Mission Statements

The U.S. Department of the Interior protects and manages the Nation’s natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.
FINAL DESIGN STATUS REPORT

Shasta Dam
Central Valley Project – Shasta/Trinity

Shasta Dam and Reservoir Enlargement Project (SDREP)
Dam Raise Final Design

Prepared by:
United States Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

August 2019
Purpose: TSC was tasked with preparing final design plans and specifications for the dam raise portion of the Shasta Dam and Reservoir Enlargement Project (SDREP). Final design activities to raise the crest of the dam 18.5 feet in order to store 20.5 feet additional water were initiated and funded in April 2018.

The design team has prepared a status report to document where they were at in the design process so that when final design activities commence, the design activities can start up as smoothly as possible. The TSC has a process for putting jobs on the shelf prior to SPECB which was followed by the design team. The guidance is provided on the intranet site at:


The design team was directed to stop design work and prepare a status report on February 28, 2019 to summarize work completed to date.

Each group at the TSC involved in the dam raise project was asked to document the status of their designs using the following format:

- Group:
- Design Feature:
- Task:
- Contact Person:
- Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):
- Status of each deliverable (includes check, TA, and PR):
- Location of Deliverable:
- List of outstanding design data and design issues:
- Tasks remaining to complete job through SPECB:
- Other notes to help when project starts up again:

The status of each design group is attached to this report and organized by design group in numerical order. An electronic version is located at the following link:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\March2019_Shutdown_StatusReport
File Directory

All electronic files for Shasta Dam Raise Final Design are located on the TSC shared directory at:

\Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN

Google Drive

During final design, a lot of information was being stored on Google Drive so that numerous offices within Reclamation could have access and collaborate in real time. The google drive location is:

https://drive.google.com/drive/folders/1qq0it0Yh7a_SQqli_1w2HI35d0aaZgBj

In case the google drive link is not active in the future, the information that is needed for the TSC design team to commence final design was copied from google drive and copied onto the TSC team drive at:

\Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN

Design Data Request

A design data request was prepared by the design team shortly after final design initiated. Due to the accelerated schedule, the design data request was a living document and the design team added to the document as needed. The folder below contains the initial design data request dated June 2018 and the design data request as of March 2019.

\Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Design Data Request

Design Charrettes

Several Design Charrettes were held in Denver to gather information from various Reclamation offices so that decisions could be made in a timely manner. Design Charrettes were held in Denver in July, August and September 2019.

- **Design Charrette 1 – July 2019**
  \Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Design Data Request\Design Charrette July 10 2018
- **Design Charrette 2 – August 2019**
  \Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Design Data Request\Design Charrette #2 August 29 2018
- **Design Charrette 3 – September 2019**
  \Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PM\Meetings\Client\2018.09.13-14 Charette 3 Mtg
Survey Data

- Mid-Pacific Survey contact is Mark Morberg
- **Dam and vicinity around dam**
  Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\CIVIL3D\June2018Mapping
- **Gallery and Core wall survey**
  Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Gallery and Core Wall Survey

Utility Maps

- Scanned pdfs of the utility locate were provided by MP Surveying. The plan was to prepare an AutoCAD file of the utility locate, but had not been received by TSC as of March 2019
- Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Design Data Request\UtilityMaps

Outstanding Design Data Requests

There were some outstanding design data requests that the team needed in order to move forward with designs/analyses. These requests are located in the folder below and include waterhammer testing, Shasta Lake City Pumping Plant, security, and accessibility inquiries.

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Design Data Request\OutstandingDDR_March2019

Spillway Configuration and Gate Type Decision

The decision to move forward with Vertical Fixed Wheel Gates was made in May 2018. The decision information is attached to this report and located at the link below:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Spillway Gate

Gate Hoist Decision

The decision to move forward with a hydraulically operated gate hoist in lieu of the wire rope was made in December 2018. The decision information is attached to this report and located at the link below:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\Spillway Gate Hoist\Gate Hoist Decision
Information from the Dam Raise Feasibility Study (previously the Q: AutoCad drive)

Z:\DO\AutoCAD\CENTRAL VALLEY PROJECT\SHASTA (KENNETT) DIVISION (214)\Shasta Dam Raise Feasibility Study

Drawings

Existing Dam Drawings

An extensive search was made for existing drawings of Shasta Dam which consist of over 10,000 drawings. While all of the drawings or at least a place holder for all drawings should be in EDRAWS, electronic copies of the pertinent drawing collected by the design team are located:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings

New Drawings:

Reference each group’s status report for location of new drawings prepared for the final design. However, in general, drawings should be located either in EDRAWS or in the folder below:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG

List of Final Design Drawings

While many of the final design drawings were not started, the team prepared a list of drawings for the project. It was stored on google drive at:

https://docs.google.com/spreadsheets/d/1VkXL0RtDxRhQcpn-_pra-ztze4lf0fa-7IEiUQxmHyY/edit#gid=1075884565

And has been copied to the TSC team drive at:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\Shasta Dam Raise Drawing List.xlsx

Drawings – 50% Milestone

Approximately 80 drawings were submitted as part of the 50% design milestone deliverable. Pdfs of the drawings are in the folder below. The group who created the drawing should be contacted for the most recent CAD version of the file.

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\50percent
Specifications:

50% Milestone – For the 50% milestone, draft Division 01 specs were created for review, but the technical specifications were not prepared. A table of contents for the anticipated technical specifications were created and included as part of the 50% deliverable. The location of the 50% are in the folder below.

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\02
50percent\8510\01_Specifications_Current Docs

TASPEC – TASPEC was not completed but was the next milestone before the project was shutdown. The most up-to-date specifications as of March 2019 are located:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8510

Project Management:

Project Management Information including the PMP, Design Schedule, Project Management Team (PMT) info, team meetings, Consultant Review Board (CRB), etc. is located at the link below. Adam Toothman (8130) was the TSC design team leader and is the contact for Project Management responsibilities:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PM

Consultant Review Board (CRB):

A CRB contract was awarded to STANTEC. The CRB reviewed the 50% designs in November 2018 and provided comments and recommendations. TSC prepared an accountability report. The CRB did not review anything after the 50% milestone.

Information relating to the CRB is located:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PM\CRB

Safety Risk Analysis:

ex 5 deliberative, ex b7f
Trip Reports

Trip Reports – Numerous trip reports were prepared by the design team to document their site visits. Trip reports are located:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports

SSLE (Safety, Security, and Law Enforcement) Requirements: SSLE provided a comprehensive list of security requirements for Shasta on February 15, 2019. While some design groups may have had time to incorporate this information, most of this information was likely not included in the specifications/drawings/etc. as of March 2019. An e-mail, included in the folder below, discusses security requirements including whether or not a security boom to protect the spillway was required. The information provided by SSLE is located:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\SSLE_SecurityRequirements

Field Exploration Request (FER)

Three Separate FERs were prepared (concrete, geotechnical, and borrow area investigation). The FERs are located:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\FER – Final

Concrete Drilling and Geologic Exploration

MP geology (MP-200) was responsible to execute the concrete drilling and geologic exploration programs. Comprehensive reports were finalized in August 2019 and located at the links below.
Field exploration of the borrow areas was not executed due to permitting issues and then funding issues. Greg Mongano is the contact for MP geology.

**Concrete Drilling Investigations:**

- Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Final Design Reports SDREP\2019 MP-200 Concrete Drilling Investigations

**Geotechnical and Geologic Explorations of the LWD and Right Abutment**

- Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Final Design Reports SDREP\2019 MP-200 Geotech_GeologicExplorations LWD_RightAbut

**Concrete Testing**

Numerous concrete cores (3-inch, 6-inch, 10-inch and 18-inch) were obtained as part of the concrete drilling investigations and transported to the TSC for testing. Testing is ongoing. Katie Bartojay (8530) and Scott Keim (8530) are the concrete laboratory contacts. The goal at this point is to complete testing of cores collected to date. Dam safety is funding the testing needed to provide input into the risk analysis assessment of the existing condition. The dam raise project will fund testing of remaining cores as funding allows.

**Geotechnical (Soils/Rock) Testing**

Numerous soil and rock samples were obtained as part of the geologic exploration program and transported to the TSC for testing. Testing is ongoing. Bobbie Rinehart (8530) and Evan Lindenbach (8530) are the geotechnical laboratory contacts. The goal at this point is to complete testing of samples collected to date. Dam safety is funding the testing needed to provide input into the risk analysis assessment of the existing condition. The dam raise project will fund testing of remaining samples as funding allows.

**Hydraulic Model Testing**

A 1:39 physical scale model of the Shasta Dam spillway and downstream area was constructed as part of the final design project. Spillway gate discharge curves were created, but operational scenarios were not performed. The current plan is to leave the model in the laboratories until March 2020 before deciding to dismantle the model. A sectional model of the spillway was planned, but not started. A model of the outlet works to replace the El. 750 tube valves with a jet-flow valve was created, but testing did not happen because a decision was made leave the existing tube valves. Connie Svoboda (8560) is the contact for the hydraulic modeling.
STATUS REPORTS
FOR EACH DESIGN GROUP
SEPARATED BY TASK
SDREP – Shasta Dam Raise Final Design

Final Status Report – April 2019

Feature: Main Concrete Dam

Group: TSC Waterways & Concrete Dams (86-68110)

Task: 2D Single Monolith

Contact Person: Roman Koltuniuk, ext. 3225

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- FE model for simulation of a taller monolith to earthquake loads
- Analysis TM

Status of each deliverable (includes check, TA, and PR):

- FE model – advanced model with generic input parameters, requires actual material properties
- Analysis TM not started

Location of Deliverable:

FE TrueGrid Model Input:

Koltuniuk computer under C: \users\RKoltuniuk\PROJECTS (most current)\2018_SHASTA\PASSIVE ANCHORS\n
List of outstanding design data and design issues:

- Proper use of cracking material model (in touch to LSDYNA to evaluate if cracking pattern shown in preliminary runs is real or a modeling issue
- Material properties for actual concrete

Tasks remaining to complete job through SPECB:

- Implement project related input parameters in the FE model
- Perform seismic runs using latest ground motions
- Prepare the Analysis TM

Other notes to help when project starts up again:
SDREP – Shasta Dam Raise Final Design

Final Status Report – April 2019

Feature: Main Dam

Group: Waterways & Concrete Dams 1 (86-68110)

Task: 

Contact Person: Hillery Venturini (Lead Analyst: Andrew Giester)

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Analysis Criteria and Data Report TM
- Structural Analysis TM
- Main Dam FEM: Full 3D dam/reservoir/foundation for raised scenario for RWSE 1069.8 and 1090.3
- Main Dam FEM: Full 3D dam/reservoir/foundation for existing scenario for RWSE 1069.8
- 50 Percent Risk Analysis – Powerpoint presentation of results (Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PM\Meetings\Design Team\8110 Group Mtgs\50%RA_12-7-18)

Status of each deliverable (includes check, TA, and PR):

- Analysis Criteria and Data Report TM: Interim with approval from Technical Approver and Peer Reviewers.
  - Next phase: Distribution to internal TSC design leads for review, input and confirmation. External TSC review would follow for design understanding and concurrence.

- Structural Analysis TM: Draft structure compiled
  - Next phase: Incorporate analysis results based on various analysis models.
The scale factors applied are shown in Table 3, and the simulations run are summarized in Table 4 to evaluate the impact of design accelerations and response spectra for chimney and gate design features only.

- Additional model refinements include: Adjustment to reservoir for updated foundation contact, refined mesh, and inclusion of internal galleries (El. 1065, El. 1005, and El. 950).
- Coordination with Spillway Team to incorporate separate, detailed spillway model into large dam model.

Table 1. Dynamic Simulations Conducted for 50% Final Design Risk Analysis – Raised Condition

| Table 2. Dynamic Simulations Conducted for 50% Final Design Risk Analysis – Existing Condition |

Table 3. Ground Motions and Scale Factors
### Table 4. Dynamic Simulations Conducted Following 50% Final Design Risk Analysis – Raised Condition

<table>
<thead>
<tr>
<th>Location of Deliverable:</th>
<th></th>
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<tbody>
<tr>
<td><strong>Reports</strong></td>
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<td>ex 5 deliberative, ex b7f</td>
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<tr>
<td><strong>Models</strong></td>
<td></td>
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<tr>
<td><strong>Original 2011 Feasibility Level FEM</strong></td>
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</tbody>
</table>
Summary of FE Model Progression (through March 2019)

ex 5 deliberative, ex b7f
List of outstanding design data and design issues:

Tasks remaining to complete job through SPECB:

Other notes to help when project starts up again:
### Table 1. Dynamic Simulations Conducted for 50% Final Design Risk Analysis

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### Table 2. Ground Motions and Scale Factors

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### Table 3. Dynamic Simulations Conducted Following 50% Final Design Risk Analysis

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</table>
Location of Deliverable:

List of outstanding design data and design issues:

Tasks remaining to complete job through SPECB:

Other notes to help when project starts up again:
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Main Concrete Dam

Group: TSC Waterways & Concrete Dams (86-68110)

Task: Thermal analysis of non-overflow monolith

Contact Person: Jerzy Salamon, ext. 3219

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):
- FE model for simulation of the non-overflow monolith raise
- Analysis report

Status of each deliverable (includes check, TA, and PR):
- FE model – advanced model for generic input parameters, requires input the actual project data (temperature and material properties etc.).
- Initial report at approx. 15% completion level

Location of Deliverable:

FE Model Input:
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Thermal Analysis for Dam Raise\Report-Thermal Analysis for Shasta Raise\FE_Modelling

Finite Element Models are located on IBR8DRSLD003 at this location:
F:\Liea\Shasta_Thermal_Analysis

Initial report:
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Thermal Analysis for Dam Raise\Report-Thermal Analysis for Shasta Raise\Report\0.09_Shasta Dam Raise - Thermal Analysis - draft.docx

Report inputs and other relevant resources are located under:
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Thermal Analysis for Dam Raise\Report-Thermal Analysis for Shasta Raise

List of outstanding design data and design issues:
- Temperature conditions at the project site including temperature inside the dam
- Mechanical material properties for new concrete

Tasks remaining to complete job through SPECB:
- Implement project related input parameters in the FE model
- Perform thermal analysis for various construction sequences, temperature conditions, material variations
- Prepare the analysis report
- Other tasks to be considered in the future but not defined in the current SOW
  - Consider the stress analysis related to the temperature loads
  - Consider modelling cooling pipes
  - Consider analysis to determine potential cracking in new concrete

Other notes to help when project starts up again:
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Passenger Elevator Tower

Group: Plant Structures Group, 86-68120

Task: Structural design to demolish concrete elevator tower structure down to El. 1065.17 and then to rebuild it to accommodate the 18.5 foot dam raise with a top of dam elevation changing from crest El. 1077.50 (NGVD29) to El. 1096.00 and top of roof parapet El. 1135.25.

Contact Person: Lisa Orgren and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 100% (SPECB) Drawings and Specifications
- Design Summary
- Pre-Val Quantity Estimate Worksheets

Status of each deliverable (includes check, TA, and PR):

- Design
  o Tower raise needs to be designed. The tower raise design was going to be contracted out to an A/E, but at 50% it was decided that the TSC would design the tower raise.

- Drawings
  o Existing: The existing elevator tower has been modeled in Revit. No site visit was performed throughout the entirety of the Elevator Tower, and, given the fact that no as-built drawings were created, this means there are potential discrepancies between what has been modeled based on the drawings and what is on site. See note below.
    ▪ Note: The site visit on 5 February 2019 did get to see a small portion of the tower. Where the drawings show a hole in the floor directly above El. 1078 NGVD29, there is no hole in the as-built tower. Also, the drawings did not show the stairs going from elevation 1078 to 1065 so these have not been modeled.
    ▪ No mechanical/electrical/other equipment has been modeled.
    ▪ Levels within Revit were created using the structural elevation of the floor. The elevation of the floor was taken from the existing drawings, and the ##.## inches of finish was subtracted from this elevation.
  o New Construction: The existing elevator tower has been copied and stretched up to the new proposed crest height. The visible portion of the tower showing above the existing crest elevation is the same as the visible portion of the tower showing above the new construction crest elevation. No proper design work has yet been completed for the Elevator Tower. Work has begun on creating general arrangements.
- No structural analysis has yet been performed, tower dimensions may change.
- No work has yet been done to connect the new tower to the dam raise.
- Further collaboration is needed with Mechanical/Electrical/Other for placement of equipment and floor layouts.
  - General:
    - Further collaboration is needed with Mikolaj Salamon (86-68130), owner of the Spillway Revit model. There are some partial towers for both the Hoist and Elevator towers modeled in the Spillway Revit model causing overlaps when linking the models.

- Specifications
  - Selective Demolition of Existing Metalwork (Section 02 41 11), Removal and Storage of Existing Metalwork (Section 02 42 11), Reinstalling Existing Metalwork (Section 02 43 11), Metal Fabrications (Section 05 50 00), and Access Hatches (Section 08 31 20) are in the early stages.

- Quantities
  - 50% quantity estimates (for demolition and replacement of the hoist tower and associated features (civil, architectural) were prepared.
    - Quantities for metalwork were not created at 50% (rather a percentage was added to just account for metalwork in the cost).
    - The structural element QEW were prepared by Stacy Johnson (Baumgart) 86-68130 team with assumptions different than the final design team assumptions; this was the case since the final design of this sub-feature was going to be shopped to an A/E design team but at 50% was added to TSC work task and not much thought was placed behind the design approach to support the quantity estimating.
    - The Plant Structures Group 86-68120 did not have an architect on staff and thus the QEW exercise was incomplete at the time.

Location of Deliverables:
- Revit Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Towers
- Draft Metalwork Specifications:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120
- Trip Report: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports\2019.02.05_Hoist Tower
- 50% quantity estimates are located in:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120\Hoist Tower

List of outstanding design data and design issues:
- Existing Drawings can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\Elevator Tower – Passenger

Tasks remaining to complete job through SPECB:


- Drawings, specs, TASpec, and 90% & Pre-Val QEWs.
- Need to model existing and new metalwork. Need to coordinate with others for metalwork needs. Drawings have not been started for metalwork. Specifications are very preliminary, need to complete site visit to really verify what is existing and what can be reinstalled.
- Develop new tower layout general arrangement drawing set (Edward Downs & Lisa Orgren was doing this at time of shutdown) and meet with disciplines to layout/arrange the floors for all equipment to be placed.
- Based on the site visit of February 2019 verify that all disciplines (architect, structural, electrical, mechanical) show floor-by-floor levels equipment for existing conditions.

**Other notes to help when project starts up again:**

- Photos of the Elevator Tower can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\Elevator Tower – Passenger
- The Elevator Tower and Hoist Tower are contained within the same Revit file.
- Edward Downs (86-68150) helped model (Revit) this tower and can be contacted with questions.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- The design team had traveled (February 5, 2019) to the site to inventory tower floors but were denied access due to mitigating circumstances related to Contractor monitoring of hazardous material lead. See Hoist Tower Trip Report. Had a new trip set up for March 19, 2019 but had to cancel since the project work for 8120 was shut down on February 28, 2019.
- Power source(s) for hoist equipment atop spillway operating deck may be installed in tower.
- Need to coordinate with Lan Nguyen 86-68110 and Patrick Maier 86-68130 to tie the tower to the new spillway wall and to support the tower atop the training wall.

The elevator tower design team consisted of the following staff:

Rodney Barthel
rbarthel@usbr.gov
303-445-3221
Structural Engineer, Reclamation

Eric Paquette
epaquette@usbr.gov
303-445-2860
Mechanical Engineer, Reclamation

Jeffery (Scott) Keim
jkeim@usbr.gov
303-445-2385
Civil Engineer, Reclamation

Kendra Schiell
kschiell@usbr.gov
303-445-3280
Civil Engineer, Reclamation

Lisa Orgren
lorgren@usbr.gov
303-445-3279
Civil Engineer (Structural), Reclamation
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Right Abutment - Gantry Crane Service and Erection Platform

Group: Plant Structures Group, 86-68120

Task:

- Structural design to demolition the entire cast-in-place, multi-level concrete facility and redesign a new Gantry Crane Service and Erection Platform to service the coaster gates and outlet works gate. The original and current facility can only service the coaster gates. The new facility would be anchored in a new mass concrete block constructed to extend the dam crest into the adjacent rock outcrop. The demolition of the existing structure is part of the dam raise project. A new gantry crane service and erection platform design was started, but the client decided after 50% that due to uncertainty in the new O&M requirements of the structure, design was stopped until further notice (see PMT briefing paper and decision).
- Design a storage rack system to store the outlet works gate.

Contact Person: Mike Shepherd, Justin Dorough, and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs) and 100% (SPECB) drawing and specifications for replacing the existing Gantry Crane Service and Erection Platform and demolition of the existing structure.

Status of each deliverable (includes check, TA, and PR):

- 50% QEW package was completed in October 2018.
- Modeled existing platform in Revit for 50% QEW.
- Modeled a new version of a steel gantry crane service and erection platform in Revit for 50%.
- Modeled a new version of a steel gantry crane service and erection platform which was similar to the existing structure in STAAD for 50%.
- After 50% deadline, TSC staff conducted a video teleconference with O&M Personnel to show them 50% steel gantry crane service building concept. O&M personnel said it was not adequate for their O&M needs, initiating a dialogue between O&M personnel and decision makers on the state of the project.
- The client agreed with O&M personnel and directed TSC to stop all work on steel platform building developed for 50% until clear direction was provided for the requirements of this structure.
- Client indicated that instead during the Dam Raise and Reservoir Enlargement Contract the area currently occupied by the Gantry Crane Service and Erection Platform would be brought to the same elevation (via mass concrete placements) as the top of the dam, but construction of the new Gantry Crane Service and Erection Platform structure would be issued as a separate contract after completion of the Dam Raise and Reservoir Enlargement Contract to design a
system which puts the coaster gates on a crawler and takes them inside a hanger type building to do maintenance and engage in welding, media blasting, painting, etc.

- Draft Specifications for the demolition of the metalwork in the gantry crane service erection platform were started (Selective demolition of Existing Metalwork (Section 02 41 11)).
- Drawings for demolition of the structure were not started.

Location of Deliverables:

- 50% QEW:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120
- Specifications (DRAFT for TASpec):
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120
- Revit Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Right Abutment\Structural
- STAAD Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8120\Gate Service Erection Platform\STAAD

List of outstanding design data and design issues:

- The entire final design concept needs to be re-evaluated with the client that would also include the O&M staff (NCAO).

Tasks remaining to complete job through SPECB:

- Drawings for demolition of the structure.
- Complete STAADPro modeling and design.
- Update quantities for 90% (Pre-Val) design.
- Finalize specifications.
- Revise Revit model to resemble a structure acceptable to the client and O&M staff.

Other notes to help when project starts up again:

- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- Confirm that a new gantry crane service erection structure is indeed not needed.
- The existing gantry crane service and erection platform is a 3-story concrete structure that is open on one side. The structure contains some miscellaneous metalwork to be removed and disposed of, two movable metal platforms, stairs, and ladders. The sides were infilled with panels by what appears to be local work force with holes in floors covered with wood panels.

The design team included the following:

Michael Shepherd
mshepherd@usbr.gov
303-445-3262
Civil Engineer, Reclamation

Justin Dorough
jdorough@usbr.gov
303-445-2223
Civil Engineer, Reclamation

Kendra Schiell
kschiell@usbr.gov
303-445-3280
Civil Engineer, Reclamation

Olaff Huerta
ohuerta@usbr.gov
303-445-3270
Structural Engineer, Reclamation

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\_March2019_Shutdown_StatusReport\FinalStatusReport_8120_GC Service Erection Platform.docx
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Hoist Tower

Group: Plant Structures Group, 86-68120

Task: Structural design to demolish concrete hoist tower structure down to El. 1065.17 and then to rebuild it to accommodate the 18.5 foot dam raise with a top of dam elevation changing from crest El. 1077.50 (NGVD29) to El. 1096.00 and top of roof parapet El. 1135.25.

Contact Person: Mike Shepherd and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 100% (SPECB) Drawings, Specification.
- Design Summary
- Pre-Val Quantity Estimate Worksheets

Status of each deliverable (includes check, TA, and PR): No deliverable has yet been completed.

- Designs
  - Tower raise needs to be designed. The tower raise design was going to be contracted out to an A/E, but at 50% it was decided that the TSC would design the tower raise.

- Drawings
  - Existing: The existing hoist tower has been modeled in Revit. Given the fact that no as-built drawings were created, there may be discrepancies between what has been modeled based on the drawings and what is on site. See note below.
    - Note: The site visit on 5 February 2019 did get to look through the entire tower. A discrepancy was noted between the as-built tower and the drawings, this note can be found in the physical files. It is possible there are other discrepancies that were missed.
    - Levels within Revit were created using the structural elevation of the floor. The elevation of the floor was taken from the existing drawings, and the ##.## inches of finish was subtracted from this elevation.
    - The existing metalwork observed during the site visit was modeled in Revit. Metalwork drawings have not been started.
    - Existing cameras and security systems atop roof will be responsibility of other groups (SSLE-Security).
  - New Construction: The existing hoist tower has been copied and stretched up to the new proposed crest height. The visible portion of the tower showing above the existing crest elevation is the same as the visible portion of the tower showing above the new
construction crest elevation. No proper design work has yet been completed for the Hoist Tower. Work has begun on creating general arrangements.

- No structural analysis has yet been performed, tower dimensions may change.
- No work has yet been done to connect the new tower to the raised dam.
- Further collaboration is needed with Mechanical/Electrical/Other for placement of equipment and floor layouts.
- Architectural work consists of sliding and roll up doors at entrance level, windows, roofing waterproofing, and detailing

  o General:
    - Further collaboration is needed with Mikolaj Salamon (86-68130), owner of the Spillway Revit model. There are some partial towers for both the Hoist and Elevator towers modeled in the Spillway Revit model causing overlaps when linking the models.

  - Specifications
    - Selective Demolition of Existing Metalwork (Section 02 41 11), Removal and Storage of Existing Metalwork (Section 02 42 11), Reinstalling Existing Metalwork (Section 02 43 11), Metal Fabrications (Section 05 50 00), and Access Hatches (Section 08 31 20) are in the early stages.

  - Quantities
    - 50% quantity estimates (for demolition and replacement of the hoist tower and associated features (civil, architectural) were prepared.
      - Quantities for metalwork were not created at 50% (rather a percentage was added to just account for metalwork in the cost).
      - The structural element QEW were prepared by Stacy Johnston (Baumgarten) 86-68130 team with assumptions different than the final design teams assumptions; this was the case since the final design of this sub-feature was going to be shopped to an A/E design team but at 50% was added to TSC work task and not much thought was placed behind the design approach to support the quantity estimating.
      - The Plant Structures Group 86-68120 did not have an architect on staff and thus the QEW exercise was incomplete at the time.

Location of Deliverables:

- Revit Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Towers

- Specifications:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120

- Trip Report: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports\2019.02.05_Hoist Tower

- 50% quantity estimates are located in:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120\Hoist Tower

List of outstanding design data and design issues:

- Existing Drawings can be found here:
Tasks remaining to complete job through SPECB:

- Drawings, specs, TASpec, and 90% & Pre-Val QEWs.
- Develop new tower layout general arrangement drawing (Mike Shepherd was doing this at time of shutdown) set and meet with disciplines to layout/arrange the floors for all equipment to be placed.
- Discuss layout and needs with client and O&M staff, to ensure layout fits the clients desired needs.
- Discuss changes that should be made to hoist tower dimensions and layout to meet changes in safety for O&M staff, and OSHA requirements.
- Based on the site visit of February 2019 verify that all disciplines (architect, structural, electrical, mechanical) show floor-by-floor levels equipment for existing conditions.

Other notes to help when project starts up again:

- Photos of the Hoist Tower can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\Hoist Tower
- The Elevator Tower and Hoist Tower are contained within the same Revit file.
- Edward Downs (86-68150) helped model (Revit) this tower and can be contacted with questions.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- The design team had traveled (February 5, 2019) to the site to inventory tower floors.
- Power source(s) for hoist equipment atop spillway operating deck may be installed in tower.
- Need to coordinate with Lan Nguyen 86-68110 and Patrick Maier 86-68130 to tie the tower to the new spillway wall and to support the tower atop the training wall.

The hoist tower design team consisted of the following staff:

Rodney Barthel  
robarthel@usbr.gov  
303-445-3221  
Structural Engineer, Reclamation

Eric Mendlin  
emendlin@usbr.gov  
303-445-6420  
Electrical Engineer, Reclamation

Eric Paquette  
epaquette@usbr.gov  
303-445-2860  
Mechanical Engineer, Reclamation

Jeffery (Scott) Keim  
jkeim@usbr.gov  
303-445-2385  
Civil Engineer, Reclamation

Kendra Schiell  
kstciell@usbr.gov  
303-445-3280  
Civil Engineer, Reclamation
Lisa Orgren  
lorgren@usbr.gov  
303-445-3279  
Civil Engineer (Structural), Reclamation

Meghan Rodwell  
mdiubaldo@usbr.gov  
303-445-2893  
Mechanical Engineer, Reclamation

Von Buhr, Michael Karl  
mvonbuhr@usbr.gov  
303-445-3829  
Civil Engineer, Reclamation

Michael Shepherd  
m shepherd@usbr.gov  
303-445-3262  
Civil Engineer / SCEP, Reclamation

Mikolaj Salamon  
msalamon@usbr.gov  
303-445-3568  
Civil Engineer, Reclamation

Olaff Huerta  
ochuerta@usbr.gov  
303-445-3270  
Structural Engineer, Reclamation

Egan, Randall  
regan@usbr.gov  
303-445-2855  
Mechanical Engineer, Reclamation

Richard LaFond  
rlafond@usbr.gov  
303-445-3226  
Chief, Civil Engineering Services Division, Reclamation

Richard Pepin  
rpepin@usbr.gov  
303-445-2391  
Materials Engineering Tech, Reclamation

Thomas Hanke  
thanke@usbr.gov  
303-445-3083  
Civil Engineer, Reclamation

Edward Downs  
edowns@usbr.gov  
303-445-3259  
Civil Engineer, Reclamation
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Left Wing Dam – Site Work

Group: Plant Structures Group, 86-68120

Task: Evaluate the site to accommodate the dam and reservoir enlargement by demolishing numerous site items (i.e., drain inlets, concrete foundations, rotunda, flatwork, and concrete walls) and reconstructing the site for parking and landscaping.

Contact Person: Sterling Westfall and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

100% (SPECB) Designs (Revit model), drawings, and specs

50% and 90% (Pre-Val) quantity estimate worksheets (QEWs) including demolition of existing site features. Final drawings and specifications for site work, concrete walls and foundations, surface drainage, miscellaneous metalwork, and communication/security features were to be prepared as part of this project.

Status of each deliverable (includes check, TA, and PR):

Designs: Revit model is in the early stages of being revised for the 90% design.

Drawings: Revit model drawings are in the early stages of being revised for the 90% design.

Specs: Specs are in the early stages, mostly requiring concrete flatwork, foundations, new equipment and reinstallation of existing equipment. Selective Demolition of Existing Metalwork (Section 02 41 11), Metal Fabrications (Section 05 50 00), and Access Hatches (Section 08 31 20) are in the early stages.

Quantities: 50% quantities were completed. 90% quantities were not started.

Location of Deliverables:

Revit Model and Drawings: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Left Abutment\Site

Backup Data from personal drive: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8120\Landscape\Backup

Metalwork Specification Sections: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120

List of outstanding design data and design issues:

- Is keeping the accessible ramp between Vista House and the raise Left Wing Dam access acceptable? (access board says it is required)
- Is replacing the lattice camera tower with a security camera pole acceptable? (Both sides of dam)
- If possible, please provide the document used from Hoover Dam that indicated a need for bollards along the dam sidewalk and the decisions for the vehicle impact rating of the bollards and the height.
- How far along the sidewalk do we want the pedestrian safety bollards? Should they be added anywhere beyond the start of the dam (Sta. 9+40)?

**Tasks remaining to complete job through SPECB:**

- Finalize site and surface drainage layouts using unfinished road designs and embankment surfaces. Coordination with other design groups will be required to lay out foundations for light poles, lattice towers, and other communication and/or security features.
- Provide drawings for site plan, sections and unpurchased equipment (vault, walls, etc.)
- Finalize specs to include items to be purchased, reinstalled and concrete specs for flatwork, foundations and other concrete features.
- Finalize metalwork specs to include any additional metalwork items and details required for metalwork demolition and new installations.
- Prepare final metalwork and fencing drawings.
- 90% (Pre-Val) quantities for metalwork, site work, and associated features.

**Other notes to help when project starts up again:**

- Take some time to refamiliarize yourself with the Revit model. There are various plan views with different potential layouts. Check progress of road layouts and geotechnical embankments before proceeding. Re-linking Revit models may be required.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.

**Main contacts when working on Left Wing Dam:**

- **Left Wing Dam Lead:** Leif Dixon (8314)
- **Site Work:** Sterling Westfall (8120)
- **Roads:** Mark Leavitt (8150)
- **Geotech:** Peter Irey (8311)
- **Retaining Wall and Core Wall:** Mary Beth Kurzdorfer and Dave Godaire (8130)
- **Misc Metal:** Kendra Schiell and Olaff Huerta (8120)
- **Surface Drainage:** John Walp (8190)
- **Water Pipes:** Amy Young (8420)
- **HVAC:** Meghan Rodwell (8410)
- **Electrical:** Eric Mendlin (8430)
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Log and Security Boom

Group: Plant Structures Group, 86-68120

Task: Provide a new log boom that would double as a security boom.

Contact Person: Brad VanOtterloo and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Originally, the design required the preparation of designs (performance specifications), specs, conceptual drawings and QEW. But SSLE (Security, Safety, and Law Enforcement) and client responses eliminated this item from the scope of the project. See final status report for documentation from SSLE that a security boom is not required.

Status of each deliverable (includes check, TA, and PR):

- The 50% QEW were completed in October 2018.
- Nothing else had been completed and since this task was deleted from the scope of work. There is no further action required.

Location of Deliverables:

- 50% QEW: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120\Security and Debris Boom
- Data: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8120\Log-Security Boom

List of outstanding design data and design issues:

- No further action required.

Tasks remaining to complete job through SPECB:

- No further action required.

Other notes to help when project starts up again:

- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- In QEW referenced Harbor OffShore Barriers.
- Facility Security per Reclamation Manual D&S SLE 03-02.
- Hoover Dam security boom obtained from the Navy but could not give TSC any specifics due to security issues (Leonard Schilling, Low Colorado Dams Office, LCD-10000).
Feature: Main Dam – Misc. Metalwork

Group: Plant Structures Group, 86-68120

Task: Provide the following miscellaneous metalwork associated with the dam raise (not all items may be listed): parapet lighted guardrails, manhole frames and covers (if required), measurement pins, electrical access covers, upstream lighting conduit junction recesses, roadway wash down frames and covers, gantry crane power outlet recess frames and covers, gate hoist structure (Penstock Coaster Gate) frames and covers on sidewalk, gate hoist structure (Penstock Coaster Gate) frames and covers on dam face, gantry crane rails, bridge expansion joint covers (if required), aluminum access ramps, measurement pins, vertical handrail pipe, inlet drains, and parapet gates. Coordinate which items are to be removed and disposed, reinstalled, and/or replaced with new.

Contact Person: Olaff Huerta, Kendra Schiell, and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs), including demolition of existing miscellaneous metalwork.
- 100% (SPECB) drawings and specifications.

Status of each deliverable (includes check, TA, and PR):

- 50% QEW package was completed in October 2018.
- Some TA Spec specifications were started but not completed including Selective Demolition of Existing Metalwork (Section 02 41 11), Removal and Storage of Existing Metalwork (Section 02 42 11), Reinstalling Existing Metalwork (Section 02 43 11), and Metal Fabrications (Section 05 50 00) are in the early stages.
- Drawings were not started (Leaning toward using AutoCAD to develop drawings in lieu of Revit since dam design team is not using Revit to generate their drawing set). Revit modeling of metalwork was started. The Revit model currently just has the lighted guardrail and crane rail modeled. Will need to coordinate with other groups (mechanical, electrical, etc.) to get metalwork needs for their groups modeled in.
- 90% QEWs were not started.

Location of Deliverables:

- 50% QEW:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120
- Specifications (DRAFT for TASpec):
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120
- Revit Models:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT
List of outstanding design data and design issues:

- The main dam design team was not far enough along to provide sufficient detail for 8120 to begin.
- Confirm that the same gantry crane rail size, location, and distance between rail centerlines remain the same as existing (as shown on original design drawings).
- Consider security options on how to prevent the public from accessing the temperature control device (TCD) from top of dam.

Tasks remaining to complete job through SPECB:

- Specs, drawings, and 90% (Pre-Val) QEWs.
- Coordinate with other groups to get their metalwork needs modeled into Revit.
- Ensure the lighted guardrail style is what is wanted by client. Verify parapet height so that height chosen for lighted guardrail meets life safety at a minimum. Verify that the parapet provides enough width to attach new lighted guardrail.
- Verify if gantry crane power outlet recesses are needed for new gantry crane.
- Verify what electrical recess boxes are needed.
- Verify if any metalwork is needed for drains (assuming that Peyton Gibson (8130) is covering currently on their drawings).
- Verify what is being disposed of, stored, and/or reinstalled. See draft specifications for what were the current assumptions.
- Verify modification to existing stop log gratings is acceptable.
- Verify if the existing downstream concrete cantilever sidewalk (original top of dam) will be demolished. If not, determine if O&M personnel will have limited access it, and if so, determine what miscellaneous metalwork (railings, fall protection) will be required to ensure employee safety.
- Coordinate with Left Wing Dam design group regarding bollard (guard posts) designs:
  - Type, security level (crash rating), location, spacing, and number required.
  - If possible, please provide the document used from Hoover Dam that indicated a need for bollards along the dam sidewalk and the decisions for the vehicle impact rating of the bollards and the height. Model bollards in Revit and include in drawings.

Other notes to help when project starts up again:

- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- Main Dam design group is responsible for road drains and piping.
- Elevations of top of lighted guardrails on main dam and on spillway bridge should match.
- Crane rails (size, location, anchor bolt spacing, splice locations, and details) should match crane rails on existing main dam.

Main contacts when working on Main Dam:

- Electrical (lighted railing and other needs)
  - Eric Mendlin
  - emendlin@usbr.gov
303-445-6420
Electrical Engineer, Reclamation

- **Main Dam team lead:**
  Anastasia (Stacy) Johnson
  abaumgart@usbr.gov
  303-445-3277
  Civil Engineer, Reclamation

- **Main Dam drawings and concrete layout:**
  Peyton Gibson
  pgibson@usbr.gov
  303-445-3196
  Civil Engineer, Reclamation

- **Mechanical Equipment**
  Ryan Stephen
  rstephen@usbr.gov
  303-445-2867
  Mechanical Engineer, Reclamation

- **Gantry Crane**
  Adalberto Silos
  asilos@usbr.gov
  303-445-2873
  Mechanical Engineer, Reclamation

  Zach Cepak
  zcepak@usbr.gov
  303-445-2830
  Mechanical Engineer, Reclamation

- **Revit Coordination:**
  Sterling Westfall
  swestfall@usbr.gov
  303-445-3272
  Civil Engineer, Reclamation

  Mikolaj Salamon
  msalamon@usbr.gov
  303-445-3568
  Civil Engineer, Reclamation
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Outlet Works – Misc. Metalwork

Group: Plant Structures Group, 86-68120

Task: Provide miscellaneous metalwork design support pertinent to replacing four 102”-dia. tube valves at El. 750 with 94”-dia. jet flow gates. Miscellaneous metalwork consists of providing grating and beam supports and access ladders down into the valve pit. Having a concrete slab over gate pit in lieu of steel grating is no longer an option. Reusing the existing grating and support beams may be considered, but new, code-compliant access ladders will be required. Existing crane rails along two sides of valve pit and along the access gallery floor are to remain in place.

Contact Person: Olaff Huerta, Kendra Schiell, and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% quantity estimates (for demolition and replacement of the existing metalwork - gratings, supports, access ladders, crane rails) were completed in October 2018. The 50% estimate was based on removing the grating and beam supports and having a new concrete slab over the gate pit in lieu of steel grating.
- 100% (SPECB) drawings and specifications were put on hold and replacement of the lower level outlet works was deleted from TSC’s scope of work after the 50% milestone. 8420 was to perform a structural evaluation of the existing El. 750 tube valves to determine if they needed to be replaced as a result of the increased head. A decision would then be needed if the El. 750 outlet works would need to be replaced as part of the dam raise project.

Status of each deliverable (includes check, TA, and PR): No metalwork designs were performed.

- No designs, drawings, or specs have been started and no work for this task was performed after the 50% design milestone.

Location of Deliverables:

50% quantity estimates are located in:

- Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120\Outlet Works\Metalwork

List of outstanding design data and design issues:

If the decision is made to include replacement of the El. 750 outlet works as part of the dam raise project:

- Decision on whether to reuse or replace existing grating and supports needs to be made.
- Access ladder may require an intermediate platform for accessing new manhole in pipe.
- Existing embedded steel hook anchors above pit may need to be evaluated for new gate loads.
• Evaluation of existing concrete will most likely be performed by other design groups (86-68130) – new design loads may apply.
• Design loads (dead, equipment, and live) still need to be determined for replacement work.

Tasks remaining to complete job through SPECB: Perform final designs (designs, specs, drawings, and quantities) of the grating, steel beams, crane rails, access ladders and platforms.

Other notes to help when project starts up again:
• Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
• Decision to replace the existing tube valves with new jet flow gates had not been made (cost prohibitive?). A study was being performed to validate this replacement condition.

• Main contacts when working on Outlet Works:
  o Outlet Works lead:
    Alan McCann
    amaccann@usbr.gov
    303-445-2848
    Mechanical Engineer, Reclamation
  o Concrete (8130):
    Shannon Wisely
    swisely@usbr.gov
    303-445-3222
    Civil Engineer, Reclamation
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Right Abutment – Site Work

Group: Plant Structures Group, 86-68120

Task: Evaluate the site to accommodate the dam and reservoir enlargement by demolishing numerous site items (i.e., drain inlets, concrete foundations, towers, flatwork, and concrete walls) and reconstructing the site for parking and landscaping.

Contact Person: Sterling Westfall and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

100% (SPECB) Designs (Revit model), drawings, and specs

50% and 90% (Pre-Val) quantity estimate worksheets (QEWs) including demolition of existing site features. Final drawings and specifications for site work, concrete walls and foundations, surface drainage, miscellaneous metalwork, and communication/security features were to be prepared as part of this project.

Status of each deliverable (includes check, TA, and PR):

Designs: Revit model is in the early stages of being revised for the 90% design.

Drawings: Revit model drawings are in the early stages of being revised for the 90% design.

Specs: Specs are in the early stages, mostly requiring concrete flatwork, foundations, new equipment and reinstallation of existing equipment. Selective Demolition of Existing Metalwork (Section 02 41 11), Metal Fabrications (Section 05 50 00), and Access Hatches (Section 08 31 20) are in the early stages.

Quantities: 50% quantities were completed in October 2018. 90% (pre-Val) quantities were not started.

Location of Deliverables:

Revit Model and Drawings: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Right Abutment\Site

Backup Data from personal drive: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8120\Landscape\Backup

Metalwork Specification Sections: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120

List of outstanding design data and design issues:

- (See “FinalStatusReport_8120_Left Wing Dam”)  
- Determine locations and extents of security fencing (if required).

Tasks remaining to complete job through SPECB:
- Finalize site work and site drainage layouts using unfinished road designs and embankment surfaces. Coordination with other design groups will be required to lay out foundations for light poles, lattice towers, and other communication and/or security features.
- Provide drawings for site plan, sections and unpurchased equipment (vault, walls, etc.)
- Finalize specs to include items to be purchased, reinstalled and concrete specs for flatwork, foundations and other concrete features.
- Finalize metalwork specs to include any additional metalwork items and details required for metalwork demolition and new installations.
- Prepare final metalwork and fencing drawings.
- Verify handrail needed for stairs going down to the lower gallery and that the access hatch and ladder are no longer needed.
- 90% and Pre-Val quantities for metalwork, site work, and associated features.

Other notes to help when project starts up again:

- Take some time to refamiliarize yourself with the Revit model. There are various plan views with different potential layouts. Check progress of road layouts and geotechnical embankments before proceeding. Re-linking Revit models may be required.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- Existing concrete canopy structure overlooking downstream side of dam is to remain in place.
- Confirm final design of Gantry Crane Service and Erection Platform and location on site plan along with the storage rack for the outlet works coaster gate.

- Main contacts when working on Right Abutment:
  
  - **Right Abutment Lead**: Anastasia (Stacy) Baumgart (8130)
  - **Site Work**: Sterling Westfall (8120)
  - **Mass Concrete**: Shohreh Hamedian and Peyton Gibson (8110)
  - **Roads**: Clark Larsen (8150)
  - **Geotech**: Kevin Schaeffer (8311)
  - **Retaining Wall**: Mary Beth Kurzdorfer and Dave Godaire (8130)
  - **Misc Metal**: Kendra Schiell and Olaff Huerta (8120)
  - **Surface Drainage**: John Walp (8190)
  - **Electrical**: Eric Mendlin (8430)
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: LWD and Right Abutment Security Gates and Guard Booths

Group: Plant Structures Group, 86-68120

Task: Dismantle the new LWD and Right abutment and Powerplant security gates for re-use and provide new guard booths on the dam crest at both ends.

Contact Person: Lisa Orgren and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 100% (SPECB) Designs, Drawings, Specifications.
- Design Summary Report
- 50% and 90% (Pre-Val) quantity estimate worksheets

Status of each deliverable (includes check, TA, and PR):

- A new security gates was designed for a separate contract and it was assumed that the gates would be installed prior to construction of the dam raise project.
- Drawings: A Revit model was created showing the basic construction and dimensions of the guard shacks based on drawings provided by the client. The Revit model does not contain drawings of the existing guard shacks.
  - Further collaboration may be needed with Sterling Westfall to assign shared coordinates to this model to get it aligned with other Revit models.
- Specs: Specifications were not started for the booths or the gates. Was considering a performance spec with a concept layout for the guard booths.
- Design: No design has been done on the guard booths.
- Quantities: 50% QEWs were completed in October 2018.

Location of Deliverable:

- Revit Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Guard Shack

List of outstanding design data and design issues:

- Drawings can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\Vehicle Barriers & Guard Shacks
- SSLE requirements can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\SSLE_SecurityRequirements
Tasks remaining to complete job through SPECB:

- Need to prepare specifications and drawings along with 90% QEW and a writeup for the Design Summary.

Other notes to help when project starts up again:

- Photos of the Existing Guard Shack can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\Security Barriers & Guard Shacks (Dam)
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\Security Barriers & Guard Shacks (Dam)
- Edward Downs (86-68150) helped model (Revit) the guard shacks and can be contacted with questions.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Spillway Bridge Metalwork, crane rails, etc.

Group: Plant Structures Group, 86-68120

Task: Provide support by providing guard and handrailing, stop log access frames and covers, gantry crane rail, and electrical access covers for the new spillway bridge structure.

Contact Person: Olaff Huerta, Kendra Schiell, and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs), including demolition of existing miscellaneous metalwork.
- 100% (SPECB) drawings and specifications.

Status of each deliverable (includes check, TA, and PR):

- 50% QEW package was completed October 2018.
- Some TA Spec specifications were started but not completed. Draft. Selective Demolition of Existing Metalwork (Section 02 41 11), Removal and Storage of Existing Metalwork (Section 02 42 11), Reinstalling Existing Metalwork (Section 02 43 11), and Metal Fabrications (Section 05 50 00) are in the early stages.
- Drawings were not started. Revit modeling of metalwork was started. The Revit model currently just has the lighted guardrail and crane rail modeled. Will need to coordinate with other groups (mechanical, electrical, etc.) to get metalwork needs for their groups modeled in.
- Draft calculations for frames and gratings for the stop log slots were started (not checked).

Location of Deliverables:

- 50% QEW:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120
- Specifications (DRAFT for TASpec):
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120
- Revit Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW\REVIT\Bridge and Hoist Deck
- Calculations:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8120\Misc Metal

List of outstanding design data and design issues:

- Is chain link fence needed for safety for accessing the spillway operating deck (hoist platform)? Is the client okay with that being the solution?
• Is a chain link fence gate okay for security for accessing the spillway operating deck?
• Consider security options on how to prevent the public from accessing the spillway operating deck from the spillway bridge.
• Writeup for Design Summary.

Tasks remaining to complete job through SPECB:
• Specs, drawings, and 90% (Pre-Val) QEWs.
• Coordinate with other groups to get their metalwork needs modeled into Revit.
• Ensure the lighted guardrail style is what is wanted by client. Verify parapet height so that height chosen for lighted guardrail meets life safety at a minimum. Verify that the parapet provides enough width to attach new lighted guardrail.
• Verify if gantry crane power outlet recesses are needed for new gantry crane.
• Verify what electrical recess boxes are needed.
• Coordinate with Left Wing Dam design group regarding bollard (guard posts) designs:
  o Type, security level (crash rating), location, spacing, and number required.
  o If possible, please provide the document used from Hoover Dam that indicated a need for bollards along the dam sidewalk and the decisions for the vehicle impact rating of the bollards and the height. Model bollards in Revit and include in drawings.

Other notes to help when project starts up again:
• Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
• No access catwalk is required for underneath bridge (for inspections).
• Bridge design group (8150) is responsible for bridge deck’s expansion joints and embedded drains and piping.
• Elevations of top of lighted guardrails on spillway bridge and on main dam should match.
• Crane rails (size, location, anchor bolt spacing, splice locations, and details) should match crane rails on existing spillway bridge.

• Main contacts when working on Spillway Bridge:
  • Electrical
    Eric Mendlin
    emendlin@usbr.gov
    303-445-6420
    Electrical Engineer, Reclamation
  • Spillway Bridge team lead:
    Ryan Kent
    rkent@usbr.gov
    303-445-2014
    Civil Engineer, Reclamation
  • Mechanical Equipment
    Ryan Stephen
    rstephen@usbr.gov
    303-445-2867
    Mechanical Engineer, Reclamation
o **Gantry Crane**
   Adalberto Silos
   asiros@usbr.gov
   303-445-2873
   Mechanical Engineer, Reclamation

   Zach Cepak
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   Mechanical Engineer, Reclamation

o **Revit Coordination:**
   Ryan Kent
   rkent@usbr.gov
   303-445-2014
   Civil Engineer, Reclamation

   Clark Larsen
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   Civil Engineer, Reclamation

   Mikolaj Salamon
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   303-445-3568
   Civil Engineer, Reclamation
Project: SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Spillway – Misc. Metalwork

Group: Plant Structures Group, 86-68120

Task: Provide support by providing miscellaneous metalwork for accessing the new spillway operating deck (aka, hoist equipment platform) from spillway bridge and spillway abutments. Metalwork consists of platforms, stairs, railings, gratings and supports, and doors and frames. Security fencing should be considered.

Contact Person: Olaff Huerta, Kendra Schiell, and Rodney Barthel

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs), including demolition of existing miscellaneous metalwork.
- 100% (SPECB) Designs, drawings, and specifications.

Status of each deliverable (includes check, TA, and PR):

- 50% QEW package was completed in October 2018.
- Some TA Spec specifications were started but not completed. Draft. Selective Demolition of Existing Metalwork (Section 02 41 11), Removal and Storage of Existing Metalwork (Section 02 42 11), Reinstalling Existing Metalwork (Section 02 43 11), and Metal Fabrications (Section 05 50 00) are in the early stages.
- Drawings were not started. Revit modeling of metalwork was started. The Revit model currently just has the lighted guardrail and crane rail modeled. Will need to coordinate with other groups (mechanical, electrical, etc.) to get metalwork needs for their groups modeled in.
- Draft calculations for the grating and supports sizing for the hoist platform was started (not checked). Calculations for the platform for accessing the hoist platform was not started.

Location of Deliverables:

- 50% QEW:  
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120
- Specifications (DRAFT for TASpec):  
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120
- Revit Model:  
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Bridge and Hoist Deck
- Calculations:  
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8120\Misc Metal
List of outstanding design data and design issues:

- Is chain link fence needed for safety/security for accessing the spillway operating deck (hoist platform)? Is the client okay with that being the solution? Where would it be acceptable to put the chain link fence?
- Consider security options on how to prevent the public from accessing the operating deck from the spillway bridge.

Tasks remaining to complete job through SPECB:

- Specs, drawings, and 90% (Pre-Val) QEWs.
- Coordinate with other groups to get metalwork needs modeled into Revit.
- Verify client is okay with the stairs accessing the operating deck.
- Move the stair location away from the hoist and elevator towers since the walls may be getting thicker.
- Change to side-mounted guardrail in every location possible to allow for wider walking surface.
- Verify dimensions of operating deck based on mechanical equipment space requirements.
- Writeup for Design Summary.

Other notes to help when project starts up again:

- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- Power source(s) for hoist equipment atop spillway operating deck will not be installed on deck (power source(s) may be located in the hoist tower or elevator tower).

Main contacts when working on Spillway:

- **Electrical (lighted railing and other needs)**
  Eric Mendlin
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  303-445-6420
  Electrical Engineer, Reclamation

- **Spillway Bridge and Operating Deck (Hoist Platform) team lead:**
  Ryan Kent
  rkent@usbr.gov
  303-445-2014
  Civil Engineer, Reclamation

- **Mechanical Equipment**
  Ryan Stephen
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  303-445-2867
  Mechanical Engineer, Reclamation

- **Gate Hoist**
  Alan McCann
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Mechanical Engineer, Reclamation

- **Revit Coordination:**
  Ryan Kent
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  Civil Engineer, Reclamation

  Clark Larsen
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  Civil Engineer, Reclamation

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SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Temperature Control Device (TCD)

Group: Plant Structures Group, 86-68120

Task: Evaluate and develop a means to modify the TCD structure to accommodate a dam raise of 18.5 feet and a reservoir raise of 20.5 feet.
For the metalwork on the TCD, the following existing components features will be removed, stored, and reinstalled: the grating, the walkover platform, and the guardrails. The following existing features will be removed and disposed of: the access stairs, chain link fence, platform, grating, supports, and guardrail at shutter structure one, and the ladders with cages. New platforms will be installed for the five shutter structures, with elevations at the mid height between the raised hoist platform and the existing platforms to remain at El. 1047.75. New ladders with safety rails will be installed to access the existing platforms. New access stairs and a watertight gate at dam parapet will be installed to access the TCD from the top of the dam.

**Contact Person:** Brandon Jackson and Rodney Barthel

**Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):**

- 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs), including demolition of existing TCD features.
- 100% (SPECB) drawings and specifications.
- Prepare specifications packages (Specs & drawings & QEW) for both the Main Dam Package and the TCD Modifications package. As of March 2019, the TCD modifications would be separate construction contract from the Dam Raise Modification contract.
- Preparing Revit Model, StaadPro Models, final designs with calculations, and two Design Summaries.

**Status of each deliverable (includes check, TA, and PR):**

- 50% QEWs were completed in October 2018.
- Drawings (assume using Revit), specifications, and 90% (Pre-Val) QEW have not been started and thus not checked, TA or PR.
- Draft metalwork specifications were prepared: Selective Demolition of Existing Metalwork (02 41 11), Removal and Storage of Existing Metalwork (02 42 11), Reinstalling Existing Metalwork (02 43 11), Metal Fabrications (05 50 00), and Watertight Gate (08 39 20).
- Revit and StaadPro models were started but are not complete and are considered draft and thus not checked, TA or PR.
- Calculations are not completed and are considered draft and thus not checked, TA or PR.
List of outstanding design data and design issues:

- **Water Hammer** - The TSC (86-68420) is updating the hydraulic transient (waterhammer) model developed when the TCD was first designed (1992) to determine the change in loadings acting on the TCD due to the dam raise. The original modeling software (WHAMO) is no longer supported, therefore, the TSC is developing an updated model using new software. Calibration of the hydraulic transient model to actual field data is necessary to finalize the TCD structural design and identify any operational limitations. A briefing paper was prepared to allow for the field test activity but was not scheduled. The results of this field investigation along with the water hammer results is needed for the structural designers to evaluate to determine next step forward.

- **Wind & Wave (Fetch) Calculations** – Rodney completed this activity.

- **Design Summary (DS)** – Rodney prepared a DS template for the TCD, and Adam Toothman prepared one for the Dam raise overall. We were going to add a paragraph summarizing the efforts in Adam’s DS and point to Rodney’s in-depth DS. Had only created the two DS templates but no one had done any work in the DSs.

**Tasks remaining to complete job through SPECB:**

- The TCD design work was going to be broken into two separate specifications packages: (1) the Main Dam specifications package would include the new threaded anchor rods (embedded in the dam’s mass concrete blocks) for the raised cantilevered girder; and (2) the remainder of the TCD raise additions and modifications would be included in its own specifications package.
Main Dam Package - Still need to complete the design of the cantilevered girder dam connection CIP (cast-in-place) anchors, prepare specifications paragraph(s), produce drawings using the Revit model, and prepare QEWs.

Raise Package - Still need to complete the final designs of the cantilevered girder dam connection, secondary steel member designs to couple the elevated deck and frame system to the existing rigid frames of both the shutter structures and low-level intakes, prepare specifications paragraph(s), produce drawings using the Revit model, and prepare QEWs.

- StaadPro models have been started for both the shutter structures and low-level intakes. Neither of the models is complete and is considered draft.
- Revit model needs to be edited to include final design details of the new installation assemblies and existing installation assemblies.
- Model new metalwork stairs for accessing the TCD. Verify the watertight gate at dam parapet wall is acceptable for accessing the TCD through the parapet wall. Verify existing platforms to remain are acceptable in size and location for needs of raised TCD.

Other notes to help when project starts up again:

- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- Photos of the TCD can be found here: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\TCD
- TCD Steel shop drawings and spec drawings are located: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\TCD
- Original TCD design calculations obtained through the archival process are located: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8120\TCD\Previous Calcs

The Design Team traveled to the site September 4, 2019 and had a follow-up scheduled for March 2019 but had to cancel since the 8120 part of the project was shut down.

Assumptions made:
  - The overall dimensions and layout of the new hoist platform remains the same as existing (as shown on TCD design drawings).
  - The new mechanical and electrical equipment on hoist deck will be same as existing. Therefore, all grating panels will be reused and reinstalled at same locations as existing, and no new grating supports will be required.
• The design team included the following:

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Lise Pederson
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Civil Engineer, Reclamation

Olaff Huerta
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Structural Engineer, Reclamation

Kendra Schiell
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Chief, Civil Engineering Services Division, Reclamation

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Raise\FIN\RPT\_March2019_Shutdown_StatusReport\FinalStatusReport_8120_TCD.docx
Feature: Spillway – Flood Routings

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SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Spillway
Other notes to help when project starts up again:
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Group: 86-68130
Task: Main Dam and Right Abutment
Contact Person: Stacy Baumgart
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Group: 86-68130

Task: Revit Model and Spillway AutoCAD Drawings

Contact Person: Patrick Maier / Mikki Salamon

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

Revit Model: A Revit model was developed for the entire Shasta Dam Raise project. This model has multiple components that were developed by separate groups and combined into one final model. This model is being used for various purposes, including design drawing production.

100% (SPECB) Drawings: The spillway design team has started developing design drawings using the Revit Model to start, and then transferring data to AutoCAD for annotation and fine-tuning. This was done due to the significant amount of drawings that will be needed, and the ability to have multiple people without Revit experience working on the drawings at the same time.

Moving forward, the Revit model is still being built/updated to show the most recent changes or designs. The model is not being used to develop spillway drawings.

Status of each deliverable (includes check, TA, and PR):

Revit Model:
- The model has been fully constructed. The model includes the latest designs from each group at the point when work was stopped. The completeness of each component of the Revit model will depend on each group working on that particular element. The spillway portion is complete and shows the latest changes to the spillway (12-foot, 3-inch wide pier, 70-foot long pier).

Spillway AutoCAD Drawings:
- The design drawings have been arranged/developed into four separate packages to date. The design drawings are not located within EDRAWS at the moment. These packages were developed to keep each drawing from a set in one place until ready for movement into EDRAWS. Drawings vary as far as completeness. Some drawings are at a 90% level, but most are at a 50% level having line work only (transferred from Revit Model) but requiring significant labeling and annotation.

Demolition Drawings – 60XXX SPWY DEMO:
- 60XX1 – Demolition Extents – Plan and Elevation, Sheet 1 of # (at 90%)
- 60XX2 – Demolition Extents – Sections and Details, Sheet 2 of # (at 50%)
60XX3 – Demolition Extents – Section and Details, Sheet 3 of # (at 50%)
60XX4 – Demolition Extents – Section and Details, Sheet 4 of # (at 50%)
60XX5 – Demolition Extents – Section and Details, Sheet 5 of # (at 50%)
60XXX – Possibly 1 or 2 more drawings to come is needed...

Backfill Drawings – 60XXX – SPWY BCKFILL:
These drawings still need to be broken up into separate sheets (tabs within file). There will likely be 4 drawings total. The line work is mostly complete from Revit, but there is still significant work with annotation. Drawings in general are at 50%.

New Spillwaay Drawings – 60XXX SPWY NEW:
60XX1 – Concrete Outline – Plan and Elevation, Sheet 1 of # (at 90%)
60XX2 – Concrete Outline – Sections and Details, Sheet 2 of # (at 75%)
60XX3 – Concrete Outline – Section and Details, Sheet 3 of # (at 50%)
60XX4 – Concrete Outline – Section and Details, Sheet 4 of # (at 50%)
60XXX – There will be many more drawings to come, especially reinforcement drawings.

Spillway Chute Aeration Ramp Drawings – 60XXX AERATION SLOT:
These drawings still need to be broken up into separate sheets (tabs within file). The line work is mostly complete from Revit, but there is still significant work with annotation. Drawings in general are at 50%.

Location of Deliverable:

Revit Model (Spillway Only):
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Spillway\Structure

AutoCAD Drawings:
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\AUTOCAD\8130\Spillway\DWGs Exported from Revit

Tasks remaining to complete job through SPECB:
The concrete outline, demolition, aeration slot and backfill drawings still need significant annotation work, but the line work is mostly complete from Revit. The latest changes from the spillway have been incorporated. There are a significant amount of additional drawings that still need to be developed,
including reinforcement drawings. The reinforcement drawings will take considerable time and effort, and cannot be completed until analyses and designs are completed.

**Other notes to help when project starts up again:**

The Revit Model can and should still be used for making changes to the actual building work / line work. Once updated, the line work can easily be transferred into AutoCAD and then annotation and clean up can take place. So far, this method appears to be working well and saving some time during drawing development.
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Final Status Report – March 2019

Group: 86-68150

Task: Right Abutment Road

Contact Person: Clark Larsen (Ryan Kent – Group Lead)

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

The deliverables consisted of 100% (SPECB) drawings and specifications, and write-up to include in the Design Summary. One drawing was created, but another would probably be needed for the roadway. The specification sections that pertained to roadways were the responsibility of Clark Larsen and Mark Leavitt (who was creating the drawings and specs for the left embankment dam).

Status of each deliverable (includes check, TA, and PR):

The drawing was reviewed at the 50% milestone (October 2018) by Mark Leavitt and Joseph Gemperline. The drawing has not been reviewed since.

Location of Deliverable: T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\CIVIL3D\Right Abutment Area\RAA Access Road

List of outstanding design data and design issues:

1. All the survey data needed for the right abutment road design is available.

Tasks remaining to complete job through SPECB:

The drawing was currently being updated for a few different areas. The updates that are needed are listed below:

1. The roadway alignment needs to be checked with the dam raise. The team working on raising the right abutment of the dam (8110 – Sherry Hamedian) was not using a Civil 3D coordinate system or Revit shared coordinates for their design. They were creating their drawings in Civil 3D, without a coordinate system. The group responsible for layout of architectural features (8120) input the drawing data from 8110 into a Revit model. This Revit model data was used as an overlay to make sure the roadway entered the dam at the right location. However, the actual coordinates and location of the roadway entering the dam needs to be verified. Coordination with 8110 will need to occur to ensure the exact roadway location on the dam is known.

2. The person in charge of site design and architectural features (8120 -Sterling Westfall) stated that he had a conversation with 8130. They stated that the client wished to continue the bridge concrete parapet around the paved parking area, upstream of the dam. This concrete parapet wall was supposedly going to be designed by 8130. There would need to be a drainage hole in this parapet wall for the runoff from the paved area.
3. The proposed roadway alignment was placed so that it would minimize the amount of cut and fill needed for the roadway embankment. The proposed alignment uses 2:1 side slopes, the steepest slopes allowed by the geotechnical engineers. There is a problem spot around proposed roadway station 1+50. The proposed embankment side slope does not connect with the existing ground surface and cannot catch the existing slope. I was currently in the process of excavating into the hillside and moving the alignment to have the proposed embankment catch the existing ground. The alignment will need to be adjusted and the hillside will need excavation cuts to fit the roadway in. The geotechnical engineers are included rock and hillside excavation in their drawings. So they will need to know how much excavation is needed for the right abutment roadway, to include in their quantities.

4. The person in charge of site design and architectural features (8120 - Sterling Westfall) recently gave me a new configuration for the gate and guard shack layout. Previously, there was only one proposed gate, with the guard shack off to the side of the road. Now there are two proposed gates. The drawing overlay is named “Shasta-LWD-Site_SAW2 - Structural Plan - Site - Linework 20190228”. This overlay shows the new general location of the guard shack and gates. A vehicle turn analysis of these gates is needed. The embankment will also need to be updated and added onto to fit the new gate configuration.
   a. I was using Autodesk AutoTURN software to see what vehicles could pass through the gates. We were currently designing the turn radius for a motor home pulling a boat (MH-B, AASHTO 2011). The client said that no semi-trucks would be passing through the right abutment area, but there is a campground that can virtually only be accessed from the right abutment. So, there is a possibility that there would be a motor home pulling a boat on the right abutment area.

5. The roadway drainage areas have not been determined, yet. The road will have a drainage ditch along the hillside. But apart from that detail the areas where the roadway will drain need to be reviewed. The site designer (8120 – Sterling Westfall) was leaning towards having a ditch along the toe of the roadway embankment that can drain off the hillside.

6. The current drawing was created from a surface that was surveyed in June 2018. The June 2018 survey did not include all of the roadway. A survey that was obtained in December 2018 contained more survey data to include all of the roadway. A vertical curve transition from the existing roadway to the proposed roadway will be needed. This has not been completed.

7. Also, there is a drawing that can be referenced that contains all the site features and their current locations in the right abutment drawing. This drawing will need to be referenced in. I do not currently know what the name of the site features drawing, but the geotechnical engineers have it referenced in their drawings. So the geotechnical engineers would be the ones to ask about it.

Specification Sections:

1. For the 50% specifications, I just listed all of the standard specification sections that I thought I would need for the right abutment roadway design. These specification sections were the same for the left embankment dam. I did not review the specification sections, so these sections will need to be reviewed and any additional information will need to be added.

Other notes to help when project starts up again:
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Group: 8150 Civil Structures

Task: Spillway Bridge

Contact Person: Ryan Kent

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

100% (SPECB) Bridge Design, Drawings, Bridge Specifications, and write-up to include in the Design Summary.

Status of each deliverable (includes check, TA, and PR):

Bridge Design – Performed initial design in MathCad, Bridge Link, and STAAD. SAP model was also set up to handle non-linear spring supports, but this did not progress past initial model set-up. Initial design documents in MathCad and Bridge Link were ~30% reviewed (“Ready for Checking” folder in the CALC folder). Will need to complete review prior to finalizing drawings.

Bridge Drawings – Drawings were in the middle of being set up. Sheets were created for all drawings and Prestressed girder details were being added, along with deck reinforcement. Nothing checked to-date.

Bridge Specifications – Specs added to Sharepoint (used Cle Elum’s prestressed girder spec) with minor adjustments made. Guide specifications for seismic isolation bearings was added to SPECS folder (see next section), but it will need to have details filled in once Bridge design is completed.

Location of Deliverable:

Design – T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8150\Spillway Bridge

Drawings - T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Bridge and Hoist Deck

Specifications - T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD

List of outstanding design data and design issues:

Current design assumes seismic loads provided by 8110 in their “Peliminary Design Load Summary” document were sufficient due to the bridge being non-dam safety related. If this changes, the design will have to be updated.

The new gantry crane was assumed to weigh the same and have the same layout as the existing crane. If this changes, the bridge design will need updated, as the crane and its pick of emergency gate governs the girder design. No mobile crane was considered in the design due to stoplog slots being moved.

Tasks remaining to complete job through SPECB: Complete review of design (revisions if needed), complete design of bearings, complete drawings, and complete seismic isolation bearing spec.
Other notes to help when project starts up again: Information provided in the “Design Documentation” file in the calculations folder.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

**Group:** 8150 Civil Structures

**Task:** Spillway Operating Deck

**Contact Person:** Ryan Kent

**Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):**

100% (SPECB) Operating Deck Design, Drawings, and Specifications. Write-up to be included in the Design Summary.

**Status of each deliverable (includes check, TA, and PR):**

Operating Deck Design – Revised designs consist of loadings, STAAD model (but members need to be revised), and RAM Connections starting to be developed for key connections. Nothing has been reviewed for the revised design. Will need to complete review prior to finalizing drawings.

Operating Deck Drawings – Sheets were created for all drawings and structure’s geometry was updated for the revised pier wall layout, as well as newer members. Nothing able to be checked to-date.

Operating Deck Specifications – Specs added to Sharepoint (used Cle Elum’s structural steel specs) with some adjustments made. Guide specifications for coatings has been added, but no adjustments/comparisons made yet.

**Location of Deliverable:**

Design – T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8150\Spillway Operating Deck

Drawings - T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Bridge and Hoist Deck

Specifications - T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD

**List of outstanding design data and design issues:**

The gate weight is still not finalized. Original design assumed the gate weighed 375-kip and hydraulic cylinder would load the structure with 700-kips (along with 100-kip of dead weight). The gates redesign increased the weight to about 425-kip. The force on the structure was increased to 840-kip (dead weight remained the same). The gate weight should be finalized, or close to it, before proceeding with the redesign of this deck structure.

Original structure supported a hoist and was approximately 25-ft tall. The new concept used a hydraulic cylinder and only requires clearance for the gate in the maintenance position (6-ft). However, the
gate/cylinder designer has requested additional space for various plates and other features on top of the gate. Current design has provided ~12” of additional clearance. This should be finalized prior to completing designs.

**Tasks remaining to complete job through SPECB:** Complete revised design with finalized gate weight, update STAAD Model as needed, complete design of connections, complete drawings (drawings are at 10% level, but Revit Model is closer to a 70% level), and complete review of final structural steel and coatings spec.

**Other notes to help when project starts up again:** Information provided in the “Design Documentation” file in the calculations folder.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Group: 8310

Task: Left Wing Dam Embankment Raise

Contact Person: Leif Dixon

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Filter, stability, seepage, and riprap design technical memoranda (TM)
- Corewall extension design
- Retaining wall design
- Final design summary
- Left Wing Dam specification sections
- Final design drawings

Status of each deliverable (includes check, TA, and PR):

All deliverables in draft form, at various stages of completion depending on availability of design data. None have been formally (signed) checked or peer reviewed since have been completed.

Location of Deliverable:

- Specification sections uploaded to the SDREP specifications Sharepoint site, but transferred to the T-drive at: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8510\SDREP CLOSEOUT

- Draft drawings - \Bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\CIVIL3D\LWD

- Draft Final Design Summary - \Bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8310\Design Summary

- Riprap design - \Bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8310

- Freeboard calculations - \Bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8310\Free Board
Corewall extension design – \Bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam\Raise\FIN\CALC\8130\LWD

Retaining wall design - \Bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam\Raise\FIN\CALC\8130\LWD

**List of outstanding design data and design issues:**

- Earthquake loads, hydrologic loads, lab work on Left Wing Dam embankment samples not yet completed, borrow FER not completed, geologic report compiling and summarizing the work completed for the Left Wing Dam not completed, lab report compiling and summarizing the lab work not yet complete

**Tasks remaining to complete job through SPECB:**

- Complete, check, and peer review all deliverables discussed above. Confirm adequacy of final design in addressing dam safety risk concerns through a team risk/risk reduction analysis.

**Other notes to help when project starts up again:**

- Obtain all necessary design data before resuming final design.
Right Abutment : Geotechnical Group 2 (8312)

Contact Person: Justin Hall or Kevin Schaeffer (x4190)

Deliverables:

Technical Memo – Seepage and Uplift Analysis (raised condition)

Technical Memo – Foundation Rock Block Analysis (raised condition)

Drawings:
- Right abutment excavation (plan and sections)
- Right abutment support (plan, sections and details)
- Right abutment grouting (plan, sections and details)

Quantities – Right abutment excavation, support and grouting

Status of each deliverable:

Technical Memo – Seepage and Uplift Analysis (raised condition):

Instrumentation review in progress. Seepage analysis in progress (approximately 30% complete with FracMan model). Closed form solutions not yet started. Design TM not yet started.

Technical Memo – Foundation Rock Block Analysis (raised condition):

Geologic background review complete. Block removal analysis and model (approximately 30% complete). Slope support design at partially complete; need to review raised condition foundation block stability to complete. Foundation modulus review not yet started due to lack of right abutment drill hole data. Design TM not yet started.

Drawings:

All drawings near 90% design level. In need of foundation block analysis to complete right abutment support drawings.

Quantities:

Quantities not yet updated for 90% design. 50% Quantities completed in October 2018. In need of foundation block analysis to complete right abutment support quantities.

Location of each deliverable:

Technical Memo – Seepage and Uplift Analysis (raised condition)

N/A

Technical Memo – Foundation Rock Block Analysis (raised condition)

N/A

Drawings:
List of outstanding design data needed and design issues

1) Right abutment support and foundation block analysis in need of data from scheduled 2019 right abutment drill holes to close out the analysis for the raised condition.
2) Right abutment gallery does not yet extend through to right abutment contact for grout curtain.

Tasks remaining to complete job through SPECB

1) Foundation block analysis needs to be completed
2) Seepage and uplift (existing versus raised condition) need to be started and completed
3) Drawings (excavation, support and grouting) need some minor adjustments are essentially ready for SPECB
4) Quantities for excavation need to be updated to include potential weathered upper portion of foundation (depending upon results from 2019 drill holes). Quantities for support are ready for SPECB but may need to be updated for additional support pending foundation block analysis.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Elevator Tower - Elevator

**Group:** Mechanical Equipment Group, 86-68410

**Task:** Structural design to demolish the concrete tower structure down to El. 1065.17 and then to rebuild it to accommodate the 18.5 foot dam raise with a top of dam elevation changing from crest El. 1077.50 (NGVD29) to El. 1096.00 and top of roof parapet El. 1135.25. Elevator will be replaced and modernized to remain in existing hoistway and adding (2) additional landings with modifying (2) existing landings.

**Contact Person:** Zac Cepak

**Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):**

- **Drawings**
  - **Existing:** The existing elevator tower has been modeled in Revit. No site visit was performed throughout the entirety of the Elevator Tower, and, given the fact that no as-built drawings were created, this means there are potential discrepancies between what has been modeled based on the drawings and what is on site. See note below.
    - No mechanical/electrical/other equipment has been modeled.
  - **New Construction:** The existing elevator tower has been copied and stretched up to the new proposed crest height. The visible portion of the tower showing above the existing crest elevation is the same as the visible portion of the tower showing above the new construction crest elevation. No proper design work has yet been completed for the Elevator Tower. Work has begun on creating general arrangements.
    - No structural analysis has yet been performed, tower dimensions may change.

- **Specifications**
  - **14 21 10 Replacement and Modernization of Elevator**

**Status of each deliverable (includes check, TA, and PR):** See above.

**Location of Deliverable:**

- **Revit Model:**
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Towers
- **Draft Metalwork Specifications:**
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8120
- **Trip Report:** Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports\2019.02.05_Hoist Tower
- **50% quantity estimates are located in:**
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8120\Hoist Tower
List of outstanding design data and design issues:

- Existing Drawings can be found here:
  o Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\Elevator Tower – Passenger
- Site visit still needed to document elevator components and photograph the machine room, pit, top and bottom of car, below the machine room floor, and hoistway guides.
- Assumptions:
  o Seismic rated rail clips will be added only to new portions of hoistway rails.
  o Existing DC motor will be reused with modern VVVF drive controls. DC motors are the least energy efficient.
  o The machine room will be located on the top floor of the elevator tower with a “dead” floor, not accessible by the elevator and above the lobby level.
- Oil tank(s) question: the hydraulic oil tanks expected being put in the elevator tower, will the tank(s) be on the same floor on the machine room or on the “dead” floor below the machine room that the elevator does not access? Fire wall needed, roof hatch (and above floor hatch) for removal/replacements.

Tasks remaining to complete job through SPECB:

- Need to model existing and new metalwork. Need to coordinate with others for metalwork needs, need to complete site visit to really verify what is existing and what can be reinstalled.
- Drawings have not been started for metalwork.
- Specification is not started.
- Drawings, specs, TASpec, and 90% & Pre-Val QEWs.

Other notes to help when project starts up again:

- Photos of the Elevator Tower can be found here:
  o Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\Elevator Tower – Passenger
- The Elevator Tower and Hoist Tower are contained within the same Revit file.
- Edward Downs (86-68150) helped model (Revit) this tower and can be contacted with questions.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- The design team had traveled (February 5, 2019) to the site to inventory tower floors but were denied access due to mitigating circumstances related to Contractor monitoring of hazardous material lead. See Hoist Tower Trip Report. Had a new trip set up for March 19, 2019 but had to cancel since the project work for 8410 was shut down on February 28, 2019.
- Power source(s) for hoist equipment atop spillway operating deck may be installed in tower.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Hoist Tower - Hoist

Group: Mechanical Equipment Group, 86-68410

Task: Structural design to demolish the concrete tower structure down to El. 1065.17 and then to rebuild it to accommodate the 18.5-foot dam raise with a top of dam elevation changing from crest El. 1077.50 (NGVD29) to El. 1096.00 and top of roof parapet El. 1135.25. The hoist in the hoist tower will be removed and replaced with new hoist matching previous capabilities adding approximately 20-feet of hook travel.

Contact Person: Zac Cepak

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Drawings
  - Existing: The existing hoist tower has not been modeled in Revit. No as-built drawings were created.
  - New Construction: The hoist in the Revit model is based on a modern hoist with a pendant control. The existing hoist tower has been copied and stretched up to the new proposed crest height. The visible portion of the tower showing above the existing crest elevation is the same as the visible portion of the tower showing above the new construction crest elevation. No proper design work has yet been completed for the Hoist Tower.
    - No structural analysis has yet been performed, tower dimensions may change. This may affect the hoist trolley runway rail centerline to centerline dimensions.
    - Revit model hoist

- Specifications
  - 41 22 20 Overhead Traveling Crane

- Quantities
  - 50% quantity estimates for demolition and replacement of the hoist tower hoist was completed in October 2018.

Status of each deliverable (includes check, TA, and PR): See above.

Location of Deliverables:

- Revit Model:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\Towers

- Specifications:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8410

- Trip Report: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports\2019.02.05_Hoist Tower

- 50% quantity estimates are located in:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8410\Hoist Tower
List of outstanding design data and design issues:

- Existing Drawings can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\Hoist Tower

Tasks remaining to complete job through SPECB:

- Drawings, specs, TASpec, and 90% & Pre-Val QEWs.
- Develop new crane layout general arrangement drawing.
- Discuss changes that should be made to hoist tower dimensions and layout to meet changes in safety for O&M staff, and OSHA requirements.
- Based on the site visit of February 2019 verify that all disciplines (architect, structural, electrical, mechanical) show floor-by-floor levels equipment for existing conditions.

Other notes to help when project starts up again:

- Photos of the Hoist Tower can be found here:
  - Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\Hoist Tower
- The Elevator Tower and Hoist Tower are contained within the same Revit file.
- Edward Downs (86-68150) helped model (Revit) this tower and can be contacted with questions.
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
- The design team had traveled (February 5, 2019) to the site to inventory tower floors.
- Power source(s) for hoist equipment atop spillway operating deck may be installed in tower.
Temperature Control Device (TCD) - Gate Hoists

**Group:** Mechanical Equipment Group

**Task:** Evaluate and develop a means to modify the TCD gate hoists to accommodate a dam raise of 18.5 feet and a reservoir raise of 20.5 feet.

**Contact Person:** Zac Cepak

**Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):**
- 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs).
- 100% (SPECB) drawings and specifications.

**Status of each deliverable (includes check, TA, and PR):**
- 50% QEWs were completed in October 2018.
- Drawings (assume using Revit), specifications, and 90% (Pre-Val) QEW have not been started and thus not checked, TA or PR.

**Location of Deliverables:**
- Revit Model: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\TCD
- Design Summary: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Design Summarys
- Trip Report: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports\2018.08.22_TCD
- 50% QEW: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8410

**List of outstanding design data and design issues:**
- None for hoists.

**Tasks remaining to complete job through SPECB:**
- Revit model needs to be edited to include final design details of the new installation assemblies and existing installation assemblies.

**Other notes to help when project starts up again:**
- Note that Vertical Datum NAVD88 = NGVD29 + 2.8 feet.
• Photos of the TCD can be found here: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\TCD

• TCD Steel shop drawings and spec drawings are located: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\TCD

• The Design Team traveled to the site September 4, 2019 and had a follow-up scheduled for March 2019 but had to cancel since the 8120 part of the project was shut down.

• Assumptions made:
  o The overall dimensions and layout of the new hoist platform remains the same as existing (as shown on TCD design drawings).
  o The new mechanical and electrical equipment on hoist deck will be same as existing. Therefore, all grating panels will be reused and reinstalled at same locations as existing, and no new grating supports will be required.
  o The hoist equipment will remain on the walkway platforms during removal, storage, and reinstall. There are 17 hoists for the TCD. The platform will be removed in 17 sections, with one hoist area per section.
  o Rough procedure will be to raise and pin the gates in the guides, disconnect the hoist ropes, reel the excess length around the drums (remove drum housing if there is an interference), and secure rope ends before platform removal.
  o The existing hoist ropes were replaced around 2013 and are in good condition for reuse. The additional rope length will be new rope extensions connected to the end of the rope on the gate side.
  o No modifications to current hoist equipment expected, repair damaged coatings as required

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\_March2019_Shutdown_StatusReport\FinalStatusReport_8410_TCD Hoists.docx
Temperature Control Device (TCD): TCD Gates, Trashracks, and Barrier Panels

Group: Mechanical Equipment Group, 86-68410

Task: TCD evaluation and modifications due to dam raise.

Contact Person: Rick Christensen and Zac Cepak

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 50% and 90% (Pre-Val) quantity estimate worksheets (QEWs) including removal and disposal of existing TCD features.
2. Prepare 100% (SPECB) specification packages (Specs & drawings & QEW) for the TCD Modification package.
3. Prepare final designs with calculations and Design Summaries for the specific mechanical equipment.

Status of each deliverable (includes check, TA, and PR):

- 50% QEWs were completed in October 2018.
- Drawings, specifications, and 90% (Pre-Val) QEW have not been started and thus not checked, TA or PR.

Location of Deliverable:

- Revit Model: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\TCD
- Design Summary: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Design Summaries
- Trip Report: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Trip Reports\2018.08.22_TCD
- 50% QEW: Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8410

List of outstanding design data and design issues:

1. Group 86-68420 needs to complete their transient analysis and field testing. This will confirm the pressure surge (upsurge and downsurge loads) and transient loads to use for the designs.
2. This transient study along with the hydraulic investigation memorandum (Group 86-68560) will then be used to determine the acceptable configuration of the new front barrier panels and the front trashracks above the existing upper gate openings for each of the TCD shutter structures. The present assumption is that new barrier panels will extend above the existing upper gate openings from El 1045 to El 1078.58 and one row of existing front trashracks will be re-installed between El 1078.58 and El 1089.83. Cladding panels will be installed between El 1045 to El
1089.83 at the sides of shutter structures No. 1 and No. 5. (Note: All elevations are in NAVD29. Add 2.8 ft to NAVD29 to get the vertical datum NAVD88)

**Tasks remaining to complete job through SPECB:**

Still need to complete the final designs, spec paragraphs and drawings, and prepare QEWs.

**Other notes to help when project starts up again:**

1. Existing temporary (emergency) curtains: Remove the curtains from the front of the TCD shutter structures 1 thru 5 before raising the pressure relief gates higher than the bottom of the middle gate openings. Damage will occur (to the curtains, PRG gates, trashracks, and/or gate hoists) if the curtains are not removed since they occupy the same guide slot as the pressure relief gates.

2. Existing water temperature sensors: Remove existing water temperature sensors from the three probewells located inside the TCD structure and from the reservoir water temperature probewell, refer to existing drawings 214-D-22226 thru 214-D-22231.

3. Existing reservoir water temperature probewell: Remove the top portion on this probewell and supports down to the top of the river outlet (Approx. El. 977.19 NAVD29) to get out of the way of the spillway cofferdam. The existing TCD water temperature probewells within the TCD shutter structures can be left in place. Refer to existing drawings 214-D-22226 thru 214-D-22231.

4. Group 86-68120 will F&I new cladding panels on the side of shutter structure No. 1 and the side of shutter structure No. 5, from approx. El. 1045 up to El 1089.83 (elevation in NAVD29).

5. Removal and disposal of existing TCD trashracks above EL 1045 from the side of shutter structure No. 1 (ref. existing drawings 214-D-22262 and 214-D-22263) and the side of shutter structure No. 5 (ref. existing drawing 214-D-22261).

6. Removal, storage and reinstallation of the existing TCD front upper trashracks above EL 1045 for shutter structures No. 1 thru No. 5 (ref. existing drawings 214-D-22258 and 214-D-22259). Depending on the final configuration for the raised TCD, one row of front trashracks may be reinstalled at a higher elevation and one row of front trashracks removed and disposed from the site.

7. Design of the new barrier panels will be similar to the designs of the existing barrier panels (ref. existing drawings 214-D-22462 and 214-D-22463). Depending on the final configuration, the barrier panel height may change to be closer to the upper trashrack panel height.

8. Raise the existing TCD gates with the gate hoists within their respective guides and pin at their storage positions at approx. El 1051.5. The hoist ropes can then be disconnected from the gates.
   a. For pressure relief gates: ref. existing drawings 214-D-22210 thru 214-D-22213.
   b. For upper gates: ref. existing drawings 214-D-22214 thru 214-D-22217.
   c. For side gates: ref. existing drawings 214-D-22218 thru 214-D-22220.
   d. For middle gates: ref. existing drawings 214-D-22396 thru 214-D-22399.

9. Remove, rehab, and reinstall the middle gates and the pressure relief gates. Reinstall these rehabbled gates and pin back at their respective storage positions.

10. Connect the hoist ropes/extension ropes to TCD gates. Unpin gates and test operate lowering and raising the gates. After testing is complete, position gates in their operating positions.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Steel Pipe

Group: 8420 – Hydraulic Equipment - Steel Pipe

Task: Penstock Analysis (including station service penstocks), Outlet Works Steel Liner Analysis, 16-inch Raw water supply pipe modifications, 10-inch potable water supply pipe modifications

Contact Person: Amy Young

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Penstock and penstock support analysis for increased reservoir head
- Outlet works steel liner analysis for increased reservoir head
- Modification design for the 16-inch raw water pipe and 10-inch potable water supply (includes 100% (SPECB) drawings and specs)
- Prepare write-up to be included in the Design Summary

Status of each deliverable (includes check, TA, and PR):

- Calculations for the penstocks, penstock supports, outlet works steel liners, 16-inch line, and 10-inch line have been completed and checked.
- Drawings have been started but are not complete.
- The steel pipe specification for water supply pipe modifications has not been started.

Location of Deliverable:

- Drawings – T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\AUTOCAD\8420\Steel Pipe
- Calculations - T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Steel Pipe

List of outstanding design data and design issues:

Design data for the pumping plant has not been provided. Accurate and as-built drawings were not found for the water supply pipes and pumping plant. We were also unable to determine the material properties for the water supply pipes from the specifications.

Tasks remaining to complete job through SPECB:

- Design and drawings for 16-inch raw water and 10-inch potable water pipe modifications for the left-wing dam raise. This includes the new taps for the 4-inch switch yard water supply, Vista house water supply, and taps for the future sprinkler system.
- Steel pipe specification for modifications to 16-inch and 10-inch pipes

Other notes to help when project starts up again:
Water treatment group assisted with the design for the 16-inch raw water and 10-inch potable water supply pipe modifications.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: River Outlets (Outlet Works)

Group: 86-68420 - Hydraulic Equipment

Task: Analysis of 850 and 950 Jet Flow Gates (96” Outlet Gate – Wheel Type)

Contact Person: Kyle Converse/ Alan McCann

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

Analysis of EL 850 and EL 950 Jet Flow Gates for increase in head. Performing structural and operational calculations to determine if existing gates need modifications or not. Also looking at seismic loads. Report to document analysis.

Status of each deliverable (includes check, TA, and PR):

Structural hand calculations for hydrostatic and hydrodynamic loading are compete. Need final seismic data to finalize calculations. FEA model is still in progress. Gate leaf is being modeled due to hand calculations with conservative assumptions showing stresses near or over allowable. Operational calculations using historical operational data has not been started.

Location of Deliverable:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Existing Jet-flow Gates

List of outstanding design data and design issues:

- May need historical operational data (motor amperages) to verify operational load calculations.

Tasks remaining to complete job through SPECB:

- Operational Calculations
- FEA of gate leaf
- Finalize hand calculations
- Assumed no modifications are going to be required

Other notes to help when project starts up again:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Existing Jet-flow Gates
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\Outlet Works\96 inch Jet Flow Gate
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Previous Reports\Shasta Spillway & Outlet Works Rope Supported Inspection_1999.pdf
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Spillway

Group: 8420

Task: Drum Gate Demo/Removal

Contact Person: Jose Luis Mena

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% and 90% (Pre-Val) Quantities
- 100% (SPECB) Demo drawings showing areas to be demoed, lines to be removed, and valves to be filled with concrete to be abandoned.
- 100% (SPECB) specification section within the general Demolition Specifications giving more detail to the valves that need to be filled with concrete and any other specific details pertaining to the Drum Gates.

Status of each deliverable (includes check, TA, and PR):

- 50% Quantities were completed in October 2018.
- 90% (Pre-Val) Quantities are not complete.
- Demo drawings and specifications are not complete.

Location of Deliverable:

- 50% Cost Estimates:
  Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\QEW-FNL\8420\8420_Drum Gate Removal_50%Est_2018-10-11.pdf

List of outstanding design data and design issues:

Tasks remaining to complete job through SPECB:

- 90% (Pre-Val) Quantity Estimates
- Demo drawings
- Specifications

Other notes to help when project starts up again:

Calculations and other information for the 50% Cost Estimate can be found here:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8420\Drum Gate Removal
Feature: Spillway - Spillway Gates (Wheel-Mounted Gates, aka Fixed-Wheel Gates)

Group: 8420 - Hydraulic Equipment Group

Task: Design New Spillway Gates

Contact Person: Alan McCann

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):
- Design of spillway gates
- 100% (SPECB) drawings and specification sections (after 50 percent milestone decision to change to hydraulic cylinder for operation of the gates, this scope was added to 8420)
- 50% and 90% (Pre-Val) Quantities

Status of each deliverable (includes check, TA, and PR):
- Design of spillway gates is not complete
- 100% (SPECB) drawings and specification sections are not complete
- 50% Quantities were completed in October 2018. 90% (Pre-Val) Quantities are not complete.

Location of Deliverable:
- see below for file locations related the new spillway gate

List of outstanding design data and design issues:
50 percent design was complete under several assumptions, see draft basis of design report provided to consultant review board. After 50 percent design it was decided to move away from wire rope or chain hoist and use a single hydraulic cylinder to operate each gate (see design decision document).

One of the issue with the 50 percent design was sealing the gate on a steeply inclined sill plate. As the gate deflects under hydrostatic load the center of the gate would move away from the inclined sill and create a leak path in the center of the gate. 50 percent design assumed the bottom of the gate would need to be unusually stiff to address this issue. After 50 percent the hydraulics labs agreed to do CFD modeling of a sill plate that is level and perpendicular to the travel of the gate. Preliminary results of the
CFD model indicated a flat sill plate recessed into the crest surface would be acceptable but further physical modeling would be needed.

Other areas of concern from a hydraulics standpoint is the geometry of the downstream side of the gate slot, it was though was some sort of offset would be needed. Reclamation facilities such as Parker had issues with flow impacting the downstream slot surface and impacting gate components. Also due to the hydraulics at the gate slot (high velocities around 70 ft/s) cavitation on the downstream pier walls could be an issue (see early work on gate slots hydraulic report: PAP-140 and PAP-105). Other Hydraulic issues include possibly need for air vents on under side of headwall just upstream of gate. It was assumed the water will spring free from the bottom of the gate and no downpull or air demand will be required downstream of the gate. Another question was flow induced vibrations and if would be an issue for the gate and operator system (gate, hydraulic cylinder, operating deck bridge). Hydraulic issues would be examined in a sectional physical model.

As part of reframing the gate leaf for a single hydraulic cylinder vs wire rope or chains attached on each side of the gate, using tub girders instead of I shaped girders was briefly examined. It appeared tub girders could be efficient if loads increased substantially, preliminary Autodesk inventor models were built to explore this concept. However, it was not clear what design guidance to use between AISC and AASHTO, neither code seems to apply well to this application of bi directional bending due to hydrostatic and operating loads with large hollow structural shapes. The plan before the project was put on hold was to continue with I shaped girders, two per section of gate, spaced at quarter points with tee sections and the faceplate spanned vertically across the two horizontal girders. The plan was to have 4 sections per gate, each 10 ft tall. Shipping this weight did not seem to be a limitation, several trucking firms stated they could ship up to 500,000 lb or more (common with mining equipment). Superloads the size we inquired about seemed to be no issue. See shipping summary and quotes. The plan was to have two lifting points spanning the middle third of the gate, connection point to hoist at the top of the gate. Each section of gate would have bolted joints for field assembly of the gates by bolting. Flanged connections were considered but it was not determined if adequate tolerances could be achieved to keep seal mounting surfaces in plane within required tolerance. It was assumed slip critical joints would be used to sandwich vertical plate members together and transfer vertical loads. The horizontal joint between leaf sections would be sealed using a flexible rubber joint. The rubber and coverbars would be recessed into the skin plate to allow the wiper seal to pass over each joint, similar to the bottom seal. Rubber blocks would be used at each end to makeup the gap between the flexible rubber joint and the vertical seal mounting surfaces. Blocks could be installed tight with j-seals and additional fasteners could be located outside of side seals to stabilize the blocks. Side guide rollers were not designed. Side guide rollers would keep gate from racking. Concepts included using rubber, coil, leaf, or conical washers to provide spring support for side guide rollers to ensure continuous contact and keep the gate tracking vertically before hydrostatic pressure is applied to gate leaf.

Development of the design with the hydraulic cylinder should continue. Use a hydraulic cylinder that has the oil supplied though the rod like BC Hydro does seems like a good choice. The plan was to explore that option more or use a single acting cylinder with clevises on each end in combination with an additional column that would be installed through the gate leaf. The column would have the hydraulic cylinder connect on the ID and have room for the cylinder with piping to travel inside the column. The other end of the column would connect to a beam that would span above the middle third of the gate and connect to the top of the gate. This arrangement would allow lifting of the gate from the top of the
gate while also allowing the hydraulic cylinder to travel into the gate. The arrangement BC hydro uses seems like it would be a cleaner installation and design. Coordination with the design of the operating deck bridge should continue including the height of the bridge above the pier top as well as how the hydraulic cylinder ties into the bridge. It was planned that each gate would have its own HPU and reservoir. The reservoir would be elevated above the top of the cylinder to allow gravity flow to each cylinder. If construction sequence allows a single tank for all spillway gates in one of the towers might be possible. Downside to single tank would be longer hydraulic lines and possible need for contraction and expansion joints in hydraulic lines.

Another design issue is the wheels/bearings/bushings. Due to the seasonal rise and fall of the reservoir it was anticipated differential thermal movement between the concrete structure of the dam and the gate could be an issue. The design of the gate needs to allow for this differential movement and the forces associated with them. Three bearing/bushing options were considered. First a cylindrical self-lubricating busing. This option used in combination with disk springs would allow centering of wheels between structural members when the gate is not loaded with hydrostatic pressure and as the gate is loaded with hydrostatic pressure thermal movement would be allowed by deflection of the disk springs. Cylindrical bushing have the disadvantage of requiring a long hub length, based on a minimum bushing length of 1.5 times the bushing inside diameter. Also, the weight of the gate needed to ensure self-closing characteristics is greater than other options. Design group disagreed if a coefficient of friction of 0.3 or 0.2 should be used in calculations. 0.3 is used in the structural evaluation of radial gates. This issue may not need to be considered on this project if seismic design criteria pushes the weight of the gate up. Second option was spherical bushings, it is not clear how this would be made into a “floating” bearing type. The axial thrust on this type of bearing in a floating application also might be an issue. Positives for this type of bearing are a reduced hub length which might decrease pier slot dimensions. Also, the spherical bushing would allow use of a wheel with a flat tread instead of the crowned tread required for cylindrical bushings. The flat thread would allow use of smaller diameter wheels. The smaller diameter wheels would however negatively impact the hoist/self-closing loads. Investigations with spherical bushing manufactures should be pursued to determine if this may be a viable option. Third option was spherical roller bearings. These have been used on many gates but none were found in this exact installation type. Portland USACE office was contacted about Bonneville gates which have used roller bearings since the 1930’s but they indicated the gate have continuous high water on them and are not subject to significant differential thermal movement. They also stated they had an aggressive maintenance program for the wheel bearings. They have the ability to remove gates from slots with a gantry and transfer to a maintenance structure for rebuilds. BC hydro uses roller bearings too. They also indicated they used a nominal 30% of hydrostatic for axial thrust design load. This is consistent with other sources and what the spillway gate designer has used in the past. This 30% is to account for various loads that could contribute to axial trust at the wheel bushings/bearings due to thermal, misalignment, etc. We did contact SKF and Timkin about this application. SKF did come back and after much conversation back and forth about this application they said they could not provide a roller bearing to handle the combination of loads (axial, 30% of hydrostatic, and radial, hydrostatic, combined) at an acceptable safety factor( as their online bearing selector tool also indicated). Additional research into dealing with the thermal and other possible differential movement loads should be done. Consultation with 8130 and 8110 (Waterways and Concrete Dams Groups 1 and 2) should be pursued further to better define design requirements for differential movement between gates and dam structure. Another question was how many wheels, 50 percent design had 38 wheels. This allowed a
smaller diameter be used. This reduced wheel weight, and diameter. The smaller diameter allow the possibility of being able to remove wheels while the gate is still in the structure. Removable downstream track sections would be provided above the gate opening to allow removal of wheels. If number of wheels is reduced and increase the diameter of the wheels the ability to remove wheels may not be possible. A catwalk downstream of the gate for access to the gate and wheels, at the same elevation as the maintenance platform on the downstream side of the headwall, might be beneficial and should be considered.

Provisions for dogging the gate should be considered.

Another possible improvement to design would be linking sections of gate together with flexible connections instead of bolted joints. If each section had 4 wheels this would ensure more equal loading of the wheels.

An operational challenge with this gate design may be dealing with debris. Woody debris was very prevalent at the site visit and recent fires in watersheds feeding lake may increase this issue. The top seal arrangement may be vulnerable with this type of gate due to debris.

**Tasks remaining to complete job through SPECB:**

- Design spillway gate, design HPU, work with manufacturers on the hydraulic cylinder, drawings, specifications.

**Other notes to help when project starts up again:**

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\DESIGN GROUPS (MISC)\8420

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\INVENTOR\Spillway Gate

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Spillway Gate

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8420\Spillway Gate

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8420\Spillway Gate

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8420\Shasta TCD Shipping Information

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PM\8420\Notes\2019.3.4 Alan Shasta Files.pdf
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Main Dam – Penstock Coaster Gate

Group: 8420, Hydraulic Equipment Group

Task: Relocate existing penstock coaster gate hoist, hydraulic power units, and position indicators; Remove and dispose of and provide and install a new coaster gate hydraulic tank; Provide new 18.5 ft stem and track

Contact Person: Andy Quiniones

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 100% (SPECB) drawings and specifications
- 50% and 90% (Pre-Val) Quantities

Status of each deliverable (includes check, TA, and PR):

- Drawings and specifications are not complete. No work has been performed since the 50% quantities, which were completed in October 2018.

Location of Deliverable:

\\bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8420\Coaster Gate

List of outstanding design data and design issues:

Penstock coaster gates will need to remain operational during the removal and constructing of the new elevator tower. The hydraulic oil stored in in the elevator tower is going to need to be available to allow emergency closure of the penstock coaster gates during construction.

Tasks remaining to complete job through SPECB: Specs, drawings and 90% (Pre-Val) quantities.

Other notes to help when project starts up again: The existing drawings as saved to:

\\bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\15x19.05 Penstock Coaster Gate
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: River Outlets (Outlet Works)

Group: Hydraulic Equipment Group, 8420

Task: Analysis of River Outlet Coaster Gate (locally at the dam called a bulkhead)

Contact Person: Alan McCann/Kyle Converse

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Analysis of the River Outlet Coaster Gate for the increase in head. Analysis should include structural and operational of gate and lifting frame. Operational should include estimating increase in downpull and used to inform gantry crane capacity/spillway bridge design criteria. Gantry crane was sized for pulling the penstock coaster gates and that will probably continue to govern the design but spillway bridge design might be impacted. Report to document the analysis.

Status of each deliverable (includes check, TA, and PR):

- No work done

Location of Deliverable:

- Not Applicable

List of outstanding design data and design issues:

- None

Tasks remaining to complete job through SPECB:

- Analysis is needed before lake water surface elevation is increased. If modification to equipment is needed this would need to be completed before lake water surface elevation is increased. It was assumed no modifications would be needed to the outlet works coaster gate.

Other notes to help when project starts up again:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PIC\2018.04.24 – McCann

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\11.05x11.05 Coaster Gate
Feature: Shasta Lake City Intake Pumping Plant

(located downstream on left side, pumps water from taps at the river outlet valve chambers to the water treatment plant above the visitor’s center)

Group: Hydraulic Equipment Group, 8420

Task: Analysis of Shasta Lake City Intake Pumping Plant for Dam Enlargement

Contact Person: Alan McCann

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Analysis of the hydraulic equipment for the increase in head and report to document the analysis.

Status of each deliverable (includes check, TA, and PR):

- No work done, needed data for analysis

Location of Deliverable:

- Not applicable.

List of outstanding design data and design issues:

- Need detailed information on the system hydraulics (steady state and transient (may need to look into suction side transients)) and all hydraulic equipment.

  E-mail to Adam Toothman on 12/20/218:
  
  o We are still seeking information on the Shasta Lake City Water Supply Pumping Plant. As part of the Dam Enlargement project we need to analyse the pumping plant for the dam enlargement but we have limited information on the pumping plant. If there is a design summary, designers operating criteria, or SOP available for the pumping plant we would appreciate a copy.

  This is the information we are looking for:

  • How is the plant operated, control narrative if available (example: fixed speed pumps or variable speed pumps, pressure sustaining valves and set points, operated from reservoir elevations xx to xx, pump on/off controlled by tank elevations xx...)
  • Documented limitations/operating conditions for the intakes at the 750 and 950 levels. (examples: 950 level cannot be used below lake water surface elevation xxx, x of the 3 taps at the 750 level or x of the 4 taps at the 950 level must be operational to meet the demands of the water treatment plant.
  • Drawings of piping, valves, and equipment from pumping plant to tank(s) at water treatment plant.
  • Detailed drawings of the pumping plant including modification not shown in the drawings listed below
  • If pumping to multiple tanks, details of both tanks and details of piping and controls between tanks.
  • Pump information: 1) Pump curves showing head, net positive suction head required (NPSHr), efficiency and power plotted as a function of capacity. 2) Pressure rating of pump casing.
  • Transient analysis
We do have drawings 214-208-2753, -2754, -2756, -2757, -2758, -2759, -2760, -2761, -2762, -2763, -2764, -4454, -4455, -4456.

Tasks remaining to complete job through SPECB:

- Analysis of equipment is needed before reservoir levels are raised. If modifications to equipment are required these would also need to be addresses before the lake level is raised.

Other notes to help when project starts up again:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\Existing Drawings\Shasta Lake City Intake

Rob Lintel provided a draft SOP which is being revised to include the pumping plant and can be found here:
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8420

Photos:
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SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: TCD

Group: 8420 – Hydraulic Equipment Group

Task: TCD – Transient Analysis

Contact Person: Nathan N. Myers, nnmyers@usbr.gov, 303-445-2862

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. Develop transient model in SIMSEN
2. Determine maximum pressures (surge and transient) within TCD structure => send to Rick Christensen to complete new panel designs
3. Transient Results Report with outcomes and recommendations. Needs to address waterhammer transients in penstock/TCD and surge in TCD.
4. No drawings or specs are included in the approved scope of work.

Status of each deliverable (includes check, TA, and PR):

1. Modeling of the TCD structure in SIMSEN is ongoing. The model is based on the transient model created in WHAMO from initial TCD design. The SIMSEN model has been run with the existing runner third-quadrant data and existing TCD structure features. New runner data to be added and raised TCD structure panels.
2. A site transient test was proposed by 8420 in FY2019 to validate the model data with the new runners. A briefing paper was prepared to include scope of testing and associated costs for testing and materials. A decision is still pending from the region if the test will take place in FY2019 or FY2020. The latest email response from TSC is in the folder.

Location of Deliverable:

- Transient Design Folder:
  Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Transient Study - Penstock & TCD

- Field Test Folder:
  Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8420\TCD Transient Test 2019

List of outstanding design data and design issues:

1. Validation of SIMSEN model – field test.
2. Pressure relief gate and panel characteristics used in model. Gates and panels are custom design by BOR engineering, so test data for hydraulic characteristics is unknown. WHAMO model has data for characteristics but the data is not confirmed to be accurate.
Tasks remaining to complete job through SPECB:

1. Rick Christensen (8410) is designing the new panels for the TCD raise. Rick needs to know the expected worst-case internal pressures acting on the panels to complete the design.
2. Rodney Barthel is designing the TCD structural raise and needs to know the expected forces due to the surge pressures in the TCD to design the anchorage and panel supports.

Other notes to help when project starts up again:

1. Rick Christensen was part of the original TCD design team and can answer questions regarding the design intents of the pressure relief gates and panels.
2. Coordination with Rick Christensen on new panel designs for TCD raise.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Turbines

Group: 8420 – Hydraulic Equipment Group

Task 3: TCD and Turbine Unit Operation Limitations

Contact Person: Shanna Durham, sdurham@usbr.gov, 303-445-2876

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. Operational limitation due to increased net head on the hydroelectric units.
2. No drawings or specifications are included in the approved scope of work.

Status of each deliverable (includes check, TA, and PR):

1. Unit Operational Restrictions and Risks:

New runners were installed on all five units at Shasta between 2005 and 2008. The new runners were optimized for the current operations at Shasta and a net head range of 330 to 480 feet. See table below to avoid damaging inlet blade cavitation per the model test. The degree of possible cavitation damage is unknown if operating into the restricted zone. If operating outside of the cavitation free zone, it is recommended to inspect the runners as soon as possible for damage. Cavitation weld repair can be done onsite without post weld heat treatment due to the Austenitic stainless steel material ASTM A743 CF3. If operation in the restricted zone is desired for long periods of time, it might also be advantageous to install cavitation monitoring sensors to research the correlation between head, operating hours, and amount of damage. The mechanical limitation is 142 MW, increasing the output would require new turbine and generator shafts and would require an evaluation rotor for maximum capability.

The Temperature Control Device (TCD) maximum design flowrate is 19,500 cfs, 3,900 cfs per unit. For net heads ranging from 375 ft to 465 feet, and all 5 units are operating at the maximum power output there should be a limit to remain below the 19,500 cfs total flowrate for the TCD. Note, if only 4 units are operating at maximum gate opening there would not be a flow restriction. Attached hill chart shows the limits for cavitation, maximum flowrate and maximum generator rating.

<table>
<thead>
<tr>
<th>Net Head (feet)</th>
<th>Restriction / Limit Long Periods of Operation due to Inlet Blade Cavitation Damage</th>
<th>No Restriction Zone due to Inlet Blade Cavitation Damage</th>
<th>Maximum Output per Unit for TCD Max Flow of 3,900 cfs (total flow 19,500 cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>Below 75 MW</td>
<td>75 MW – 142 MW</td>
<td>130 MW</td>
</tr>
<tr>
<td>440</td>
<td>Below 85 MW</td>
<td>85 MW – 142 MW</td>
<td>133 MW</td>
</tr>
<tr>
<td>450</td>
<td>Below 95 MW</td>
<td>95 MW – 142 MW</td>
<td>136 MW</td>
</tr>
<tr>
<td>460</td>
<td>Below 105 MW</td>
<td>105 MW – 142 MW</td>
<td>139 MW</td>
</tr>
<tr>
<td>470</td>
<td>Below 115 MW</td>
<td>115 MW – 142 MW</td>
<td>NONE</td>
</tr>
<tr>
<td>480</td>
<td>Below 125 MW</td>
<td>125 MW – 142 MW</td>
<td>NONE</td>
</tr>
</tbody>
</table>
Below 135 MW | 135 MW – 142 MW | NONE
---|---|---
Below 142 MW | 142 MW | NONE
ALL | NONE | NONE

*Note: Net head is the gross head (difference in elevation between forebay and tailwater) minus head loss in the penstock. Head loss (cubic feet per second) is 0.00000038*(flowrate)^2. Maximum net head with head loss most likely possible is 495 feet due to high tailwater, see calculation below. Generator efficiency at 142 MW is 98.7%. Rated head for the new runners is 425 feet (The minimum head at which the unit will produce the generator rating).

Reservoir maximum elevation with dam raise is 1087 feet, tailwater normal range is 578 to 586 feet (maximum all 5 units and spill 632.5 feet). With maximum reservoir elevation the tailwater should be at least 586 feet due to high releases required to maintain flood control. New maximum net head = 1087 feet – 586 feet – 6 feet (head loss) = 495 feet net head.

**Location of Deliverable:**
Z:\DO\TSC\jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Unit Operation Limitations

**List of outstanding design data and design issues:**
1. None

**Tasks remaining to complete job through SPECB:**
1. None

**Other notes to help when project starts up again:**
1. Inspection of each Unit for cavitation and review of operations.
2. If inlet blade cavitation is occurring, investigate operations to determine if Alstom’s cavitation boundaries on the predicted operational hill chart are accurate or if they need to become more conservative to reduce cavitation and frosting on the stainless steel runners.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: River Outlets (Outlet Works)

Group: 8420

Task: El. 750 Tube Valve Analysis

Contact Person: Wes Bower x2864

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Analysis of Tube Valve at Elevation 750. Report to document the analysis

Status of each deliverable (includes check, TA, and PR):

- At approximately 30% completion.

Location of Deliverable:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\INVENTOR\Tube Valve

List of outstanding design data and design issues:

- 3D model of body sections of tube valve must be modeled.
- FEA of tube valves must be performed.
- Hand calc “checks” need to be developed to check the FEA.
- Calculations require checking and peer review.

Tasks remaining to complete job through SPECB:

- Complete model. Perform FEA. Check with hand calcs and peer review.

Other notes to help when project starts up again:

- No existing calcs could be found. Initial FEA with Autodesk Inventor has been promising, however the imbedded FEA package is very limited in the program. This may be a job for Jerzy Salamon and his folks in 8110 who have more powerful software.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Turbines

Group: 8420 – Hydraulic Equipment Group

Task: Turbine Operating Mechanism and WG Calculations (Pending Approval)

Contact Person: Nathan N. Myers, nnmyers@usbr.gov, 303-445-2862

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. Determine stresses in operating mechanism linkages with increase in head.
2. Determine stresses in wicket gates with increase in head.
3. Evaluate new stress levels in components and compare to acceptable design standards.
4. Provide mechanical evaluations summary report with recommendations.
5. No drawings or specs are included in the approved scope of work.

Status of each deliverable (includes check, TA, and PR):

1. Client asked questions regarding impacts to turbine mechanical components due to dam raise and increase in head during review meeting in FY2019. A change order to the service agreement for this work has not been initiated or approved.
2. Data and drawing collections started. No calculations have been performed.

Location of Deliverable:

- Design Folder:
  Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8420\Turbine Operating Mech and WG Calcs

List of outstanding design data and design issues:

1. N/A

Tasks remaining to complete job through SPECB:

1. Complete change order approval process to perform work.
2. Calculate stresses in operating mechanism linkages under new maximum reservoir head.
3. Calculate stresses in wicket gates under new maximum reservoir head.
4. Prepare design summary with results and recommendations if design changes are required.

Other notes to help when project starts up again:

1. N/A
Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Electrical Distribution

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) drawings of conduit layout and sections of new conduit to transformer and panels
2. Single Line Diagrams
3. Conduit and Cable Schedules
4. Metered data (30 days of data)
5. 100% (SPECB) Specifications for:
   a. Distribution panels
   b. Transformers
   c. Raceways and Boxes
   d. Conductors and Cables

Status of each deliverable (includes check, TA, and PR):

1. Modeling of conduit did not start. Conduit drawings were not started.
2. Single Line Diagrams were created at 50% design. Major revisions were about to be made due to the extent of the tower demolition. See outstanding issues below.
3. Conduit and Cable schedules were developed based on the 50% design. The schedules will need to be adjusted based on revisions to the single line diagrams.
4. Metered data was being analyzed.
   a. T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8430\Load Studies - Metered Data
5. Specifications:

Location of Deliverable:

Drawing are located in eDRAWS, Denver Vault, Work in Progress. The following are the drawing numbers:

<table>
<thead>
<tr>
<th>Name</th>
<th>Content</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cable and Conduit schedule calculations and metered data can be found here:
T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8430

**List of outstanding design data and design issues:**

1. In Feb 2019, the extent of the demolition of the towers changed from removing the entire portion of both towers to demolition down to EL 1065. The electrical rooms in the towers are located at EL 1051. Therefore, the electrical rooms could remain energized during construction. Overhead 2.4kV bus systems, 2.4kV to 480V transformers, 2.4kV fuses switches, and 2.4kV transfer switches could remain. Original panels PDDR and PDDL would be replaced due to new breakers and loads being added. The single line diagrams from 50% design were not edited based on this change.

2. The spillway gate HPUs were going to be specified with integral motor controllers. Therefore, motor control centers in the towers were no longer necessary. The MCCs were for hoist operated gates in the 50% design. The new HPUs would be powered from 480V breakers in PDDR and PDDL. See “Final Status Report – 8430 – Spillway” for more detailed information.
3. Existing transformers feeding PDDR and PDDL would probably need to be replaced with larger dry-type transformers due to the metered data and anticipated load of the spillway gates (40Hp each). The physical size of new transformers would need to be confirmed.

4. Contractor Use Power: In Feb 2019, NCAO and CVO expressed concern that power from the dam and powerplant for Contractor use may not be permitted by the power users due to funding issues. This will need to be determined and correctly written into the specifications under Division 01.

5. Batch Plant Power at Left Wing Dam / Upper Vista House parking lot: The amount of power needed for an onsite batch plant was anticipated to be 3.8MVA. This was the size of the batch plant at Folsom Spillway. The issues were:
   a. The Contractor was going to be given the responsibility for determining if they wanted to put the batch plant at Toyon or at the Upper Vista House parking lot. Since this would not be a specifically stated in the specifications, the electrical design group was not responsible for designing any infrastructure to support the batch plant.
   b. Power from the 13.8kV loop near the switchyard, then up the hill using overhead power lines, and then underground to the Upper Vista House parking lot:
      i. The 13.8kV loop does not have enough available capacity for a 3.8MVA batch plant. Only the Upper Vista House and minor Contractor Use Power could be supplied by the 13.8kVA line.
      ii. The timing of the need for this batch plant did not give the Contractor enough time to design and procure an overhead powerline and the pad mounted equipment for this option. TSC does not design overhead powerlines, so a Contractor would need to hire a design firm prior to procuring material.
   c. New utility service from Shasta Lake City. See Emails and meeting summaries in folders under this folder. T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8430\Concrete Batch Plant
      i. The existing line to the water treatment facility on the hill above the UPPER VISTA HOUSE could be used for the temp feed to the Upper Vista House and some Contractor Use Power. It does not have capacity for 3.8MVA.
      ii. A new overhead line with additional capacity for 3.8 MVA would cost money and take time for the utility company to install.

6. Upper Vista House Power:
   a. The existing Upper Vista House is fed with 2.4kV conductors from the hoist tower, through an electrical alcove in the Left Wing Dam, then underground into the basement level electrical room at the Upper Vista House.
   b. The electrical room has a 2.4kV overhead bus bar system and 2.4kV fused disconnects which feed multiple 240V transformers for the UPPER VISTA HOUSE and guard building and one 480V transformer for parking lot lighting.
   c. The design budget did not have budget for 8430 to redesign the electrical room. No change order was issued to do this work, but we were expected to include this in the scope of the project.
   d. During excavation of the Left Wing Dam, the 2.4kV feeder to the UPPER VISTA HOUSE will be removed. Prior to excavation, a new (temporary or permanent)
A plan was determined during a meeting in Feb 2019 with the help of Royce Taft (NCAO- Electrical Engineer), Roger Worsley (MPCO-Project Manager), and Dan Vallegos (CVO-Electrical Engineer Supervisor). The plan was:

i. TSC to put together specs and drawings for an outdoor unit substation similar to the one at Keswick (drawing 214-214-60126-RD-1). The unit substation would probably be fitted with a preliminary or secondary metered section for a temporary utility service from Shasta Lake City. Shasta Lake City said they would entertain either.

ii. Temporary Service: This would be required if the Contractor could not get the permanent power feed installed to meet the construction schedule. The temporary service and would be connected to the new unit substation prior to excavating the Left Wing Dam. The 208V distribution panels in the UPPER VISTA HOUSE would need to be refed from the new unit substation. The 2.4kV feed would then be able to be removed to permit excavation of the LWD.

iii. Permanent Feed: The Contractor would design and install a new overhead power line from the existing 13.8kV OH loop near the switchyard, up the hill, under the road, and underground to the unit substation location. The Contractor would cut over from the utility service to the 13.8kV service.

iv. A location was also being determined, but not finalized. The location will need to be highly coordinated with NCAO, MPCO, and TSC groups for excavation, foundation, and possible retaining wall.

v. See T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8430\UPPER VISTA HOUSE Power

7. System Study and equipment fault duty ratings: Since CVO manages the system studies, then TSC would need CVO to perform the fault duty calculations of all electrical equipment. This would include transformers, panels, feeders to panels, and any medium voltage equipment being provided. If this project starts back up again, coordinate with CVO early in the process to get them scheduled and get them the correct scope of work.

Tasks remaining to complete job through SPECB:

1. Model conduit and electrical equipment in Revit.
2. Complete load calculations for existing and new loads when motor sizes are known.
5. Determine if existing conductors in 2.4kV system are adequate for existing and new loads.

Other notes to help when project starts up again:
1. The facility electricians may replace original 480V panels (PDDR and PDDL) and 2.4kV cable prior to the Dam Raise. Coordinate any equipment that was replaced in 2019 and beyond.

2. A clear understanding of the scope of work will need to be established prior to developing the budget and schedule. The Electrical Design group and some other groups did not have a clear understanding of the scope of work in May. Many of the aspects of the electrical scope and design will depend on:
   a. Selection of loads for:
      i. Elevator
      ii. Hoist
      iii. Spillway gate HPUs
      iv. Gantry Crane
      v. Right Abutment building requirements
   b. Decisions on:
      i. UPPER VISTA HOUSE power (temporary and permanent)
      ii. Timing of LWD excavation
      iii. Contractor Use Power
      iv. Batch Plant loads and spec requirements
      v. Shasta Lake City utility service
      vi. Procurements of electrical equipment and installation services under separate contracts prior to the Dam Raise project
      vii. Extent of Tower Demo
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Left Wing Dam Electrical Design

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) Drawings of underground conduit to transformer at the security building.
2. Lighting plans
3. Conduit and Cable Schedules
4. 100% (SPECB) Specifications for:
   a. Relocation of lighting
   b. Handrail lighting – Combo spec with Plant Structures (Division 05)
   c. Lighting (if new lights are needed)
   d. Wiring devices
   e. Raceways and Boxes
   f. Conductors and Cables

Status of each deliverable (includes check, TA, and PR):

1. Modeling of conduit did not start. Conduit drawings were not started.
2. Lighting plans were not started.
3. Conduit and Cable schedules were not started.
4. Specifications:
   b. Lit Handrail: Electrical Design Group did not edit Division 05.

Location of Deliverable:

None developed.

List of outstanding design data and design issues:

1. 8430 will need the final layout of the ramp, stairs, and road prior to locating new and relocated light poles.
2. Power for outdoor weddings and parties will need to be located.
3. Empty conduit for power and communications to future buildings will need to be determined. Prior to 50% design, there was a mention of wanting additional power for a future visitor center. TSC is not sure that this idea is still desired.
Tasks remaining to complete job through SPECB:

1. Define power requirements for 2 new sump pumps at existing security building. New sump pump system would be a packaged unit with one electrical feed from the existing panel at the security building. The sump pump system would eliminate the need for the septic system.
2. Model conduit and electrical equipment in Revit.
3. Lighting layout and recircuiting requirements would need to be determined.
4. If new security barriers are installed prior to the dam raise, then these barriers will need to be removed and relocated to the new abutment. This work will need to be included in the specification.
5. There may be a need for Contractor use power in this area. Some of the power may be for Chillers that will help cool the blocks of concrete on the main dam, a conveyor system, and a concrete batch plant. See “Final Status Report – 8430 – Electrical Distribution” for detailed information.

Other notes to help when project starts up again:

1. Gathering design data and coordination of electrical distribution work was done by 8430 in this area.
2. Detailed designs were not developed for this area by Feb 2019.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Revit Modeling

Contact Person: Darryl Liscomb and Eric Mendlin

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) Drawings of conduit and electrical equipment

Status of each deliverable (includes check, TA, and PR):

1. The MEP model was set up by linking models from other subfeatures. All subfeatures are included in one MEP model.
2. The MEP model was created in Revit 2019.
3. Modeling of new electrical equipment and conduit did not start.
4. Modeling of existing electrical equipment and conduit for the Hoist Tower did start. The existing drawings of the electrical equipment and conduit in the Hoist and Elevator towers are very detailed and accurate. Existing equipment may not need to be modelled. Modeling of existing equipment was not included in the staff day estimate produced in May of 2018.

Location of Deliverable:

T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\REVIT\MEP

List of outstanding design data and design issues:

1. Need to identify and validate features required are shown in the model. Examples include: galleries, blockouts, walls, cableways, etc.

Tasks remaining to complete job through SPECB:

1. Coordinate with other groups to correct their models and keep consistent Revit practices
2. Model electrical equipment and conduit in Revit
3. Create drawings for issuing with milestone packages
4. Update legends, schedules, and notes with applicable project date.

Other notes to help when project starts up again:

1. The right abutment and left wing dam (family elements) may require modification to add galleries to be used for routing conduit and cable to new/modified existing equipment. This should be the responsibility of structural groups but may need to be modified by 8430 if the existing galleries are not being modeled.
2. Consider using the model for other Shasta work. Models should be living documents to improve O&M as well as future planning.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Right Abutment Electrical Design

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) Drawings of underground conduit to transformer and panels at new storage building(s).
2. Lighting plans.
3. Conduit and Cable Schedules
4. 100% (SPECB) Specifications for:
   a. Distribution panels
   b. Transformers
   c. Service disconnect switch
   d. Lighting
   e. Wiring devices
   f. Raceways and Boxes
   g. Conductors and Cables

Status of each deliverable (includes check, TA, and PR):

1. Modeling of conduit did not start. Conduit drawings were not started.
2. Lighting plans were not started.
3. Conduit and Cable schedules were not started.

Location of Deliverable:

None developed.

List of outstanding design data and design issues:

1. The requirements of the storage buildings were not defined as of Feb 2019. The plan was to install empty conduit from the dam to the right abutment for future installation of power conductors.

Tasks remaining to complete job through SPECB:

1. Determine power requirements for the buildings.
2. Model conduit and electrical equipment in Revit.
3. Lighting selection and layout inside buildings and outside will need to be determined.
4. If new security barriers are installed prior to the dam raise, then these barriers will need to be removed and relocated to the new abutment. This work will need to be included in the specification.

5. There may be a need for Contractor use power in this area. Some of the power may be for Chillers that will help cool the blocks of concrete on the main dam. The amount of power needed was unknown.

**Other notes to help when project starts up again:**

1. There may be a paint area at the new building.
2. No work was done by 8430 in this area.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Security

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) Drawings of conduit layout and sections of new conduit.
2. 100% (SPECB) Specifications for:
   a. Raceways and Boxes
   b. Fiber optic cable

Status of each deliverable (includes check, TA, and PR):

1. Modeling of conduit did not start. New conduit should be modeled. Existing conduit should be modeled if existing conduits are to be reused.
2. Drawings and specs for the security conduit and fiber were not developed.

Location of Deliverable:

None developed.

List of outstanding design data and design issues:

1. There is existing surface mounted conduit on the downstream face of the dam. This conduit contains fiber for security. The plan was to reuse this conduit.
2. The security requirements need to be reviewed by the electrical design group.

Tasks remaining to complete job through SPECB:

1. Model conduit in Revit.
2. Define the scope for the Contractor in specs and drawings. The Contractor was going to be required to provide underground conduit and embedded conduit to locations of security devices. Fiber would be provided by the Contractor. Security devices and any cabling other than fiber was to be procured and provided by SSLE. The extent of installation of surface mounted conduit was not fully know. Surface mounted conduit and above grade pull boxes may need to be included in the Contractor’s scope of work.
3. See Security requirements in this folder: T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CORS\8430\Security
4. SSLE was going to review SpecD and provide one more round of comments so that TSC could incorporate those comments into SpecB.

Other notes to help when project starts up again:
1. If the dam raise project is delayed too long, then some or all of the security devices may have been upgraded. The scope of the security work may change to be a remove and relocate devices in new locations. This will need to be fully understood when developing the TBE.
2. Security associated with the relocated gates will need to be incorporated in to the scope of work.
3. Depending on the future security devices and cameras, the site lighting layout and design will need to consider security requirements. Consult with SSLE.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Spillway (Power and Controls)

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) Drawings of conduit layout and sections from Towers to Spillway Gates
2. Single Line Diagrams for electrical equipment in Towers
3. Network Diagram of Spillway controls
4. Existing equipment layout drawing
5. Conduit and Cable Schedules
6. Metered data (30 days of data)
7. Control method
8. 100% (SPECB) Specifications for:
   a. System Control and Monitoring – Division 25
   b. Cyber Security – Division 25
   c. Local PLC and HMI for each Hydraulic Pressure Unit – In HPU specification
   d. Raceways and Boxes
   e. Conductors and Cables
   f. Panelboards
   g. Human Machine Interface

Status of each deliverable (includes check, TA, and PR):

1. Modeling of conduit did not start. Conduit drawings were not started.
2. Sketch of existing equipment on elevation floor drawings was completed, however, Revit modeling of existing and new distribution equipment were not started.
3. See “Final Status Report – Electrical Distribution” for detailed information about the following items:
   a. Single Line Diagrams were created at 50% design. Major revisions were about to be made due to the extent of the tower demolition.
   b. Conduit and Cable schedules were developed based on the 50% design. The schedules will need to be adjusted based on revisions to the single line diagrams.
   c. Metered data was being analyzed.
4. Specifications:
   a. Section 25 00 01 – System Control and Monitoring: Defines control method.
   c. Local PLC and HMI for each HPU: Prepared PLC requirements to be included in HPU spec section.
   d. Raceways and Boxes: Guide spec only. Did not edit.
   e. Conductors and Cables: Guide spec only. Did not edit.
Location of Deliverable:

Drawing are located in eDRAWS, Denver Vault, Work in Progress. The following are the drawing numbers:

- Network Diagram: 214-D-T53459

List of outstanding design data and design issues:

1. Estimated HPU motor size was 40Hp for each gate. Need this confirmed. Need to know if there are any smaller motors. Possible dual motor design.
2. Each HPU is independent of the other HPU system. There were no motorized valves connecting the gates. There was a possibility of manual valves interconnecting the gate systems, but control of one gate from a different HPU would require a lot of thought in developing the operational requirements and specification requirements.
3. Need a list of all Inputs & Outputs to be included in HPU for incorporation into control design.

Tasks remaining to complete job through SPECB:

1. Coordinate P&ID drawings from hydraulic equipment group with Network Diagram and PLC specifications.
2. Develop HMI spec and cyber security spec
3. Model conduit and electrical equipment in Revit.
4. Interface spec for HPUs for spillway gates with PLC control.

Other notes to help when project starts up again:

1. The design intent in Feb 2019 was to power:
   a. Gates 1-4 from a new 480V panel in the Hoist Tower (PDDL)
   b. Gates 5-8 from a new 480V panel in the Elevator Tower (PDDR)
   c. Allocate power for one gate from each panel to operate at a time. Other gates would be blocked from operating due to limited capacity on transformers in towers.
   d. Consider one breaker and one branch circuit per gate or one branch circuit for up to 4 gates since operation will be limited to 1 gate at a time for each bank of 4 gates. Existing drum gates have a feed from one breaker.
2. System Control Functions Design Intent:
   a. Operator Control: Spillway gates will be able to be controlled from HMIs.
   b. Gate positions: Gates will be operated from closed position to open position to maintenance position. It will need to be determined if and how many intermediate positions will be required.
   c. Automatic gate operation by PLC will not be part of this scope.
   d. Normal operation of gates from two central control stations:
i. One PLC in hoist tower and one PLC in the elevator tower.
ii. Each would be able to control HPU’s 1-8.
iii. Access to the PLCs will be password protected.
iv. PLCs will be capable of operating at most two gates from closed position, open position and maintenance position.
v. Two central locations provide redundancy and operation location flexibility.
e. Local control for backup purposes or maintenance:
i. Each HPU would have an integral PLC and HMI.
ii. HPU and integral controls would be located on the maintenance deck.
iii. Provides independent control for individual gates.
iv. Each PLC controls the gate position of the associated gate according to predefined setpoints or operator manual control.
v. The PLC manages failure and emergency signals.
vi. Through interfacing of the HMI, programmed parameters can be checked and modified on site when required.
vii. Access to the PLCs will be password protected.
f. Remote monitoring: PLCs will provide an interface for remote CVACS supervision only.
g. Input devices: The input devices will be pushbuttons, level switches, limit switches and sensors. They provide feedback signal to provide continuous monitoring.
h. Output devices: The output elements will be valves, motors, control relays and alarms. They control the opening of the gates. The PLC controls the gate position according to predefined setpoints or operator manual control. The PLC will also manage failure and emergency signals. Through interfacing of the HMI, programmed parameters can be checked and modified on site when required.
i. PLC communication:
i. Fiber will be routed for connection between each PLC; providing a flat-architecture self-healing ring between all PLC control units.
ii. Fiber to the power plant control room will be provided for CVACS monitoring.
iii. Electrical interface terminal blocks and cabling will be used to account for discrete and analog signals.

3. The construction schedule prior to February 5, 2019 had the elevator tower being raised before the hoist tower. Therefore, it was planned to keep Drum Gates 1 and 2 operational from the hoist tower while Drum Gate 3 was replaced with new spillway gates 8 and 7. Gates 7 and 8 would be powered the elevator tower. Then Drum Gate 2 could be replaced with Gates 4, 5, and 6. Gates 5 and 6 would be powered from the elevator tower. Gate 4 may not be required to operate until power is available from the hoist tower. If required to operate, it could be temporarily powered from the elevator tower or a portable EG set. Gates 1-4 would be powered from the Hoist tower after it was rebuilt.
a. The construction schedule from February 5, 2019 had the hoist tower demo and re-build occurring during the construction of spillway gates 7 and 8.
b. The amount of tower demo and the timing of the tower demo, will need to be dependent on spillway gate construction and hoist tower electrical outages.
During design, 8430 will need to have a good understanding of the construction sequence in order to keep the correct amount of gates in operation at any given time. Any of the following combination of gates in operation were acceptable at the time of the 50% design:

i. Existing drum gates 1 and 2
ii. Existing drum gate 1 and new spillway gates 7 and 8
iii. New spillway gates 5, 6, 7, and 8.

4. Consider conduit routing through concrete wall behind spillway gates or surface mounted conduit.

5. The most current meeting notes from a spillway meeting can be found in the pdf in this folder: T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CORS\8430
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: TCD – Electrical

Group: 8430 – Electrical Design Group

Task: TCD Electrical Design

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 100% (SPECB) Drawings of conduit layout and sections of new conduit to TCD.
2. 100% (SPECB) Specifications for:
   a. Relocating MCCs and 480V panel on TCD platform
   b. Raceways and Boxes
   c. Conductors and Cables
   d. System Controls and Monitoring
   e. Cybersecurity
   f. Human Machine Interface
3. Load calculation for every upstream and downstream electrical equipment.
4. Protection schematic to provide interlocking and operation of gates consistent with SOP operation intent.

Status of each deliverable (includes check, TA, and PR):

1. Modeling of conduit from the elevator tower to the TCD did not start. Conduit drawings were not started. Conduit on the TCD was not planned to be modeled. If design budget and schedule permit, then conduit on the TCD platform could be modeled in Revit.
2. Drawings and specs for the TCD were not developed

Location of Deliverable:

Guide specs on T Drive in project folder.

List of outstanding design data and design issues:

1. In Feb 2019, the extent of the demolition of the towers changed to demolition down to EL 1065. The electrical rooms in the towers are located at EL 1051. Therefore, the electrical rooms could remain energized during construction. This aspect was not analyzed in respect to changing the plan for temporary and permanent power to the TCD. It may be possible to power the TCD from PDDR during the entire dam raise construction window.
2. The existing instrumentation RTDs do not function properly. The temperature is measured further out in the reservoir. Therefore, the RTDs in the TCD are not used and are not needed.
   a. Existing RTD’s and suspending cables were not correctly located and not suitable for varying submersion levels.
3. The existing telemetry equipment is not functional.
4. Currently there is no interlock in place to prevent more than two TCD gates from operating at any given time.
5. The conduit for power from the elevator tower (panel PDDR) to the TCD (panel PBQDR) and conduit from the dam to the RTDs at the TCD are routed out of the dam to the spillway balcony near the elevator tower. The conduits needed to be removed as part of the demolition and installation of the pier for spillway gate 8. Therefore, a temporary power feed to the TCD is required.
   a. One option is to bring power from panelboard PLDR, Block 60, EL 1005. There is a conduit from PLDR up to the top of the dam for gantry crane power. This conduit will not be needed during construction, so the TCD can temporarily be fed from this panel.
   b. Another option is to bring power from panel PDDR (elevator tower) or PDDL (hoist tower) with the conduit routed around construction activities.
   c. A third option is provide power from a portable engine generator. The TCD gates are only operated from the TCD while personnel is present. The engine generator would only be turned on when the TCD gates are required to be operated.
6. Permanent power for the TCD in the existing location was to be provided from new panel PDDR in the elevator tower. This conduit would need to exit the raise portion of the dam near where the new TCD would be located. The conduit would need to be above the water. A junction box would be installed where the conduit exits the dam from near the new crest of the dam. Conduit would be installed from the junction box down to panel PBQDR in the existing location. When the TCD was raised, then the conduit down to panel PBQDR would be removed, but the junction box near the crest of the dam would be re-used to feed panel PBQDR in the raised location. See document titled “Electrical - sequencing.doc” for a detailed explanation of the anticipated sequencing. This sequence may change if the TCD and dam raise are under one solicitation. T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8510\Const Sched\2018-11 50\%\TCD Construction Schedule

**Tasks remaining to complete job through SPECB:**

1. Model conduit and electrical equipment in Revit. Focus on modeling of conduit for temporary power to TCD and permanent power to TCD since this will need to be installed prior to the concrete being poured for the dam raise.
2. Prepare specifications for relocation of existing equipment and installation of new conduit and conductors.
3. Prepare specifications and drawings for one new PLC and HMI (local). This would give the operator at the TCD gate the ability to see the status of each gate and operate each gate. Blocking of gate operation would need to be designed into the PLC logic based on final determination of capacity of PDDR and transformer.

**Other notes to help when project starts up again:**

1. Panel PDDR should be sized for operation of 2 of the 15Hp gates at a time. Consider breakers with adjustable settings to avoid nuisance tripping on inrush currents when multiple motors are in operation, i.e. elevator, spillway gates, TCD gates.
a. Load calculation was performed to identify all existing loads fed from PDDR.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Electrical

Group: 8430 – Electrical Design Group

Task: Workload and Project Management (8430 considerations)

Contact Person: Eric Mendlin and Henry Vu

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. Task Based Estimate

Status of each deliverable (includes check, TA, and PR):

1. A formal Task Based Estimate will need to be provided to include all scope items for this project. At the time of TBE development in May 2018, 8430 did not know the extend of all of the items that would be involved with the design. The development of a formal TBE using WBS tasks will be critical to the success of 8430 in the redesign.

Location of Deliverable:

1. Meeting Notes:
   T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\PM\Meetings\Design Team\8430 Group Mtgs

2. Task List:
   T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8430\PM and task lists

3. Emails and discussions with MPCO and NCAO
   T:\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CORS\8430

List of outstanding design data and design issues:

1. If CVO is not able to perform the equipment recommendations, then TSC Power System Analysis and Control (8440) would need to perform a system study and provide equipment recommendations to the Electrical Design group for specifications.

Other notes to help when project starts up again:

1. The facility electricians may replace equipment between Feb 2019 and the restart of final design. Coordinate any equipment that was replaced in 2019 and beyond.

2. A clear understanding of the scope of work will need to be established prior to developing the budget and schedule. The Electrical Design group and some other groups did not have a clear understanding of the scope of work in May. Many of the aspects of the electrical scope and design will depend on:
a. Selection of loads for:
   i. Elevator
   ii. Hoist
   iii. Spillway gate HPUs
   iv. Gantry Crane
   v. Right Abutment building requirements

b. Decisions on:
   i. UVH power (temporary and permanent)
   ii. Timing of LWD excavation
   iii. Contractor Use Power
   iv. Batch Plant loads and spec requirements
   v. Shasta Lake City utility service
   vi. Procurements of electrical equipment and installation services under separate contracts prior to the Dam Raise project
   vii. Extent of Tower Demo

3. The design schedule was condensed and 8430 was asked to figure out how to “make it work”. Based on this, specifications and drawings were going to be completed at a different level of detail than typical packages. After getting into each subfeature, it was difficult to determine what could be designed to a lower level and what would need a full design level. The level of design will need to be determined when developing the TBE.

4. There are a lot of subfeatures and decisions in each subfeature that need to be properly vetted and technically approved prior to proceeding with electrical design documentation.

5. There is a considerable amount of coordination with other groups. Other groups will need to be given a clear scope so that they can provide equipment sizing to 8430 prior to 8430 proceeding with design.

6. Between the start of design and 90% design the Electrical Design Group had two GS-13 Electrical Engineers resign from Reclamation. Both of these members were assigned to Shasta with the most staff days allocated to them. This left a large void in the team. There are many aspects of design that were not near 90% design. Some was due to slower than normal coordination, but some was due to reduced staff available for this project. The electrical design group was planning on staffing this project in March and April with 3.5 FTE engineers to complete the 90% design and 90% quantity worksheets. The design was put on hold Feb 28, 2019.

7. An extended final design schedule will be needed for the redesign of this project. Other groups need adequate time to complete their designs prior to the Electrical Design Group performing final modeling and calculations for the project. The loads need to be known so that conduit, conductors, panels, and transformers can be sized. The Electrical Design Group will need ample time after coordination to complete 90% design. The design stopped 4 weeks before 90% was to be completed. 8430 probably needed 3-4 more months to develop a standard 90% design given the breath of this project and the staff allocated. Prior to knowing the loads, 8430 could start on the following:
   a. Documenting existing conditions
   b. Preparing demolition and standard specifications
   c. Selecting and laying out light fixtures
   d. Modeling security conduits
   e. Coordinating conduit routing (general routing since sizes will not be known
8. Staffing for this project:
   a. 8430 attempted to staff the project with a few engineers doing work across multiple subfeatures. With this plan and the reduction of high level personnel, some subfeatures were worked on for staff days than others. The LWD, Right Abutment, lighting, and security was given less time because there were less meetings and less coordination from other groups. The spillway and TCD were given the most time since they had regular meetings and involved equipment critical to operation of the facility.
   b. For a restart, each subfeature should have a dedicated 8430 member assigned. That member would attend subfeature meeting and be responsible for that portion of the design. In addition to each subfeature, major electrical systems include:
      i. Lighting (indoors and outdoors)
      ii. Security (including security barriers)
      iii. Electrical Distribution (Single Line Diagrams, load calcs, equipment specs, conduit and cable sizing): This may need two people when developing SLDs for the Towers/dam as well as the Upper Vista House.
      iv. UVH substation and 208V distribution: This will take some focus and design effort. In this design, Upper Vista House was part of the LWD subfeature cost estimate. The UVH electrical work was not given it’s due credit by other groups. For the restart, it would probably be best if 8430 led this subfeature. Civils and geotechs will need to get involved as support.
      v. Modeling (1 FTE when conduit and devices are being modeled)
      vi. PLC/Controls
      vii. Existing drawings and demolition
9. The 8430 lead should meet with 8430 members regularly or at least get a regular status update. The Status Report template would be a good form to use for each electrical area or for each subfeature. Reporting monthly or bi-weekly on the progress would be good for the 8430 lead and 8430 GM. A bi-weekly report could list how many hours and dollars were spent on that item.
10. Meetings: Plan for one hour long meeting every other week for each of the following:
    a. TCD
    b. Towers
    c. Main Dam
    d. Right Abutment
    e. LWD
    f. UVH (may be run by 8430)
    g. Spillway
    h. Group Leads Meeting
11. 8430 budget recap:
   a. 8430s budget was not enough to do a detailed design for the dam raise.
   b. Not all scope items were included in the budget, i.e. UVH 208V distribution indoors, tower demolition, temporary use power for batch plant and UVH.
   c. 8430 budget (labor only):

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Staff Days (budget)</th>
<th>Budget</th>
<th>Spent</th>
<th>% spent (labor dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>132</td>
<td>$122,112</td>
<td>$96,264.25</td>
<td>78.8%</td>
</tr>
<tr>
<td>2019</td>
<td>300</td>
<td>$283,200</td>
<td>$100,622.50</td>
<td>35.5%</td>
</tr>
</tbody>
</table>
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Construction Schedule

Group: 86-68510 - Construction Management and Specifications Group

Task: Create a construction schedule for the Left Abutment Dam Raise and the Temperature Control Device (TCD).

Contact Person: Stefano Truschke, 303-445-3099

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- Construction schedule in Primavera, along with notes documenting assumptions and productions rates used to create the schedule.

Status of each deliverable (includes check, TA, and PR):

- Left Abutment Dam schedule: 50% schedule peer reviewed and sent to Mid-Pacific Construction Office (MPCO) by email on November 28, 2018.
- TCD schedule: 50% schedule peer reviewed and sent to MPCO under a transmittal memo dated January 15, 2019.

Location of Deliverable:

Left Abutment Dam:

Schedule: `\bor\do\tsc\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8510\Const Sched\2018-11 50\%\Shasta LAD - November 2018.xer` (also in Primavera database under MP root)

Notes: `\bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8510\Const Sched\2018-11 50\%\Shasta Dam - LAD - Government Schedule Notes.docx`

TCD:

Schedule: `\bor\do\tsc\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8510\Const Sched\2018-11 50\%\TCD Construction Schedule\Shasta - TCD Construction Schedule 7 days per wk Dec-Apr - 2019.02.04.xer` (also in Primavera database under MP root)

Notes: `\bor\do\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8510\Const Sched\2018-11 50\%\TCD Construction Schedule\Shasta TCD Raise Notes_Rev 1_09142018 R1.docx`

Master Schedule as of 03/04/19 (By MPCO): `\bor\do\tsc\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8510\Const Sched\2018-11 50\%\Draft SDREP - Dam Raise Construction Schedule_021319`
List of outstanding design data and design issues:
- Tower schedule.
- Seeding calendar for the left abutment dam.

Tasks remaining to complete job through SPECB:
- Update schedules based on Spec D.

Other notes to help when project starts up again:
The Mid-Pacific Region took responsibility for creating the overall schedule of the raise. They requested TSC put together fragnet schedules for the Left Abutment Dam and the TCD that could be imported into the master schedule.

Before resuming new work on the schedule, check with MPCO to see if they have updated the schedule since February 13, 2019.

TCD: The schedule for the towers will affect the TCD schedule as the permanent power to the TCD runs through the elevator tower.

MP requested TCD construction take place in phases to allow operation of the TCD April through the first week of December. This will require one shutter structure to be out for the duration of construction and all three of the shutter’s gate openings will need to be blocked.

Construction Liaison support for the project was primarily performed by MPCO with Randy Wyatt taking the lead. TSC supported and facilitated this effort primarily through Brian Hollis.

Team

Stefano Truschke  
303-445-3099  
Civil Engineer, Reclamation

Kenneth Tindall  
303-445-3235  
Civil Engineer, Reclamation

Ed Frazar  
303-445-3297  
Civil Engineer, Reclamation

Brian Hollis  
303-445-2899  
Construction Liaison, Reclamation

Nancy Arthur  
303-445-3078  
Civil Engineer, Reclamation
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Specifications

Group: 86-68510 - Construction Management and Specifications Group

Task: Specifications for Shasta Dam Raise Final Design.

Contact Person: Michael Von Buhr, 303-445-3829

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% project specifications
- 100% (SPECB) Project Specifications

Status of each deliverable (includes check, TA, and PR):

- 50% level of Spec. Package Completed.
- TASPEC and SPECB not completed.

Location of Deliverable:

Specifications – 50% Milestone
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\02 50percent

Specifications – TA SPEC (at time of shutdown):
Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\SPEC\03 SpecD\8510\SDREP CLOSEOUT

List of outstanding issues:

Specifications are in a developmental phase. The level of completion is between 50% and T/A Spec, this includes DIV 1 Specs. Many questions were left unanswered in the DDR, which directly effects the level of completeness in all the Specification Divisions and Sections.

Architect needs to review all Design Docs and Specs and update as needed. (At the time this project was active TSC did not have a full time Architect to review project.)

Tasks remaining to complete job through SPECB:

Obtain answers from MPCO to the questions in the DDR and have designers update all outstanding Spec Sections.

Other notes to help when project starts up again:

Before resuming new work, check with TSC Project Manager to see if the Scope of Work has changed. The specs were not developed to a TA Spec level, but that was the next milestone in the project before the shutdown.
TSC supported and facilitated this effort primarily through Nancy Arthur with Michael Von Buhr and Denise Fuzere in support.

**Team:**

**POC’s for Specs:**

Nancy Arthur  
303-445-3078  
Civil Engineer, Reclamation

Michael Von Buhr  
303-445-3829  
Civil Engineer, Reclamation

Denise Fuzere  
303-445-3078  
Civil Engineer, Reclamation

Ed Frazar  
303-445-3297  
Civil Engineer, Reclamation
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Cost Estimates

Group: 86-68520 - Estimating Services Group

Task: Prepare Cost Estimates for Shasta Dam Raise final design from the 50% design through the IGCE.

Contact Person: Tom Hanke, 303-445-3083

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

- 50% Final Design Field Cost Estimate
- Cost Risk Analysis (as part of finalizing the 50% Final Design Cost Estimate)
- VE Study “Cost” Proposals
- 90% (Pre-Val) Cost Estimate
- IGCE

Status of each deliverable (includes check, TA, and PR):

All the above listed deliverables due prior to project “going on the shelf” have been completed, including Peer Reviews:

- 90% and IGCE cost estimates were not started

Location of Deliverable:

General Estimate Information:

- Z:\DO\TSC\Support\Groups\8520\_Preval & IGCE\_Jobs\MP\Shasta Dam\Dam Raise\50% Design

Specific deliverable locations:

- 50% Final Design Field Cost Estimate (including backup material):
  - Z:\DO\TSC\Support\Groups\8520\_Preval & IGCE\_Jobs\MP\Shasta Dam\Dam Raise\50% Design\FinalEst\Client
- Cost Risk Analysis:
  - Z:\DO\TSC\Support\Groups\8520\_Preval & IGCE\_Jobs\MP\Shasta Dam\Dam Raise\50% Design\CRA
- VE Study “Cost” Proposals:
  - Z:\DO\TSC\Support\Groups\8520\_Preval & IGCE\_Jobs\MP\Shasta Dam\Dam Raise\VE Study

Quantity Estimate Worksheets:

- Copy of 50% Final Design Cost Estimate QEWs with zero dollars located:
List of outstanding design data and design issues:
Once the project restarts, if separate contracts required, then these will need to be determined.

Tasks remaining to complete job through SPECB:
Complete next round of cost estimates which is currently the 90% Final Design Cost Estimate or Prevalidation Estimate which is still to be determined. There have been discussions of using the 90% Final Design Estimate for the Prevalidation estimate due to initial time constraints but that may now change. No final determination was made and will require further discussions once the project restarts.

Other notes to help when project starts up again:
The Unit Price Level of the 50% Final Design Field Cost Estimate is October 2018.

The 50% Final Design Cost estimate was treated as though it was a Prevalidation Estimate per Client direction. Therefore the files are located as shown below and NOT on the general Z:\Drive project folder.

The 50% Final Design Field Cost Estimate assumed that the whole project would be awarded as ONE complete construction contract per Client direction although the anticipation is that it will most likely be split up in multiple contracts (possibly separate contracts for each: TCD and Outlet Works Valves).

The Cost Risk Analysis utilized pay item cost percentages and not actual dollar values due to the Prevalidation cost estimate restrictions described above.

Team:

Estimate:
• Tom Hanke, Team Lead – Sr. Estimator – 303-445-3083 (primarily Concrete Work)
• Alvin Jansen, Estimator – 303-445-3671 (TCD, Steel Cofferdam, Elevators)
• Ngoc Dam, Estimator – 303-445-3415 (Electrical)
• Edlen Bigas, Estimator – 303-445-2602 (Left and Right Abutment Earthwork)
• Alan Culley, Estimator – 303-445-3138 (Spillway Demolition, Contraction Jt. Grouting, Cooling System)
• Jerry Zander, Sr Estimator – 303-445-3038 – Peer Reviewer
• Lonnie Zlomke, Sr. Estimator – 303-445-3087 – Peer Reviewer (Electrical)
• Jim Jetton, Sr. Estimator – 303-445-3089 – Peer Reviewer

Cost Risk Analysis (CRA):
• Dan Maag, Sr. Estimator – 303-445-3084 – Peer Reviewer
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019


Group: 86-68540 – Materials and Corrosion Laboratory Group

Task 1: The purpose of this analysis is to design a cathodic protection system for the new spillway gates after Shasta Dam is raised 18.5 feet and the associated 20.5 ft raise of Shasta Lake (reservoir).

Contact Person: Jessica Torrey, Materials Engineer (jtorrey@usbr.gov)

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. Water Corrosivity Analysis and Report
2. 50% CP Design and Drawings
3. 50% Quantity Worksheets

Status of each deliverable (includes check, TA, and PR):

1. Complete
2. Complete
3. Complete

Location of Deliverable:

1. Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT and Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8540\Water Quality
2. Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\CALC\8540\CP\Spillway Gates and Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8540\Spillway Gates and Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\NEW DWG\AUTOCAD\8540\Spillway Gates CP
3. Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8540\CP

List of outstanding design data and design issues:

- The gate design was changing as we were shutting down the project. Will need to coordinate with 8520- Hydraulic Equipment Group (Alan McCann).
- The rectifier will need to be sized. Recommendation is to write spec to include a current requirement test once the gates are installed rather than sizing with the limited information available.

Tasks remaining to complete job through SPECB:

- 100% design of CP system using final gate design
- SPECB-level specification paragraphs, drawings, quantity worksheets
Other notes to help when project starts up again:

- We were speaking to Greg Smith from CerAnode Technologies about the MMO anodes— they may have a more robust anode configuration that could be mounted on the concrete pier walls and withstand the high current flows if the gates were to open.

Task 2: The purpose of this analysis is to provide information on the amount and type of California-specific hazardous materials that may be encountered during the Shasta Dam raise construction.

Contact Person: Lise Pederson, LPederson@usbr.gov

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

2. 02 83 20 - Removal and Disposal of Asbestos Containing Equipment
3. 02 83 35 - Removal and Disposal of Coatings and Equipment with Coatings with Regulated Metals
4. 02 83 37 - Removal and Disposal of Mercury-containing Equipment
5. 02 84 40 - Removal and Disposal of Polychlorinated Biphenyls
6. 02 87 20 - Removal and Disposal of Used Oil
7. 51 02 80 - Hazardous Materials Survey and Analytical Results

Status of each deliverable (includes check, TA, and PR):

Items 1-7, draft started.

Location of Deliverable:

1. \BOR.DOI.NET\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8540\Hazmat
2. --6. \BOR.DOI.NET\DO\TSC\Support\Groups\8540\EC&M\_D&E\CA\zz CA working specs
7. Is excerpted from No. 1 above.

List of outstanding design data and design issues:

None noted.

Tasks remaining to complete job through SPECB:

See deliverables listed above.

Other notes to help when project starts up again: None._

Task 3: Provide specifications that contain surface preparation and coating systems that may be used during the Shasta Dam raise construction.

Contact Person: Richard Pepin, rpepin@usbr.gov

Deliverables (Specs, etc.):
1. Coatings for ferrous metals: 09 96 20
2. Coatings for concrete, gypsum board and wood: 09 91 10

Status of each deliverable (includes check, TA, and PR):

Items 1, draft started for 09 96 20 (50%).

Location of Deliverable:

2. \BOR.DOI.NET\DO\TSC\Jobs\Support\Groups\8540\MERL\Coatings\Shasta Dam\Dam Raise

List of outstanding design data and design issues:

None noted.

Tasks remaining to complete job through SPECB:

See deliverables listed above.

Other notes to help when project starts up again:

None.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Feature: Temperature Control Device

Group: 86-68540 – Materials and Corrosion Laboratory Group

Task 1: The purpose of this analysis is to design a cathodic protection system for existing upset rods and couplers and box girder (if required) components of the TCD after Shasta Dam is raised 18.5 feet and the associated 20.5 ft raise of Shasta Lake (reservoir).

Contact Person: Daryl Little, Materials Engineer (dlittle@usbr.gov)

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. 50% CP System Design for TCD upset rods and couplers.
2. 50% CP System Drawings for TCD upset rods and couplers.
3. 50% Quantity Worksheets for CP on upset rods and couplers.

Status of each deliverable (includes check, TA, and PR):

1. Complete
2. Complete
3. Complete

Location of Deliverable:

1. Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DATA\8540\TCD\Upset Rods CP Design 2009
2. Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\DWG\8540 TCD CP\50%
3. Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\EST\50percent\8540\CP

List of outstanding design data and design issues:

1. Determine if the box beam is sealed and need for CP.
2. Determine condition and need for CP on dam connections.
3. Verify clearance for anodes on upset rods and couplers.
4. Verify location of additional anodes for CP design on upset rods and couplers.

Tasks remaining to complete job through SPECB:

1. 100% design of CP system using final anode locations and any additional structures requiring CP.
2. SPECB-level specification paragraphs, drawings, quantity worksheets

Other notes to help when project starts up again:
1. Site visit will be required to determine clearance of anodes, locations or additional anodes, need for CP on box beam dam connection, and determination of if the box beam is sealed and condition.

**Task 2:** TCD hazmat report.

**Contact Person:** Lise Pederson, Civil Engineer (lpederson@usbr.gov)

**Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):**

None. TCD hazmat report is included in overall facility report.

**Status of each deliverable (includes check, TA, and PR):**

**Location of Deliverable:**

**List of outstanding design data and design issues:**

**Tasks remaining to complete job through SPECB:**

**Other notes to help when project starts up again:**

**Task 3:** Provide specifications and estimates that contain surface preparation and coating systems that may be used during the Shasta Dam raise construction.

**Contact Person:** Richard Pepin, rpepin@usbr.gov

**Deliverables (Specs, etc.):**

1. Coatings for ferrous metals: 09 96 20
2. Estimates for repair of existing coatings

**Status of each deliverable (includes check, TA, and PR):**

- Items 1, draft started for 09 96 20, 30% complete.
- Item 2, estimates, 30% complete (See Rodney’s sheets)

**Location of Deliverable:**

1. \BOR.DOI.NET\DO\TSC\Jobs\Support\Groups\8540\MERL\Coatings\Shasta Dam\Dam Raise

**List of outstanding design data and design issues:**

None noted.

**Tasks remaining to complete job through SPECB:**
See deliverables listed above.

**Other notes to help when project starts up again:**

After a year on the shelf the coatings spec and estimate will need to be started over as the spec and prices becomes dated very quickly.
SDREP – Shasta Dam Raise Final Design

Final Status Report – March 2019

Group: 8560 – Hydraulic Investigations and Laboratory Services

Task: Physical Modeling and Hydraulic Analysis

Contact Person: Connie Svoboda, csvoboda@usbr.gov, 303-445-2152

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):

1. Peer-reviewed Hydraulic Lab report including data collected from 1:60-scale physical model of Shasta Dam and supporting computational fluid dynamics (CFD) modeling, analytical assessments, and outlet work ratings.


2. Peer-reviewed Hydraulic Lab report including analytical assessment of spillway cavitation potential and air slot design as a cavitation prevention technique.


Status of each deliverable (includes check, TA, and PR):

All reports are in draft form as of 6/6/2019. The final peer-reviewed reports are expected by 7/31/2019 and will be accessible via TSC Team drive and Hydraulics Laboratory database.

Location of Deliverable:

Reports can be found here:

Z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\_Final Design Reports SDREP\8560 - Physical Modeling
List of outstanding design data and design issues:

- No physical modeling was conducted on stilling basin modifications in the 1:60-scale physical model due to stop work request issued on January 15, 2019.
- No physical modeling was conducted on the replacement outlet works in the outlet works model due to stop work request issued on December 13, 2018.
- Gate operation strategies including asymmetric gate operation were not assessed in the 1:60-scale physical model.
- Final design of ramp aerator location and sidewall ramps was not determined in the 1:60-scale physical model.
- Wall heights for spillway chute were investigated in the 1:60-scale physical model, but not optimized.
- A sectional physical model of spillway crest, gates, and associated features was not constructed; therefore a detailed assessment of hydraulic performance of spillway features, bridge interaction was not conducted.

Tasks remaining to complete job through SPECB:

Tasks will be determined in collaboration with designers.

Other notes to help when project starts up again:

The 1:60-scale physical model will be held on the floor of the Hydraulics Laboratory until the floor space is required for other project work.

Changes to the spillway pier width and length, center-to-center spacing of piers, and abutment pier extensions were under discussion when the project ended and should be revisited upon future start-up.
Feature: Temperature Control Device

Task: The purpose of this analysis is to provide recommendations on modifying the TCD upper gate (UG) configuration to maximize TCD performance after Shasta Dam is raised 18.5 feet and the associated 20.5 ft raise of Shasta Lake (reservoir).

Contact Person: Tracy Vermeyen, Hydraulic Engineer (tvermeyen@usbr.gov)

Deliverables (Designs, Analyses, Reports, Drawings, Specs, etc.):
- Technical Memorandum (TM PAP-1173): Temperature Control Device Gate Configuration Recommendations for Shasta Dam Raise

Status of each deliverable (includes check, TA, and PR):
- Completed: October 2018

Location of Deliverable:

z:\DO\TSC\Jobs\MP\Shasta Dam\2018-PDC-Dam Raise\FIN\RPT\Final Design Reports SDREP\8460 - 2018.11.08 TCD Gate Configuration TM PAP-1173.signed.pdf

List of outstanding design data and design issues:
None

Tasks remaining to complete job through SPECB:
None

Other notes to help when project starts up again: