Constructability Analysis Technical Memorandum

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Date:	February 22, 2021
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Subject:	Constructability Analysis - Draft Task Order No. 2, Task HR53

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Acronyms and Abbreviations

Alt	Alternative
ATF	Federal Bureau of Alcohol, Tobacco, and Firearms
Authority	Sites Project Authority
Cal/OSHA	California Department of Industrial Relations, Division of Occupational Safety and Health
Caltrans	California Department of Transportation
CCR	California Code of Regulations
cfs	cubic feet per second
CY	cubic yards
DSOD	State of California Department of Water Resources, Division of Safety of Dams
DWR	California Department of Water Resources
ERS	Emergency Release Structure
ft	feet
GCID	Glenn-Colusa Irrigation District
HP-HRS	horsepower-hours
I/O	Inlet/Outlet Works
MAF	million-acre-foot
MSHA	Mine Safety and Health Administration
MUTCD	Manual on Uniform Traffic Control Devices
NMWS	normal maximum reservoir water surface
TCCA	Tehama-Colusa Canal Authority
TM	technical memorandum

1.0 Introduction

1.1 Project Overview and Reservoir Alternatives

The Sites Project Authority (Authority) is preparing a feasibility-level evaluation for a 1.5-million-acre-foot (MAF) reservoir as a preferred alternative ("Alternative 1") for the Sites Reservoir Project. The principal storage feature of the Project is Sites Reservoir. Figure 1-1 shows the location of Sites Reservoir, and the various dams, roads, and other features to be constructed to form the reservoir. Sites Reservoir would have a nominal storage capacity of 1.5 MAF. Table 1-1 outlines key aspects of Sites reservoir for the reservoir engineering (HR) contract.

Table 1-1. Sites Reservoir

Total Storage Capacity	1.5 MAF
Active Storage Capacity	1.4 MAF
Approximate Inundation Area	13,200 acres
Dam/Saddle Dam Crest Elevation (Without Camber)	517 feet
Normal Maximum Reservoir Water Surface Elevation	498 feet
Minimum Operating Water Elevation	340 feet
Top of Dead Pool Elevation	300 feet
Inlet/Outlet Facilities Conveyance Capacity:	
Tehama-Colusa Canal	2,100 cfs
Glenn-Colusa Irrigation District Canal	1,800 cfs

cfs = cubic feet per second
MAF = million acre feet

The reservoir boundaries and water surface elevations provided in Table 1-1 are based on topographic information provided by the California Department of Water Resources (DWR) for their use on the project. New topographic information will be obtained for the reservoir site in future phases of the project. The information provided in Table 1-1 should be verified when the new surveys are completed.

Sites Reservoir construction would require relocating Sites Lodoga Road prior to the Sites Dam construction. Other new paved or unpaved roads would also be provided to access project facilities from existing roads, and for operation and maintenance access between main dam and saddle dam areas.

In the reservoir area, demolition and removal of the town of Sites and other ranch buildings within the reservoir area would be required, along with the removal of metal fencing, asphalt-concrete paving, overhead utilities, and other buildings. Water wells would be closed, septic tanks would be removed, and proper plugging of existing gas exploration wells would be verified. Trees would be removed within one foot of grade in all areas located below the normal maximum operating water surface (NMWS). Stumps will not be removed.

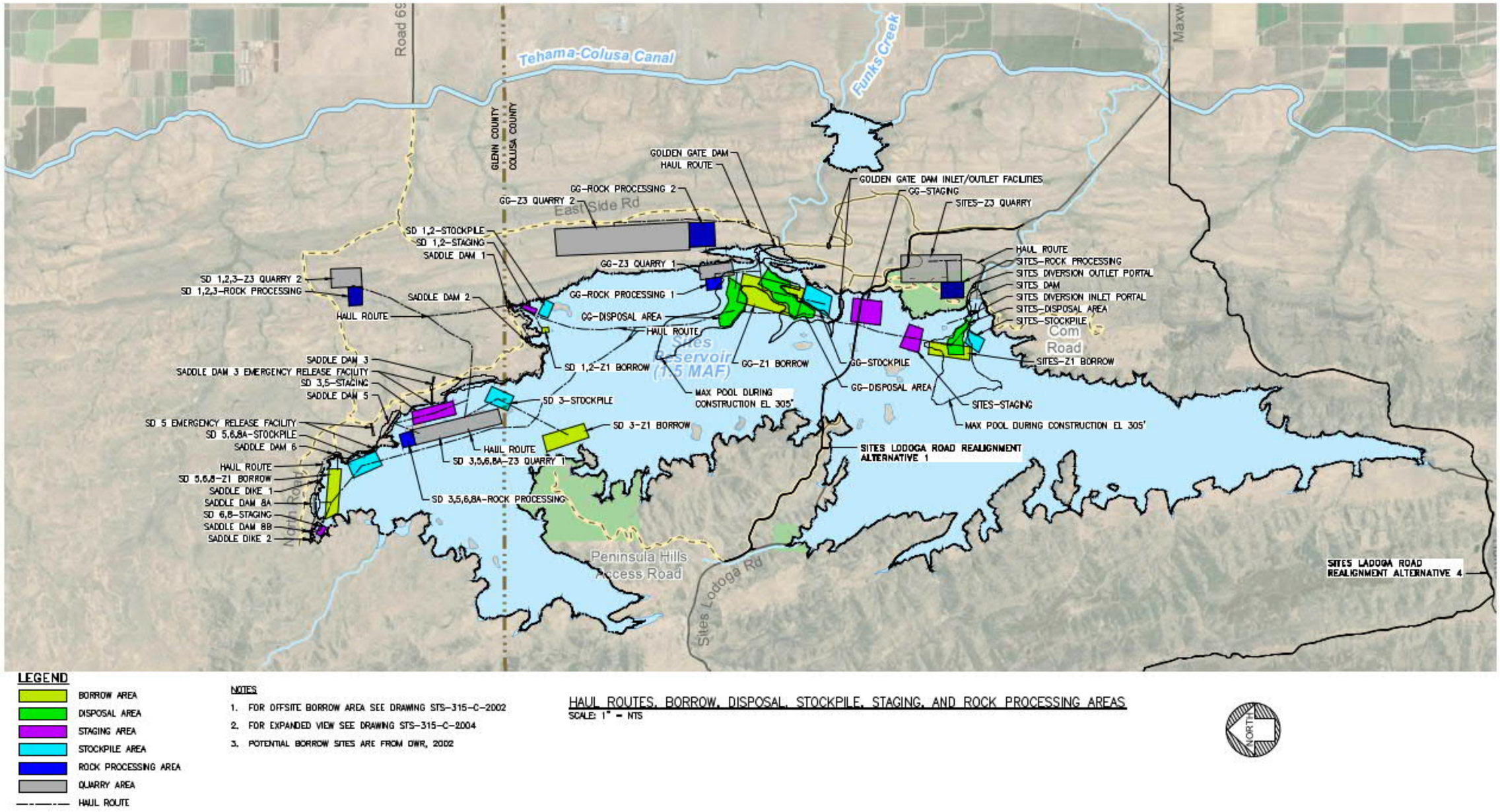


Figure 1-1. Haul Routes, Borrow, Disposal, Stockpile, Staging, and Rock Processing Areas

This technical memorandum (TM) reflects the constructability considerations for the following reservoir (HR) facilities (Figure 1-1). The key dimensions of the facilities are included in Table 1-2.

- Main Dams, Saddle Dams and Dikes, and Reservoir Rim: The Sites Reservoir dams include two main dams, Golden Gate Dam on Funks Creek and Sites Dam on Stone Corral Creek, and saddle dams and dikes on the reservoir rim on tributaries to the Hunters Creek drainage.
- Spillway: This structure is a concrete overflow spillway located at Saddle Dam 8B that would discharge into Hunters Creek to the north.
- Inlet/outlet (I/O) Works: These facilities include a vertical tower with multiple intake levels connected to two inlet/outlet tunnels. These provide for normal reservoir operation and for making the major portion of emergency reservoir releases that will be required by DSOD as part of dam permitting. The tunnels connect to reservoir conveyance pipelines (HC) at the downstream tunnel portal.
- Sites Dam Outlet Works: This outlet works tunnel would be located in the north abutment of Sites Dam; it would be used initially for construction diversion for both main dams and subsequently for stream maintenance and a portion of the emergency reservoir releases to Stone Corral Creek after construction.
- Emergency Release Structures: These structures provide emergency release capacity to supplement the release capacities at the I/O Works and Sites Dam tunnel. They include intakes and tunnels located at Saddle Dams 3 and 5 for Alternative 1 only; they would discharge to Hunter's Creek tributaries on the north side of the reservoir.

Table 1-2. Reservoir Facility Descriptions

Reservoir Elevation at full pool (feet)	498.0
Reservoir Area at full pool (acres)	13,200
Dam / Dike Crest Elevation (feet) (without camber)	517.0
Main Dams	2 main dams – see below
Saddle Dams	7 saddle dams and 2 saddle dikes – see below
Dam / Dike:	Max. Ht. Above Streambed / Crest Length (ft)
Golden Gate Dam	287 / 2,221
Sites Dam	267 / 781
Saddle Dam 1	27 / 318
Saddle Dam 2	57 / 250
Saddle Dam 3	107 / 3,422
Saddle Dam 5	77 / 1,894
Saddle Dam 6	47 / 362
Saddle Dam 8A	82 / 1,300
Saddle Dam 8B	37 / 475
Saddle Dike 1	12 / 122
Saddle Dike 2	12 / 198
Saddle Dike 3	Not required
I/O Tower	Top elev. 558 ft. 258 ft high / 7 elevations to draw water from reservoir
I/O Tunnels	Approx. 3,110 ft long/Dual 23 ft Internal diameter tunnels

Sites Diversion/Outlet Tunnels	Approx. 1,590 ft long/12 ft internal diameter tunnel
Emergency Release System (on north rim)	Two emergency release systems located at Saddle Dams 3 and 5
Spillway	Weir crest length = 85.5 feet, crest elevation = 504 feet

Alt = Alternative
ft = feet
I/O = Inlet/outlet works
MAF = million acre feet

- Creek Diversions during Construction: The Sites Dam outlet works (above) would be used for diversion of flows to Stone Corral Creek during construction. A 4-foot diameter steel pipe encased in reinforced concrete in the foundation of Golden Gate Dam would be used to divert flows to Funks Creek; the steel pipe would be plugged with concrete at the completion of construction.
- Roads: Roads include local roads (recreational use and public access), maintenance roads, and construction access roads.
- Bridges: Two bridges crossing the reservoir (lengths of 1,400 feet and 1,633 feet for the west bridge and east bridge, respectively) with fill prisms, providing an east-west connection from rural communities of Maxwell, Lodoga, and Stonyford for Alternative 1 only.

1.2 Purpose and Scope

The purpose of this TM is to demonstrate that the project can be constructed with existing technology and available construction materials, work force, and equipment and includes the following:

- Description of County coordination and approval process to demonstrate public acceptance.
- Development of material balance diagram for the dams showing borrow material sources (on- or off-site) and their available volumes, locations of placement within the dams and their required volumes, disposal, and shrink and swell factors.
- Equipment use tables (including schedule and duration of use).
- Construction sequencing plan and construction schedule for the facilities within the HR contract. The constructability analysis will demonstrate the ability to provide public benefits by 2030.
- The work force staff and equipment needs estimated over the construction period for facilities within the HR contract.

1.3 Limitations

The scope of work for this TM was restricted to the development of the constructability analysis for the Sites Reservoir under the Reservoir (HR) contract. Conveyance facilities are separately considered in a companion TM for the HC contract.

The information presented in this TM is based on study-level topographic maps that originated from DWR for their 2003 studies. Updated site-specific design-level topographic maps will be prepared for use in preliminary and final phases of design.

AECOM represents that our services were conducted in a manner consistent with the standard of care ordinarily applied as the state of practice in the profession, within the limits prescribed by our client.

This TM is intended for the sole use of the Sites Project Authority. The scope of services performed may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or of the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

2.0 County Coordination and Approval Process

The central and southern portions of the reservoir and associated facilities are located within Colusa County, including the main dams, I/O Works, and the Sites Lodoga road relocation. The northern portion of the reservoir falls within Glenn Country, including the saddle dams and County roads providing access to the north end of the reservoir. Coordination with both Counties will be required throughout the upcoming design and construction phases of the project. Some project features also fall within Yolo County, but County coordination for these falls within the HC Contract.

To date, Colusa County has been the primary contact for coordination and has been representing Glenn County when necessary. There is no agreement between the Counties regarding representation going forward. For this reason, it should be assumed that coordination will be required with both Counties separately unless the Counties enter into a partnering agreement.

Coordination with the Counties will be needed for the following design and construction activities:

- Establishing design criteria for all public roads to be constructed or upgrades to support project construction and operation.
- Obtaining approval of designs and all required County Permits needed for construction that are the responsibility of the owner.
- Obtaining County permits for installing and abandoning existing and new water wells.
- Obtaining County permits for demolition of structures and management of hazardous waste materials.
- Obtaining County permits for abandoning and demolishing septic tanks and leach fields.
- Obtaining County permits for drilling geotechnical borings and installing groundwater monitoring wells when the work is located within County right-of-way.

There are other potential coordination aspects that may be required, but clarification from the Counties would be needed as indicated below:

- Need for building permits for the construction and removal of temporary office complexes located outside the project limits, including the renovation of existing buildings for that purpose.
- Need for building permits for the operation and maintenance buildings and warehouse.

3.0 Public Interface and Site Safety

3.1 Public Interface

Construction of the Sites Reservoir and its various facilities will involve approximately 6 years of regularly transporting construction equipment and materials on public roadways leading to the site. The anticipated increase in traffic in the rural area of the project warrants special planning. The Authority is taking measures for the appropriate conveyance of construction traffic considering the safety and convenience of the traveling public. Construction access routes to the site have been defined to avoid the community of Maxwell as described below. Narrow, rural public roadways impacted by the project would be reconstructed and widened as a first order of work to accommodate the increase in traffic volume and size.

The portion of Sites Lodoga Road inundated by the reservoir would be realigned with bridges, and a causeway would be constructed across the reservoir and open to traffic prior to closing the existing road. If it is determined that construction should be accelerated, a temporary detour route has been

identified that would be constructed to convey public traffic around the construction of the Sites Dam while the dam and realigned Sites Lodoga Road are being constructed. Huffmaster Road is a gravel road that will be realigned, but without the time and construction sequencing sensitivities as Sites Lodoga Road. Each of these realignments will involve minor traffic impacts when the new roadway is conformed (tied-in) to the existing roadway. This minor traffic impact will be managed with single lane traffic control and flaggers during construction hours with all lanes being opened to traffic during the non-construction hours.

Traffic control measures involving public traffic will be per the Manual on Uniform Traffic Control Devices (MUTCD).

3.2 Site Safety

The contractor is responsible for means and methods to complete the work safely and is required to provide for public safety and to provide safe access for inspection and to Authority employees.

California Code of Regulations, Title 8 (CCR Title 8) and California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA) would have overall jurisdiction regarding project safety, including tunneling. Mine Safety and Health Administration (MSHA) would have jurisdiction over quarry operations. Federal Bureau of Alcohol, Tobacco, and Firearms (ATF) would have jurisdiction over the handling of explosives related to blasting of excavations, including quarries.

Work around construction equipment requires special precautions and the contractor will be required to provide and maintain equipment as required by CCR Title 8.

There are abandoned gas wells within the reservoir area. Locations are based on current data provided by the California Division of Oil, Gas, and Geothermal Resources (now Geologic Energy Management Division). Early in construction, proper closure of these wells would be verified to insure worker and reservoir safety. List of wells would also be periodically verified as reservoir design continues.

4.0 General Considerations

4.1 Procurement Packages

Procurement packages should divide the work in a manner that considers market conditions, resource availability, and bonding considerations, and is conducive to concurrent construction of dam packages. The construction procurement strategy and program should also recognize the need for participation from large, national and international contractors with adequate resources to complete the anticipated work. The procurement strategy should consider contractor prequalification and proposals as necessary to provide for contracting with constructors who are qualified for the work involved and should anticipate adequate time in the procurement schedule.

For the purposes of this constructability analysis, and considering the site arrangement, contractor resources, and work type, potential contract packages were anticipated as follows:

- Roadway construction contracts as Design-Build Contracts, possibly numerous contracts grouped logically by road type, location, and overall Sites Reservoir program schedule;
- Golden Gate and Sites Dams, including Golden Gate and Sites Bypass Facilities (Funks Creek and Stone Corral Creek);
- Inlet/Outlet Facilities, including the approach channel; and
- Saddle Dams, including Emergency Release Structures and Spillway Structure 8B.

The dams and inlet/outlet facilities would likely be contracted as design-bid-build delivery methods.

4.2 Site Access

Initially, construction efforts will concentrate on providing early access to critical path elements, such as accessing the route for the realigned Sites Lodoga Road across the reservoir including bridge foundation areas from existing roads, and accessing the Inlet-Outlet Facility Portals and the Golden Gate Dam Foundation area. This access would initially be provided via improved existing "jeep" trails and ranch roads from near Funks Reservoir and from the existing Sites Lodoga Road. This early primary access would involve initial improvements sufficient for limited heavy equipment required for the first excavation stages of construction of these critical elements.

Similarly, access to the northern end of the project would initially be provided on existing roads, including County Road 68, County Road D, and County Road 69, and along existing ranch roads and jeep trails. This would include sufficient improvements to allow heavy equipment to access the Saddle Dams and associated facilities. Early improvement work could include improvements to the existing TCCA and GCID canal bridges or replacement (was assumed in schedule) of these bridges that would allow heavy equipment to reach the site.

Construction of an optional temporary public detour of a portion of the Sites Lodoga Road, connecting to Peterson Road, in order to reroute public traffic from the existing route, would reduce construction schedule risk . This would allow for improved access to the abutments of Sites Dam such that foundation excavation can begin, as well as development of the Sites Diversion portals. This detour route will include a new intersection with Peterson Road, near to or north of the existing intersection of Peterson Road and Sites Lodoga Road.

4.3 Public Access and Traffic Routing

An objective of the traffic handling strategy will be to avoid the comingling traveling public with construction activities and avoid public interface with heavy off-road equipment, and to minimize public interface with other construction equipment required on public roadways. One significant public interface is the delivery of commercial, off-site aggregates to the project. These include dam filter and drain materials, as well as concrete and asphalt aggregates. Haul routes for these materials would include the use of Delevan Road/McDermott Road/Maxwell Sites Road and County Roads 68, D and 69. These routes would need to be improved and maintained sufficiently during the course of construction such that public traffic and gravel trucks can safely use the roadways together. Meeting environmental mitigation measures will be an important consideration in planning and constructing existing County roads to be used to access the north end of the reservoir.

4.4 Weather Considerations

It is anticipated that wet winter weather will slow down some construction activities, with more impact on some items and less on others. The highest impact would be placement of the Zone 1 Core material as this material is fine grained, and sensitive to moisture. Other activities, such as Dam Foundation Excavation, Zone 2 Filters, Drains, and Transition, Zone 3 Rockfill, and Zone 4 Random will be more tolerant to wet weather. However, zoned dam embankments such as those on the Sites Reservoir project are placed with all zones to a common elevation, meaning that each zone is dependent on adjacent zones for advancement. If Zone 1 Core materials are stopped due to weather, Zones 2, 3, and 4

would be stopped similarly, although a portion of Zone 3 could be placed in the upstream shell zone. There is a potential that DSOD may require a shutdown during wet winter weather.

Wet winter weather can also restrict the construction of the causeway fill prisms or other roadway embankments as the compaction requirements may be unattainable as soils exceed their optimum moisture content for compaction.

The construction schedule included in this report does not attempt to show winter block-out periods, but the overall durations used in the schedule reflect some double shifting during dry periods, particularly of the Zone 1 Clay Core to compensate for winter conditions when this work would be shut down.

Night or second-shift work, as well as Saturday work, would be employed for logistics reasons during summer as well as weather make-up. An example of this would be to place Zone 1 Core material and Zone 2 Filter and Drain materials during day shift, and place Zone 3 Rockfill and Zone 4 Random fill at night. As the dam section changes with height and relative proportion of materials, the strategy would be adjusted.

The Golden Gate and Sites Dam foundations will be slightly weathered to fresh bedrock at the impervious core zone and chimney filter zones. These foundation conditions will have some tolerance to wet weather, such that grout cap and grouting work could continue through the winter, although there would be shutdown periods during storm events. The Saddle Dam core and chimney filter foundations are on moderately weathered bedrock that likely will not be as weather-tolerant as the slightly weathered foundation at Golden Gate and Sites Dams.

Portal Excavation and Tunneling will be somewhat tolerant to inclement weather. The Golden Gate and Sites diversions, including the associated cofferdams, would need to be commissioned during the drier periods to avoid creek flows at that time.

4.5 Environmental Impacts and Impacts On Construction

It is beyond the scope of work for this TM to provide a detailed evaluation of environmental impacts due to construction; this is addressed by others. Project planning will need to consider protection of species, such as nesting birds. A strategy of brush and tree clearing or netting of trees prior to nesting season could be employed to deter nesting birds, which otherwise could impact construction. Giant Garter snake habitat is potentially present and work adjacent to creeks and drains needs to be considered as well.

Dust control measures, similar to those employed on similar civil construction works, would be implemented. These would include gravel plating of haul roads, use of dust suppressants or surfactants on haul roads, water applied to haul roads, spray bars and dust catchment systems on aggregate processing equipment and batch plants, and other measures. Stockpiles and other open sources of fugitive dust would likely require temporary seeding. Air monitoring stations would be utilized.

Dewatering operations may need to employ an on-site treatment facility that will likely include settling basins with treatment for oil/grease, settable solids, pH, and turbidity. It is assumed for this TM that treated water from the settling basins would be used for on-site dust suppression or discharged to Funks or Stone Corral Creek. Final disposition of water from dewatering operations will be developed in agency consultations and through mitigation measures for the project.

Existing asphalt salvaged from roadway construction would be pulverized and utilized in roadway construction. This would be accomplished utilizing rotomills, asphalt reclaimers, as well as asphalt

recycling and crushing equipment at salvaged asphalt stockpiles. The processed materials would be used as road base, but would not be used for new asphalt concrete surfacing.

4.6 Site Staging

Staging areas will be required for various activities, including office facilities, field lab facilities, material storage, equipment maintenance, aggregate production and stockpiling. Some staging areas within the reservoir area have been identified, while others likely will need to be identified in areas outside the reservoir. These would include staging for public roadway/bridge construction and downstream portals for the Inlet/Outlet Facilities, Emergency Release Structure (ERS) ERS-1, ERS-2, and the Sites Diversion. Typically, staging areas would be plated with crushed aggregates from commercial sources or processed on-site materials.

Haul routes would be constructed between various elements, including site access points, quarry and borrow areas, and staging areas. Typically, haul routes would be plated for all-weather use. Plating would be with crushed aggregates from commercial sources or processed from on-site materials. Construction-related traffic would use designated routes, both within the project limits and on public roadways. Within the project limits, heavy equipment haul routes would be separate from light equipment and personnel vehicle travel routes as a matter of site safety. All construction contractors will be required to submit and receive approval for all staging and temporary haul routes.

4.7 Geotechnical Construction Considerations

One of the more significant geotechnical challenges will be the production of rockfill from the quarries. The harder fresh sandstone materials desired for rockfill are interbedded with undesirable weathered sandstone and mudstone. These beds are at an inclination of roughly 50 degrees and will need to be excavated and either wasted or used as Zone 4 Random embankment fill, as the rockfill materials are mined. The contractors will need to develop a strategy involving multiple mining faces in order to continuously expose and mine sandstone for rockfill. Drilling and blasting of the mudstone/sandstone interbeds will need to consider preservation of the better sandstone materials.

Dam foundation grouting operations are anticipated that would consist of a two-row grout curtain, with one row of consolidation holes upstream and one row downstream of the curtain holes. The rows would parallel the dam centerline, and be spaced 10 feet apart. In addition, a 40-foot-wide by 3-foot-thick concrete grout cap was included to mitigate surface leakage of grout during grouting of the upper stage.

Each row of consolidation and curtain grout holes would consist of mandatory primary and secondary holes spaced at 10-foot centers. In addition, it was assumed that tertiary holes (between the primary and secondary holes) would be required over half the length of the dam to meet grout closure criteria. Consistent with dam foundation grouting practices, the drilling depth of consolidation holes was estimated to be one-quarter the height of the dam, with a minimum depth of 50 feet. In addition, the drilling depth of curtain holes was estimated to be one-half the height of the dam, with a minimum depth of 100 feet. Water pressure testing will be completed in all grout holes prior to grouting. Additional grout verification holes will be installed as part of accepting the grouting in areas of the foundation. Grouting will begin at the low point of the core trench excavation an proceed up slope up the abutments. Once grouting is proceeding up the abutments, earthwork placement within the core trenches can begin with DSOD approval.

It is anticipated that dewatering will be required in the deeper portions of the dam foundations at the valley bottoms. Dewatering may include a combination of perimeter dewatering wells and sumps within the excavations. Dewatering water would be pumped to upstream basins for later use.

Construction of the causeway across the reservoir will involve large fill prisms constructed on native ground that may involve compressible alluvial material which could limit the location/limits of the prisms or introduce preconsolidation settlement periods into the construction schedule, which are not currently reflected.

4.8 Cost and Schedule Risks

There are a number of risks that could adversely affect cost and schedule and include the following:

- Administrative milestones, permitting, geotechnical investigation, engineering and design, agency (DSOD) approvals, and environmental permitting;
- Real estate acquisition;
- Delays in procurement;
- Protective species work windows or mitigation measures;
- Cultural clearing and accommodation for tribal cemetery and other cultural resources;
- Delays in access or access improvements;
- Insufficient or unqualified labor force due to regional economy, labor disputes, or other factors;
- Unsatisfactory contractor performance, lack of experience or resources;
- Insufficient construction water availability;
- Insufficient availability of off-site materials for filters, drains, transition, and concrete aggregate;
- Unexpected foundation conditions requiring deeper excavations;
- Adverse weather conditions beyond those normally experienced at this site;
- Dam foundation grouting could take longer than anticipated thus delaying embankment construction;
- Unexpected tunneling ground and dewatering conditions;
- Difficulties in developing and processing material from on-site borrow areas and coordination of borrow areas between contractors on different contracts; and
- Unavailability of heavy construction equipment for the project due to other competing large projects in the State or region.

4.9 Site Utilities and Power

Power supply is currently limited at the project. Various project elements will require permanent electric power service brought to the site, but likely would not be of the same capacity or to the same areas in time for construction use. It may be possible for permanent power service to be brought to the site in order to service major facilities, such as aggregate processing equipment or office and shop facilities. However, it is anticipated that generators of various capacities would be needed.

4.10 Construction Water

The project will rely on early development of construction water sources. Water for construction use will be obtained from numerous sources due to the size of the project footprint. Within the 13,200 acre reservoir footprint (Alternative 1), water would be obtained from existing private wells that will be acquired along with property by the Authority. The Authority should seek to acquire water from nearby local water purveyors (ditches, canals, and wells) and possibly local landowners (wells) for use in the construction of roads. Excavation dewatering operations will also provide a source of construction water.

Construction water uses include moisture conditioning of fill materials, batching concrete, grouting, and dust suppression for haul roads, stockpiles, disposal areas, quarries, and borrow areas. The average volumes of construction water for reservoir construction are estimated to be on the order of 750,000 to 1,000,000 gallons per day.

Water used for construction purposes would also be transferred to the facility footprints from the GCID Main Canal, by trucks and/or temporary pipelines. The pipelines are not expected to be buried except at crossings of heavily trafficked areas, where they may be installed several feet below ground surface.

It is assumed for the purposes of this analysis that more water may be used from existing or new groundwater wells than surface water for the reservoir facilities located within the Antelope Valley. Because the groundwater quality within Antelope Valley is variable, it may not be fully suitable for use in some construction activities (e.g., mixing concrete). Water for grout and concrete will come from wells or the GCID canal meeting potable water standards.

5.0 Site Materials and Use / Material Balance Diagrams

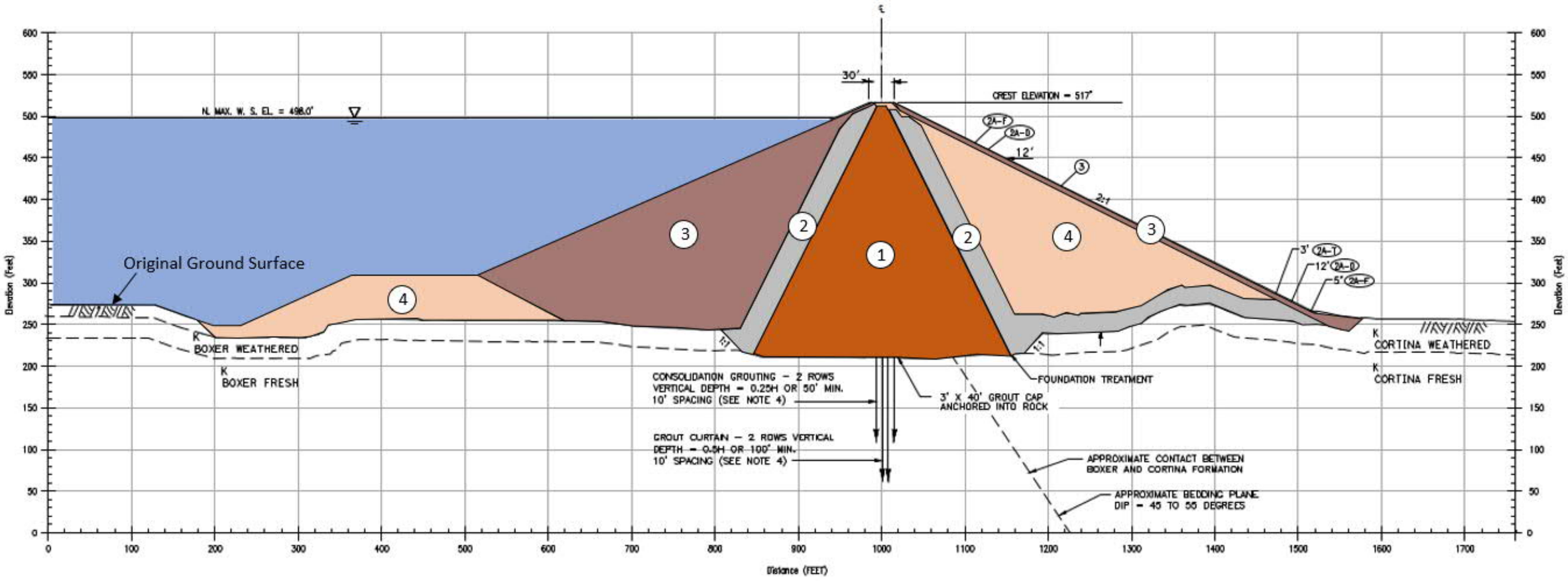
5.1 Dam Section

The proposed dams comprising the Sites Reservoir would be constructed as zoned earth and rockfill embankment dams using four general types of fill materials: Zone 1 impervious core materials that include fine-grained materials; Zone 2 filter, drain, and transition materials; Zone 3 rockfill; Zone 4 random materials; and riprap.

A typical main dam section is provided in Figure 5-1 showing the dam zones. Upstream of the impervious core (Zone 1) material, a 30-foot wide zone of filter and transition materials (Zones 2) are included for compatibility between the core and rockfill shell (Zone 3). Downstream of the core, two 15-foot-wide zones of filter and drain materials (Zone 2) are included for filter compatibility between embankment materials, to provide control of embankment seepage, and to prevent piping of the core material. The downstream embankment section also incorporates a 20-foot-thick blanket of filter, drain, and transition (Zones) to control foundation seepage and to provide for seepage collection at the downstream toe. Shell materials consist of rockfill (Zone 3) upstream and random materials (Zone 4) downstream. A 4-foot-thick zone of riprap is included for upstream slope protection. A 12-foot-wide rockfill material (Zone 3) is included along the downstream slope of the random shell material (Zone 4) for erosion protection. Zone 1, 3, and 4 materials would be obtained from on-site borrow areas and quarries. Zone 2 materials would be imported from off-site commercial sources.

5.2 Borrow Areas and Quarry Sources

It is anticipated that earth and rockfill for the reservoir facilities (approximately 80% of materials required) would come from onsite sources, and aggregate that includes filter, drain, transition materials, and concrete aggregate (approximately 20% of material required) would be obtained from offsite commercial sources (e.g., Orland Sand & Gravel and/or Butte Sand and Gravel). On-site rock quarries were identified from previous work by DWR and appear to be adequate to provide the required quantities of material based on limited available geotechnical data. This will need to be verified through future geotechnical investigations



Zone① Core
Zone② Upstream and Downstream Filter, Drain, and Transition
Zone③ Rockfill and Riprap
Zone④ Random

Figure 5-1. Typical Embankment Section (Golden Gate and Sites Dam)

5.2.1 Onsite Borrow Areas, and Quarries, and Rock Processing

The on-site borrow areas and quarries include alluvial materials for the earthfill portion (Zone 1 core) of the dams and rock quarries for the rockfill portion (Zone 3) of the dams. Approximate locations of the borrow areas and quarries are shown on Figure 1-1. There are four alluvial borrow areas identified within the reservoir, two rock quarries and rock processing areas identified within the reservoir, and three rock quarries and rock processing areas identified outside the reservoir inundation area.

It is assumed all riprap materials and rockfill materials would be sourced from the following quarry locations:

- Saddle Dam Rockfill Quarries: There are two rockfill quarries for Saddle Dams. SD3,5,6,8A-Z3 Quarry 1 located inside the reservoir and SD 1, 2, 3-Z3 Quarry 2 located outside the reservoir. Neither of these are existing quarries, and they would need to be developed by the Contractor.
- Golden Gate Rockfill Quarries: There are two rockfill quarries for Golden Gate Dam. GG-Z3 Quarry 1 located inside the reservoir and GG-Z3 Quarry 2 located outside the reservoir. Neither of these are existing quarries, and they would need to be developed by the Contractor.
- Sites Dam Rockfill Quarry: There is one rockfill quarry for Sites Dam. Sites-Z3 Quarry located outside the reservoir. This is not an existing quarry, and it would need to be developed by the Contractor.

After the completion of project construction, the three quarries outside the inundation area would be decommissioned and regraded, including installing perimeter fences and grading slopes to promote positive drainage from the quarry bottoms. Revegetation would occur at the bottom of the quarries and not along the slopes because of the steepness and substrate (i.e., rock) of the quarry slopes. The three quarries would be visible after project construction.

5.2.2 5.2.2 Offsite Quarries

High quality sand and gravel would be needed for filter, drain, and transition materials in the dam embankments and for concrete structures (e.g., spillway on Saddle Dam 8B, I/O Works). Figure 5-2 shows the general locations of the offsite quarries. The primary sources of aggregate in the region are alluvial deposits associated with historical/abandoned river channels. The contractor(s) would have discretion over the source locations of the aggregate and for the purposes of this analysis it is assumed that all aggregate would come from existing active locations (Email Confirmation from L. Warner-Herson, October 16, 2020). There are several potential offsite sources of aggregate:

- The Willows/Orland Quarries, located in Glenn County, which contain multiple existing active and inactive mining locations, stretched between the towns of Willows and Orland, and are approximately 35 miles north of Sites Reservoir.
- Butte Sand and Gravel, located in Sutter County, which consists of a single mining location, is on SR 20 near the town of Sutter and is approximately 30 miles east of Sites Reservoir.

The Willows/Orland Quarries have sand and gravel mines that are sourcing material from the historical/abandoned channel of Stony Creek, which has an estimated capacity in excess of 160 million cubic yards, DWR (2003). As such, existing active mines in this area could potentially provide a source of aggregates for the project. Aggregate from the Willows/Orland Quarry area has been used by local batch plants for making concrete. Butte Sand and Gravel is a permitted, operating quarry.

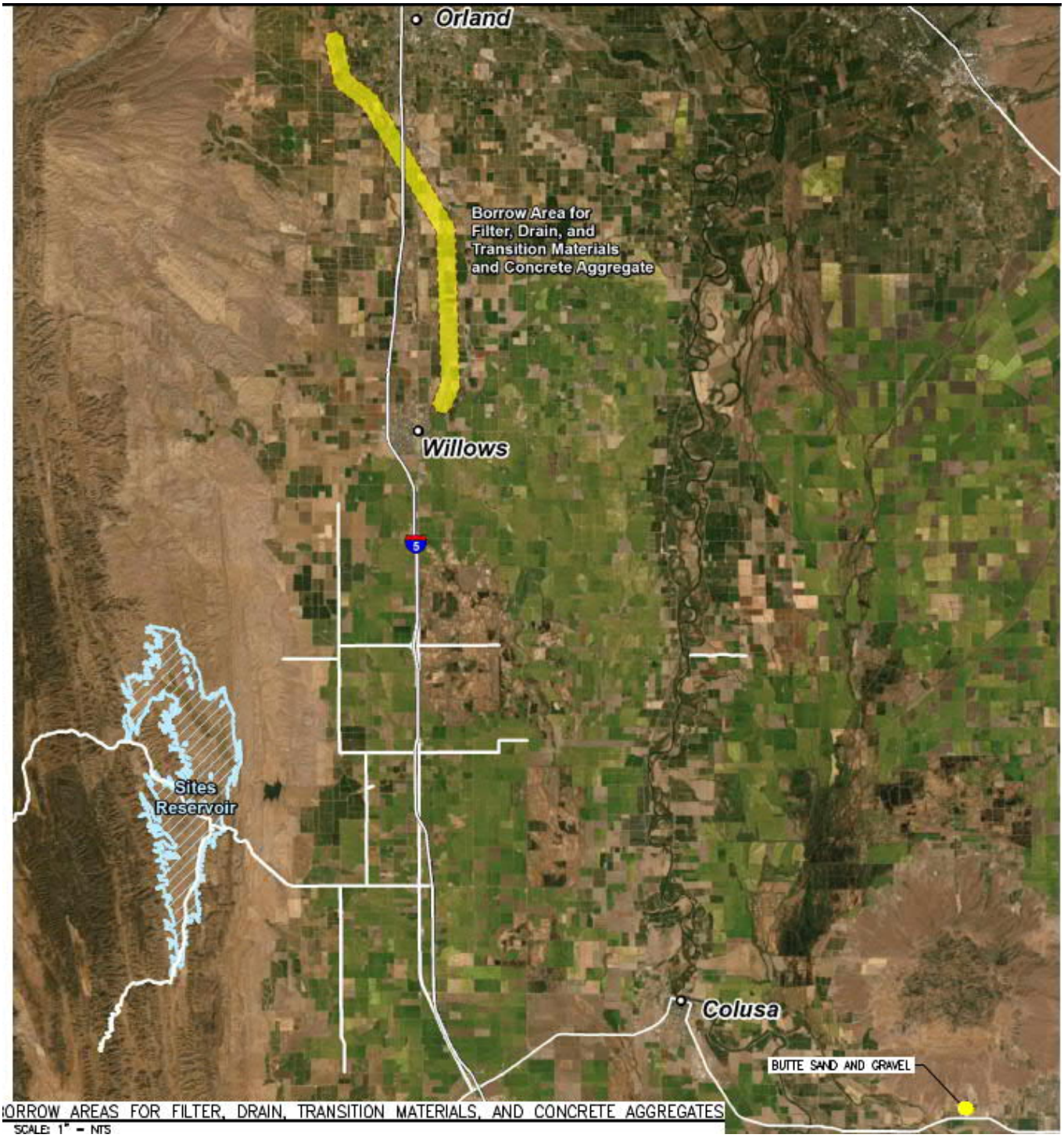


Figure 5-2. Offsite Quarries Location

5.3 Material Balance Diagrams

The material balance diagrams in Appendix A show the flow of materials from source to destination for use in constructability analysis for the dams and cost estimation. They indicate the estimated amount of required earth and rock borrow materials required for the dams, embankment dam quantities,

excavated waste materials to be disposed, and the amount of required imported sand and gravel for the filter, drain and transition zones. Estimates for material bulking and shrink factors are also indicated on the material balance diagrams.

6.0 Construction Sequencing Plan and Construction Schedule

6.1 General Plan and Approach

Initially, construction efforts will concentrate on access to critical elements, such as the realignment of Sites Lodoga Road across the reservoir including bridge foundation areas, the Inlet-Outlet Facilities Portals, and the Golden Gate Dam Foundation area. This access would initially be provided via existing access routes from near Funks Reservoir and from the existing Sites Lodoga Road. This early primary access would involve initial improvements sufficient for limited heavy equipment required for the first stages of construction of these critical elements.

Similarly, access to the northern end of the project would initially be provided on existing roads, including County Road 68, County Road D, and County Road 69. This would include sufficient improvements to allow heavy equipment to access the Saddle Dams and associated facilities. Early improvements could include improvements to the existing canal bridges or replacement of these bridges that would allow heavy equipment to reach the site.

Initial access will allow for setup of staging, stockpile, office, and shop facilities, as well as mobilization of manpower and resources.

6.2 Calendar and Work Hours

A condensed version of a potential construction schedule for the HR works is shown in Figure 6-1and is based on the following (refer to Appendix B for the detailed schedules for Alternatives 1 and 2):

- The construction schedule is calculated on 20 working days per month to account for holidays and weather delays.
- Productions and durations are calculated on 10-hour work shifts, accounting for breaks.
- Crews would likely work 6 days per week on critical functions.
- Night or second-shift work generally pertains to tunneling work and various portions of dam foundation excavation and dam embankment. Night or second shifts would be employed for logistics reasons as well as weather make-up. An example of this would be to place Zone 1 Core material and Zone 2 Filter and Drain materials during day shift, and place Zone 3 Rockfill and Zone 4 Random at night. As the dam section changes with height and relative proportion of materials, the strategy would be adjusted.
- The duration of dam embankment construction would be the same for all embankment zone types. General practice would be to use adequate resources to place at least two embankment zone types for each shift. The overall duration is set by the zoned material with the longest duration, typically Zone 1 Core.

Some activities, such as foundation cleaning, grout cap, dental concrete, and grouting are scalable, meaning that the number of crews or shifts will be adjusted by the contractor to meet his schedule on critical activities such as foundation excavation and embankment

Sites Reservoir
Preliminary Construction Schedule
HR Facilities Alt 1 - 1.5 MAF
Roadways, Dams, and I/O Facilities
December 2020

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		CWC Award of Funds	0 days	Fri 12/1/23	Fri 12/1/23	
2		Determine Engineering Procurement & Delivery Method	120 days	Sat 1/1/22	Thu 6/16/22	
3		Sites Board Approval/NTP for Phase 3	23 days	Wed 6/1/22	Fri 7/1/22	
4		Real Estate Access & Permitting (Geotech & Surveying)	260 days	Mon 7/5/21	Fri 7/1/22	3FF
5		Initial Geotech & Surveying	130 days	Mon 7/4/22	Fri 12/30/22	3,4
6		Final Geotech Investigation	130 days	Mon 1/2/23	Fri 6/30/23	5
7		**Reservoir Facilities**	**1800 days**	**Mon 12/5/22**	**Fri 10/26/29**	
8		**Engineering**	**405 days**	**Mon 12/5/22**	**Fri 6/21/24**	
11		**Administrative and General - Dams and I-O**	**300 days**	**Mon 6/24/24**	**Fri 8/15/25**	
16		**Administrative and General - Roads**	**210 days**	**Fri 9/1/23**	**Fri 6/21/24**	
21		**Roads, Bridges, Access, and Site Development**	**801 days**	**Mon 6/24/24**	**Mon 7/19/27**	
32		**Process and Haul Filter Materials to Project**	**1180 days**	**Mon 1/20/25**	**Fri 7/27/29**	
37		**Golden Gate Dam Construction**	**1195 days**	**Mon 9/23/24**	**Fri 4/20/29**	
60		**Sites Dam Construction**	**956 days**	**Fri 7/11/25**	**Fri 3/9/29**	
90		**Saddle Dams**	**871 days**	**Fri 7/25/25**	**Fri 11/24/28**	
91		**Saddle Dam 3**	**771 days**	**Fri 7/25/25**	**Fri 7/7/28**	
111		**Saddle Dam 5**	**821 days**	**Fri 10/3/25**	**Fri 11/24/28**	
131		**Minor Saddle Dams (SD1,SD2,SD6,SD8A, Dike 1, and Dike**	**711 days**	**Fri 11/14/25**	**Fri 8/4/28**	
151		**Saddle Dam 8B - Spillway**	**257 days**	**Fri 12/26/25**	**Mon 12/21/26**	**132**
163		**Emergency Release Structure No. 1**	**285 days**	**Fri 12/26/25**	**Thu 1/28/27**	
175		**Emergency Release Structure No. 2**	**410 days**	**Fri 3/27/26**	**Thu 10/21/27**	
187		**Inlet Outlet Facilities**	**1015 days**	**Mon 10/27/25**	**Fri 9/14/29**	
207		**Dams and I/O Ready for Commissioning**	0 days	Fri 6/22/29	Fri 6/22/29	21,90,37,60,162,163,175,204
208		Dams and I/O Startup and Commissioning	90 days	Mon 6/25/29	Fri 10/26/29	207
209		Dams and I/O Substantial Completion	0 days	Fri 10/26/29	Fri 10/26/29	208

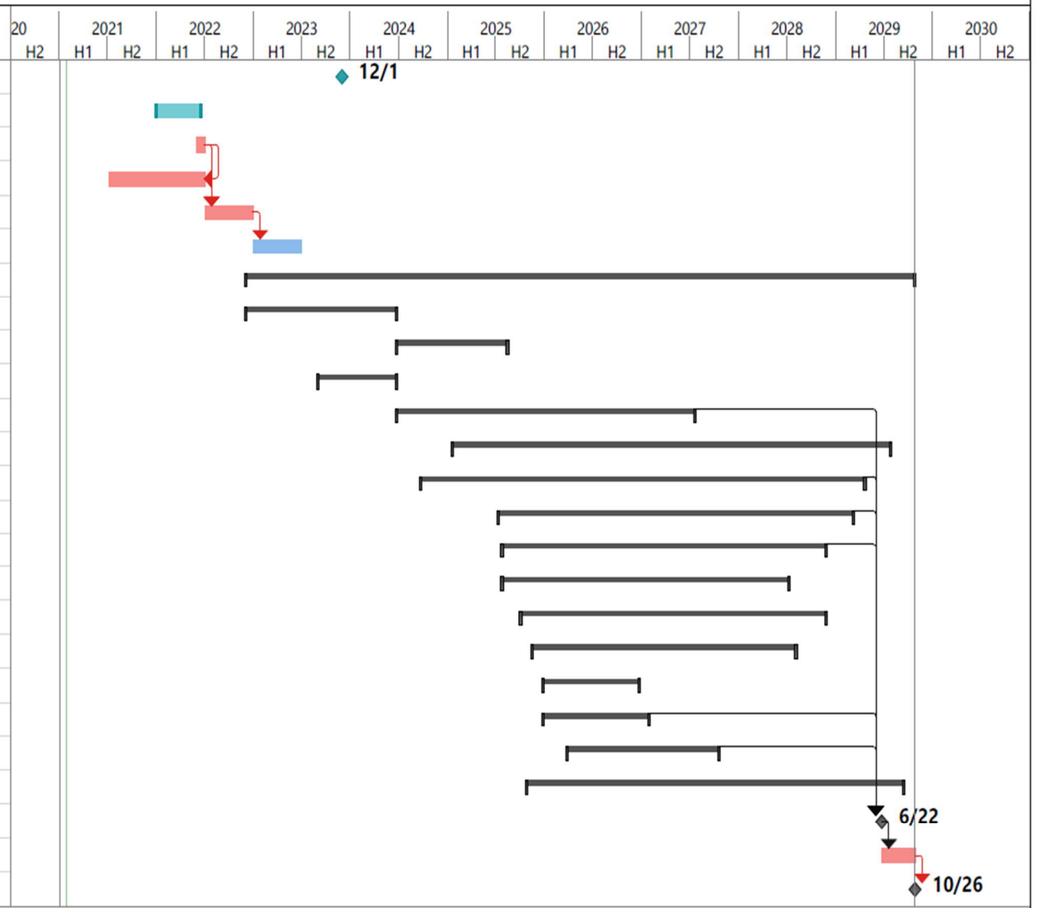


Figure 6-1. Potential Construction Schedule - HR Facilities

(refer to Appendix B for the detailed schedules)

The schedule critical path includes the following elements or activities:

- Real Estate Acquisition
- Permitting
- Engineering studies including geotechnical investigations and reporting
- Engineering
- Procurement and Contractor Mobilization
- Early Site Access and Staging Development
- Inlet-Outlet Facilities

6.3 Procurement and Contract Packaging

The construction schedule includes some assumptions on procurement and contract packaging, such as:

- Roadwork - Most or all roadwork would be contracted as Design-Build, providing for an earlier start on critical roadwork (including bridges) that provides the early access for construction, as well as routing of public traffic in order to avoid conflicts with construction activities.
- Dam Packages:
    - Golden Gate Dam and Sites Dam, including Diversion and Bypass facilities
    - Saddle Dams, including ERS-1 and ERS-2
- Inlet-Outlet Facilities

As stated in Section 4.1, the dams and inlet/outlet facilities would likely be contracted as design-bid-build delivery methods.

6.4 Commissioning and Interface with HC Facilities

Commissioning of the HR facilities relies on several key elements; Roadwork must be substantially completed such that public traffic is routed in its final form across the Sites Lodoga causeway (roadway prisms and bridges), the dam facilities are complete, and the inlet-outlet facilities are complete and operational, and the pumping and conveyance facilities are completed sufficiently to provide sufficient water for operational testing.

This reservoir (HR) facilities schedule must be properly linked to pumping and conveyance (HC) facilities to reflect the above relationships.

Additionally, some access points developed under HR may be needed for tie-in of HC facilities. These logic dependencies should be made once the HC schedule activities are incorporated into the combined construction schedule.

7.0 Work Force Staff and Equipment Needs

7.1 Labor Force, Project Labor Agreements

Providing for a sufficient labor force for a project of this magnitude will pose a challenge, but is manageable. It is anticipated that much of the labor force would come from the surrounding region, with contractors also bringing some skilled work force from other areas. While Colusa County is rural, with a population of about 20,000, the surrounding counties, including Sacramento and Yolo Counties, the regional population is over two million. It may be advantageous to consider project labor

agreements with trade unions as a means of accommodating the project labor requirements, as well as avoiding labor disputes. A project labor agreement, well in advance of the need for craft labor, would provide for established labor rates, benefits, and work rules, as well as stability of the workforce. Unions and contractors will have advance notice in identifying required craft manpower and training programs. Further, project labor agreements will minimize the risk of labor disputes during the course of the work. This strategy has been used successfully on other major civil works projects in California, including dam construction.

7.2 Equipment and Workforce Use

The estimated Equipment Use Tables are included in Appendix C. The approach to estimating the equipment use, and limitations, includes the following:

- The Equipment Use Tables are intended to inform the project team regarding expected equipment type, hours and horsepower, as well as expected manpower.
- At this point in the project, the design is at feasibility level. Further design development will determine final quantities and other factors will influence the final equipment use.
- Various contractors will approach the work differently from each other, and likely different from our interpretation of equipment use and staffing.
- The Equipment Use Tables are an approximation of the equipment, crews, and production needed to complete the project. This is somewhat dictated by a lack of design details, although some details and quantities have been extrapolated based on best industry practices and expectations.
- Site geologic study and interpretation is incomplete. Future geotechnical work will affect final design and quantities.
- Procurement strategies and outcomes, including contract packages, will have some impact on the use and timing of equipment and crews.
- The Equipment Use tables have been grouped with similar work in one "Package". The Roadways Package under the "General and Indirects" heading would include the General and Indirect costs for all of the Roadways.
- Similarly, in the Equipment Use Tables, data is grouped for multiple features (i.e., Saddle Dams 1, 2, 6, 8A, and 8B). This is the combined total for Saddle Dams 1, 2, 6, 8A, and 8B in Alternative 1.
- Travel Speeds for Vehicles - The average speed for pickup trucks and supervisory vehicles would be about 20 mph, but will vary with individual duties and activities.
- Travel Speeds for off-site Hauling Vehicles - For off-site haul vehicles (Such as those making deliveries to the job) an average of 40 mph was used from their point on origination to the delivery site and return to point of origin.
- Travel Speeds for on-site Hauling Vehicles - We utilize average speeds for hauling calculations. For on-site haul vehicles, such as those used to haul excavated or processed material, we use an average of 15 mph.
- Travel Speeds for Support equipment, such as water trucks and graders, would be about 15 mph. Operational speeds while performing work would be about 3 - 5 mph.
- No off-road, mobile, electric powered equipment is anticipated at this time.
- Electric power generation is included in the Equipment Use Tables as applicable for the various aggregate processing and batch plant needs. It is possible that some of this equipment would use direct line power, if such line power is available to the site on time and is economical.

- Power supply for such facilities as offices, QC labs, and shop facilities will be included in the Equipment Use Tables as diesel generated power. Line power or diesel generated power will not be duplicated in the data.
- It is anticipated that approximately half of the pickup trucks will be gasoline powered, the other half would be diesel powered. All other equipment would be diesel powered.
- Within the Sites Reservoir Inundation Area there are approximately 26 houses, two motor homes, 31 barns, and 49 other structures (combination of sheds, silos, and a pump houses, silos and water towers) that would be demolished once all property owner negotiations are completed. (This information is provided under the Demolition heading in Appendix 2C for Alternative 1.) Limited information is available, as these facilities are on private property and not currently accessible, but estimates can be verified from aerial photography.
- The average workforce and staffing have been evaluated. Workforce and staff will vary during the course of the work as work activities ramp up, peak, and taper off toward completion.
- Regarding staff and workforce commute, it is anticipated that much of the workforce will come from the surrounding area, including the greater Sacramento area. The average daily commute is expected to be approximately 70 miles each way, or about 1.5 hours each way.
- Start and End dates are reflective of the Preliminary Construction Schedule produced as a separate document. The manpower and equipment presented here demonstrates the overall level of effort to complete each task within that time frame. Schedule allowances have been made for ramp-up and resource leveling during that time frame, including allowances for double-shift work as well as multiple crews as needed to maintain the construction schedule.
- On-site batch plants are anticipated for each work package. Each batch plant would likely be capable of producing between 100 and 400 CY per hour. Plants would be large, portable plants, powered by either generator or line power, depending on availability. Generation typically would be approximately 350 HP at each plant. Aggregate for batching concrete would be imported from off-site sources and hauled to the site by conventional highway trucks; belly dump, side dump, or truck and pup, with capacities of between 23 and 25 tons.

The actual daily equipment and workforce use will vary based on what activities are being performed across the project at any given time. For example, drilling and blasting, rock bolting and excavation may not all occur simultaneously during portal excavation for any one of the tunnel portals. During the drill/blast shifts, the equipment necessary for the excavation and rock bolting may sit idle, depending on work room available.

7.3 Estimate of Peak Heavy Equipment Utilization

The Table 7-1 below represents the estimated peak heavy equipment and workforce needs for the project. The ranges listed are indicative of projected resources during peak construction as represented in the construction schedule during a day-shift operation. The actual daily maximums will not necessarily occur every day across all equipment categories, but will rise and fall based on what activities are being performed across the project at any given time. For example, drilling and blasting, rock bolting and excavation may not all occur simultaneously during portal excavation for any one of the tunnel portals. During the drill/blast shifts, the equipment necessary for the excavation and rock bolting may sit idle, depending on work room available. The table does not include light equipment, such as generators, pumps, and light plants.

Table 7-1. Estimate of Peak Heavy Equipment Utilization

[Golden Gate Dam, Sites Dam, and Saddle Dam 5 (Combined Zoned Materials Production & Placement, Borrow Area and Quarry Development, Dam Roads Construction, ERS-1 and I/O Facilities)]

Equipment Category	Function	Number of Equipment Pieces (Range)
Large Bulldozers – CAT D-7 to D-10 or similar	Quarry and borrow excavation, processing, foundation excavation, placement of zoned material in embankments, roadway excavation and embankment	40-60
Large Excavators – CAT 330 to 390, and 5130 or similar, including excavators with hydraulic breakers	Quarry and borrow excavation, processing, foundation excavation, placement of zoned material in embankments, roadway excavation and embankment, riprap placement	30-50
Articulated and Rigid Frame Haul Trucks – 40 Ton to 100 Ton or similar	Hauling of quarry and borrow excavation, processing, foundation excavation, placement of zoned material in embankments, roadway excavation and embankment, riprap placement	100-140
Highway Trucks, Belly or Side Dump	Haul off-site aggregates, Zone 2, roadway aggregates	50-75
Compactors	Compaction of embankments, base, and surface aggregates	25-35
Support Equipment – Graders, Water Wagons, Water Trucks, Maintenance and Mechanics Trucks	Water for compaction, dust control, haul road maintenance, intermediate and final grading	30-70
Roadheaders, Muckers, Track Drills, Bench Drills	Quarry, roadway, and dam foundation drilling and blasting, tunnel construction	25-40
Pickups and Staff Vehicles	Owner & Engineer staff	40-60
Pickups and Crew Trucks	Supervisory personnel, QA/QC including contractor staff, foremen, lead craftsmen	225-300
Personnel		
Contractor Supervisory Staff	Project Managers, Superintendents, Engineers, Schedulers, QA/QC, Safety, Survey, Clerical	150-250
Contractor Craft and Foremen		500-750

8.0 Conclusions

The objective of this TM is to show that the project can be constructed with existing technology and availability of construction materials, work force, and equipment, and show public benefits by 2030.

Construction Schedule: This study shows that the HR facilities can be constructed by the end of 2029, for a duration of about five years, with commissioning in 2030 (together with the HC facilities). It is

noted that the Sites construction schedule reflects a five-year construction duration; however, as discussed in this TM, there are risks that could cause delay of construction completion.

Table 8-1 shows recent precedence for large reservoir projects that have been constructed in California approximately within the duration estimated for Sites.

Table 8-1. Precedence of Recent Large Dams

Project	Reservoir Capacity (MAF)	Embankment Dam Volume (million CY)	Years of Construction
Sites, Colusa and Glen Counties	1.5	18 (2 main dams, & 7 saddle dams)	Est. 2024-2029 (5 years)
Diamond Valley, Riverside County	0.8	110 (3 large dams)	1995-2000 (5 years)
Seven Oaks, San Bernardino County	0.146	38	1993-2000 (7 years)

Availability of Construction Materials: About 85 percent of the earth and rock construction materials to build the dams is available on site. The remaining 15 percent (sand and gravel) would need to be hauled from existing commercial quarries some 35 miles from the project site. It is anticipated that concrete for the I/O works and bridge would be batched on site, and that the concrete aggregate would be imported from the sources located 35 miles from the project site. Aggregate road base would be imported or produced from on-site quarry operations.

Work Force: As discussed in this TM, providing for a sufficient labor force for this project poses a challenge, but is manageable. It is anticipated that much of the labor force would come from the surrounding region, with contractors also bringing some skilled work force from other areas. The surrounding counties, including Sacramento and Yolo Counties, have a regional population of over two million. It may be advantageous to consider project labor agreements with trade unions as a means of accommodating the project labor requirements, as well as avoiding labor disputes. This strategy has been used successfully on other large civil works projects in California, including dam construction.

Equipment Availability: The required equipment consists of standard heavy earthmoving and tunneling equipment. A project of this magnitude would require transporting equipment from across the nation and placing new equipment orders with equipment manufacturers to satisfy the demand. Large contractors would use their own equipment, lease or purchase new equipment.

In summary, although there are risks to the scheduled five-year completion of construction, the project can be constructed with existing technology and available construction materials, work force, and equipment, and show public benefits by 2030.

9.0 References

Department of Water Resources (DWR) (2003). Sites Reservoir Engineering Feasibility Study, Golden Gate, Sites, and Saddle Dams. February.

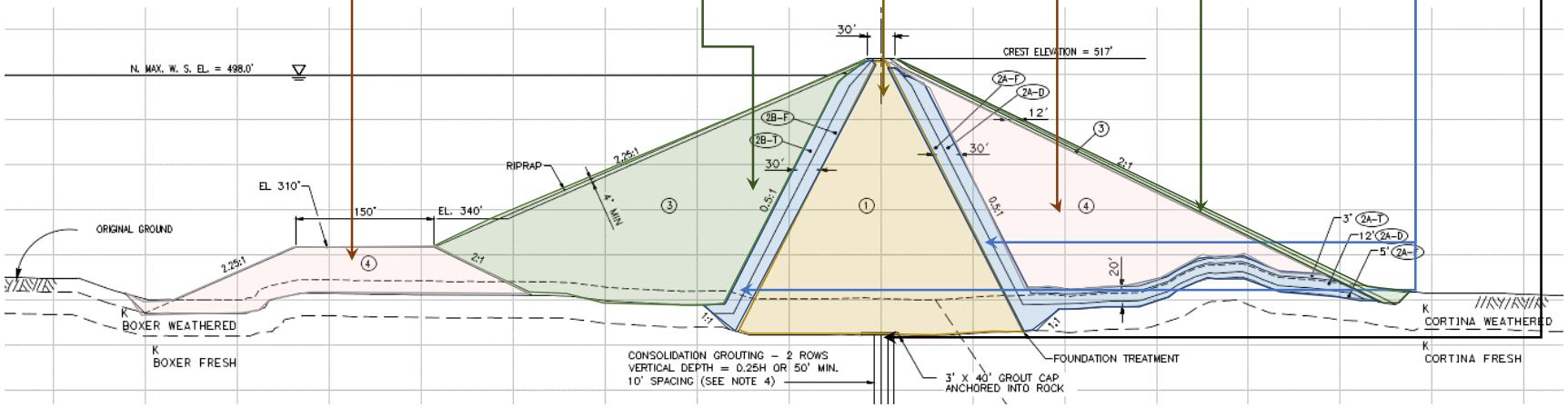
Appendix A
Material Balance Diagrams for Dam Construction

MATERIALS BALANCE
SITES DAM - 1.5 MAF RESERVOIR

Calculated by: RN
Reviewed by: MS
Date: January, 2021

Dam and Diversion Foundation Excavations	On Site Borrow	Off Site Borrow

Dam Soil, BCY 179,000
I/O Structure Soil, BCY 13,000
Dam Rock, BCY 391,000
Diversion, BCY 30,000
Sites-Z3 Quarry, BCY 3,071,000
Sites-Z1 Borrow, BCY 1,128,000
Quarry, Tons* 910,500
312,000
Stockpile, BCY 421,000
Shrinkage factor - 10%
Bulking factor - 10%
Stockpile, BCY 1,768,000
Shrinkage factor - 10%
Filter/Drain, Tons 687,500
Transition, Tons 202,000
Concrete Aggregate, Tons 21,000
Conversion factor: 1 CY = 1.7 Tons
Conversion factor: 1 CY = 1.7 Tons
Shrinkage Factor 10%
Disposal/Quarry Restoration, BCY 192,000
Zone 4, ECY 660,000
Zone 3 and Riprap, ECY 1,090,000
Disposal, BCY 614,000
Quarry Restoration, BCY 1,154,000
Zone 1, ECY 710,000
Disposal, BCY 339,000
Filter/Drain, Transition. CY 476,000
Concrete Aggregate. CY 12,000



BCY - Bank Cubic Yards - Consists of volume of material in natural state, before excavated from ground
ECY - Embankment Cubic Yards - Consists of in-place embankment volume
Shrinkage/Bulking Factor - Changes in material volumes due to shrinkage/bulking.
* Includes 10% allowance for overbuild/waste.

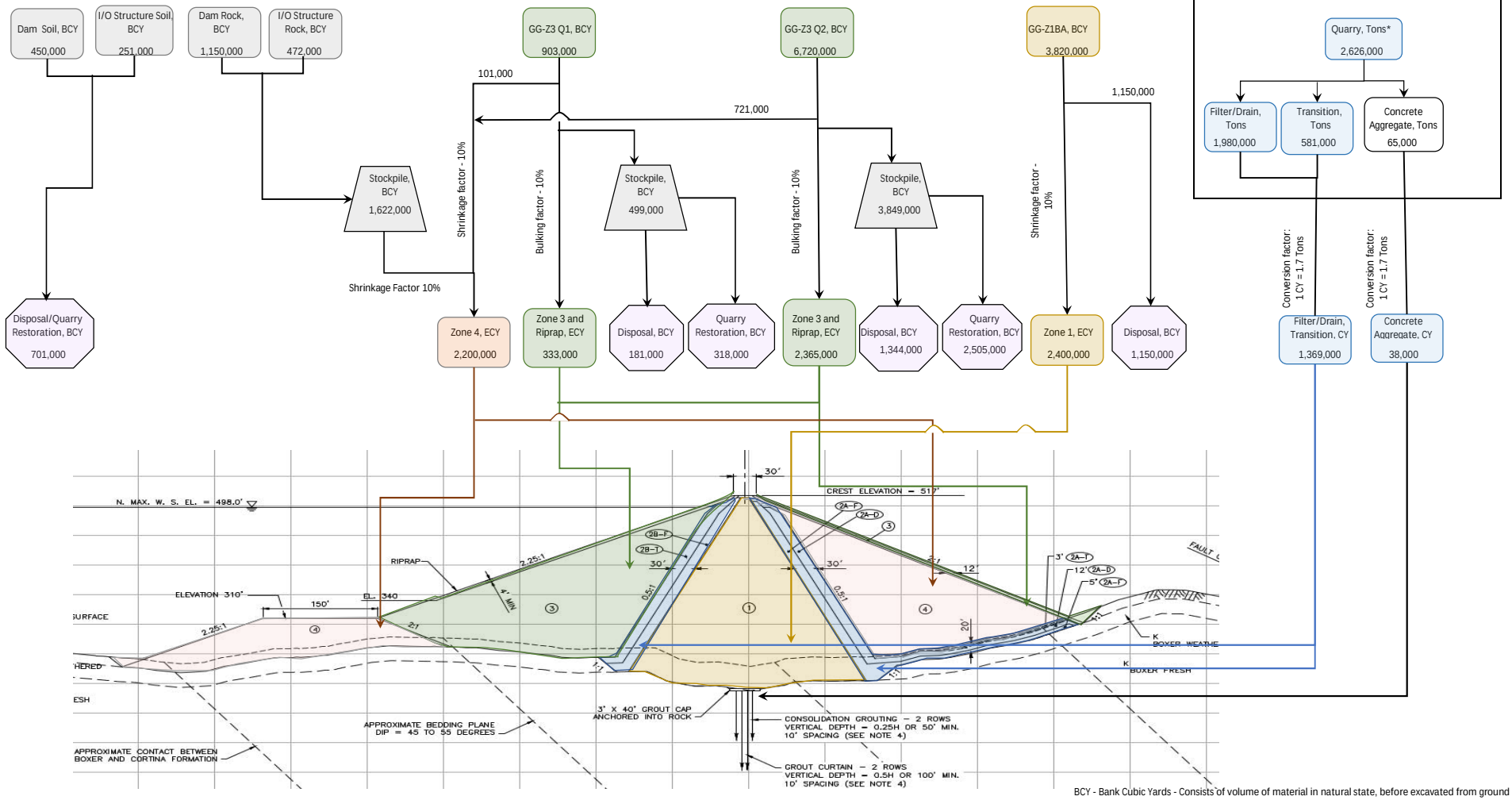
MBD DIAGRAMS
SITES DAM - 1.5 MAF RESERVOIR (ALTERNATIVE 1)
FIGURE 1

MATERIALS BALANCE
GOLDEN GATE DAM - 1.5 MAF RESERVOIR

Calculated by: RN
Reviewed by: MS
Date: January, 2021

GOLDEN GATE DAM - 1.5 MAF RESERVOIR

Dam and I/O Structure Foundation Excavations	On Site Borrow	Off Site Borrow



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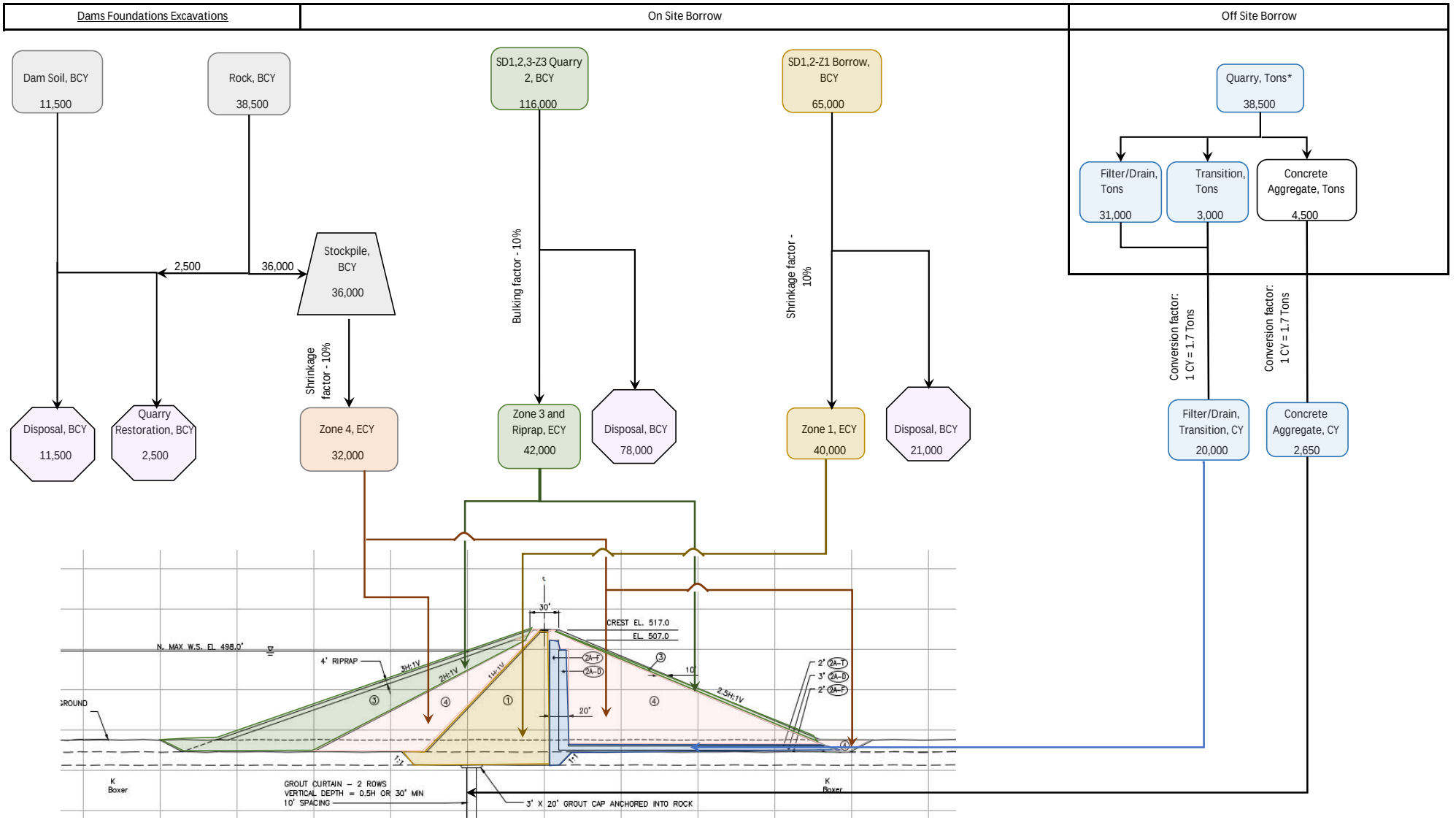
ECY - Embankment Cubic Yards - Consists of in-place embankment volume
Shrinkage/Bulking Factor - Changes in material volumes due to shrinkage/bulking.
* Includes 10% allowance for overbuild/waste.

MATERIALS BALANCE
SADDLE DAMS 1 AND 2 - 1.5 MAF RESERVOIR

Calculated by: RN
Reviewed by: MS
Date: January, 2021



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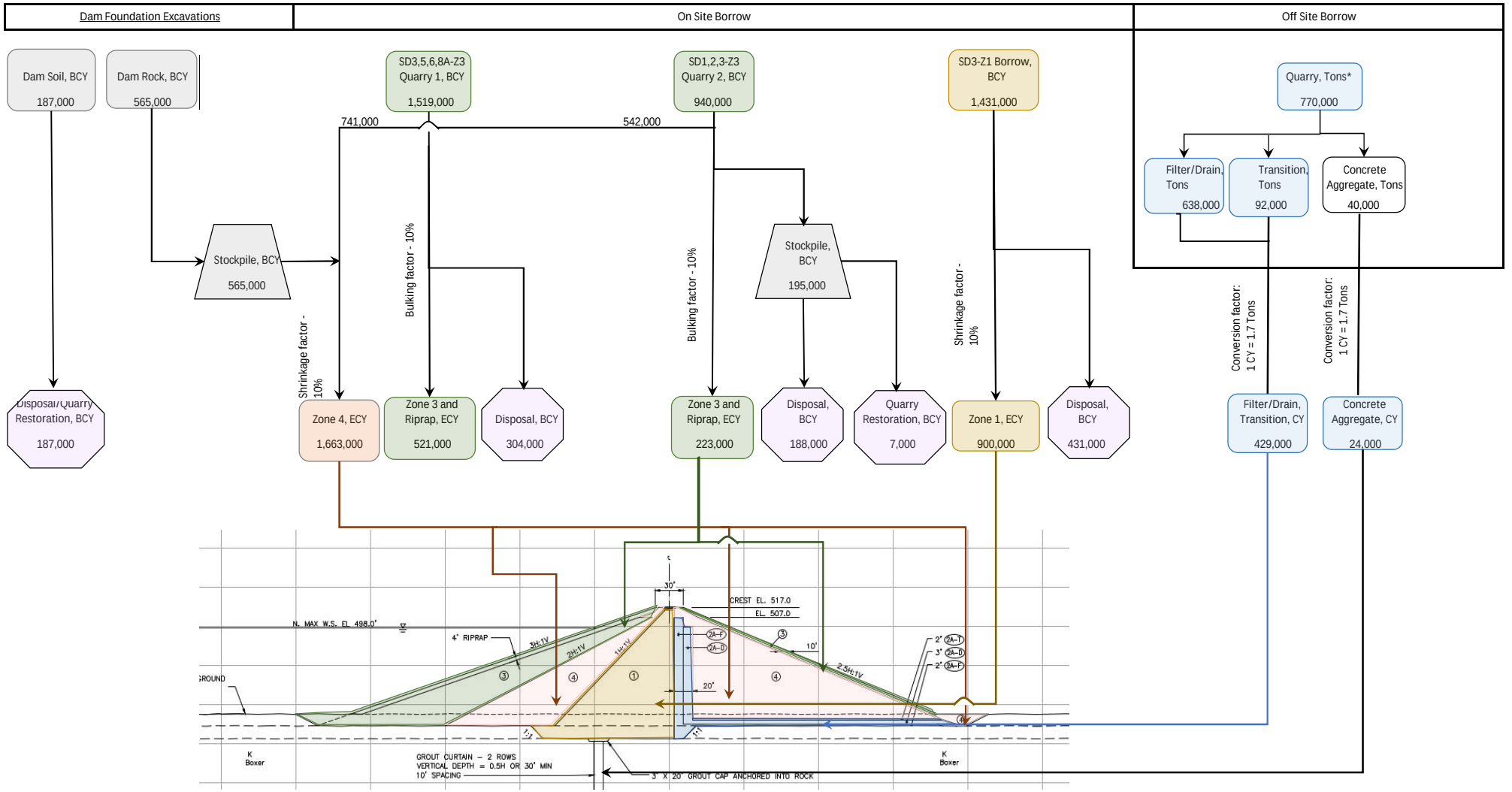
ECY - Embankment Cubic Yards - Consists of in-place embankment volume
Shrinkage/Bulking Factor - Changes in material volumes due to shrinkage/bulking.
* Includes 10% allowance for overbuild/waste.

MBD DIAGRAMS
SADDLE DAMS 1 AND 2 - 1.5 MAF RESERVOIR (ALTERNATIVE 1)
FIGURE 3

MATERIALS BALANCE
SADDLE DAM 3 and ERS 1 - 1.5 MAF RESERVOIR

Calculated by: RN
Reviewed by: MS
Date: January, 2021



BCY - Bank Cubic Yards - Consists of volume of material in natural state, before excavated from ground
ECY - Embankment Cubic Yards - Consists of in-place embankment volume
Shrinkage/Bulking Factor - Changes in material volumes due to shrinkage/bulking.
* Includes 10% allowance for overbuild/waste.

MBD DIAGRAMS
SADDLE DAM 3 AND ERS-1 - 1.5 MAF RESERVOIR (ALTERNATIVE 1)
FIGURE 4

MATERIALS BALANCE
SADDLE DAM 5 AND ERS 2 - 1.5 MAF RESERVOIR

Calculated by: RN
Reviewed by: MS
Date: January, 2021

Dams Foundation Excavations	On Site Borrow	Off Site Borrow

Dam Soil, BCY 82,000

Dam Rock, BCY 256,000

Stockpile, BCY 256,000

SD3,5,6,8A-Z3 Quarry 1, BCY 615,000

266,000

Stockpile, BCY 130,000

SD3-Z1 Borrow, BCY 590,000

Shrinkage factor - 10%

Bulking factor - 10%

Shrinkage factor - 10%

Quarry, Tons* 305,000

Filter/Drain, Tons 248,000

Transition, Tons 36,000

Concrete Aggregate, Tons 21,000

Conversion factor: 1 CY = 1.7 Tons

Conversion factor: 1 CY = 1.7 Tons

Disposal/ Quarry Restoration, BCY 82,000

Zone 4, ECY 470,000

Zone 3 and Riprap, ECY 241,000

Disposal/Quarry Restoration,BCY 123,000

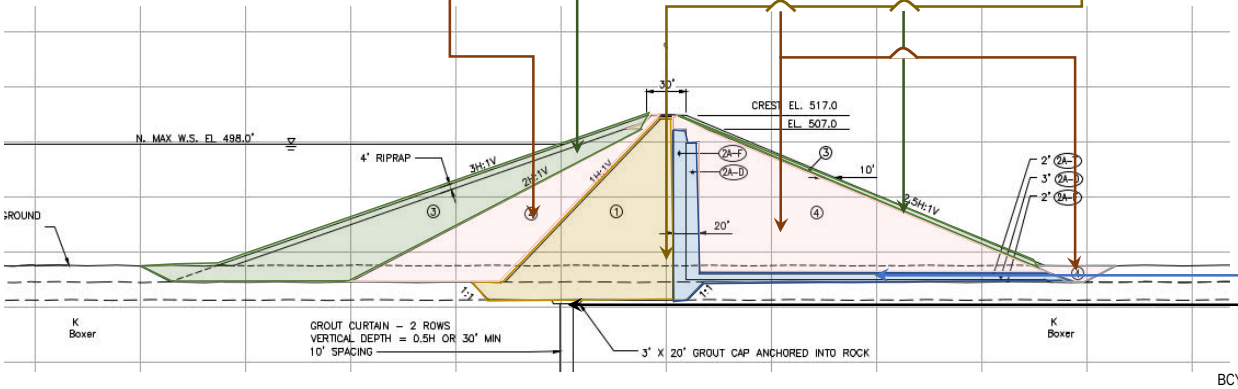
Quarry Restoration, BCY 7,000

Zone 1, ECY 369,000

Disposal, BCY 180,000

Filter/Drain, Transition, CY 167,000

Concrete Aggregate, CY 12,000



BCY - Bank Cubic Yards - Consists of volume of material in natural state, before excavated from ground
ECY - Embankment Cubic Yards - Consists of in-place embankment volume
Shrinkage/Bulking Factor - Changes in material volumes due to shrinkage/bulking.
* Includes 10% allowance for overbuild/waste.

MATERIALS BALANCE
SADDLE DAM 6, 8A, 8B, SADDLE DIKE 1 AND 2 - 1.5 MAF RESERVOIR

Calculated by: RN
Reviewed by: MS
Date: January, 2021

Dams Foundation Excavations	On Site Borrow	Off Site Borrow

Dam Soil, BCY 96,000

Dam Rock, BCY 264,000

264,000

Stockpile, BCY 264,000

374,000

SD3,5,6,8A-Z3 Quarry 1, BCY 743,000

Bulking factor - 10%

Stockpile, BCY 151,000

SD3-Z1 Borrow, BCY 647,000

Shrinkage factor - 10%

Quarry, Tons* 435,000

Filter/Drain, Tons 321,000

Transition, Tons 45,000

Concrete Aggregate, Tons 69,000

Conversion factor: 1 CY = 1.7 Tons

Conversion factor: 1 CY = 1.7 Tons

Disposal/ Quarry Restoration, BCY 96,000

Shrinkage factor - 10%

Zone 4, ECY 574,000

Zone 3 and Riprap, ECY 240,000

Disposal/ Quarry Restoration, BCY 149,000

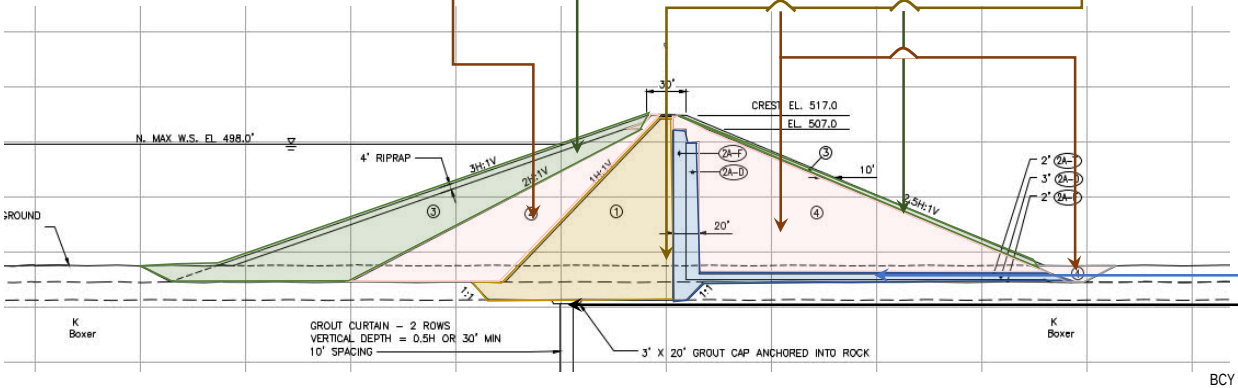
Quarry Restoration, BCY 2,000

Zone 1, ECY 410,000

Disposal, BCY 191,000

Filter/Drain, Transition, CY 215,000

Concrete Aggregate, CY 41,000

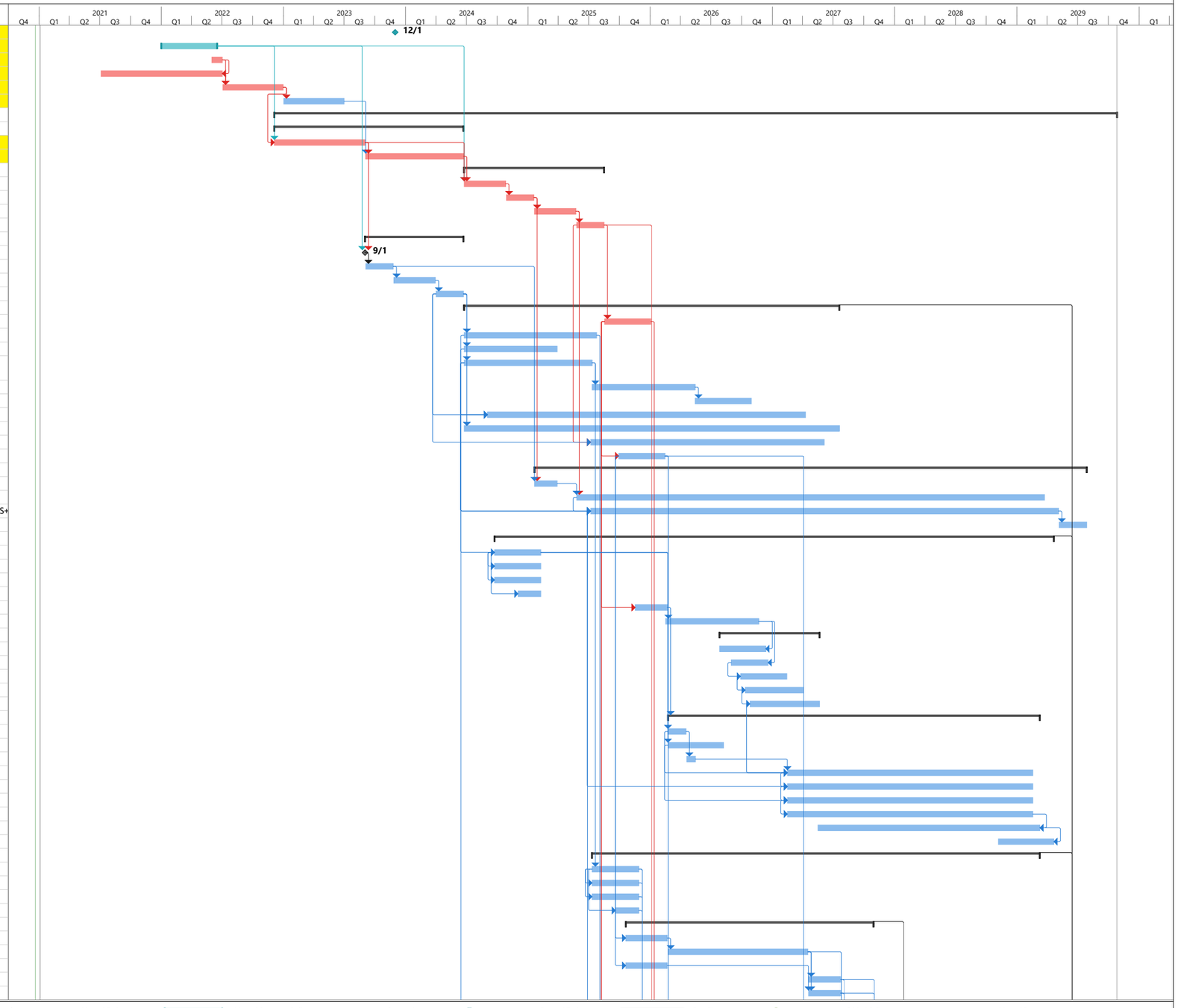


BCY - Bank Cubic Yards - Consists of volume of material in natural state, before excavated from ground
ECY - Embankment Cubic Yards - Consists of in-place embankment volume
Shrinkage/Bulking Factor - Changes in material volumes due to shrinkage/bulking.
* Includes 10% allowance for overbuild/waste.

Appendix B
Construction Schedules

Sites Reservoir
Preliminary Construction Schedule
HR Facilities Alt 1 - 1.5 MAF
Roadways, Dams, and I/O Facilities
December 2020

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		CWC Award of Funds	0 days	Fri 12/1/23	Fri 12/1/23	
2		Determine Engineering Procurement & Delivery Method	120 days	Sat 1/1/22	Thu 6/16/22	
3		Sites Board Approval/NTP for Phase 3	23 days	Wed 6/1/22	Fri 7/1/22	
4		Real Estate Access & Permitting (Geotech & Surveying)	260 days	Mon 7/5/21	Fri 7/1/22	3FF
5		Initial Geotech & Surveying	130 days	Mon 7/4/22	Fri 12/30/22	3,4
6		Final Geotech Investigation	130 days	Mon 1/2/23	Fri 6/30/23	5
7		**Reservoir Facilities**	**1800 days**	**Mon 12/5/22**	**Fri 10/26/29**	
8		**Engineering**	**405 days**	**Mon 12/5/22**	**Fri 6/21/24**	
9		Preliminary Engineering	195 days	Mon 12/5/22	Fri 9/1/23	2,5FS-20 days
10		Final Engineering	210 days	Mon 9/4/23	Fri 6/21/24	6,9
11		**Administrative and General - Dams and I-O**	**300 days**	**Mon 6/24/24**	**Fri 8/15/25**	
12		Bidding and Contract Award - Dams and I-O	90 days	Mon 6/24/24	Fri 10/25/24	2,9,10
13		Notice To Proceed - Dams and I-O	60 days	Mon 10/28/24	Fri 1/17/25	12
14		Early Submittals And Approvals - Dams and I-O	90 days	Mon 1/20/25	Fri 5/23/25	13
15		Mobilization - Dams and I-O	60 days	Mon 5/26/25	Fri 8/15/25	14
16		**Administrative and General - Roads**	**210 days**	**Fri 9/1/23**	**Fri 6/21/24**	
17		Contract Award - Roads - (D-B Contracts)	0 days	Fri 9/1/23	Fri 9/1/23	2,9
18		Notice To Proceed - Roads - Design (D-B Contracts)	60 days	Mon 9/4/23	Fri 11/24/23	17
19		Roads - Intitial Designs, Submittals, and Approvals	90 days	Mon 11/27/23	Fri 3/29/24	18
20		Mobilization - Roads	60 days	Mon 4/1/24	Fri 6/21/24	19
21		**Roads, Bridges, Access, and Site Development**	**801 days**	**Mon 6/24/24**	**Mon 7/19/27**	
22		Early Site Access and Staging Development	100 days	Mon 8/18/25	Fri 1/2/26	15
23		Northern Construction Access Roads (CR 68, CR 69, N. Rd)	284 days	Mon 6/24/24	Thu 7/24/25	20
24		County Roads F, D, McDermott, Delevan	200 days	Mon 6/24/24	Fri 3/28/25	20
25		Southern Construction Access Roads (Maxwell-Sites, Shoo-fly, A-1)	274 days	Mon 6/24/24	Thu 7/10/25	20
26		Ancillary Roads B1, B2, C1, C2, Comm N., Comm South	220 days	Fri 7/11/25	Thu 5/14/26	25
27		Stone Corral Recreation Road to Sites Dam	120 days	Fri 5/15/26	Thu 10/29/26	26
28		Sites Lodoga Road Realignment and Bridge	680 days	Mon 9/2/24	Fri 4/9/27	20SS+30 days,25SS+50 days
29		Huffmaster Road Realignment	801 days	Mon 6/24/24	Mon 7/19/27	20
30		Reservoir Footprint Mitigation Actions	500 days	Mon 7/7/25	Fri 6/4/27	15SS+30 days,20SS+30 days
31		Demolition and Clearing	100 days	Mon 9/29/25	Fri 2/13/26	22SS+30 days
32		**Process and Haul Filter Materials to Project**	**1180 days**	**Mon 1/20/25**	**Fri 7/27/29**	
33		Offsite Quarry Development	50 days	Mon 1/20/25	Fri 3/28/25	13,18
34		Process Filter Materials	1000 days	Mon 5/26/25	Fri 3/23/29	14,33
35		Filter Material Haul to Stockpile	1000 days	Mon 7/7/25	Fri 5/4/29	34SS+30 days,23SS+100 days,25SS+
36		Quarry Reclamation and Restoration	60 days	Mon 5/7/29	Fri 7/27/29	35
37		**Golden Gate Dam Construction**	**1195 days**	**Mon 9/23/24**	**Fri 4/20/29**	
38		Golden Gate Access and Staging	100 days	Mon 9/23/24	Fri 2/7/25	25SS+65 days
39		Erosion and Sediment Control	100 days	Mon 9/23/24	Fri 2/7/25	38SS
40		Clearing / Grubbing Topsoil Salvage from Work Areas	100 days	Mon 9/23/24	Fri 2/7/25	38SS
41		Demolition	50 days	Mon 12/2/24	Fri 2/7/25	38SS+50 days
42		GG Dam - Bypass Pipeline and U/S Cofferdam	70 days	Mon 11/17/25	Fri 2/20/26	22SS+65 days
43		GG Dam - Foundation Excavation (Some Dbl Shift)	200 days	Mon 2/16/26	Fri 11/20/26	31
44		**GG Dam - Foundation Preparation and Grouting**	**215 days**	**Mon 7/27/26**	**Fri 5/21/27**	
45		Foundation Cleaning	100 days	Mon 7/27/26	Fri 12/11/26	43FF+15 days
46		Dental Excavation and Concrete	80 days	Mon 8/31/26	Fri 12/18/26	43FF+20 days
47		Grout Cap	100 days	Mon 9/28/26	Fri 2/12/27	46SS+20 days
48		Consolidation Grouting	125 days	Mon 10/12/26	Fri 4/2/27	47SS+10 days
49		Curtain Grouting	150 days	Mon 10/26/26	Fri 5/21/27	48SS+10 days
50		**GG Dam - Embankment**	**795 days**	**Mon 2/23/26**	**Fri 3/9/29**	**42**
51		Initial Borrow Development (Core Material)	40 days	Mon 2/23/26	Fri 4/17/26	38
52		Initial Quarry Development for Zones 3 and 4	120 days	Mon 2/23/26	Fri 8/7/26	38
53		Borrow Overburden and Waste to Disposal Site	20 days	Mon 4/20/26	Fri 5/15/26	51
54		Place Zone 1 - Core	525 days	Mon 2/15/27	Fri 2/16/29	51SS+20 days,53,49SS+80 days
55		Place Zone 2A & 2B - Filters, Drains and Transitions	525 days	Mon 2/15/27	Fri 2/16/29	54SS,35SS+30 days
56		Place Zone 3 - Rockfill (Some Dbl Shift)	525 days	Mon 2/15/27	Fri 2/16/29	55SS,52SS+40 days
57		Place Zone 4 - Random (Some Dbl Shift)	525 days	Mon 2/15/27	Fri 2/16/29	56SS
58		Place Rip Rap	475 days	Mon 5/17/27	Fri 3/9/29	57FF+15 days
59		**Site Reclamation and Topsoil Replacement**	120 days	Mon 11/6/28	Fri 4/20/29	58FF+30 days
60		**Sites Dam Construction**	**956 days**	**Fri 7/11/25**	**Fri 3/9/29**	
61		Sites Dam Access and Staging	100 days	Fri 7/11/25	Thu 11/27/25	25
62		Erosion and Sediment Control	100 days	Fri 7/11/25	Thu 11/27/25	61SS
63		Clearing / Grubbing Topsoil Salvage from Work Areas	100 days	Fri 7/11/25	Thu 11/27/25	61SS
64		Demolition	50 days	Fri 9/19/25	Thu 11/27/25	61SS+50 days
65		**Sites Diversion Outlet Facility**	**530 days**	**Mon 10/20/25**	**Fri 10/29/27**	
66		Develop Downstream Portal	90 days	Mon 10/20/25	Fri 2/20/26	31SS+15 days
67		Tunnel Excavation and Lining - Double Shift	300 days	Mon 2/23/26	Fri 4/16/27	66
68		Develop Upstream Portal	90 days	Mon 10/20/25	Fri 2/20/26	31SS+15 days
69		Outlet Structure Concrete	70 days	Mon 4/19/27	Fri 7/23/27	67
70		Inlet Structure Concrete	70 days	Mon 4/19/27	Fri 7/23/27	67,68

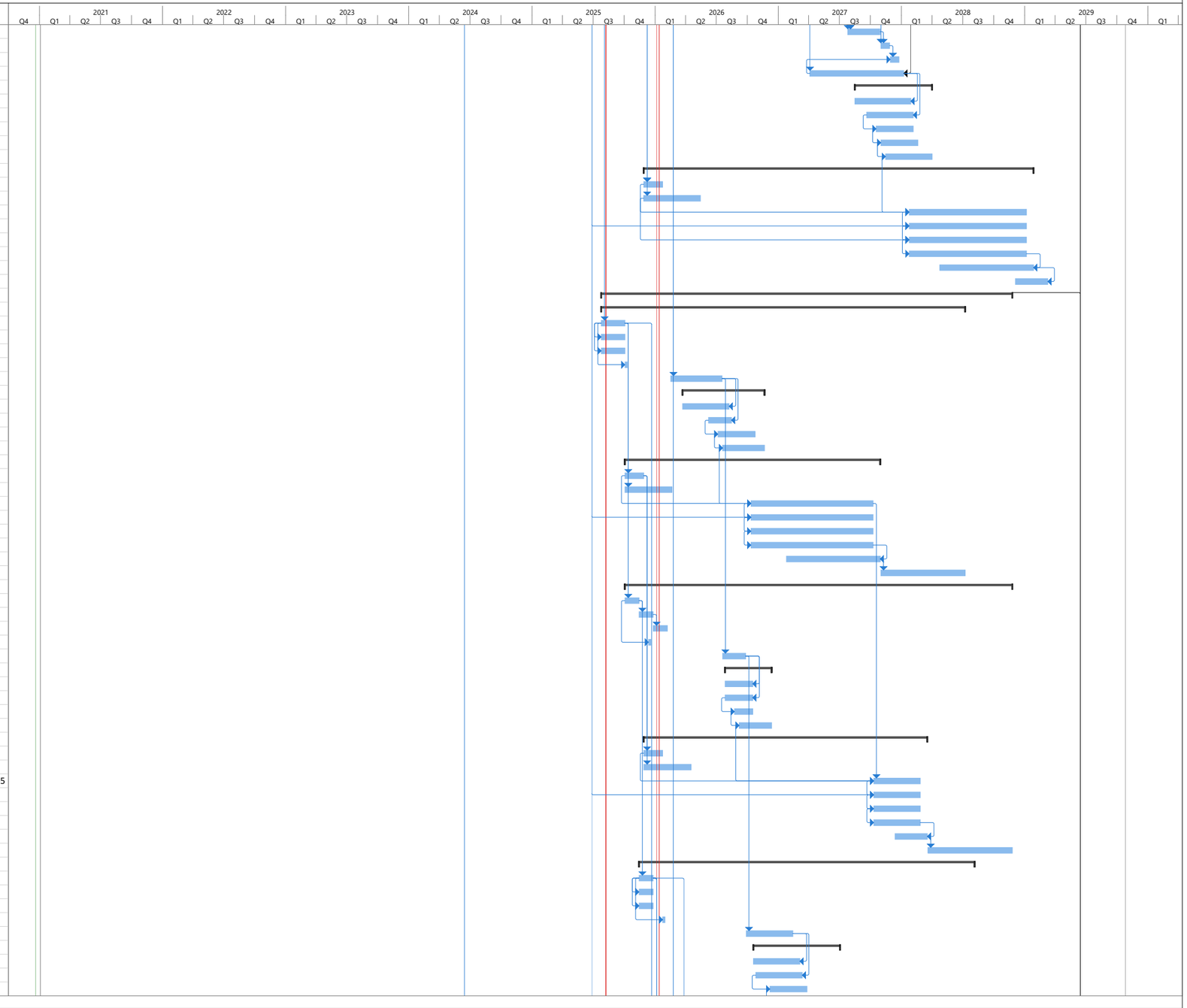


Project: Sites Reservoir
Date: Mon 12/21/20

Task | Milestone | Project Summary | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | External Tasks | Deadline | Critical Split | Manual Progress
Split | Summary | Inactive Task | Inactive Summary | Duration-only | Manual Summary | Finish-only | External Milestone | Critical | Progress

Sites Reservoir
Preliminary Construction Schedule
HR Facilities Alt 1 - 1.5 MAF
Roadways, Dams, and I/O Facilities
December 2020

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
71		Mechanical	70 days	Mon 7/26/27	Fri 10/29/27	67,69,70
72		**Sites Diversion Completion and Restoration**	20 days	Mon 11/1/27	Fri 11/26/27	69,70,71
73		**Construct Cofferdam to El. 310**	20 days	Mon 11/29/27	Fri 12/24/27	74SS+30 days,72
74		**Sites Dam - Foundation Excavation**	200 days	Mon 4/5/27	Fri 1/7/28	31,65FF+50 days
75		**Sites Dam - Foundation Preparation and Grouting**	**165 days**	**Mon 8/16/27**	**Fri 3/31/28**	
76		Foundation Cleaning	120 days	Mon 8/16/27	Fri 1/28/28	74FF+15 days
77		Dental Excavation and Concrete	100 days	Mon 9/20/27	Fri 2/4/28	74FF+20 days
78		Grout Cap	80 days	Mon 10/18/27	Fri 2/4/28	77SS+20 days
79		Consolidation Grouting	80 days	Mon 11/1/27	Fri 2/18/28	78SS+10 days
80		Curtain Grouting	100 days	Mon 11/15/27	Fri 3/31/28	79SS+10 days
81		**Sites Dam - Embankment**	**826 days**	**Fri 11/28/25**	**Fri 1/26/29**	
82		Initial Borrow Development (Core Material)	40 days	Fri 11/28/25	Thu 1/22/26	61,62,63,64
83		Initial Quarry Development for Zones 3 and 4	120 days	Fri 11/28/25	Thu 5/14/26	61
84		Place Zone 1 - Core	250 days	Mon 1/24/28	Fri 1/5/29	82SS+20 days,80SS+50 days
85		Place Zone 2A & 2B - Filters, Drains and Transitions	250 days	Mon 1/24/28	Fri 1/5/29	84SS,35SS+30 days
86		Place Zone 3 - Rockfill (Some Dbl Shift)	250 days	Mon 1/24/28	Fri 1/5/29	85SS,83SS+40 days
87		Place Zone 4 - Random (Some Dbl Shift)	250 days	Mon 1/24/28	Fri 1/5/29	86SS
88		Place Rip Rap	200 days	Mon 4/24/28	Fri 1/26/29	87FF+15 days
89		**Site Reclamation and Topsoil Replacement**	70 days	Mon 12/4/28	Fri 3/9/29	88FF+30 days
90		**Saddle Dams**	**871 days**	**Fri 7/25/25**	**Fri 11/24/28**	
91		**Saddle Dam 3**	**771 days**	**Fri 7/25/25**	**Fri 7/7/28**	
92		Saddle Dam 3 - Access and Staging	50 days	Fri 7/25/25	Thu 10/2/25	23
93		Erosion and Sediment Control	50 days	Fri 7/25/25	Thu 10/2/25	92SS
94		Clearing / Grubbing Topsoil Salvage from Work Areas	50 days	Fri 7/25/25	Thu 10/2/25	92SS
95		Demolition	5 days	Fri 10/3/25	Thu 10/9/25	92SS+50 days
96		Saddle Dam 3 - Foundation Excavation (Dbl Shift)	110 days	Mon 2/16/26	Fri 7/17/26	31
97		**Saddle Dam 3 - Foundation Preparation and Grouting**	**175 days**	**Mon 3/23/26**	**Fri 11/20/26**	
98		Foundation Cleaning	100 days	Mon 3/23/26	Fri 8/7/26	96FF+15 days
99		Dental Excavation and Concrete	50 days	Mon 6/8/26	Fri 8/14/26	96FF+20 days
100		Grout Cap	80 days	Mon 7/6/26	Fri 10/23/26	99SS+20 days
101		Curtain Grouting	90 days	Mon 7/20/26	Fri 11/20/26	100SS+10 days
102		**Saddle Dam 3 - Embankment**	**541 days**	**Fri 10/3/25**	**Fri 10/29/27**	
103		Initial Borrow Development (Core Material)	40 days	Fri 10/3/25	Thu 11/27/25	92
104		Initial Quarry Development for Zones 3 and 4	100 days	Fri 10/3/25	Thu 2/19/26	92
105		Place Zone 1 - Core	260 days	Mon 10/12/26	Fri 10/8/27	103SS+20 days,101SS+60 days
106		Place Zone 2A & 2B - Filters, Drains and Transitions	260 days	Mon 10/12/26	Fri 10/8/27	105SS,35SS+30 days
107		Place Zone 3 - Rockfill	260 days	Mon 10/12/26	Fri 10/8/27	106SS
108		Place Zone 4 - Random	260 days	Mon 10/12/26	Fri 10/8/27	107SS
109		Place Rip Rap	200 days	Mon 1/25/27	Fri 10/29/27	108FF+15 days
110		**Site Reclamation and Topsoil Replacement**	180 days	Mon 11/1/27	Fri 7/7/28	109
111		**Saddle Dam 5**	**821 days**	**Fri 10/3/25**	**Fri 11/24/28**	
112		Saddle Dam 5 - Access and Staging	30 days	Fri 10/3/25	Thu 11/13/25	92
113		Erosion and Sediment Control	30 days	Fri 11/14/25	Thu 12/25/25	112
114		Clearing / Grubbing Topsoil Salvage from Work Areas	30 days	Fri 12/26/25	Thu 2/5/26	113
115		Demolition	5 days	Fri 12/12/25	Thu 12/18/25	112SS+50 days
116		Saddle Dam 5 - Foundation Excavation	50 days	Mon 7/20/26	Fri 9/25/26	96
117		**Saddle Dam 5 - Foundation Preparation and Grouting**	**100 days**	**Mon 7/27/26**	**Fri 12/11/26**	
118		Foundation Cleaning	60 days	Mon 7/27/26	Fri 10/16/26	116FF+15 days
119		Dental Excavation and Concrete	60 days	Mon 7/27/26	Fri 10/16/26	116FF+15 days
120		Grout Cap	40 days	Mon 8/24/26	Fri 10/16/26	119SS+20 days
121		Curtain Grouting	70 days	Mon 9/7/26	Fri 12/11/26	120SS+10 days
122		**Saddle Dam 5 - Embankment**	**601 days**	**Fri 11/28/25**	**Fri 3/17/28**	
123		Initial Borrow Development (Core Material)	40 days	Fri 11/28/25	Thu 1/22/26	103
124		Initial Quarry Development for Zones 3 and 4	100 days	Fri 11/28/25	Thu 4/16/26	103
125		Place Zone 1 - Core	100 days	Mon 10/11/27	Fri 2/25/28	121SS+60 days,123SS+20 days,105
126		Place Zone 2A & 2B - Filters, Drains and Transitions	100 days	Mon 10/11/27	Fri 2/25/28	125SS,35SS+30 days
127		Place Zone 3 - Rockfill	100 days	Mon 10/11/27	Fri 2/25/28	126SS
128		Place Zone 4 - Random	100 days	Mon 10/11/27	Fri 2/25/28	127SS
129		Place Rip Rap	70 days	Mon 12/13/27	Fri 3/17/28	128FF+15 days
130		**Site Reclamation and Topsoil Replacement**	180 days	Mon 3/20/28	Fri 11/24/28	129
131		**Minor Saddle Dams (SD1,SD2,SD6,SD8A, Dike 1, and Dike 2**	**711 days**	**Fri 11/14/25**	**Fri 8/4/28**	
132		Minor Saddle Dams - Access and Staging	30 days	Fri 11/14/25	Thu 12/25/25	112
133		Erosion and Sediment Control	30 days	Fri 11/14/25	Thu 12/25/25	132SS
134		Clearing / Grubbing Topsoil Salvage from Work Areas	30 days	Fri 11/14/25	Thu 12/25/25	132SS
135		Demolition	5 days	Fri 1/23/26	Thu 1/29/26	132SS+50 days
136		Minor Saddle Dams - Foundation Excavation	100 days	Mon 9/28/26	Fri 2/12/27	116
137		**Minor Saddle Dams - Foundation Preparation and Grout**	**185 days**	**Mon 10/19/26**	**Fri 7/2/27**	
138		Foundation Cleaning	100 days	Mon 10/19/26	Fri 3/5/27	136FF+15 days
139		Dental Excavation and Concrete	100 days	Mon 10/26/26	Fri 3/12/27	136FF+20 days
140		Grout Cap	80 days	Mon 12/7/26	Fri 3/26/27	139SS+30 days

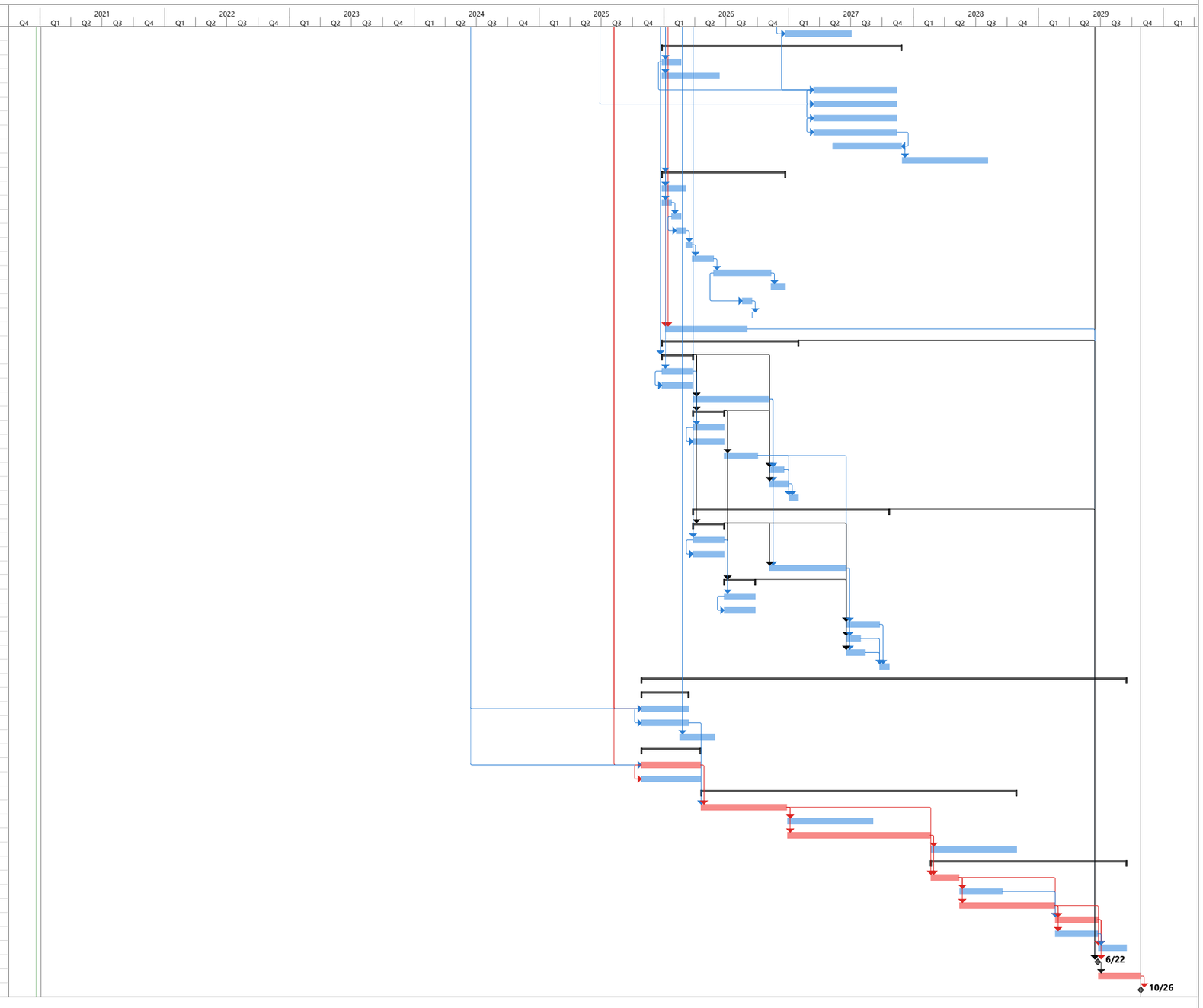


Project: Sites Reservoir
Date: Mon 12/21/20

Task | Milestone | Project Summary | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | External Tasks | Deadline | Critical Split | Manual Progress
Split | Summary | Inactive Task | Inactive Summary | Duration-only | Manual Summary | Finish-only | External Milestone | Critical | Progress

Sites Reservoir
Preliminary Construction Schedule
HR Facilities Alt 1 - 1.5 MAF
Roadways, Dams, and I/O Facilities
December 2020

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
141		Curtain Grouting	140 days	Mon 12/21/26	Fri 7/2/27	140SS+10 days
142		**Minor Saddle Dams - Embankment**	**501 days**	**Fri 12/26/25**	**Fri 11/26/27**	
143		Initial Borrow Development (Core Material)	40 days	Fri 12/26/25	Thu 2/19/26	132
144		Initial Quarry Development for Zones 3 and 4	120 days	Fri 12/26/25	Thu 6/11/26	132
145		Place Zone 1 - Core	175 days	Mon 3/15/27	Fri 11/12/27	141SS+60 days,143SS+20 days
146		Place Zone 2A & 2B - Filters, Drains and Transitions	175 days	Mon 3/15/27	Fri 11/12/27	145SS,35SS+30 days
147		Place Zone 3 - Rockfill	175 days	Mon 3/15/27	Fri 11/12/27	146SS
148		Place Zone 4 - Random	175 days	Mon 3/15/27	Fri 11/12/27	147SS
149		Place Rip Rap	145 days	Mon 5/10/27	Fri 11/26/27	148FF+10 days
150		**Site Reclamation and Topsoil Replacement**	180 days	Mon 11/29/27	Fri 8/4/28	149
151		**Saddle Dam 8B - Spillway**	**257 days**	**Fri 12/26/25**	**Mon 12/21/26**	**132**
152		Batch Plant Setup and Operational	50 days	Fri 12/26/25	Thu 3/5/26	132
153		SD 8B - Foundation Excavation	20 days	Fri 12/26/25	Thu 1/22/26	132
154		SD 8B - Foundation Cleaning	20 days	Fri 1/23/26	Thu 2/19/26	153
155		SD 8B - Dental Excavation and Concrete	20 days	Fri 2/6/26	Thu 3/5/26	154SS+10 days
156		SD 8B - Grout Cap	12 days	Fri 3/6/26	Mon 3/23/26	155
157		SD 8B - Foundation Grouting	45 days	Tue 3/24/26	Mon 5/25/26	156
158		SD 8B - Mass Concrete	120 days	Tue 5/26/26	Mon 11/9/26	157
159		SD 8B - Bridge	30 days	Tue 11/10/26	Mon 12/21/26	158
160		SD 8B - Clay Backfill	20 days	Tue 8/18/26	Mon 9/14/26	158SS+60 days
161		SD 8B - Riprap and Drain Gravel	3 days	Tue 9/15/26	Thu 9/17/26	160
162		**Rim Grouting**	171 days	Mon 1/5/26	Mon 8/31/26	15,22
163		**Emergency Release Structure No. 1**	**285 days**	**Fri 12/26/25**	**Thu 1/28/27**	
164		**Develop Downstream Portal**	**65 days**	**Fri 12/26/25**	**Thu 3/26/26**	**92**
165		Portal Excavation	65 days	Fri 12/26/25	Thu 3/26/26	132
166		Rock Bolting	65 days	Fri 12/26/25	Thu 3/26/26	165SS
167		Tunnel Excavation and Lining (Dbl Shift)	160 days	Fri 3/27/26	Thu 11/5/26	164
168		**Develop Upstream Portal**	**65 days**	**Fri 3/27/26**	**Thu 6/25/26**	**164**
169		Portal Excavation	65 days	Fri 3/27/26	Thu 6/25/26	165
170		Rock Bolting	65 days	Fri 3/27/26	Thu 6/25/26	169SS
171		Outlet Structure Concrete	70 days	Fri 6/26/26	Thu 10/1/26	168
172		Install 10-Ft Cut and Cover Pipe	30 days	Fri 11/6/26	Thu 12/17/26	164,167
173		Inlet Structure Concrete	40 days	Fri 11/6/26	Thu 12/31/26	167,168
174		ERS - 1 Completion and Restoration	20 days	Fri 1/1/27	Thu 1/28/27	171,172,173
175		**Emergency Release Structure No. 2**	**410 days**	**Fri 3/27/26**	**Thu 10/21/27**	
176		**Develop Downstream Portal**	**65 days**	**Fri 3/27/26**	**Thu 6/25/26**	**164**
177		Portal Excavation	65 days	Fri 3/27/26	Thu 6/25/26	132
178		Rock Bolting	65 days	Fri 3/27/26	Thu 6/25/26	177SS
179		Tunnel Excavation and Lining (Dbl Shift)	160 days	Fri 11/6/26	Thu 6/17/27	176,167
180		**Develop Upstream Portal**	**65 days**	**Fri 6/26/26**	**Thu 9/24/26**	**176,168**
181		Portal Excavation	65 days	Fri 6/26/26	Thu 9/24/26	177
182		Rock Bolting	65 days	Fri 6/26/26	Thu 9/24/26	181SS
183		Outlet Structure Concrete	70 days	Fri 6/18/27	Thu 9/23/27	171,176,179
184		Install 10-Ft Cut and Cover Pipe	30 days	Fri 6/18/27	Thu 7/29/27	176,179
185		Inlet Structure Concrete	40 days	Fri 6/18/27	Thu 8/12/27	179,180
186		ERS - 2 Completion and Restoration	20 days	Fri 9/24/27	Thu 10/21/27	183,184,185
187		**Inlet Outlet Facilities**	**1015 days**	**Mon 10/27/25**	**Fri 9/14/29**	
188		**Develop Downstream Portal**	**100 days**	**Mon 10/27/25**	**Fri 3/13/26**	
189		Portal Excavation	100 days	Mon 10/27/25	Fri 3/13/26	22SS+50 days,25SS+50 days
190		Rock Bolting	100 days	Mon 10/27/25	Fri 3/13/26	189SS
191		**Intake Channel Excavation**	75 days	Mon 2/16/26	Fri 5/29/26	31
192		**Develop Upstream Portal**	**125 days**	**Mon 10/27/25**	**Fri 4/17/26**	
193		Portal Excavation	125 days	Mon 10/27/25	Fri 4/17/26	22SS+50 days,25SS+50 days
194		Rock Bolting	125 days	Mon 10/27/25	Fri 4/17/26	193SS
195		**Tunnels Excavation and Lining (Double Shift)**	**660 days**	**Mon 4/20/26**	**Fri 10/27/28**	
196		North Tunnel Excavation - Two Headings, Double Shift	180 days	Mon 4/20/26	Fri 12/25/26	190,193
197		North Tunnel Lining	180 days	Mon 12/28/26	Fri 9/3/27	196
198		South Tunnel Excvation - Double Shift	300 days	Mon 12/28/26	Fri 2/18/28	196
199		South Tunnel Lining	180 days	Mon 2/21/28	Fri 10/27/28	198
200		**Intake and Outlet Structures**	**410 days**	**Mon 2/21/28**	**Fri 9/14/29**	
201		Intake Structure Foundation	60 days	Mon 2/21/28	Fri 5/12/28	196,198
202		Tunnel Bifurcation	90 days	Mon 5/15/28	Fri 9/15/28	201
203		Intake Structure Concrete	200 days	Mon 5/15/28	Fri 2/16/29	201
204		Intake Structure Gates and Mechanical	90 days	Mon 2/19/29	Fri 6/22/29	203,202,201
205		Tower Access Bridge	90 days	Mon 2/19/29	Fri 6/22/29	203
206		I/O Completion and Restoration	60 days	Mon 6/25/29	Fri 9/14/29	203,204,205
207		**Dams and I/O Ready for Commissioning**	0 days	Fri 6/22/29	Fri 6/22/29	21,90,37,60,162,163,175,204
208		Dams and I/O Startup and Commissioning	90 days	Mon 6/25/29	Fri 10/26/29	207
209		Dams and I/O Substantial Completion	0 days	Fri 10/26/29	Fri 10/26/29	208



Project: Sites Reservoir
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Task | Milestone | Project Summary | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | External Tasks | Deadline | Critical Split | Manual Progress
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Appendix C
Equipment and Workforce Use Tables

Sites Reservoir
Constructability Analysis Technical Memorandum
Alt 1 - 1.5 MAF Dams, Roadways, and I-O Facilities
Equipment Use Tables for Air Quality Analysis
December, 2020

Notes:

- The AQ Tables are intended to inform the project team regarding expected equipment type, hours and horsepower, as well as expected manpower.
- At this point in the project, the design is at feasibility level. Further design development will determine final quantities and other factors will influence the final equipment use.
- Various contractors will approach the work differently from each other, and likely different from our interpretation of equipment use and staffing.
- The AQ Tables are an approximation of the equipment, crews, and production needed to complete the project. This is somewhat dictated by a lack of design details, although some details and quantities have been extrapolated based on best industry practices and expectations.
- Site geologic study and interpretation is incomplete. Future geotechnical work will effect final design and quantities.
- Procurement strategies and outcomes, including contract packages, will have some impact on the use and timing of equipment and crews.
- The AQ tables have been grouped with similar work in one "Package". The Roadways Package under the "General and Indirects" heading would include the General and Indirect costs for all of the Roadways.
- Similarly, in the AQ Tables, data is grouped for multiple features (i.e. Saddle Dams 1, 2, 6, 8A, and 8B). This is the combined total for Saddle Dams 1, 2, 6, 8A, and 8B in Alternative 1.
- Travel Speeds for Vehicles - The average speed for pickup trucks and supervisory vehicles would be about 20 mph, but will vary with individual duties and activities.
- Travel Speeds for off-site Hauling Vehicles - For off-site haul vehicles (Such as those making deliveries to the job) an average of 40 mph was used from their point on origination to the delivery site and return to point of origin.
- Travel Speeds for on-site Hauling Vehicles - We utilize average speeds for hauling calculations. For on-site haul vehicles, such as those used to haul excavated or processed material, we use an average of 15 mph.
- Travel Speeds for Support equipment, such as water trucks and graders, would be about 15 mph. Operational speeds while performing work would be about 3 - 5 mph.
- No off-road, mobile, electric powered equipment is anticipated at this time.
- Electric power generation is included in the AQ Tables as applicable for the various aggregate processing and batch plant needs. It is possible that some of this equipment would use direct line power, if such line power is available to the site on time and is economical.
- Power supply for such facilities as offices, QC labs, and shop facilities will be included in the Final AQ Tables as diesel generated power. Line power or diesel generated power will not be duplicated in the data.
- It is anticipated that approximately half of the pickup trucks will be gasoline powered, the other half would be diesel powered. All other equipment would be diesel powered.
- Within the Sites Reservoir Inundation Area there are approximately 240 houses, 295 barns, and 450 other structures (combination of sheds, silos, and a pump houses) that would be demolished once all property owner negotiations are completed. This information is provided under the Demolition heading in Appendix 2C for Alternative 1. It will be the same for Alternative 2. Limited information is available, as these facilities are on private property and not currently accessible.
- The average workforce and staffing have been evaluated. Workforce and staff will vary during the course of the work as work activities ramp up, peak, and taper off toward completion.
- Regarding staff and workforce commute, it is anticipated that much of the workforce will come from the surrounding area, including the greater Sacramento area. The average daily commute is expected to be approximately 70 miles each way, or about 1.5 hours each way.
- Start and End dates are reflective of the Preliminary Construction Schedule produced as a separate document. The manpower and equipment presented here demonstrates the overall level of effort to complete each task within that time frame. Schedule allowances have been made for ramp-up and resource leveling during that time frame, including allowances for double-shift work as well as multiple crews as needed to maintain the construction schedule.
- For on-site batched concrete, HP-HRS and Manhours have been calculated on a cubic yard basis, using a 50 CY / hour capacity batch plant, operating at 40 % utilization. Component values for the concrete, such as aggregate and cement, have been added to values for batching. The total values for HP-HRs and Manhours are included in activities requiring batched concrete.
- Columns and Rows in this spreadsheet can be expanded and contracted by clicking on the "+" (Expand) and "-" (Contract) signs at the spreadsheet margins. The spreadhsheet is 4000 lines of detail and these functions will facilitate the user's navigation.

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

Abbreviations	Description
WBS	Work Breakdown Structure
MO	Calendar Month
HR	Work Hour
Day	Work Day of 10 Hours
Week	Work Week of 5 - 10 hour shifts
Shift	A Single Shift of 10 work hours
LS	Lump Sum
CY	Cubic Yard - typically references concrete
BCY	Bank Cubic Yard - references excavation quantities
ECY	Embanked Cubic Yard - references embankment or fill quantities
SY	Square Yard
AC	Acre
LF or FT	Linear Foot
AF or AC-FT	Acre - Foot
Ton or TN	US Ton
HP	Horse Power
HP-HR	1 Horsepower X 1 Hour
KW	Kilowatt
LBS	Pounds

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
	Project Site Staffing and Support Facilities									
	Daily Staff and Work Force Personnel Trips									Average
	Owners and Engineers Contract Management Staff					4/1/2024	11/23/2029			88
	Golden Gate and Sites Reservoir Package					5/26/2025	4/20/2029			230
	Saddle Dams Package					5/26/2025	11/24/2028			188
	Inlet Outlet Facilities Package					5/26/2025	9/14/2029			139
	Roadways Package					4/1/2024	7/19/2027			202
	Owners and Engineers Contract Management Staff									
	Owner and Engineer's Project Management Staff		VARIABLE		1,200			61,130,000	372,000	31
	Management Night Shift Staff							12,320,000	72,000	9
	Owner's Quality Control-Quality Assurance Program		VARIABLE		1,200			71,980,000	408,000	34
	QC Night Shift Staff							18,480,000	112,000	14
	Golden Gate and Sites Dams Package General and Management Staff					5/26/2025	4/20/2029			
	Demolition	1	LS	300	33			972,833	4,333	13
	Erosion and Sediment Control	1	LS	250	28			378,472	3,889	14
	Clearing and Grubbing	80	ACRE	180	20			693,700	1,600	8
	Setup Water Supply for Dust Control and Compaction	1	LS	300	33			622,833	4,000	12
	Reservoir Clearing	1,050	ACRE	2100	233			4,287,500	28,000	12
	Mobilization	1	LS	500	56			1,636,667	9,444	17
	Project Management Staff		VARIABLE		800			44,677,500	235,000	33
	Management Night Shift Staff							5,775,000	36,000	6
	Contractor Quality Control Program		VARIABLE		800			18,816,000	104,000	13
	QC Night Shift Staff							4,620,000	30,000	5
	Contractor's Safety Program		VARIABLE		800			15,400,000	96,000	12
	Safety Night Shift Staff							1,155,000	12,000	4
	Contractor's Environmental Program		VARIABLE		800			6,160,000	42,400	5
	Contractor's Shop and Yard Support Facilities		VARIABLE		800			11,700,000	32,000	4
	Construction Surveying		VARIABLE		700			10,780,000	56,000	8
	Saddle Dams Package General and Management Staff					5/26/2025	11/24/2028			
	Demolition	1	LS		11			324,278	1,444	13
	Erosion and Sediment Control	1	LS	350	39			529,861	5,444	14
	Clearing and Grubbing	154	ACRE	3	57			1,978,330	4,563	8
	Setup Water Supply for Dust Control and Compaction	1	LS		44			830,444	5,333	12
	Reservoir Clearing	-	ACRE	5	-			-	-	
	Mobilization	1	LS		56			2,081,111	10,556	19
	Project Management Staff		VARIABLE		700			31,365,000	166,000	27
	Management Night Shift Staff							2,887,500	20,000	4
	Contractor Quality Control Program		VARIABLE		700			12,388,000	70,000	10
	QC Night Shift Staff							7,700,000	45,000	9
	Contractor's Safety Program		VARIABLE		700			7,700,000	47,000	7
	Safety Night Shift Staff							2,887,500	20,000	4
	Contractor's Environmental Program		VARIABLE		700			5,390,000	37,100	5
	Contractor's Shop and Yard Support Facilities		VARIABLE		700			7,542,500	21,000	3
	Construction Surveying		VARIABLE		600			9,240,000	48,000	8

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
Inlet - Outlet Facilities Package General and Management Staff						5/26/2025	9/14/2029			
	Demolition	1	LS	20	2			31,789	156	**7**
	Erosion and Sediment Control	1	LS	80	9			121,111	1,244	**14**
	Clearing and Grubbing	22	ACRE	3	8			282,619	652	**8**
	Setup Water Supply for Dust Control and Compaction	1	LS	250	28			519,028	3,333	**12**
	Reservoir Clearing	-	ACRE	5	-			-	-	
	Mobilization	1	LS	300	33			1,248,667	6,333	**19**
	Project Management Staff		VARIABLE		800			29,632,500	153,000	**22**
	Management Night Shift Staff							8,085,000	54,000	**9**
	Contractor Quality Control Program		VARIABLE		800			9,308,000	48,000	**6**
	QC Night Shift Staff							3,465,000	24,000	**4**
	Contractor's Safety Program		VARIABLE		800			4,620,000	32,000	**6**
	SafetyNight Shift Staff							1,155,000	12,000	**4**
	Contractor's Environmental Program		VARIABLE		800			4,620,000	26,400	**3**
	Contractor's Shop and Yard Support Facilities		VARIABLE		800			8,620,000	24,000	**3**
	Construction Surveying		VARIABLE		800			10,780,000	56,000	**7**
Roadways Package General and Management Staff						4/1/2024	7/19/2027			
	Demolition	1	LS	100	11			324,278	1,444	**13**
	Erosion and Sediment Control	1	LS	600	67			908,333	9,333	**14**
	Clearing and Grubbing	461	ACRE	770	86			6,073,161	13,689	**16**
	Setup Water Supply for Dust Control and Compaction	1	LS	400	44			830,444	5,333	**12**
	Reservoir Clearing	-	ACRE	5	-			-	-	
	Mobilization	1	LS	400	44			1,664,889	8,444	**19**
	Project Management Staff		VARIABLE		800			46,320,000	264,000	**33**
	Management Night Shift Staff							-	-	**0**
	Contractor Quality Control Program		VARIABLE		800			13,392,000	80,000	**10**
	QC Night Shift Staff							-	-	**0**
	Contractor's Safety Program		VARIABLE		800			9,240,000	64,000	**10**
	Safety Night Shift Staff							-	-	**0**
	Contractor's Environmental Program		VARIABLE		800			9,240,000	60,800	**7**
	Contractor's Shop and Yard Support Facilities		VARIABLE		800			12,500,000	40,000	**5**
	Construction Surveying		VARIABLE		800			16,940,000	88,000	**11**

	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
	Dams										
	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
		Golden Gate Dam									
Golden Gate Da											
	20.03-1	**Process and Haul Filter Materials to Project**									
	20.03-1.01	**Golden Gate**	**2,560,800**	**Tons**							
	20.03-1.01.01	Process and Stockpile on Project - Zone 2A - Filter	726,000	Tons	2678	298	5/26/2025	5/4/2029	149,639,796	335,895	**32**
	20.03-1.01.02	Process and Stockpile on Project - Zone 2A - Drain	803,000	Tons	2962	329	5/26/2025	5/4/2029			
	20.03-1.01.03	Process and Stockpile on Project - Zone 2A - Transition	107,800	Tons	398	44	5/26/2025	5/4/2029			
	20.03-1.01.04	Process and Stockpile on Project - Zone 2B - Filter	451,000	Tons	1664	185	5/26/2025	5/4/2029			
	20.03-1.01.05	Process and Stockpile on Project - Zone 2B - Transition	473,000	Tons	1745	194	5/26/2025	5/4/2029			
	21.01-2	**Foundation Preparation and Grouting**									
	21.01-2.01	**Foundation Excavation**									
	21.01-2.01.01	Topsoil Salvage	125,000	BCY	207	23	9/23/2024	2/7/2025	1,629,250	3,219	**14**
	21.01-2.01.02	Dam Foundation Excavation - Common	325,000	BCY	537	60	2/16/2026	11/20/2026	4,236,046	8,358	**14**
	21.01-2.01.03	Dam Foundation Rock Exc - Rippable Rock	991,000	BCY	1638	182	2/16/2026	11/20/2026	13,484,522	27,311	**15**
	21.01-2.01.04	Dam Foundation Rock Ex - Drill and Shoot	159,000	BCY	398	44	2/16/2026	11/20/2026	4,095,159	10,566	**24**
	21.01-2.02	**Foundation Preparation and Grouting**	217,000	SY							
		(Includes Initial and Final Cleaning under Core and Cleaning under Shell)									
	21.01-2.02.01	Foundation Preparation - Beneath Core	65,000	SY	650	72	7/27/2026	12/11/2026			
Golden Gate Dam	21.01-2.02.01.a	Initial Foundation Cleaning - Core	65,000	SY	650	72	7/27/2026	12/11/2026	671,668	6,503	**9**
	21.01-2.02.01.b	Final Foundation Cleaning - Core	65,000	SY	650	72	7/27/2026	12/11/2026	671,668	6,503	**9**
	21.01-2.02.01.c	Dental Excavation	3,700	BCY	361	40	7/27/2026	12/18/2026	453,113	2,814	**7**
	21.01-2.02.01.d	Dental Concrete	3,700	CY	336	37	7/27/2026	12/18/2026	1,004,719	4,830	**13**
	21.01-2.02.01.e	Grout Cap with Anchors	9,900	CY	450	50	9/28/2026	2/12/2027	2,484,550	14,920	**30**
	21.01-2.02.01.f	Curtain Grouting	96,100	LF	1602	178	10/26/2026	5/21/2027	6,746,200	30,260	**17**
	21.01-2.02.01.g	Consolidation Grouting	40,000	LF	1000	111	10/12/2026	4/2/2027	3,008,334	13,337	**12**
	21.01-2.02.01.h	Type III Cement	4,800	Tons	2602	289	11/30/2026	7/9/2027	1,402,190	14,458	**5**
	21.01-2.02.02	Foundation Preparation - Beneath Shell	152,000	SY	190	21	10/12/2026	5/21/2027	314,769	1,272	**6**
	21.01-2.02.03	Foundation Drainage									
	21.01-2.02.03.a	Furnish and Install Foundation Drain Pipe	500	LF	30	3	7/27/2026	12/11/2026	20,017	168	**5**
	21.01-2.02.03.b	Furnish and Install Foundation Drain Manholes	3	EA	30	3	7/27/2026	12/11/2026	20,017	168	**5**
	21.01-2.02.03.c	Seepage Partition Walls	700	CY	350	39	7/27/2026	12/11/2026	463,985	3,783	**10**
	21.01-3	**Embankment**									
	21.01-3.01	**Develop Borrow Areas**	1	LS							
	21.01-3.01.01	Z1 Strip/Overburden/Waste to Stockpile	1,150,000	BCY	1045	116	2/23/2026	4/17/2026	6,477,755	9,295	**8**
	21.01-3.01.02	Z3 Strip/Overburden/Waste to Stockpile-Q1	499,000	BCY	907	101	2/23/2026	8/7/2026	4,223,358	11,096	**11**
	21.01-3.01.03	Z3 Strip/Overburden/Waste to Stockpile-Q2	3,849,000	BCY	6123	680	2/23/2026	8/7/2026	38,914,268	74,844	**11**
	21.01-3.01.04	Z4 Strip/Overburden/Waste to Stockpile	0	BCY							
	21.01-3.02	**Restore Borrow Areas**									
	21.01-3.02.01	Replace Overburden from Stockpile	2,199,200	ECY	3635	404	11/6/2028	4/20/2029	4,236,046	8,358	**14**
	21.01-3.02.02	Topsoil Replacement	125,000	ECY	207	23	11/6/2028	4/20/2029	1,463,960	2,759	**12**
	21.01-3.03	**Furnish and Install Zone 1 - Core**	2,400,000	ECY	3879	431	2/15/2027	2/16/2029	36,947,613	68,960	**16**

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
Golden Gate Dam											
	21.01-3.04	**Furnish and Install Zone 2A - Filter**	726,000	Tons	1034	115	2/15/2027	2/16/2029			**11**
	21.01-3.05	**Furnish and Install Zone 2A - Drain**	803,000	Tons	1144	127	2/15/2027	2/16/2029			
	21.01-3.06	**Furnish and Install Zone 2B - Filter**	107,800	Tons	154	17	2/15/2027	2/16/2029	15,611,628	44,594	
	21.01-3.07	**Furnish and Install Zone 2A - Transition**	451,000	Tons	643	71	2/15/2027	2/16/2029			
	21.01-3.08	**Furnish and Install Zone 2B - Transition**	473,000	Tons	674	75	2/15/2027	2/16/2029			
	21.01-3.09	**Furnish and Install Zone 3 - Rockfill**	2,600,000	ECY	4727	525	2/15/2027	2/16/2029	92,320,800	188,224	**39**
	21.01-3.10	**Furnish and Install Zone 4 - Random**	2,200,000	ECY	4000	444	2/15/2027	2/16/2029	30,440,003	57,781	**13**
	21.01-3.11	**Furnish and Install Riprap**	98,000	ECY	255	28	5/17/2027	3/9/2029	1,360,127	3,679	**13**
	21.01-3.12	**Production and Placement of Dam Crest Gravel**	1,300	CY	9	1	3/9/2029	3/10/2029	55,730	160	**16**

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
		Sites Dam									
Sites Dam	**20.03-1**	**Process and Haul Filter Materials to Project**									
	20.03-2.02	**Sites Dam**	**889,900**	**Tons**	**3283**	**365**					**32**
	20.03-2.02.01	Process and Stockpile on Project - Zone 2A - Filter	242,000	Tons	893	99	5/26/2025	5/4/2029			
	20.03-2.02.02	Process and Stockpile on Project - Zone 2A - Drain	297,000	Tons	1096	122	5/26/2025	5/4/2029	52,001,116	116,728	
	20.03-2.02.03	Process and Stockpile on Project - Zone 2A - Transition	42,900	Tons	158	18	5/26/2025	5/4/2029			
	20.03-2.02.04	Process and Stockpile on Project - Zone 2B - Filter	148,500	Tons	548	61	5/26/2025	5/4/2029			
	20.03-2.02.05	Process and Stockpile on Project - Zone 2B - Transition	159,500	Tons	588	65	5/26/2025	5/4/2029			
	22.01-3	**Foundation Preparation and Grouting**									
	22.01-3.01	**Foundation Excavation**									
	22.01-3.01.01	Topsoil Salvage	58,000	BCY	94	10	7/11/2025	11/27/2025	739,176	1,467	**14**
	22.01-3.01.02	Dam Foundation Excavation - Common	121,000	BCY	196	22	5/3/2027	2/4/2028	1,542,069	3,050	**14**
	22.01-3.01.03	Dam Foundation Rock Exc - Rippable Rock	344,000	BCY	625	69	5/3/2027	2/4/2028	4,932,061	9,730	**14**
	22.01-3.01.04	Dam Foundation Rock Ex - Drill and Shoot	47,000	BCY	118	13	5/3/2027	2/4/2028	1,210,524	2,866	**22**
	22.01-3.02	**Foundation Preparation and Grouting**									
		(Includes Initial and Final Cleaning)									
	22.01-3.02.01	Foundation Preparation - Beneath Core	20,000	SY							
	22.01-3.02.01.a	Initial Foundation Cleaning - Core	20,000	SY	200	22	9/13/2027	4/28/2028	206,668	2,003	**9**
	22.01-3.02.01.b	Final Foundation Cleaning - Core	20,000	SY	200	22	9/13/2027	4/28/2028	206,668	2,003	**9**
	22.01-3.02.01.c	Dental Excavation	800	BCY	107	12	10/18/2027	3/3/2028	111,094	715	**6**
	22.01-3.02.01.d	Dental Concrete	800	CY	80	9	10/18/2027	3/3/2028	242,057	1,173	**13**
	22.01-3.02.01.e	Grout Cap with Anchors	3,500	CY	159	18	11/15/2027	3/3/2028	878,379	5,277	**30**
	22.01-3.02.01.f	Curtain Grouting	31,800	LF	795	88	12/13/2027	4/28/2028	2,391,627	10,602	**12**
	22.01-3.02.01.g	Consolidation Grouting	13,900	LF	348	39	11/29/2027	3/17/2028	1,046,902	4,642	**12**
	22.01-3.02.01.h	Type III Cement	1,600	Tons	1143	127	11/29/2027	4/28/2028	615,950	6,350	**5**
	22.01-3.02.02	Foundation Preparation - Beneath Shell	69,100	SY	86	10	9/13/2027	4/28/2028	141,465	576	**6**
	22.01-3.02.03	Foundation Drainage									
	22.01-3.02.03.a	Furnish and Install Foundation Drain Pipe	500	LF	30	3	9/13/2027	4/28/2028	20,017	180	**6**
	22.01-3.02.03.b	Furnish and Install Foundation Drain Manholes	1	EA	30	3	9/13/2027	4/28/2028	20,017	180	**6**
	22.01-3.02.03.c	Seepage Partition Walls	0								
	22.01-4	**Embankment**									
	22.01-4.01	**Develop Borrow Areas**	1	LS							
	22.01-4.01.01	Z1 Strip/Overburden/Waste to Stockpile	339,000	BCY	308	34	11/28/2025	1/22/2026	1,909,531	2,742	**8**
	22.01-4.01.02	Z3 Strip/Overburden/Waste to Stockpile	1,768,000	BCY	2857	317	11/28/2025	5/14/2026	18,063,367	34,925	**11**
	22.01-4.01.03	Z4 Strip/Overburden/Waste to Stockpile	0	BCY	0	0			0	0	
	22.01-4.02	**Restore Borrow Areas**		BCY			5/7/2029	9/7/2029			
	22.01-4.02.01	Replace Overburden from Stockpile	842,800		1393	155	1/1/2029	4/6/2029	10,985,040	21,672	**14**
	22.01-4.02.02	Topsoil Replacement	58,000		96	11	1/1/2029	4/6/2029	679,281	2,759	**12**
	22.01-4.03	**Furnish and Install Zone 1 - Core**	710,000	ECY	1147	127	2/21/2028	2/2/2029	10,930,339	20,400	**16**
	22.01-4.04	**Furnish and Install Zone 2A - Filter**	242,000	Tons	345	38	2/21/2028	2/2/2029			**11**
	22.01-4.05	**Load, Haul and Place - Zone 2A - Drain**	297,000	Tons	423	47	2/21/2028	2/2/2029			
	22.01-4.06	**Load, Haul and Place - Zone 2A - Transition**	42,900	Tons	61	7	2/21/2028	2/2/2029	5,425,178	15,499	
	22.01-4.07	**Load, Haul and Place - Zone 2B - Filter**	148,500	Tons	212	24	2/21/2028	2/2/2029			
	22.01-4.08	**Load, Haul and Place - Zone 2B - Transition**	159,500	Tons	227	25	2/21/2028	2/2/2029			
	22.01-4.09	**Furnish and Install Zone 3 - Rockfill**	1,050,000	ECY	1909	212	2/21/2028	2/2/2029	36,490,071	74,075	**38**
	22.01-4.10	**Furnish and Install Zone 4 - Random**	660,000	ECY	1200	133	2/21/2028	2/2/2029	9,132,002	17,338	**13**
	22.01-4.11	**Furnish and Install Riprap**	40,000	ECY	104	12	5/22/2028	2/23/2029	555,156	1,504	**13**
	22.01-4.12	**Production and Placement of Dam Crest Gravel**	450	CY	3	0	2/24/2029	2/25/2029	18,577	53	**16**

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Equipment AQ Tables

	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
		Saddle Dam 3									
Sac	**20.03-3**	**Process and Haul Filter Materials to Project**									
	20.03-3.02	**Saddle Dam 3**	**730,400**		**2694**	**299**					**32**
	20.03-3.02.01	Process and Stockpile on Project - Zone 2A - Filter	319,000	Tons	1177	131	5/26/2025	5/4/2029			
	20.03-3.02.02	Process and Stockpile on Project - Zone 2A - Drain	319,000	Tons	1177	131	5/26/2025	5/4/2029	149,639,796	335,895	
	20.03-3.02.03	Process and Stockpile on Project - Zone 2A - Transition	92,400	Tons	341	38	5/26/2025	5/4/2029			
	20.03-3.02.04	Process and Stockpile on Project - Zone 2B - Filter	0	Tons	0	0	5/26/2025	5/4/2029			
	20.03-3.02.05	Process and Stockpile on Project - Zone 2B - Transition	0	Tons	0	0	5/26/2025	5/4/2029			
	23.01-2	**Foundation Preparation and Grouting**									
	23.01-2.01	**Foundation Excavation**									
Saddle Dam 3	23.01-2.01.01	Topsoil Salvage	106,000	BCY	171	19	7/25/2025	10/2/2025	1,350,902	2,672	**14**
	23.01-2.01.02	Dam Foundation Excavation - Common	81,000	BCY	131	15	2/16/2026	7/17/2026	1,032,294	2,042	**14**
	23.01-2.01.03	Dam Foundation Rock Exc - Rippable Rock	565,000	BCY	913	101	2/16/2026	7/17/2026	7,517,105	15,224	**15**
	23.01-2.01.04	Dam Foundation Rock Ex - Drill and Shoot	0	BCY					0	0	
	23.01-2.02	**Foundation Preparation and Grouting**	0	0							
	23.01-2.02.01	Foundation Preparation - Beneath Core	48,000	SY							
	23.01-2.02.01.a	Initial Foundation Cleaning - Core	48,000	SY	480	53	3/23/2026	8/7/2026	496,001	4,802	**9**
	23.01-2.02.01.b	Final Foundation Cleaning - Core	48,000	SY	480	53	3/23/2026	8/7/2026	496,001	4,802	**9**
	23.01-2.02.01.c	Dental Excavation	2,300	BCY	329	37	6/8/2026	8/14/2026	411,994	2,561	**7**
	23.01-2.02.01.d	Dental Concrete	2,300	CY	329	37	6/8/2026	8/14/2026	729,101	3,669	**10**
	23.01-2.02.01.e	Grout Cap with Anchors	7,600	CY	345	38	7/6/2026	10/23/2026	1,907,333	11,456	**30**
	23.01-2.02.01.f	Curtain Grouting	36,700	LF	918	102	7/20/2026	11/20/2026	2,761,650	12,240	**12**
	23.01-2.02.01.g	Consolidation Grouting	0	LF	0	0			0	0	
	23.01-2.02.01.h	Type III Cement	1,300	Tons	918	102	7/20/2026	11/20/2026	494,700	5,100	**5**
	23.01-2.02.01.i	Backfill Concrete	6,400	CY	183	20	6/8/2026	8/14/2026	1,466,009	7,968	**39**
	23.01-2.02.02	Foundation Preparation - Beneath Shell	172,000	SY	215	24	3/23/2026	8/7/2026	356,187	1,434	**6**
Saddle Dam 3	23.01-2.02.03	Foundation Drainage									
	23.01-2.02.03.a	Furnish and Install Foundation Drain Pipe	1,000	LF	30	3	3/23/2026	8/7/2026	20,017	180	**6**
	23.01-2.02.03.b	Furnish and Install Foundation Drain Manholes	3	EA	30	3	3/23/2026	8/7/2026	20,017	180	**6**
	23.01-2.02.03.c	Seepage Partition Walls	600	CY	300	33	3/23/2026	8/7/2026	377,701	3,149	**9**
	23.01-3	**Embankment**									
	23.01-3.01	**Develop Borrow Areas**	1	LS							
	23.01-3.01.01	Z1 Strip/Overburden/Waste to Stockpile	431,000	BCY	392	44	10/3/2025	11/27/2025	2,427,752	3,486	**8**
	23.01-3.01.02	Z3 Strip/Overburden/Waste to Stockpile, Q1	304,000	BCY	737	82	10/3/2025	2/19/2026	3,430,598	9,009	**11**
	23.01-3.01.03	Z3 Strip/Overburden/Waste to Stockpile, Q2	195,000	BCY	473	53	10/3/2025	3/19/2026	2,200,551	5,783	**11**
	23.01-3.01.04	Z4 Strip/Overburden/Waste to Stockpile	0	0					0	0	
	23.01-3.02	**Restore Borrow Areas**	0	0			10/25/2027	6/30/2028			
	23.01-3.02.01	Replace Overburden from Stockpile	372,000	ECY	615	68	11/1/2027	7/7/2028	4,848,645	9,573	**14**
	23.01-3.02.02	Topsoil Replacement	106,000	ECY	175	19	11/1/2027	7/7/2028	1,241,440	2,759	**12**
	23.01-3.03	**Furnish and Install Zone 1 - Core**	900,000	ECY	1455	162	10/12/2026	10/8/2027	13,855,357	25,865	**16**
	23.01-3.04	**Load, Haul and Place - Zone 2A - Filter**	319,000	Tons	454	50	10/12/2026	10/8/2027			**11**
	23.01-3.05	**Load, Haul and Place - Zone 2A - Drain**	319,000	Tons	454	50	10/12/2026	10/8/2027			
Saddle Dam 3	**23.01-3.06**	**Load, Haul and Place - Zone 2A - Transition**	92,400	Tons	132	15	10/12/2026	10/8/2027	4,452,805	12,725	
	23.01-3.07	**Load, Haul and Place - Zone 2B - Filter**	0	Tons	0	0					
	23.01-3.08	**Load, Haul and Place - Zone 2B - Transition**	0	Tons	0	0					
	23.01-3.09	**Furnish and Install Zone 3 - Rockfill**	610,000	ECY	1109	123	10/12/2026	10/8/2027	21,198,998	43,038	**38**
	23.01-3.10	**Furnish and Install Zone 4 - Random**	1,663,000	ECY	3024	336	10/12/2026	10/8/2027	23,009,877	43,679	**13**
	23.01-3.11	**Furnish and Install Riprap**	130,000	ECY	236	26	1/25/2027	10/29/2027	1,798,731	3,418	**13**
	23.01-3.12	**Production and Placement of Dam Crest Gravel**	1,900	CY	13	1			80,499	231	**16**

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	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
		Saddle Dam 5									
Saddle Dan	**20.03-4**	**Process and Haul Filter Materials to Project**									
	20.03-4.02	**Saddle Dam 5**	**283,800**	**Tons**	**1047**	**116**					**32**
	20.03-4.02.01	Process and Stockpile on Project - Zone 2A - Filter	121,000	Tons	446	50	5/26/2025	5/4/2029			
	20.03-4.02.02	Process and Stockpile on Project - Zone 2A - Drain	126,500	Tons	467	52	5/26/2025	5/4/2029	16,583,797	37,230	
	20.03-4.02.03	Process and Stockpile on Project - Zone 2A - Transition	36,300	Tons	134	15	5/26/2025	5/4/2029			
	20.03-4.02.04	Process and Stockpile on Project - Zone 2B - Filter	0	Tons	0	0					
	20.03-4.02.05	Process and Stockpile on Project - Zone 2B - Transition	0	Tons	0	0					
	23.02-2	**Foundation Preparation and Grouting**									
	23.02-2.01	**Foundation Excavation**									
	23.02-2.01.01	Topsoil Salvage	58,000	CY	94	10	12/26/2025	2/5/2026	739,176	1,467	**14**
	23.02-2.01.02	Dam Foundation Excavation - Common	24,000	CY	39	4	7/20/2026	9/25/2026	305,870	613	**14**
	23.02-2.01.03	Dam Foundation Rock Exc - Rippable Rock	256,000	CY	465	52	7/20/2026	9/25/2026	3,831,730	7,766	**15**
	23.02-2.01.04	Dam Foundation Rock Ex - Drill and Shoot	0	CY					0	0	
Saddle Dam 5	**23.02-2.02**	**Foundation Preparation and Grouting**									
	23.02-2.02.01	**Foundation Preparation - Beneath Core**	23,000	SY							
	23.02-2.02.01.a	Initial Foundation Cleaning - Core	23,000	SY	230	26	7/27/2026	10/16/2026	214,669	1,791	**7**
	23.02-2.02.01.b	Final Foundation Cleaning - Core	23,000	SY	230	26	7/27/2026	10/16/2026	214,669	1,791	**7**
	23.02-2.02.01.c	Dental Excavation	1,300	CY	186	21	7/27/2026	10/16/2026	232,870	1,449	**7**
	23.02-2.02.01.d	Dental Concrete	1,300	CY	186	21	7/27/2026	10/16/2026	412,102	2,074	**10**
	23.02-2.02.01.e	Grout Cap with Anchors	4,200	CY	191	21	8/24/2026	10/16/2026	1,054,171	6,334	**30**
	23.02-2.02.01.f	Curtain Grouting	14,600	LF	365	41	9/7/2026	12/11/2026	1,098,043	4,870	**12**
	23.02-2.02.01.g	Consolidation Grouting	0	LF	0				0	0	
	23.02-2.02.01.h	Type III Cement	520	Tons	365	41	3/1/2027	6/4/2027	196,696	2,029	**5**
	23.02-2.02.01.i	Backfill Concrete	0	CY	0	0			0	0	
	23.02-2.02.02	**Foundation Preparation - Beneath Shell**	73,000	SY	91	10	7/27/2026	10/16/2026	151,174	612	**6**
	23.02-2.02.03	**Foundation Drainage**					7/27/2026	10/16/2026			
	23.02-2.02.03.a	Furnish and Install Foundation Drain Pipe	300	LF	10	1	7/27/2026	10/16/2026	6,005	60	**6**
	23.02-2.02.03.b	Furnish and Install Foundation Drain Manholes	2	EA	20	2	7/27/2026	10/16/2026	12,010	120	**6**
	23.02-2.02.03.c	Seepage Partition Walls	0	0					0	0	
Saddle Dam 5	**23.02-3**	**Embankment**									
	23.02-3.01	**Develop Borrow Areas**	1	LS							
	23.02-3.01.01	Z1 Strip/Overburden/Waste to Stockpile	180,000	CY	164	18	11/28/2025	1/22/2026	1,013,910	1,456	**8**
	23.02-3.01.02	Z3 Strip/Overburden/Waste to Stockpile, Q1	130,000	CY	315	35	11/28/2025	1/22/2026	1,467,034	3,858	**11**
	23.02-3.01.03	Z3 Strip/Overburden/Waste to Stockpile, Q2	0	CY	0	0			0	0	
	23.02-3.01.04	Z4 Strip/Overburden/Waste to Stockpile	0	CY					0	0	
	23.02-3.02	**Restore Borrow Areas**									
	23.02-3.02.01	**Replace Overburden from Stockpile**	124,000	ECY	205	23	8/4/2028	4/12/2029	1,616,219	3,191	**14**
	23.02-3.02.02	**Topsoil Replacement**	58,000	ECY	96	11	8/4/2028	4/12/2029	679,281	2,759	**12**
		Includes moisture conditioning in Borrow Area	0	0							
	23.02-3.03	**Furnish and Install Zone 1 - Core**	369,000	ECY	596	66	10/11/2027	2/25/2028	5,680,700	10,607	**16**
											11
Saddle Dam 5	**23.02-3.04**	**Load, Haul and Place - Zone 2A - Filter**	121,000	Tons	172	19	10/11/2027	2/25/2028			
	23.02-3.05	**Load, Haul and Place - Zone 2A - Drain**	126,500	Tons	180	20	10/11/2027	2/25/2028	1,730,160	4,948	
	23.02-3.06	**Load, Haul and Place - Zone 2A - Transition**	36,300	Tons	52	6	10/11/2027	2/25/2028			
	23.02-3.07	**Load, Haul and Place - Zone 2B - Filter**	0	Tons	0	0					
	23.02-3.08	**Load, Haul and Place - Zone 2B - Transition**	0	Tons	0	0					
	23.02-3.09	**Furnish and Install Zone 3 - Rockfill**	190,000	CY	345	38	10/11/2027	2/25/2028	6,602,972	13,408	**38**
	23.02-3.10	**Furnish and Install Zone 4 - Random**	470,000	CY	855	95	10/11/2027	2/25/2028	6,503,095	12,346	**13**
	23.02-3.11	**Furnish and Install Riprap**	47,000	CY	85	9	12/13/2027	3/17/2028	650,312	1,235	**13**
	23.01-3.12	**Production and Placement of Dam Crest Gravel**	1,100	CY	7	1	3/18/2028	3/19/2029	43,346	124	**16**

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	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
		Saddle Dams 1, 2, 6, 8A, 8B									
Saddle Dams 1, 2, 6, 8	**20.03-5**	**Process and Haul Filter Materials to Project**									
	20.03-4.03	**Saddle Dams 1, 2, 6, 8**	**399,806**	**Tons**	**1475**	**164**					**32**
	20.03-4.03.01	Process and Stockpile on Project - Zone 2A - Filter	173,800	Tons	641	71	5/26/2025	5/4/2029	23,362,581	52,443	
	20.03-4.03.02	Process and Stockpile on Project - Zone 2A - Drain	177,606	Tons	655	73	5/26/2025	5/4/2029			
	20.03-4.03.03	Process and Stockpile on Project - Zone 2A - Transition	48,400	Tons	179	20	5/26/2025	5/4/2029			
	20.03-4.03.04	Process and Stockpile on Project - Zone 2B - Filter	0	Tons	0	0					
	20.03-4.03.05	Process and Stockpile on Project - Zone 2B - Transition	0	Tons	0	0					
	23.03-2	**Foundation Preparation and Grouting**									
	23.03-2.01	**Foundation Excavation**									
	23.03-2.01.01	Topsoil Salvage	74,000	CY	120	13	11/14/2025	12/25/2025	943,085	3,122	**23**
	23.03-2.01.02	Dam Foundation Excavation - Common	33,500	CY	54	6	9/28/2026	2/12/2027	426,942	851	**14**
	23.03-2.01.03	Dam Foundation Rock Exc - Rippable Rock	302,500	CY	550	61	9/28/2026	2/12/2027	4,527,727	9,176	**15**
	23.03-2.01.04	Dam Foundation Rock Ex - Drill and Shoot	0	CY					0	0	
	23.03-2.02	**Foundation Preparation and Grouting**									
	23.03-2.02.01	**Foundation Preparation - Beneath Core**	16,400	SY							
	23.03-2.02.01.a	Initial Foundation Cleaning - Core	16,400	SY	164	18	10/19/2026	3/5/2027	141,223	1,095	**6**
	23.03-2.02.01.b	Final Foundation Cleaning - Core	16,400	SY	164	18	10/19/2026	3/5/2027	141,223	1,095	**6**
	23.03-2.02.01.c	Dental Excavation	1,500	CY	214	24	10/26/2026	3/12/2027	268,695	1,673	**7**
	23.03-2.02.01.d	Dental Concrete	1,500	CY	214	24	10/26/2026	3/12/2027	475,501	2,394	**10**
	23.03-2.02.01.e	Grout Cap	4,900	CY	223	25	12/7/2026	3/26/2027	1,230,083	7,391	**30**
	23.03-2.02.01.f	Curtain Grouting	16,200	LF	405	45	12/21/2026	7/2/2027	1,218,375	5,400	**12**
	23.03-2.02.01.g	Consolidation Grouting	0	0	0				0	0	
	23.03-2.02.01.h	Type III Cement	571	Tons	405	45	12/21/2026	7/2/2027	218,250	2,250	**5**
	23.03-2.02.01.i	Backfill Concrete	2,200	CY	314	35	10/26/2026	3/12/2027	830,102	6,652	**19**
	23.03-2.02.02	**Foundation Preparation - Beneath Shell**	38,400	SY	48	5	10/19/2026	3/5/2027	79,521	324	**6**
	23.03-2.02.03	**Foundation Drainage**									
	23.03-2.02.03.a	Furnish and Install Foundation Drain Pipe	1,200	LF	40	4	10/19/2026	3/5/2027	26,690	240	**6**
	23.03-2.02.03.b	Furnish and Install Foundation Drain Manholes	4	EA	40	4	10/19/2026	3/5/2027	26,690	240	**6**
	23.03-2.02.03.c	Seepage Partition Walls	0	LF					0	0	
	23.03-3	**Embankment**									
	23.03-3.01	**Develop Borrow Areas**	1	LS							
	23.03-3.01.01	Z1 Strip/Overburden/Waste to Stockpile	212,000	CY	153	17	12/26/2025	2/19/2026	949,902	1,366	**8**
	23.03-3.01.02	Z3 Strip/Overburden/Waste to Stockpile, Q1	174,000	CY	281	31	12/26/2025	6/11/2026	1,309,046	3,441	**11**
	23.03-3.01.03	Z3 Strip/Overburden/Waste to Stockpile, Q2	0	CY	0	0			0	0	
	23.03-3.01.04	Z4 Strip/Overburden/Waste to Stockpile	0	CY							
	23.03-3.02	**Restore Borrow Areas**									
	23.03-3.02.01	**Replace Overburden from Stockpile**	154,400	ECY	255	28	11/29/2027	8/4/2028	2,012,449	3,975	**14**
	23.03-3.02.02	**Topsoil Replacement**	58,000	ECY	96	11	11/29/2027	8/4/2028	679,281	2,759	**12**
	23.03-3.03	**Furnish and Install Zone 1 - Core**	369,000	CY	596	66	3/15/2027	11/12/2027	5,680,700	10,607	**16**

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	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
Saddle Dams 1, 2, 6, 8											
	23.03-3.04	**Load, Haul and Place - Zone 2A - Filter**	173,800	Tons	248	28	3/15/2027	11/12/2027			**11**
	23.03-3.05	**Load, Haul and Place - Zone 2A - Drain**	177,606	Tons	253	28	3/15/2027	11/12/2027			
	23.03-3.06	**Load, Haul and Place - Zone 2A - Transition**	48,400	Tons	69	8	3/15/2027	11/12/2027	2,437,375	6,963	
	23.03-3.07	**Load, Haul and Place - Zone 2B - Filter**	0	Tons	0	0					
	23.03-3.08	**Load, Haul and Place - Zone 2B - Transition**	0	Tons	0	0					
	23.03-3.09	**Furnish and Install Zone 3 - Rockfill**	224,000	CY	373	41	3/15/2027	11/12/2027	7,784,556	15,809	**38**
	23.03-3.10	**Furnish and Install Zone 4 - Random**	606,000	CY	1102	122	3/15/2027	11/12/2027	8,384,840	15,920	**13**
	23.03-3.11	**Furnish and Install Riprap**	55,000	CY	100	11	5/10/2027	11/26/2027	761,003	1,451	**13**
	23.03-4	**Saddle Dam 8**									
	23.03-4.01	**Mass Concrete**	19,500	CY	1200	133	5/26/2026	11/9/2026	6,798,000	36,933	**28**
	23.03-4.03	**Clay Backfill**	20,000	CY	100	11	8/18/2026	9/14/2026	611,116	1,729	**15**
	23.03-4.04	**Riprap and Drain**	1	LS	20	2	9/15/2026	9/17/2026	25,224	92	**4**
	23.03-4.05	**Production and Placement of Dam Crest Gravel**	800	CY	5	1	9/18/2026	9/18/2026	30,961	89	**16**
	23.03-4.06	**Rim Grouting**	51,300	LF	1283	143	12/21/2026	7/2/2027	3,859,693	17,110	**12**

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	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
	Inlet-Outlet and ERS Facilities										
ERS-1 Facilities	**23.01-4**	**ERS-1 Facilities**									
	23.01-4.01	**Upstream Portal Excavation and Rock Bolts**	27,500	CY	79	9	3/27/2026	6/25/2026	361,996	1,317	**15**
	23.01-4.02	**Upstream Portal Backfill**	24,800	CY	99	11	1/2/2027	1/15/2027	376,035	1,540	**14**
	23.01-4.03	**Inlet and Valve Structures**	2,200	CY	489	54	6/26/2026	12/31/2026	1,781,820	11,812	**11**
	23.01-4.04	**Downstream Portal Excavation and Rock Bolts**	35,100	CY	100	11	12/26/2025	3/26/2026	596,444	2,111	**19**
	23.01-4.05	**Downstream Portal Backfill**	37,900	CY	152	17	12/18/2026	1/8/2027	577,347	2,364	**14**
	23.01-4.06	**Tunnel Excavation and Initial Support (Double Shift)**	828	LF	1,035	115	3/27/2026	11/5/2026	3,072,800	14,950	**13**
	23.01-4.07	**Tunnel Concrete Lining**	828	LF	331	37	3/27/2026	11/5/2026	1,151,713	6,941	**19**
	23.01-4.08	**10-Ft Steel Pipe Cut and Cover Section**	388	LF	13	14	11/6/2026	12/17/2026	407,839	2,167	**15**
	23.01-4.09	**Mechanical, Valves, Trashrack, and Metals**	1	LS	30	33	1/1/2027	1/28/2027	708,167	3,333	**10**
	23.01-4.10	**Riprap Discharge Channel**	5,000	CY	33	4	1/1/2027	1/28/2027	125,803	330	**9**
ERS-2 Facilities	**23.02-4**	**ERS-2 Facilities**									
	23.02-4.01	**Upstream Portal Excavation and Rock Bolts**	27,215	CY	78	9	7/15/2027	10/13/2027	465,227	1,647	**19**
	23.02-4.02	**Upstream Portal Backfill**	24,500	CY	98	11	8/13/2027	9/1/2027	372,237	1,524	**14**
	23.02-4.03	**Inlet and Valve Structures**	2,200	CY	489	54	6/18/2027	9/23/2027	1,781,820	11,812	**7**
	23.02-4.04	**Downstream Portal Excavation and Rock Bolts**	31,867	CY	91	10	6/26/2026	9/24/2026	542,764	1,921	**19**
	23.02-4.05	**Downstream Portal Backfill**	34,400	CY	138	15	7/30/2027	8/20/2027	524,170	2,147	**14**
	23.02-4.06	**Tunnel Excavation and Initial Support (Double Shift)**	832	LF	1,040	116	11/6/2026	6/17/2027	3,087,644	15,022	**13**
	23.02-4.07	**Tunnel Concrete Lining**	832	LF	333	37	11/6/2026	6/17/2027	1,155,540	6,970	**19**
	23.02-4.08	**10-Ft Steel Pipe Cut and Cover Section**	400	LF	133	15	6/18/2027	7/29/2027	417,251	2,217	**15**
	23.02-4.09	**Mechanical, Valves, Trashrack, and Metals**	1	LS	300	33	9/24/2027	10/21/2027	708,167	3,333	**10**
	23.02-4.10	**Riprap Discharge Channel**	4,200	CY	28	3	9/24/2027	10/21/2027	106,742	280	**9**
Golden Gate	**21.01-4**	**Golden Gate Dam Bypass Pipeline Facilities**									
	21.01-4.01	**Upstream Cofferdam**	150,000	CY	600	67	11/17/2025	2/20/2026	2,507,000	7,333	**11**
	21.01-4.02	**Install 48-Inch Steel Pipe and Encasement**	2,100	LF	525	58	11/17/2025	2/20/2026	2,987,875	14,458	**2**
	21.01-4.03	**Riprap Discharge Channel**	75	CY	1	0	11/17/2025	2/20/2026	3,812	10	**9**
Sites Dam Diversion Facilities	**22.01-2**	**Sites Dam Diversion Facilities**									
	22.01-2.01	**Upstream Cofferdam**	160,000	CY	640	71	11/29/2027	12/24/2027	2,674,133	7,822	**11**
	22.01-2.02	**Upstream Portal Excavation and Rock Bolts**	15,800	CY	45	5	10/20/2025	2/20/2026	268,400	950	**19**
	22.01-2.03	**Upstream Portal Backfill**	24,500	CY	98	11	7/24/2027	8/15/2027	372,237	1,524	**14**
	22.01-2.04	**Inlet and Valve Structures**	2,200	CY	489	54	4/19/2027	7/23/2027	1,781,820	11,812	**7**
	22.01-2.05	**Downstream Portal Excavation and Rock Bolts**	12,500	CY	36	4	10/20/2025	2/20/2026	214,720	760	**19**
	22.01-2.06	**Downstream Portal Backfill**	34,400	CY	138	15	7/24/2027	8/20/2027	524,170	2,147	**14**
	22.01-2.07	**Tunnel Excavation and Initial Support (Double Shift)**	1,590	LF	1,988	221	2/23/2026	4/16/2027	5,902,151	28,716	**13**
	22.01-2.08	**Tunnel Concrete and Steel Lining**	1,590	LF	636	71	2/23/2026	4/16/2027	2,215,280	13,347	**19**
	22.01-2.09	**Mechanical, Valves, Trashrack, and Metals**	1	LS	450	50	7/26/2027	10/29/2027	1,062,250	5,000	**10**
	22.01-2.10	**Riprap Discharge Channel**	75	CY	1	0	7/26/2027	10/29/2027	3,812	10	**9**

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
Main Inlet/Outlet Facilites	**25.01**	**Main Inlet/Outlet Facilites**									
	25.01-1	**Downstream Portal and Intake Channel Excavation and Rock B**	63,000	CY	140	16	10/27/2025	3/13/2026	1,048,331	3,938	**25**
	25.01-2	**Upstream Portal and Intake Channel Excavation and Rock Bolts**	475,000	CY	1,060	118	10/27/2025	4/17/2026	7,195,076	27,358	**23**
	25.01-3	**Tunnel Excavation and Lining**									
	25.01-3.01	**Tunnel Excavation and Initial Support (Double Shift)**	6,220	LF	12,440	1,382	4/20/2026	10/27/2028	36,932,978	179,689	**13**
	25.01-3.02	**Tunnel Concrete Lining (Double Shift)**	6,220	LF	2,073	230	4/20/2026	10/27/2028	18,750,340	91,543	**40**
	25.01-4	**Intake and Outlet Structures**									
	25.01-4.01	**Concrete Piling Foundation**	480	LF	160	18	2/21/2028	5/12/2028	676,889	2,502	**14**
	25.01-4.02	**Multi-Level Inlet/Outlet Tower Cast In Place Concrete**	20,015	CY	2,502	278	5/15/2028	2/16/2029	10,856,820	79,952	**14**
	25.01-4.03	**Access Bridge**	1	LS	600	67	2/19/2029	6/22/2029	1,563,133	9,320	**14**
	25.01-4.04	**Gates, Mechanical, and Appurtenances**	1	LS	600	67	6/25/2029	9/14/2029	1,416,333	6,667	**10**
	25.01-4.05	**Trash Racks, Miscellaneous Metals and Equipment**	1	LS	350	39	6/25/2029	9/14/2029	826,194	3,889	**10**

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

	WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
	Roadways										
	26.01	**Early Site Access and Staging Development**					8/18/25	1/2/2026			
	26.01-1	**Grading and Drainage**	1	Allowance	1,000	111			8,388,889	27,778	**25**
	26.01-2	**Production and Placement of Subbase and Base Course**	30,000	TN	200	22			1,476,444	4,889	**22**
	26.03	**Northern Construction Access Roads (CR 68, CR 69, N. Rd)**					6/24/2024	7/24/2025			
	26.03-1	**Grading and Drainage**	636,200	CY	1,060	118			8,892,222	29,444	**25**
	26.03-2	**Production and Placement of Subbase and Base Course**	108,000	CY	720	80			5,315,200	17,600	**22**
	26.03-3	**Asphalt, Signage, Finishes**	26,720	TN	178	20			1,248,967	4,944	**25**
	26.04	**County Roads F, D, McDermott, Delevan Rd**					6/24/2024	3/28/2025			
		Grading and Drainage	55,700	CY	159	18			1,333,833	4,417	**25**
		Production and Placement of Subbase and Base Course	37,400	CY	249	28			1,755,173	5,257	**19**
		Asphalt, Signage, Finishes	25,110	TN	167	19			1,542,894	5,567	**30**
	26.05	**Southern Construction Access Roads (Maxwell-Sites, A-1)**					6/24/2024	7/10/2025			
		Grading and Drainage	703,600	CY	1,173	130			9,840,167	32,583	**25**
		Production and Placement of Subbase and Base Course	32,300	CY	215	24			1,515,511	4,539	**19**
		Asphalt, Signage, Finishes	-	TN	-	-			-	-	
	26.06	**Ancillary Roads B1, B2, C1, C2, Comm N., Comm South**					7/11/2025	5/14/2026			
		Grading and Drainage	969,200	CY	1,615	179			13,548,056	44,861	**25**
		Production and Placement of Subbase and Base Course	35,400	CY	236	26			1,663,538	4,982	**19**
		Asphalt, Signage, Finishes	5,800	TN	39	4			360,317	1,300	**30**
	26.07	**Sites Lodoga Road Realignment and Bridge**					9/2/2024	4/9/2027			
		Grading and Drainage	2,601,000	CY	4,335	482			36,365,833	120,417	**25**
		Production and Placement of Subbase and Base Course	51,600	CY	344	38			2,424,818	7,262	**19**
		Asphalt, Signage, Finishes	34,420	TN	229	25			2,115,706	7,633	**30**
		Bridge Construction	1	LS	6,000	667			51,589,322	269,318	**48**
		Cast in Place Concrete Super-Structure	57000	CY	3,500	389					
	26.08	**Huffmaster Road Realignment East**					6/24/2024	7/19/2027			
		Grading and Drainage	5,200,000	CY	4,333	481			59,959,091	197,392	14
		Production and Placement of Subbase and Base Course	84,000	CY	560	62			3,947,378	11,822	19
		Asphalt, Signage, Finishes	56,640	TN	378	42			3,492,300	12,600	30
	26.09	**Recreation Roads**					5/15/2026	7/30/2027			
		Grading and Drainage	1,019,400	CY	1,699	189			13,446,641	39,643	21
		Production and Placement of Subbase and Base Course	58,720	CY	391	43			2,756,116	8,254	19
		Asphalt, Signage, Finishes	39,480	TN	263	29			2,429,828	8,767	30
	26.10	**Sites Lodoga Rd Detour/Shoo-Fly**					6/24/2024	7/10/2025			
		Grading and Drainage	1,968,000	CY	1,640	182			22,693,956	74,711	14
		Production and Placement of Subbase and Base Course	20,000	CY	133	15			937,502	2,808	19
		Asphalt, Signage, Finishes	7,800	TN	52	6			480,422	1,733	30

Sites Reservoir
Alt 1 - 1.5 MAF HR Facilities
Equipment AQ Tables

On - Site Concrete Batching Model

NOTE:Batching crew hours and horsepower are in each activity requiring batched concrete

WBS Item	Description	Quantity	Measure	Production Hours	Production Shifts	Start Date	End Date	Total HP-HRS	Total Manhours	Personnel
	Concrete Aggregate and Cementitious Materials	HP-Hr/Ton	Man-Hr/Ton							
	Produce and Truck to Batchplant	58.4	0.1							
	Cement or Flyash (To Site)	175.3	0.4							
				Limited Plant Productin Basis						
		Plant Capacity Production Basis								
				40%	Production					
	PER BATCH PLANT			200	CY / Day					
		Quantity		HP-HRS	HP-HRS/CY	Man Hours	MH/CY			
	Batching / Hauling									
	Concrete Batch Plant	1		800	4	10	0.05			
	Laborer	1		0	0	10	0.05			
	CAT 980 Loader	1		1628	8.14	10	0.05			
	Silos	2		120	0.6	0	0			
	Pigs	2		120	0.6	0	0			
	Concrete Mixer Trucks	3		5640	28.2	30	0.15			
			Total	8308		60				
				Batch	42		0.3			
				Aggregate	100		0.3			
				Cement	50		0.2			
				Totals:	192	HP-HR/CY	0.80	MH/CY		