intake C-E-5—3,000 cfs with Cylindrical Tee Screens would be the same as for Intake C-E-3—3,000 cfs with Cylindrical Tee Screens, as described in Section 6.1.5.

7. References

California Building Standards Commission (CBSC). 2016. 2016 California Fire Code: California Code of Regulations Title 24, Part 9.

California Department of Water Resources (DWR). 2020. Preliminary Flood Water Surface Elevations (Not for Construction). September.

Figures



Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.1

INTAKES

DESIGNED	B CHELONIS
DRAWN	D CORBETT
CHECKED	J REYNOLDS
APPROVAL RECOMMENDED	
APPROVAL BY	P RYAN
REV / DATE / DESCRIPTION	SEP. 2024

DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

INATKE 3
PHASE 1 SITE PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

PROJECT NO.

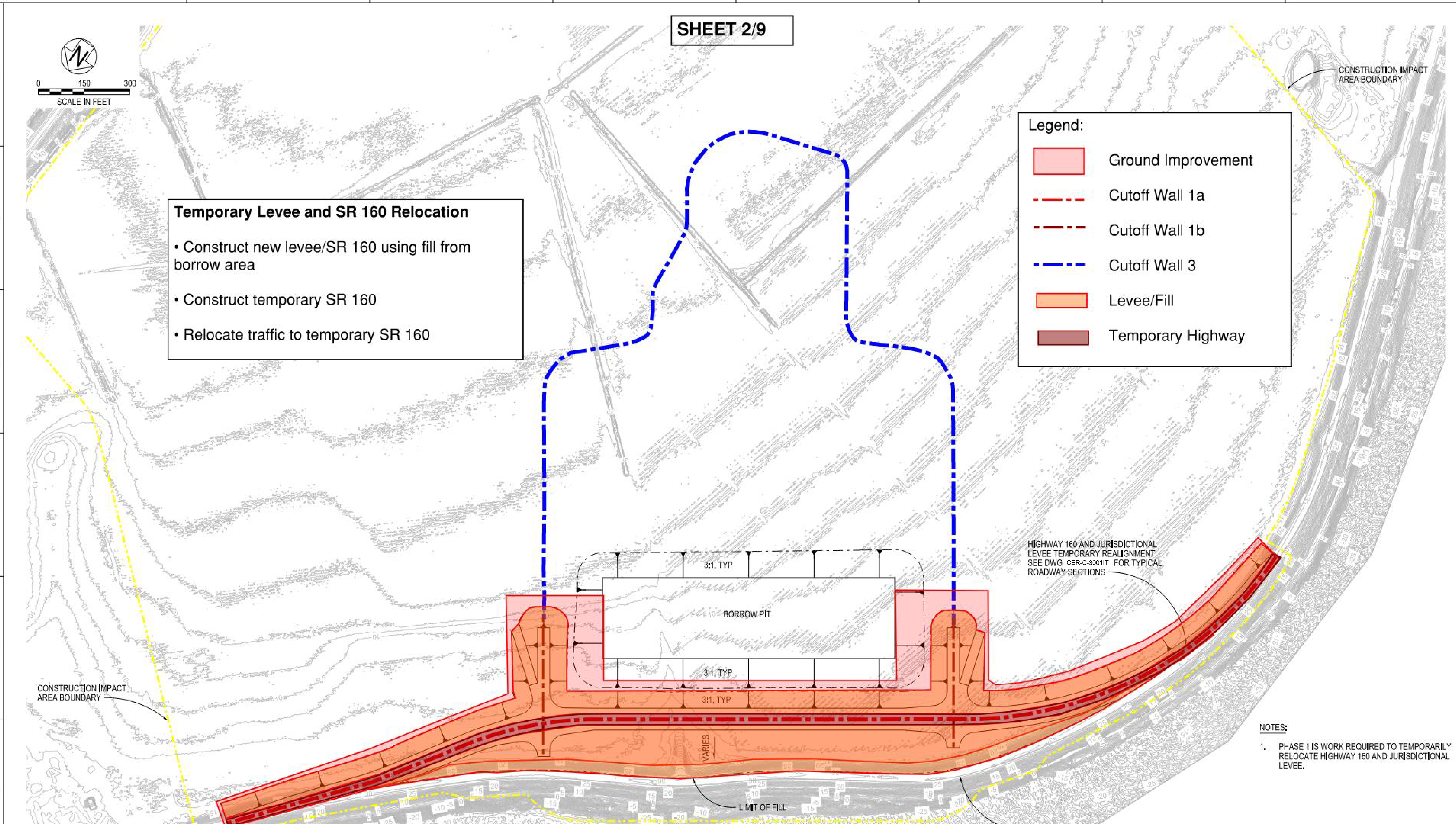
SHEET NO. CER-C-1016IT

REV SEQUENCE NO. X

STX-C-1016IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:10:53:02 AM

SHEET 2/9



Temporary Levee and SR 160 Relocation

- Construct new levee/SR 160 using fill from borrow area
- Construct temporary SR 160
- Relocate traffic to temporary SR 160

NOTES:

1. PHASE 1 IS WORK REQUIRED TO TEMPORARILY RELOCATE HIGHWAY 160 AND JURISDICTIONAL LEVEE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.2 INTAKES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

REV	DATE	DESCRIPTION	SUB.	APPD
	SEP. 2024			

DESIGNED: B CHELONIS
APPROVAL RECOMMENDED:
DRAWN: D CORBETT
APPROVAL BY: P RYAN
CHECKED: J REYNOLDS

DCA
DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

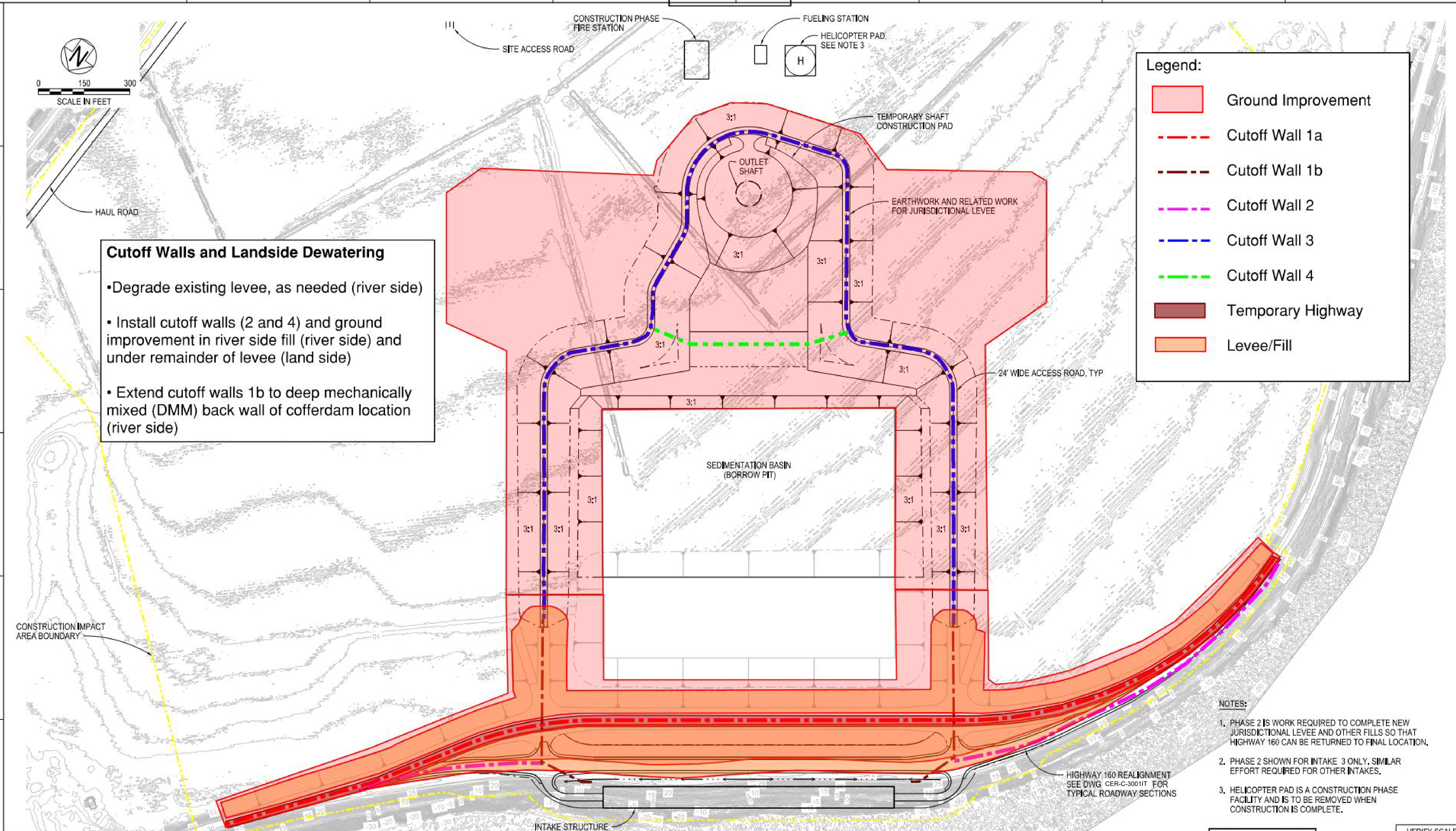
DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

PHASE 1 SITE PLAN

PROJECT NO.
SHEET NO. CER-C-1016IT
REV | SEQUENCE NO. X

STX-C-1016IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:10:53:02 AM



Cutoff Walls and Landside Dewatering

- Degrade existing levee, as needed (river side)
- Install cutoff walls (2 and 4) and ground improvement in river side fill (river side) and under remainder of levee (land side)
- Extend cutoff walls 1b to deep mechanically mixed (DMM) back wall of cofferdam location (river side)

NOTES:

1. PHASE 2 IS WORK REQUIRED TO COMPLETE NEW JURISDICTIONAL LEVEE AND OTHER FILLS SO THAT HIGHWAY 160 CAN BE RETURNED TO FINAL LOCATION.
2. PHASE 2 SHOWN FOR INTAKE 3 ONLY. SIMILAR EFFORT REQUIRED FOR OTHER INTAKES.
3. HELICOPTER PAD IS A CONSTRUCTION PHASE FACILITY AND IS TO BE REMOVED WHEN CONSTRUCTION IS COMPLETE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.3 INTAKES

REV	DATE	DESCRIPTION	SUB.	APPD
	SEP. 2024			

DESIGNED: B CHELONIS
DRAWN: D CORBETT
CHECKED: J REYNOLDS
APPROVAL RECOMMENDED:
APPROVAL BY: P RYAN

DCA — DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

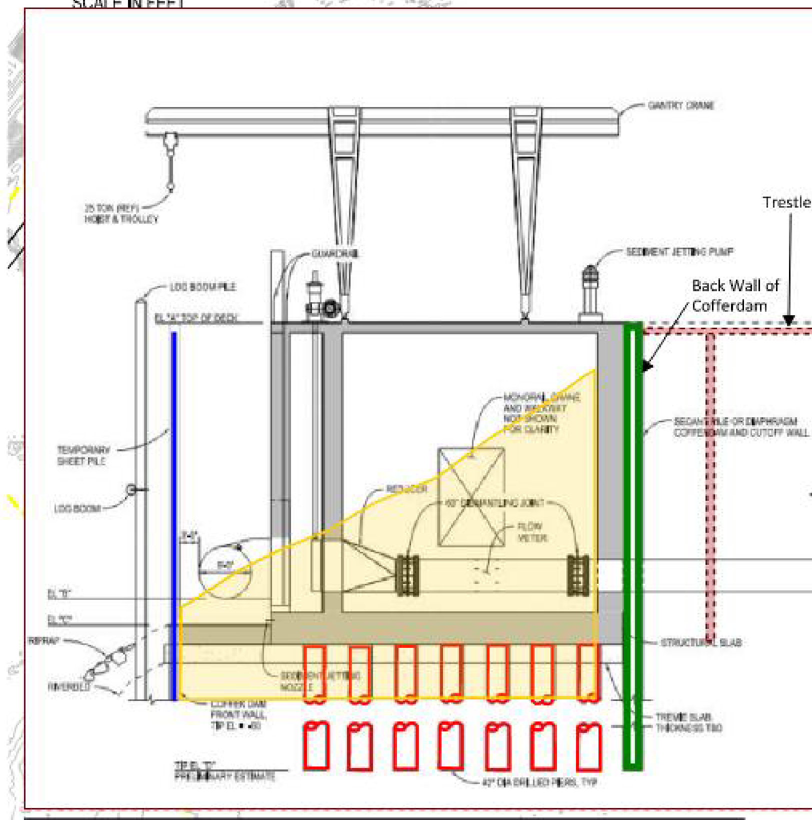
PHASE 2 SITE PLAN

VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

PROJECT NO. W8X97000
SHEET NO. CER-C-1017IT
REV | SEQUENCE NO. X

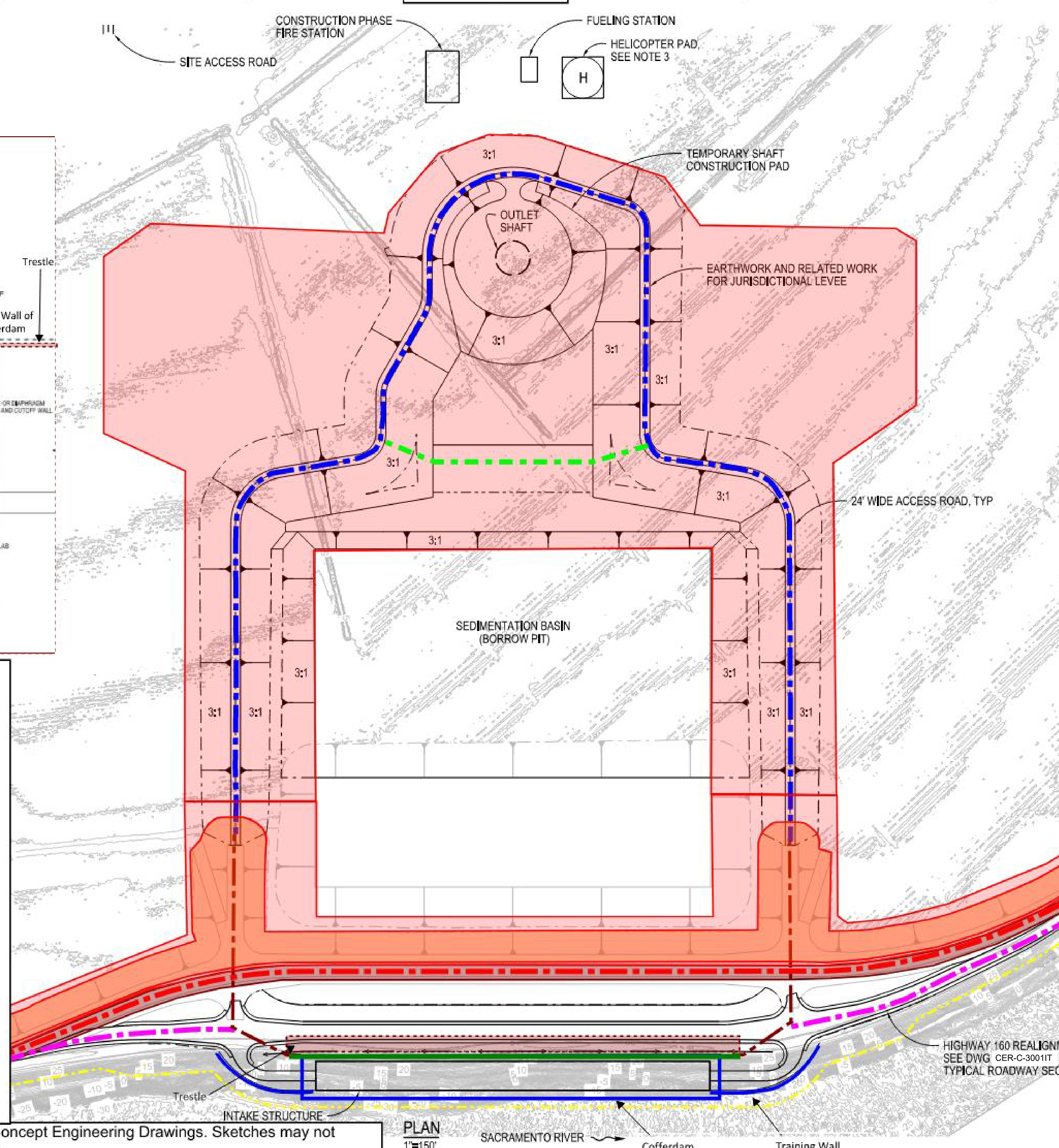
STX-C-1017IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:11:03:58 AM



Cofferdam, Training Wall, and Drilled Piers

- Construct trestle (river side)
- Place sheet pile (cofferdam and training walls) (river side)
- Construct DMM back wall of cofferdam, tie into slurry walls 1b (river side)
- Set up cofferdam dewatering WTP (river side)
- Install cofferdam back wall tie-backs and internal supports/excavate cofferdam/partial dewatering (river side)
- Place drilled pier starter casings/install drilled piers (river side)



Legend:

- Ground Improvement
- Cutoff Wall 1a
- Cutoff Wall 1b
- Cutoff Wall 2
- Cutoff Wall 3
- Cutoff Wall 4
- Temporary Highway
- Levee/Fill*
- Existing Ground
- Back Wall of Cofferdam
- Sheet Pile
- Trestle

*For clarity, ground improvement & levee/fill not shown on river side of temporary highway

NOTES:

1. PHASE 2 IS WORK REQUIRED TO COMPLETE NEW JURISDICTIONAL LEVEE AND OTHER FILLS SO THAT HIGHWAY 160 CAN BE RETURNED TO FINAL LOCATION.
2. PHASE 2 SHOWN FOR INTAKE 3 ONLY. SIMILAR EFFORT REQUIRED FOR OTHER INTAKES.
3. HELICOPTER PAD IS A CONSTRUCTION PHASE FACILITY AND IS TO BE REMOVED WHEN CONSTRUCTION IS COMPLETE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.4 INTAKES

DESIGNED	B CHELONIS
DRAWN	D CORBETT
CHECKED	J REYNOLDS
APPROVAL RECOMMENDED	
APPROVAL BY	P RYAN
DATE	SEP. 2024

DCA — DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

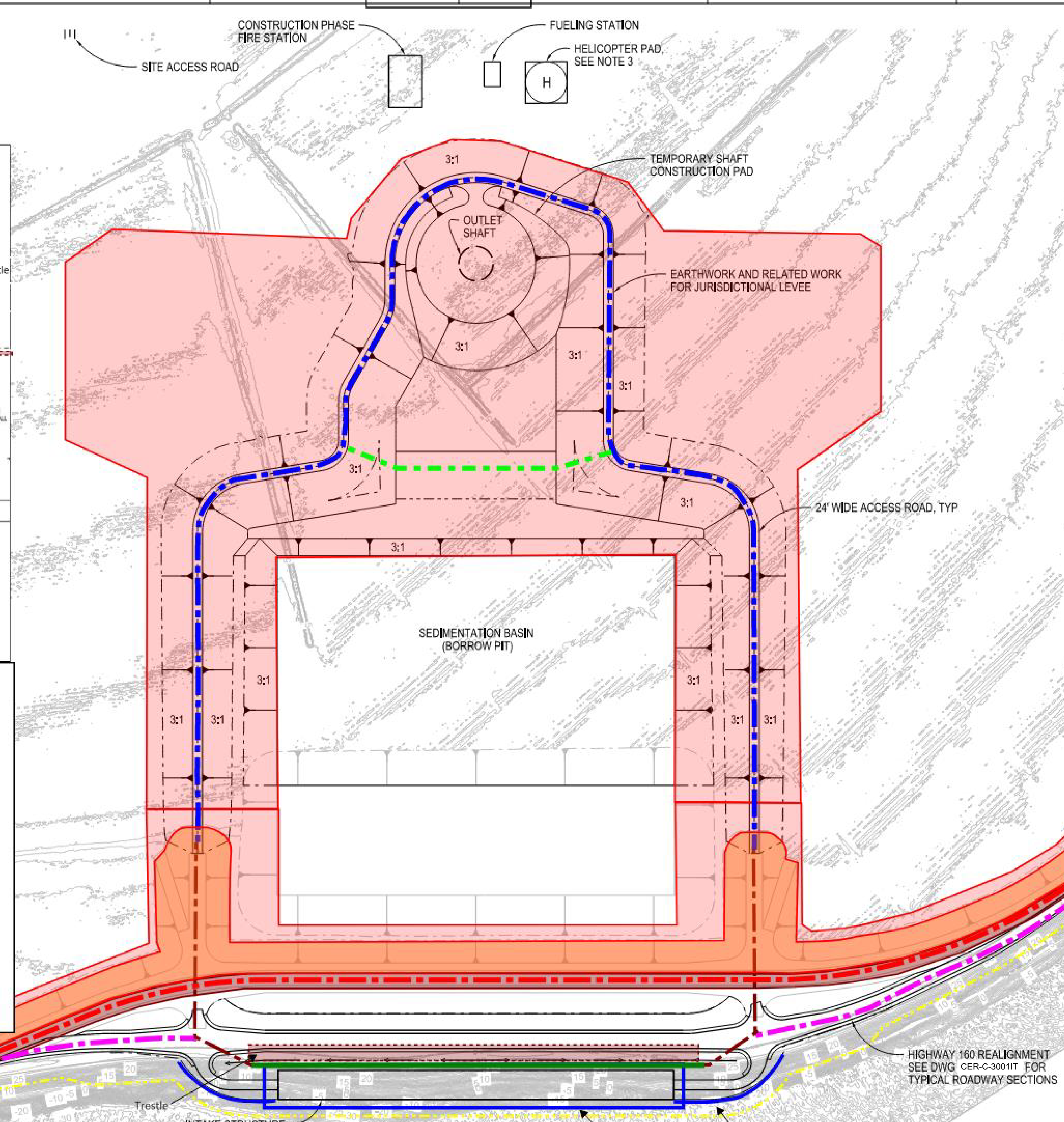
PHASE 2 SITE PLAN

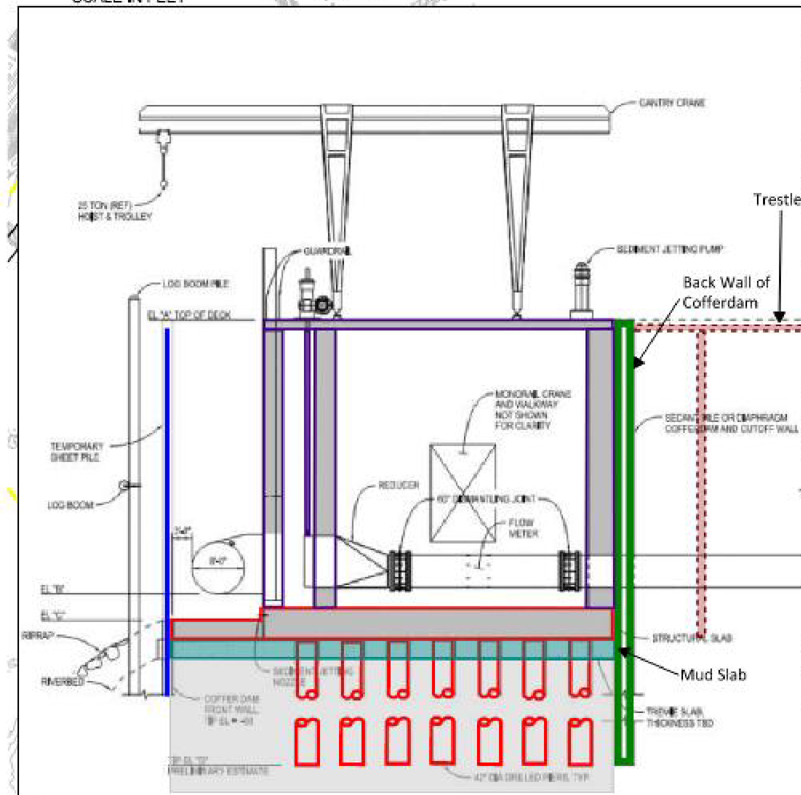
VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING.

PROJECT NO. W8X97000
SHEET NO. CER-C-1017IT
SEQUENCE NO. X

STX-C-1017IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:11:03:58 AM





Complete Cofferdam and Initial Intake Structure

- Place tremie seal (river side)
- Dewater cofferdam (river side)
- Pour mud slab (river side)
- Clean/cut top of pier casings and expose rebar (river side)
- Build floor slab (river side)
- Build walls and roof deck, including gate chambers and required mechanical/electrical (river side)

NOTES:

1. PHASE 2 IS WORK REQUIRED TO COMPLETE NEW JURISDICTIONAL LEVEE AND OTHER FILLS SO THAT HIGHWAY 160 CAN BE RETURNED TO FINAL LOCATION.
2. PHASE 2 SHOWN FOR INTAKE 3 ONLY. SIMILAR EFFORT REQUIRED FOR OTHER INTAKES.
3. HELICOPTER PAD IS A CONSTRUCTION PHASE FACILITY AND IS TO BE REMOVED WHEN CONSTRUCTION IS COMPLETE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.5 INTAKES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.

DESIGNED	B CHELONIS
DRAWN	D CORBETT
CHECKED	J REYNOLDS
APPROVAL RECOMMENDED	
APPROVAL BY	P RYAN
DATE	SEP. 2024

DCA — DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

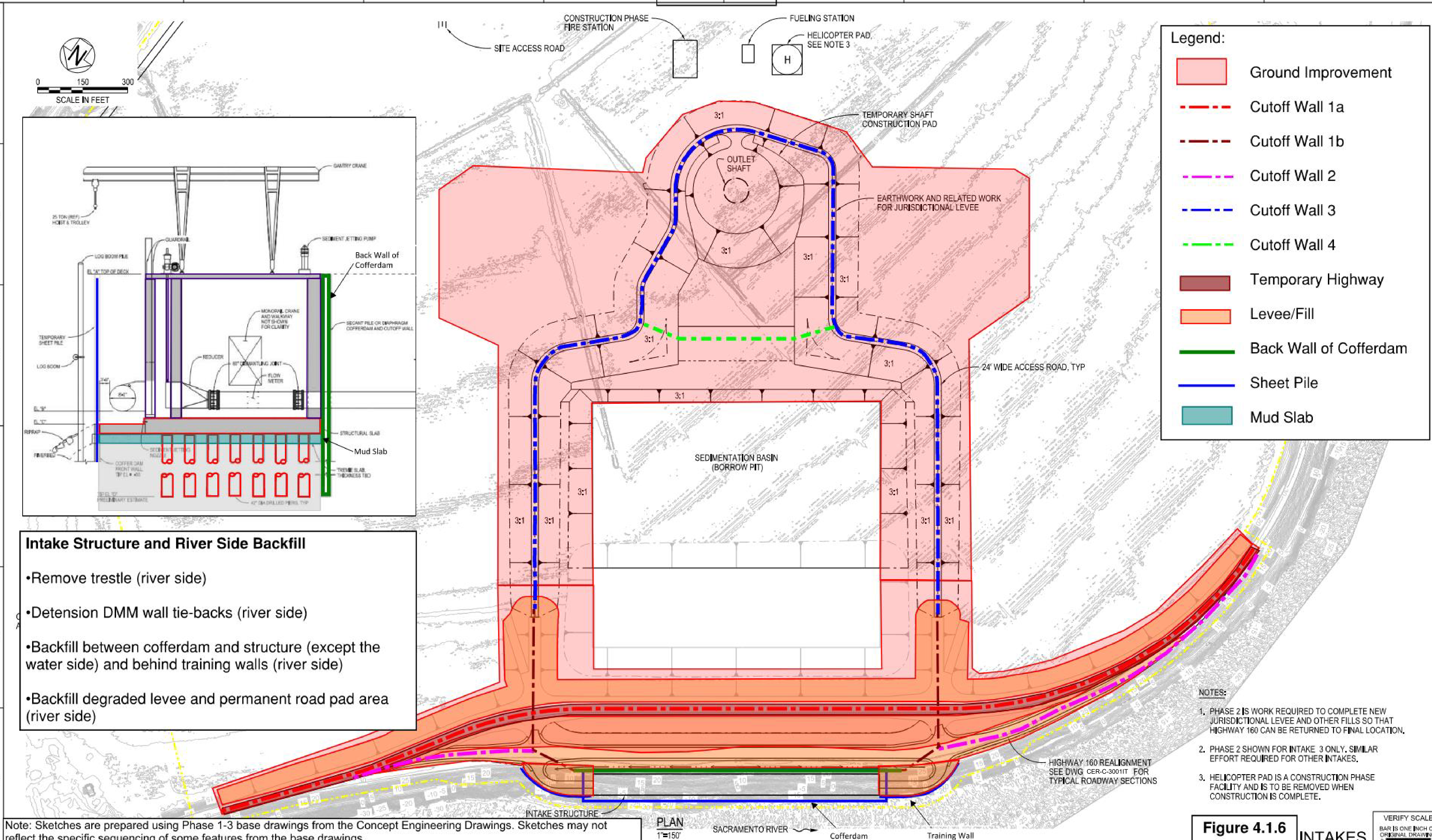
DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

PHASE 2 SITE PLAN

PROJECT NO. W8X97000
SHEET NO. CER-C-1017IT
SEQUENCE NO. X

STX-C-1017IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:11:03:58 AM



Intake Structure and River Side Backfill

- Remove trestle (river side)
- Detension DMM wall tie-backs (river side)
- Backfill between cofferdam and structure (except the water side) and behind training walls (river side)
- Backfill degraded levee and permanent road pad area (river side)

NOTES:

1. PHASE 2 IS WORK REQUIRED TO COMPLETE NEW JURISDICTIONAL LEVEE AND OTHER FILLS SO THAT HIGHWAY 160 CAN BE RETURNED TO FINAL LOCATION.
2. PHASE 2 SHOWN FOR INTAKE 3 ONLY. SIMILAR EFFORT REQUIRED FOR OTHER INTAKES.
3. HELICOPTER PAD IS A CONSTRUCTION PHASE FACILITY AND IS TO BE REMOVED WHEN CONSTRUCTION IS COMPLETE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.6 INTAKES

VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING.

DESIGNED: B CHELONIS | APPROVAL RECOMMENDED:
DRAWN: D CORBETT | APPROVAL BY: P RYAN
CHECKED: J REYNOLDS
SEP. 2024 | REV | DATE | DESCRIPTION | SUB. | APPD

DCA — DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

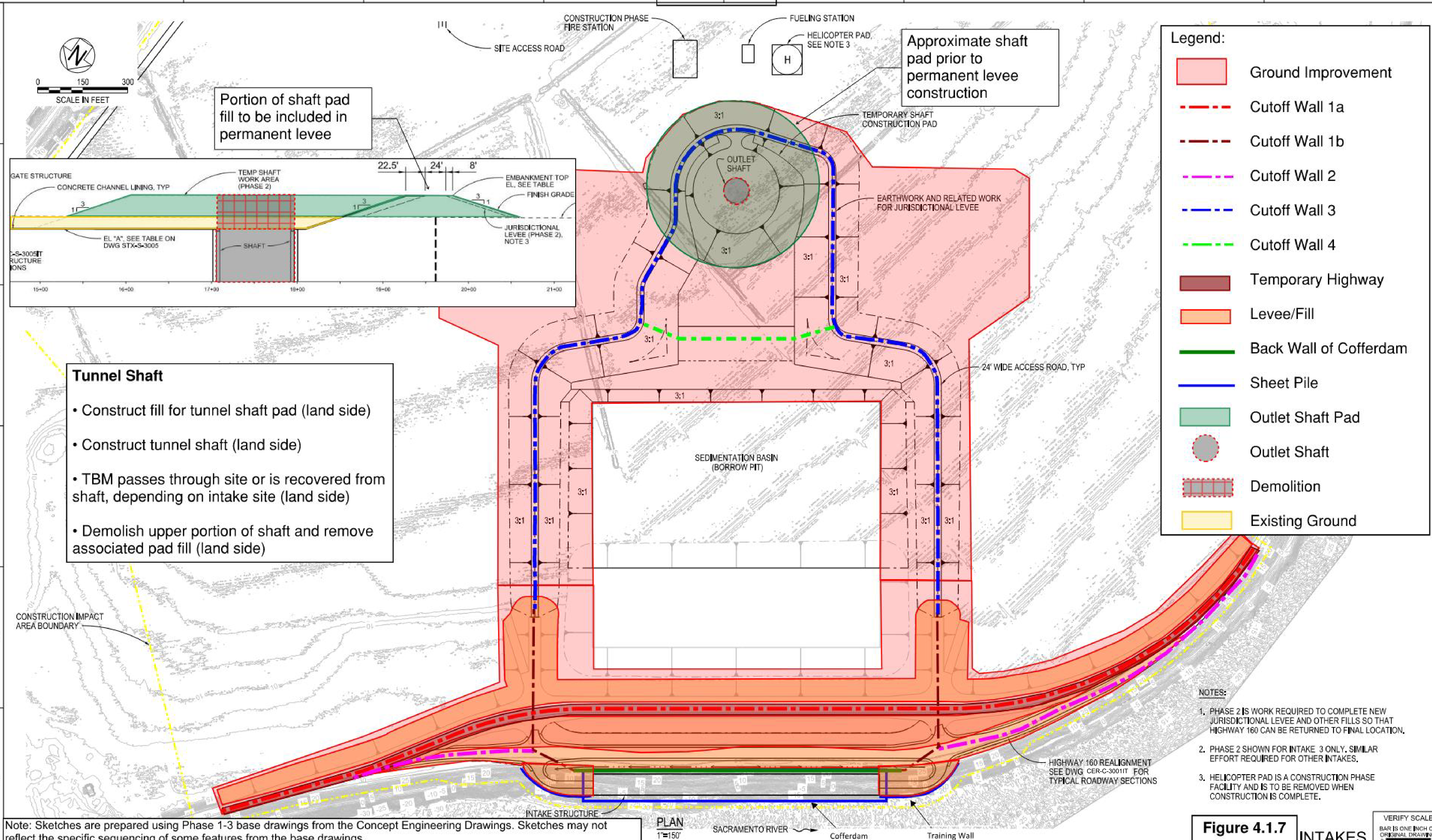
DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

PHASE 2 SITE PLAN

PROJECT NO. W8X97000
SHEET NO. CER-C-1017IT
REV | SEQUENCE NO. X

STX-C-1017IT_W8X97000.dgn

SHEET 7/9



Tunnel Shaft

- Construct fill for tunnel shaft pad (land side)
- Construct tunnel shaft (land side)
- TBM passes through site or is recovered from shaft, depending on intake site (land side)
- Demolish upper portion of shaft and remove associated pad fill (land side)

NOTES:

1. PHASE 2 IS WORK REQUIRED TO COMPLETE NEW JURISDICTIONAL LEVEE AND OTHER FILLS SO THAT HIGHWAY 160 CAN BE RETURNED TO FINAL LOCATION.
2. PHASE 2 SHOWN FOR INTAKE 3 ONLY. SIMILAR EFFORT REQUIRED FOR OTHER INTAKES.
3. HELICOPTER PAD IS A CONSTRUCTION PHASE FACILITY AND IS TO BE REMOVED WHEN CONSTRUCTION IS COMPLETE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.7 INTAKES

DESIGNED B CHELONIS
DRAWN D CORBETT
CHECKED J REYNOLDS
APPROVAL RECOMMENDED
APPROVAL BY P RYAN
SEP. 2024
REV DATE DESCRIPTION SUB. APPD

DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

PHASE 2 SITE PLAN

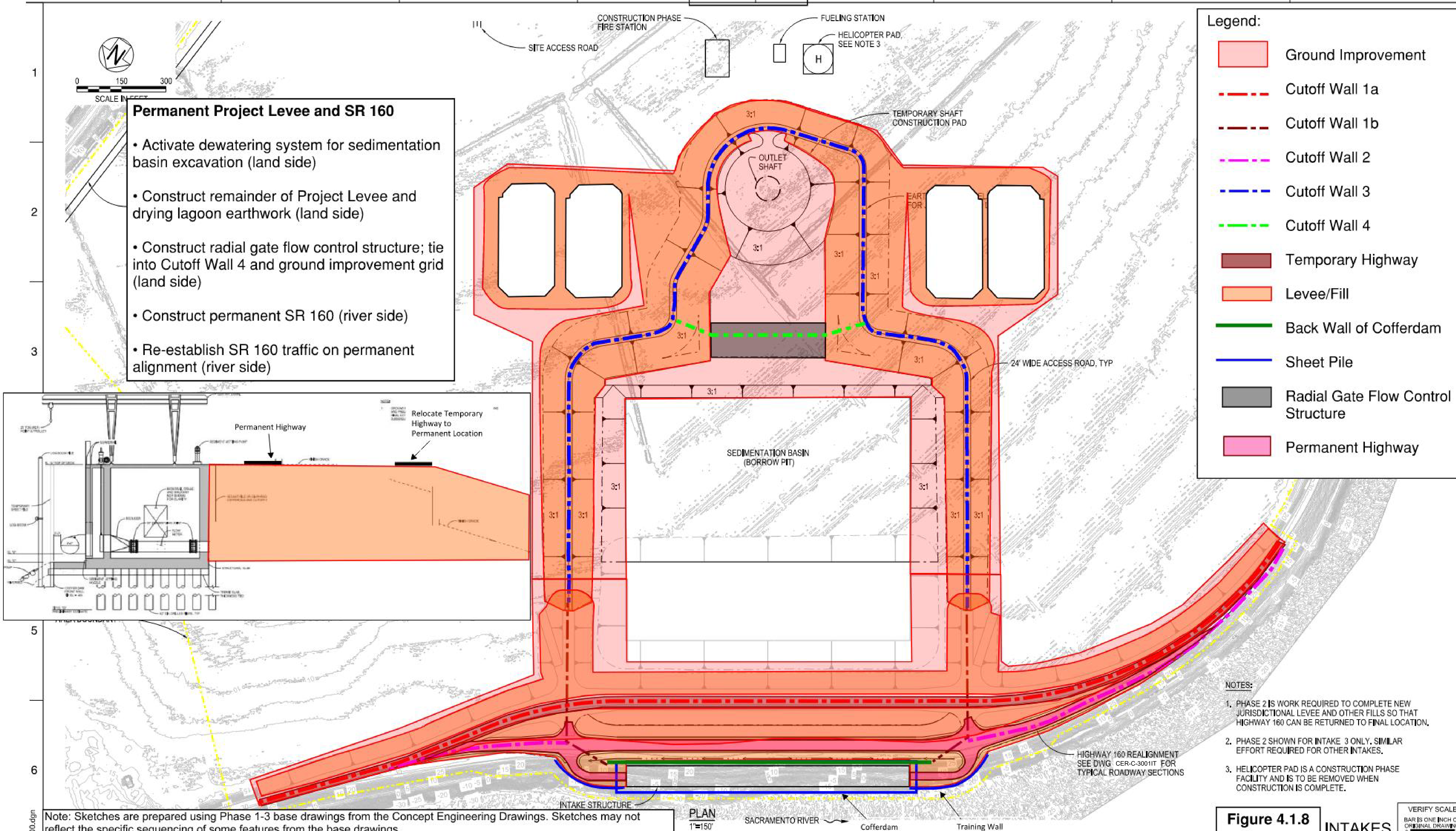
VERIFY SCALE: BAR IS ONE INCH ON ORIGINAL DRAWING.
PROJECT NO. W8X97000
SHEET NO. CER-C-1017IT
REV SEQUENCE NO. X

STX-C-1017IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:11:03:58 AM

Permanent Project Levee and SR 160

- Activate dewatering system for sedimentation basin excavation (land side)
- Construct remainder of Project Levee and drying lagoon earthwork (land side)
- Construct radial gate flow control structure; tie into Cutoff Wall 4 and ground improvement grid (land side)
- Construct permanent SR 160 (river side)
- Re-establish SR 160 traffic on permanent alignment (river side)



NOTES:

1. PHASE 2 IS WORK REQUIRED TO COMPLETE NEW JURISDICTIONAL LEVEE AND OTHER FILLS SO THAT HIGHWAY 160 CAN BE RETURNED TO FINAL LOCATION.
2. PHASE 2 SHOWN FOR INTAKE 3 ONLY. SIMILAR EFFORT REQUIRED FOR OTHER INTAKES.
3. HELICOPTER PAD IS A CONSTRUCTION PHASE FACILITY AND IS TO BE REMOVED WHEN CONSTRUCTION IS COMPLETE.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.8 INTAKES

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DESIGNED: B CHELONIS	APPROVAL RECOMMENDED	DELTA CONVEYANCE PROJECT CONCEPT ENGINEERING REPORT	PROJECT NO.	W8X97000
DRAWN: D CORBETT	APPROVAL BY: P RYAN		SHEET NO.	CER-C-1017IT
CHECKED: J REYNOLDS		PHASE 2 SITE PLAN	REV / SEQUENCE NO.	X

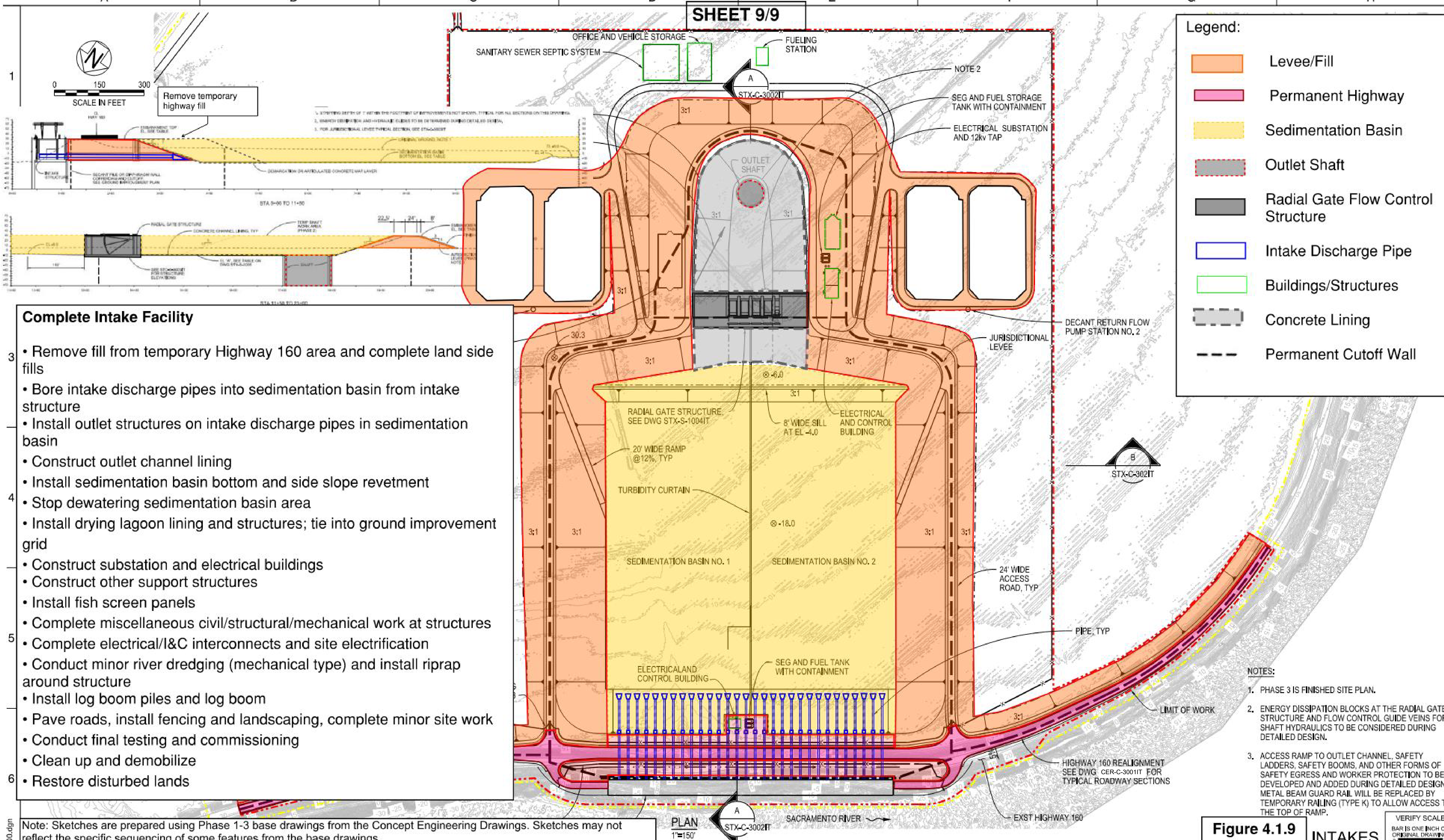
SEP. 2024

REV | DATE | DESCRIPTION | SUB. | APPD

DCA DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

STX-C-1017IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:11:03:58 AM



Complete Intake Facility

- Remove fill from temporary Highway 160 area and complete land side fills
- Bore intake discharge pipes into sedimentation basin from intake structure
- Install outlet structures on intake discharge pipes in sedimentation basin
- Construct outlet channel lining
- Install sedimentation basin bottom and side slope revetment
- Stop dewatering sedimentation basin area
- Install drying lagoon lining and structures; tie into ground improvement grid
- Construct substation and electrical buildings
- Construct other support structures
- Install fish screen panels
- Complete miscellaneous civil/structural/mechanical work at structures
- Complete electrical/I&C interconnects and site electrification
- Conduct minor river dredging (mechanical type) and install riprap around structure
- Install log boom piles and log boom
- Pave roads, install fencing and landscaping, complete minor site work
- Conduct final testing and commissioning
- Clean up and demobilize
- Restore disturbed lands

NOTES:

1. PHASE 3 IS FINISHED SITE PLAN.
2. ENERGY DISSIPATION BLOCKS AT THE RADIAL GATE STRUCTURE AND FLOW CONTROL GUIDE VEINS FOR SHAFT HYDRAULICS TO BE CONSIDERED DURING DETAILED DESIGN.
3. ACCESS RAMP TO OUTLET CHANNEL, SAFETY LADDERS, SAFETY BOOMS, AND OTHER FORMS OF SAFETY EGRESS AND WORKER PROTECTION TO BE DEVELOPED AND ADDED DURING DETAILED DESIGN. METAL BEAM GUARD RAIL WILL BE REPLACED BY TEMPORARY RAILING (TYPE K) TO ALLOW ACCESS TO THE TOP OF RAMP.

Note: Sketches are prepared using Phase 1-3 base drawings from the Concept Engineering Drawings. Sketches may not reflect the specific sequencing of some features from the base drawings.

Figure 4.1.9 INTAKES

DESIGNED B CHELONIS | APPROVAL RECOMMENDED
DRAWN D CORBETT | APPROVAL BY P RYAN
CHECKED J REYNOLDS

SEP. 2024

REV | DATE | DESCRIPTION | SUB. | APPD

DCA DELTA CONVEYANCE DESIGN & CONSTRUCTION AUTHORITY

DELTA CONVEYANCE PROJECT
CONCEPT ENGINEERING REPORT

PHASE 3 SITE PLAN

VERIFY SCALE — BAR IS ONE INCH ON ORIGINAL DRAWING.
PROJECT NO. W8X97000
SHEET NO. CER-C-1018IT
REV | SEQUENCE NO. X

STX-C-1018IT_W8X97000.dgn

PLOT DATE:2021\05\20 PLOT TIME:11:05:57 AM