Subject:	**Intakes Operations and Maintenance Equipment and Facility Needs (Final Draft)**
Project feature:	Intakes
Prepared for:	California Department of Water Resources (DWR) / Delta Conveyance Office (DCO)
Prepared by:	Delta Conveyance Design and Construction Authority (DCA)
Copies to:	File
Date/Version:	December 23, 2021
Reference no.:	EDM_IN_CE_TMO_Intake-O-M-Equip-Facility-Needs_000939_V03_FD_20211223

1. Purpose

The purpose of this technical memorandum (TM) is to identify the site footprint needs for equipment and facilities required for the operations and maintenance (O&M) of the Intake facilities for the Delta Conveyance System (Project). This TM is not intended to be a complete summary of equipment and facilities required O&M, nor is it intended to be a complete description of the O&M requirements for the facility.

1.1 Background

Water diversions at intakes located along the Sacramento River are planned for the Project in the North Delta region between the communities of Freeport and Courtland. These intakes would include several systems to meet regulatory and operational requirements. Key systems needed to meet these requirements would include fish screens, sediment management, and flood control. These systems require a number of operational-focused equipment and facilities to operate and maintain the facilities efficiently.

1.2 Summary of Results

Table 1 summarizes the O&M facilities and equipment required for each Project intake (3,000 cubic feet per second [cfs] capacity), unless otherwise noted.

Table 1. Intake Operational Equipment and Facility Requirements

Functional System	O&M Requirement	Facility and/or Equipment Needs	Comments
Fish Screens and Cleaner	Screen inspections and repairs	Gantry crane with 25-ton hoist and trolley	Assumed max weight to be picked is the tee screen at 15,000 lbs, size to be verified during design.
		Spare screens (5 tee screen units and up to 5 vertical screen panels) Spare Blank panels (15, 3 per screen bay for 5 bays), both screen types Bulkhead Panels: Up to 15 bulkhead assemblies (stop log sets) for face of structure plus 2 bulkhead assemblies for box conduits (total of 17) for vertical plate option; 5 sets of 2 bulkhead assemblies for tee screens and gate structures (total of 10) for tee screen option Spare baffle assemblies (5, complete, vertical plate only).	Assume bulkhead panels for up to 15 bays and two box conduits for vertical plate option and for 5 tee screen units and gate structures for tee screen option. A bulkhead panel assembly consists of stackable stop log sections, size and number per assembly to be determined during design. Assumed that bulkhead assemblies would be required up to 200-year elevation for worst-case scenario. Assume five spare baffle assemblies.
		Spare screen and panel storage facility composed of covered, 12-ft-high exterior CMU wall enclosure with gravel pad, boom truck access, approximate dimensions – 180 ft x 80 ft for vertical flat-plate option and approximately 80 ft x 84 ft for the cylindrical tee screen option. Cover would be moveable and high enough to cover the largest panels. Screen and panel rubber seal protective provisions for exterior storage. Spare screen, baffle assembly, blank panel, and bulkhead panel storage, and transport racks/apparatuses. Tee screen transport frames; one per spare screen, stored at screen storage Screen and panel lifting device(s), stored at screen storage. Portable valve actuator for gate or baffle adjustment. Portable ADV flow meter and all rigging assembly parts Vehicle requirements: Fork lift for moving screens and storage racks.	Storage area would be used for log boom spares, spare fish screens, blanks, baffle plates, slide gates and bulkheads. A mobile crane would be used for loading and unloading panels to transport to their final location. Fork lift required at each intake. Two trailers and one tractor unit to be shared between intakes. Boom truck for sharing between intakes. Work barge for instream work that cannot be undertaken from land side, including approach velocity verification, boom inspections/repairs, for example, launched elsewhere and docked at the intake for the duration of the work. Dock lowered into place with gantry crane or boom truck.

Table 1. Intake Operational Equipment and Facility Requirements

Functional System	O&M Requirement	Facility and/or Equipment Needs	Comments
		Tractor unit with two flatbed trailers for transporting tee screens and panels. 25-ton boom truck crane for lifting tee screens or panels, to transfer to/from the storage location. 30-ft x 12-ft work barge with mini-crane and trailer and a 35-ft x 12-ft modular floating dock. Bridge inspection lift stored in garage.	
	Log Boom	Actual needs depend on design; a few spare booms and hardware would be expected to be stored on site. Store in gate storage enclosure.	
	Screen Cleaning	**Vertical Plate Screens:** Screen cleaner lifting frame (one). Full set of replacement components for screen cleaner. Brushes and counter weights. **Tee Screens:** Brushes (interior and exterior for 5 screen units) **Vehicle Requirements (both screen types):** High-pressure washer on trailer. Boom truck to lift cleaner frame in and out of place (same as for screen/panel transport).	Spare screen cleaner replacement components to include the entire screen cleaner assembly except the lifting device.
	Motor replacement	Spare Sediment jetting pump motor. Tee screen drive motors (six spares).	

Table 1. Intake Operational Equipment and Facility Requirements

Functional System	O&M Requirement	Facility and/or Equipment Needs	Comments
Intake Structure	Isolation for inspection and maintenance	Bulkhead assemblies per Fish Screens entry above Storage racks and yard for storage, combined with screen storage.	
	Emergency Closure	Manual hydraulic mule with portable power actuator for closing gates. Same unit noted above. Emergency backup power supply for closing flood/control gates. Consisting of standby generator within building and separate fuel storage for natural gas.	
	Flow control	Control and isolation gates per engineering concept drawings. Emergency backup power supply (same as noted for Emergency Closure). One spare flow meter of each type (tee or vertical flat plate), including all accessories.	
	Piping (tee screens)	Roof/bridge crane within valve chamber. Tool air system within valve chamber.	Roof crane would be used for moving piping to access hatch for removal from the chamber with the overhead gantry crane.
Box Conduits	Isolation for inspection and maintenance (vertical flat plate)	Control gates, one per box conduit, permanently installed. Six bulkhead assemblies, 3 per box conduit, are required for isolation of one 500 cfs section. Storage racks and yard for storage, combined with screen storage. (Same as for isolation of one 500 cfs section).	Assume bulkhead gate assemblies from Fish Screen structure entry above can be used for this purpose. Gate structure would need to be same width as bulkhead slot on face of structure. Assumed that bulkhead assemblies would be required up to 200-year elevation for worst-case scenario.

Table 1. Intake Operational Equipment and Facility Requirements

Functional System	O&M Requirement	Facility and/or Equipment Needs	Comments
Radial Gates	Isolation for inspection and maintenance	Sixteen 30-ft x 15-ft metal bulkhead assemblies for large gates; four 16-ft x 15-ft assemblies for smaller gates. Storage racks and yard for storage, combined with screen storage. Vehicle requirements: 25-ton boom truck crane for lifting panels, to transfer to/from the storage location. Verify reach during final design.	May be able to use intake bulkhead assemblies.
	Flow control	Two spare radial gate hoist motors, two lifting cables, sacrificial anodes, spare parts.	
	Emergency Closure	Emergency backup power supply for radial gates consisting of standby generator within building and separate fuel storage for natural gas.	
Sediment Management	Sediment jetting	Jetting sediment in front of and inside the intake (vertical flat plate screens) requires spare jetting nozzles for replacing worn or damaged ones. One spare jetting pump. Five (vertical flat plate) or two (tee) spare flow control valves and actuators.	
	Sediment dredging	Permanent dredge piping from sediment settling basins to sediment drying beds, plus decant/underdrain return flow lines. Floating dredging pipes and floats. Small floating dock for operator access. Vehicle requirements: Dredging barge, capable of dredging to basin floor and compatible with maximum dredging rates to be determined during future sediment quantity analyses, safety equipment, life vests. Actual size and type to be determined during design. Dredge trailer. Truck to pull trailer. Size to be verified during final design. Expected to be same as flatbed tractor trailer rigs described above.	Depending on the size of dredge, transportation between storage and intakes would be by a trailer and three-quarter-ton truck, or tractor trailer. Modular dredging equipment is available that can be disassembled, transported from the storage area to the applicable intake, and reassembled at place of use.

Table 1. Intake Operational Equipment and Facility Requirements

Functional System	O&M Requirement	Facility and/or Equipment Needs	Comments
	Sediment removal	Spare underdrain dewatering pump and accessories. Manual actuator for adjustable weir. Spare weir gate parts. Two laydown areas for material staging and loading, each equal to size of one drying basin. **Vehicle requirements (quantity/need TBD—assumed to be contract operation):** 18-cubic yard sediment transport trucks. Front end loader(s). CAT 926M or equivalent (can be rented for summer drying/disposal season). https://www.cat.com/en_US/products/new/equipment/wheel-loaders/small-wheel-loaders.html Truck-loading conveyor(s)/stacker(s). Tractor with disc/harrow for breaking up sediment.	Front end loader and tractor stored in CMU enclosure overnight.
Access and Security		Automatic vehicle gates, where shown on drawings. Security cameras at intake and settling basins (locations TBD). Key card entry for gates and buildings. Short wave radios for onsite communications.	
Electrical/ I&C	Control buildings	Electrical and Control building at intake structure. Electrical and Control building at radial gate structure. Phone and internet service. Uninterruptable power supply for each PLC. Spare PLC (or hot-swap). Spare input/output and communication cards. Spares for instrumentation.	Fuel storage to be bunded and surrounded by CMU wall.

Table 1. Intake Operational Equipment and Facility Requirements

Functional System	O&M Requirement	Facility and/or Equipment Needs	Comments
Site Management	Landscape management	Small utility garage for mowers, trimmer's and landscaping tools.	Assume that no irrigation would be required, drought tolerant plants would be used.
	Site access	Vehicle requirements: Small utility vehicles. Three-quarter-ton truck - Ford F-250 or equivalent.	
	Garage/ warehouse	Storage of boom truck, tractor unit, dredges and trailer, boat and trailer, bridge inspection unit and fork lift. Pressure washer. Three-quarter-ton truck. Fuel storage for vehicles Storage for spare parts and equipment	Intake C-E-3 would be used to house dredges and common vehicles in the offseason. Trailers would be stored in the CMU yard.
	Welfare facilities	Washrooms and locker room. Office with computer station, cable/internet and WiFi. Lunchroom, small kitchen. Water well for potable and raw water supply. Leach field and septic tank.	Water well would also be available for other needs, possibly including landscape irrigation (if needed, see above) and pressure washer water supply.

Notes:
ADV = acoustic Doppler velocimeter
cfs = cubic feet per second
CMU = cement masonry unit
ft = foot/feet
I&C = instrumentation and controls
lbs = pound(s)
PLC = programmable logic controller
TBD = to be determined

2. Methodology

The methodology employed to determine the O&M facility and equipment needs for the Project involved the following:

- Identify the main facility components and their requirements for O&M activities.
- Incorporate feedback from DWR staff
- Estimate material storage area and facility footprints based on equipment required for O&M activities

2.1 Data and Information Sources

The following information was reviewed relative to O&M needs at the facilities:

- Supplier data
  - Radial gate
  - Gate valves
  - Ultrasonic flow meter
  - Dredging barge
  - Fish screen supplier information

2.2 Assumptions

Basic assumptions that apply to identifying and evaluating intake O&M needs include the following:

- Supplier-provided equipment would be operated and maintained in accordance with the supplier's recommendations.
- Number of spare parts would be provided in accordance with the equipment suppliers recommendations.
- Levee inspections would be in accordance with the U.S. Army Corps of Engineers inspection manual and Central Valley Flood Protection Board/DWR current procedures.
- Welfare facilities in accordance with California Employment Law
- O&M staff would not be permanently based at the intake facilities.
- Some equipment would be used at other intakes, as noted.
- Seasonal sediment disposal equipment (trucks, loaders, etc.) would be rented.

3. Analysis and Evaluation

The intakes achieve their primary functions of diverting flows, protecting fish, and managing sediment by using the following key systems:

- Fish screens (vertical flat-plate screens and cylindrical tee screens options would be considered)
- Intake structure
- Box conduits
- Sediment settling basins and drying lagoons
- Radial gates
- Tunnel drop shaft

The following are the ancillary systems and requirements that are required for operating, maintaining, and controlling the primary systems:

- Access and security
- Electrical, instrumentation and control
- General site management

These systems require regular O&M activities to run reliably and efficiently. To achieve this, the following operational equipment and facilities were identified for each of the previously listed primary and ancillary intake systems.

3.1 Primary Systems

3.1.1 Fish Screens

For inspection and maintenance of the vertical flat-plate and tee screens, a gantry crane is required to install and remove the screens, blank panels, bulkhead panels, and baffle panels. A gantry crane would be permanently installed at the intake structure so that the screens, blank screens, bulkheads, and baffle plates could be removed.

The number of spare screens and blanks panels for the vertical plate screens should be enough to replace 5 screen bays. One set per screen bay includes one screen panel and three blank panels for a total of 5 screen panels and 15 blank panels. Spares for the cylindrical tee screens should include 5 spare cylindrical tee screens and associated blank panels (complete with motor and brushes) for replacing a damaged unit while it is under repair.

The number of bulkhead panels for the vertical plate screens should be enough to isolate a single 500 cfs flow section. Up to 17 bulkhead panels assemblies (set of stop logs) are required; consisting of 15 for face of structure plus one each for the two box conduits. A bulkhead panel assembly consists of a set of stackable stop log sections, size and number per assembly to be determined during design. This arrangement would allow the control gate to be worked on inside the intake structure. Double isolation is not required for work inside the intake structure since workers can escape through the roof.

The number of bulkhead panels for the cylindrical tee screens should be enough to isolate 5 cylindrical tee screen systems. This would result in five sets of bulkhead panels assemblies, each set including two panel assemblies for a total of 10. One set of bulkhead panels would be installed on the front of the intake structure and one in the discharge pipe control gate box. Double isolation is required for work inside the discharge pipe since workers cannot escape from the pipe. Since the cylindrical screen system includes a sluice gate on the front of the intake and two in the control gate box, only one bulkhead panel assembly is required at each location.

It is assumed that bulkhead assemblies would be required up to 200-year elevation for worst-case scenario.

For in-place screen inspections of vertical plate screens, a bridge inspection lift would be used from the top of the intake structure; this style of crane provides a stable platform for inspections.

For monitoring the incoming water velocity in front of the screens, a portable Acoustic Doppler Velocimeter (ADV) flow meter would be required to verify that flows do not exceed the permitted approach velocity.

3.1.1.1 Fish Screen Cleaners

Fish screen efficiency would be reduced when the screen becomes fouled by sediment and aquatic growth or vegetation. To prevent flow capacity reduction, a screen cleaner would be required to remove particles stuck to the screen face.

For vertical screens, the cleaner would be a framed structure with a long brush that sweeps back and forth across the screen face; depending on the length of the screen, more than one cleaner could be required. Access would be required to perform maintenance on the cleaner, so the bridge inspection lift would be used for in situ maintenance activities, such as bearing and chain greasing, and instrument replacements. For larger repairs, the cleaner would be removed with the gantry crane and repaired in the shop or on the ground. Typical spare parts to be stored onsite include motors, chains, and brushes. One spare set of a complete cleaner assembly should be provided. A lifting frame would be included for removing the cleaner arm system for repairs or maintenance. The gantry crane would be used for lifting out the cleaning system.

For the tee screens, the brush cleaner would be attached to the cylindrical screen unit, with one set of brushes on the inside of the screen and a second set on the exterior. The entire tee screen would need to be removed for maintenance and repair. This requires that blank panels would be first removed from above the screen and inserted in the guide channel behind the screen to stop the flow, then the tee screen would be lifted out with the gantry crane and fixed at the top of the guide rail or set aside for repair or maintenance. Spare tee screen cleaner parts would include six electric motors and spare brushes for five tee screens.

A high-pressure mobile power washer would be required at the intake to clean the screens once they are removed.

Spare screens and blank panels, spare baffles, and bulkhead panels would be stored within storage frames in a 180-feet by 80-feet gated CMU storage enclosure adjacent to the sediment settling basins. The storage yard would also incorporate a secondary area for power washing the screens. This area could drain to the sediment drying basins. Partial removable covers would be included to prevent ultraviolet damage to the bulkhead seals. Access would be provided by a double gate at both ends and an access road down the middle.

Spare motors, meters brushes, cathodic protection anodes, cables, and other smaller components would be stored in an enclosed storeroom. Screens would be transferred to the intake, using a flat-bed truck. A 25-ton boom truck would be required for loading the screens onto the flat-bed truck. Off-loading would be undertaken with the in situ gantry crane. A fork lift truck would be situated at the storage facility to lift smaller items (single baffles for example) onto the flat-bed truck. Each intake would have its own forklift, but the boom truck would be shared between the intakes and stored at Intake C-E-3.

3.1.2 Intake Structure

3.1.2.1 Cylindrical Tee Screens

The area behind the cylindrical tee screens would include sluice gates for isolation and flow adjustment. Piping would be installed behind the sluice gate and leads to the sedimentation basins. Flow would be monitored with an acoustic flow meter installed on the piping. This equipment would require regular maintenance and inspection.

To isolate the cylindrical tee screens intake, the sluice gate on the piping on the upstream side of the meter chamber would be closed. A bulkhead gate could be installed between the screens and the sluice gate if double isolation is necessary. The sluice gate would be operated using electric actuators, but in an emergency, either emergency back-up power would be available, or in the worst case a portable power actuator for gate actuation would be used to close the gates. Similar to the vertical plate screens, there would also be blank panels that could be used to isolate flow into the intake piping when the cylindrical tee screens are removed for maintenance. The blank panels above the tee screens and the tee screens themselves would be lifted out for maintenance using the overhead gantry crane.

3.1.2.2 Vertical Plate Screens

Metal baffle panel assemblies would be installed inside the structure, and behind the screen panels to adjust the flow velocity at the face of the vertical flat-plate screens. These baffle assemblies would be adjusted so the flow velocity is compliant with the regulatory approach velocity requirements. A portable actuator would be used to adjust the baffle assemblies.

A control gate at the rear of the intake would also be used to control flow entering the box conduits and sedimentation basins.

Bulkheads and drop gates are used to isolate the intake structure with vertical flat-plate fish screens. Fifteen bulkhead panel assemblies on the front of the intake and two assemblies at the (one in each box conduit) would be used to isolate a single 500 cfs section to inspect and maintain the inside of the intake structure. The bulkheads assemblies would be stored within the storage yard in frames. A 25-ton boom truck would be used to lift them onto a flat-bed truck for transport to the intake where the gantry crane would be used to lift them off the truck and lower them into place. Note that double isolation would not be provided at the front (face) of the intakes. The intake structure would be large enough to allow observation of bulkhead panel performance and provide suitable time for personnel to escape if leakage were to be excessive.

3.1.3 Box Conduits

The vertical flat-plate screen intakes convey the flow from the intake structure at the river through large 12-feet by 12-feet box conduits. The conduits can be isolated for inspection and maintenance by one bulkhead panel assembly and roller gate at the back of the intake structure and by two bulkhead panel assemblies in the gate structure near the downstream end of the conduit prior to the outlet into the sedimentation basins. The bulkhead panel assemblies may be the same size as those used to isolate the intake structure and those bulkheads may be suitable for box conduit isolation without purchasing additional bulkheads. If needed, these bulkheads would be stored at the storage yard and transported to the conduits by a flat-bed truck. A 25-ton boom truck would be used to load and unload the gates. Access into the conduits is required to inspect, repair, and replace the ultrasonic flow meters installed inside the box conduits for flow measurement. This type of flow meter does not typically require much maintenance, but when it malfunctions, the whole unit is likely to be replaced. It is therefore not anticipated that spare parts would be kept for this meter, but rather one complete replacement meter for each intake. Double isolation would be provided to enable the repair or replacement of the flow meters.

3.1.4 Sediment Management

Sediment management would be a regular O&M activity at the intakes. For vertical plate screen systems, sediment management starts at the intake where sediment jetting equipment is used to wash sediment out of the intake structure and into the box conduits before it is allowed to settle in the sedimentation basins. Also, jetting in the front of the intakes would be intended to help keep the bottom of the fish screens and screen cleaner devices free of excessive sediment buildup. Jetting pumps feeding a series of sequentially actuated nozzles would be used to flush the sediment through the structure and into the conduits. A spare set of sediment jetting pumps would be required to replace an existing pump that could require periodic maintenance or replacement. Spare jetting nozzles would be required to replace damaged or warn nozzles.

For cylindrical tee screen systems, the velocity through the screen system and piping should be sufficient to keep sediment moving until it reaches the settling basins. So, sediment jetting is only required on the face of the screen structure as shown on the engineering concept drawings.

The sedimentation basin would be used to accumulate and temporarily store sediment to prevent siltation of the downstream tunnels. Sediment stored within the basins would be removed by a hydraulic dredging barge. The hydraulic barge consists of a pontoon-style barge with a hydraulic cutting boom between the pontoons. The cutter could be extended down to the bottom of the basins and enables settled sediment to be removed. The boom would be attached to a hose that floats on the surface and is connected to the drying lagoon piping on the side of the basins. Dredge spare parts such as suction pump, winch cables, cutting head, and other consumables would be required for barge O&M. Safety equipment such as life vests and life rings would be stored on the barge. The dredging barges would be stored when not in use at the central garage at Intake C-E-3 and would be portable or easily broken down for transport to and from the intakes and garage.

In order to dispose of the sediment, it must be first dried. Wet sediment would be pumped into the drying lagoons from the dredging barge, where the excess water is drained from beneath and decanted off the top and pumped back into the main sedimentation basins. A spare pump for pumping the decanted water back into the sedimentation basins would be required.

The dried sediment would predominantly consist of coarse to fine sand and would require offsite disposal. A tractor with a disc harrow would be used to promote drying of the drained sediment. A small, wheeled front loader would load the sediment onto trucks to a holding area and into conveyors and stackers for transferring into trucks for hauling offsite. It is assumed that the tractor and harrow, the loader, the stackers, and the haulage trucks would be contracted as and when needed to dispose of the sediment.

3.1.5 Radial Gates

Four (4) radial gates measuring 30 feet wide by 40 feet high plus one (1) 15 feet wide by 8 feet high gate are used to isolate and control flow leaving the sedimentation basins prior to entering the exit channel to the tunnel shaft. To maintain, inspect, and repair the radial gates, each gate must be capable of being isolated. Bulkhead panel assemblies would be inserted within guide channels on both the upstream and downstream sides to isolate each gate. Bulkhead panel assemblies would be stored in a storage yard adjacent to the channel. Stop log frames would be used for storage, and a 25-ton boom truck would be used to lift the gates onto a flat-bed truck for transportation to the radial gate location. The boom truck (or a rented mobile crane, depending on reach) would be used to insert the logs into the guide channels to isolate the flow. Enough gates would be required to fully isolate the downstream channel. This number of gates would also allow any one radial gate to be isolated on the front and back. For downstream tunnel maintenance, double isolation could be necessary; in this scenario, Bulkhead panel assemblies would be used in addition to the closed radial gates to provide the additional level of safety.

Depending on the type of radial lifting mechanism used, additional spares would be required. Elsewhere within the Delta, electric motors and lifting cables are typically used to raise and lower the gates. In this case, a spare motor would be required as well as spare steel lifting cables. Corrosion prevention in the form of cathodic protection is an important part of gate maintenance, and spare sacrificial anodes would be required for the gates.

Emergency backup power would be required at the radial gates. A diesel or natural gas-powered generator would be housed within the local control building adjacent to the radial gates. The fuel tank would be sited adjacent to the control building with enough fuel for 48 hours' operation.

3.2 Ancillary Systems

3.2.1 Access and Security

Access to the facility would be restricted to authorized personal only; as such, vehicle and pedestrian access gates would require key card entry into the facility. Vehicle gates would be automatic roller type. Office buildings would also require separate key card entry. Main entrances would be covered by closed-circuit television (CCTV) connected to the site office and relayed to a central control room. The site office would be able to open gates and allow people who do not have key card access to enter. Additional CCTV would cover the intake structures and the sedimentation basins.

3.2.2 Electrical/Instrumentation and Controls

Instrumentation and control (I&C) would be located within two small (24 feet by 12 feet) buildings: one at the intake structure and the other at the radial gates structure. These buildings would house the electrical panels and I&C for displaying flow from the ultrasonic flow meters at the intakes and the radial gates. The buildings would also contain a 40-kilowatt (50 horsepower) standby power generator. The control signals would be relayed back to the main site office at each intake.

The entire sites on each side of Highway 160 would have perimeter security fencing. Site surveillance cameras would be provided. Specific height, fence type, possible aesthetic features and surveillance system details would be determined during final design.

3.2.3 Site Management

The intake facility has several supplementary O&M requirements to maintain the facility's aesthetics and for the welfare of the operational staff and visitors.

Landscape maintenance is required to maintain the intake's visual appearance. This includes maintaining grass, shrubs, and trees and mowing grassed areas. Drought-resistant grasses and shrubs would be used to avoid the need for an irrigation system.

A 2000-square foot (sq. ft.) fuel storage yard would be required at each intake for refueling of O&M vehicles.

The welfare of the operators and visitors is important to maintaining a healthy working environment. The intakes would require a separate building approximately 3000 sq. ft. that would include washrooms, a locker room, a lunchroom, and an office with internet and WiFi. Adjoining the office building would be a storeroom and workshop with tools and other equipment for undertaking minor repairs. There would be a vehicle bay for maintenance or repair of small equipment.

Intake C-E-3 would include a garage facility to store materials and equipment that would be shared between the intakes. The garage facility would be repurposed from the construction fire station facility and would include offices and storage rooms in addition to storage bays for the dredges, boom truck, barge, and vehicles.

4. Conclusions and Recommendations

For successful O&M of the intake facility, provisions should be made for including the items listed in Table 1 as part of the Project.

5. Document History and Quality Assurance

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

Approval Names and Roles			
Prepared by	**Internal Quality Control review by**	**Consistency review by**	**Approved for submission by**
Mark Draper / EDM Project Engineer	Phil Ryan / EDM Intakes Lead and Design Manager	Gwen Buchholz / DCA Environmental Consultant	Terry Krause / EDM Project Manager

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

Note to Reader

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