

## CONSULTANT PROGRESS REPORT



**TO:** Mark Harris (GVWUA) and Anna Mauss (CWCB)  
**FROM:** Angie Fowler, PE  
**DATE:** July 25, 2018  
**SUBJECT:** Dam and Canyon Facilities Master Plan Phase 2 – POGG1 2017-873

---

This memo summarizes the Phase 2 of the Master Plan for the Roller Dam Rehabilitation Project (Dam and Canyon Facilities Master Plan Phase 2) status and serves as the 100% Final Report required by the Colorado Water Conservation Board (CWCB).

### Project Objectives

The objectives of this project were to develop the final designs, research permitting and environmental compliance requirements, develop technical specifications, and construction cost estimates for the following projects:

1. Upgrade the Roller Dam Electrical and Control Systems
2. Rehabilitate the Canal Headworks
3. Rehabilitate the Roller Tracks and Canal Concrete
4. Replace the Radial Gates at the Canal Station 22 Spillway

### Summary of Work

The final designs for Projects #1 and #2 were completed and influenced by several factors including, but not limited to, 1) operations of the facilities; 2) Reclamation design criteria; 3) Permitting requirements; and 4) existing conditions, to name a few. Costs supporting Project #1 were developed and being used to garner financial support for the implementation of this project anticipated to commence in Fall 2018. Final drawings for these projects are attached.

Costs supporting Projects #2-#4 will be developed in the future with input from local Contractors and vendors and permitting agencies.

Project #3 was addressed as separate projects due to the permitting requirements (NEPA, specifically). The Canal Concrete rehabilitation is included in the Project #2 drawings, and the Roller Tracks concrete rehabilitation deliverable is presented as a general performance specification. The ACOE and CDPHE permits will inform the construction mitigation requirements of this project and hence, inform the construction methods, phasing and cost estimate.

Project #4 was surveyed, and capacity of the existing structure was modeled to verify that, when needed, the structure can spill canal water back into the Colorado River. It was determined, based upon this work, that the replacement of the radial gates is not required at this time. A memo documenting the hydraulics analysis is attached.

A summary of the permitting and environmental compliance coordination and permitting is provided in this section as it applies to the overall designs of all four projects.

*Permitting and Environmental Compliance*

SGM, GVWUA and Reclamation Planning, Engineering and Environmental staff met several times throughout this project to discuss the existing conditions, preliminary designs, project expectations, project challenges, and various permitting requirements of the US Fish and Wildlife, Army Corps of Engineers, and State Historical Preservation Office/Cultural agencies, for these projects. It was determined based upon these discussions and several site visits that the permit applications will be addressed on a project-by-project basis as each one has a different construction area and area of influence.

A list of specific major tasks and milestones completed during this project are provided below by project.

**Task 1 – Upgrade the Roller Dam Electrical and Control Systems (Project #2)**

- Coordinated with electrical and controls systems vendors regarding electrical and control systems project and obtained quotes to align with two separate parts of the project (wiring and controls)
- Conducted several meetings with GVWUA and Reclamation staff regarding project and GVWUA operational needs for the electrical and controls systems both for the rollers and headgates/headworks, specifically:
  - Evaluated motors to support Project #3 (Headworks Replacement)
  - Discussed new electrical service and underground distribution for the site
  - Discussed new electrical distribution for the dam
  - Design controls / automation for the dam gates
  - New headgate power distribution and controls
  - Electrical upgrades to the dam keeper's house and outbuildings
- Developed 30%, 60%, and 100% design drawings
- Conducted site visits with Serpentix (controls vendor), MVC (Contractor), GVWUA, Reclamation, and SGM staff to review the preliminary electrical designs
- Evaluated Serpentix's recommended approach and scope of work integrating the electrical and control systems into the final electrical and headworks drawings as they influence the power unit needs, specifications, and potentially the hydraulic unit selection for the headgates
- Secured funding from the Colorado River District and the Colorado Basin Roundtable for construction of this project

**Task 2 – Rehabilitate the Canal Headworks (Project #3)**

- Maintained on-going dialogue with GVWUA and Reclamation staff regarding project and GVWUA operational needs for the headgates/headworks
- Finalized Headworks Rehabilitation Alternatives
  - 1A - Evaluated options with a different number of gates (current number, 9)
    - Dual operators with fewer number of gates
    - Wider gates have potential for "chatter" however higher cross-sectional area through the structure; not limiting as the downstream conditions in canal dictate hydraulics and diversion of water into the canal
  - 1B - Different materials (stainless steel vs cast iron)
    - Cast iron – durability is better; however, need to be custom-built
    - Stainless steel fabricated gates – easier to repair and replaced; smooth surfaces on front and back side of gates; electrical actuator with oil-filled

- Met with a Contractor regarding the constructability of the Rehabilitation Alternatives and determined that there is too much risk associated with being able to construct the project in the timeframe allowable and the inability to access portions of the project with necessary equipment
- Determined that a Headworks Replacement Alternative is needed
  - Preliminary drawings were developed for a 3 gate (14' x 7') configuration with 36" piers
  - Grizzly/bar screens were added to the upstream side of the gates
  - Metal decking was added to span over the diversion structure
  - Crane/trolley is included to allow for safe cleaning and maintenance of debris on the bar screens and to support the operation of stop logs
  - Two operators will be used for each gate (at either end)
- Conducted several meetings with GVVUA and Reclamation staff regarding project and GVVUA operational needs for the headgates/headworks
- Coordinated with Reclamation surveyor to obtain field data for the gates, frames, pedestals, and slides
- Coordinated with Reclamation's Technical Services Center to obtain concrete cores to verify the structural integrity of the canal walls (supporting the headworks)
  - Received chloride data on the concrete cores which informed the design.
  - Chloride results indicated that the higher concentrations are within the overlay material of the piers and headworks concrete.
  - Designs were finalized with the assumption that the existing material will be removed where any new structural attachments and flanges will be installed.
  - Integrated the concrete information and survey data into the designs
- Evaluated the alignment and stability of each gate installation
- Coordinated with gate suppliers and typical installation specification tolerances
  - Two vendors are provided technical specifications and information for 3 gates per major bay (9 total)
  - Materials considered are cast iron for the two downstream bays (better tolerance in operating the headgates and can endure more impact of vegetation debris) and stainless steel and cast-iron options for the upstream bay.
  - Hydraulic and electrical actuators were also considered and evaluated
- Coordinated with Reclamation staff regarding SHPO permitting
- Coordinated with Army Corp of Engineers regarding 404 permitting for the project
- Completed 60% and 100% designs of the headgates and headworks, specifically including:
  - Existing conditions at the headgates and headworks site
  - Evaluation of replacement and rehabilitation options for existing gate frames and slides
  - AutoCAD layout of headworks, identifying the details of each gate location
  - Construction access information and coffer dam details
  - General and special conditions to administrate the work (on drawings as notes)

### Task 3. Rehabilitate Canal Concrete (Project #4)

#### Task 3a. Roller Tracks

- Prepared a performance specification for repair of the Roller Track alignment/grooves, as follows:
  - Remove all loose concrete to a depth at least 1" beyond the back face of the existing reinforcement (the method that would be most efficient in this case would be hydro demolition, which removes concrete with high-pressure water).
    - The repair area is estimated to be 2 feet wide by 24 feet long, which is adjacent to the full length of the roller track.

- During the demolition, concrete would be removed to sound concrete, and may be 24" wide by 5" deep.
- Edges of the removal area would be square cut or dovetail cut to provide a clean edge to work to, and to facilitate anchorage to the existing concrete.
- Blast clean existing reinforcement to remove all corrosion, then coat with a corrosion inhibitor. New epoxy coated reinforcing would be installed to lap with the existing. The reinforcement would be #3 dowels, 12" on center, with a 4" leg drilled and epoxied in-place 2" clear of the track base. The leg of the dowel would be installed to avoid the existing track bolt embedment region.
- Placed new concrete via the shotcrete method, which requires no formwork, and allows installation of the material at a very low water/cement ratio, thereby reducing shrinkage and the possibility of future cracking.
  - The selected shotcrete mix design materials should be compatible with the existing concrete (the 1987 Reclamation dam concrete cores indicated concrete strengths from 2,500 to 3,500 psi and noted sandstone and shale aggregates). Materials such as silica fume, which significantly increases the abrasion resistance of the concrete, could also be considered.
- Scree the final surface to achieve the profile, followed by steel troweling to provide a smooth surface.
- The construction phasing of this work should consider prioritizing areas that have experienced the most concrete erosion, followed by additional locations until complete. Access to the repair areas would likely begin with the gate in the raised position, with sandbags on the crest acting to divert water away from the work area. Scaffolding would likely be supported from the top of the piers and the footbridge. As work progressed vertically, the gates could be lowered to allow access to upper areas.

#### Task 3b. Canal Concrete

- The Structural Sheets included in the July 23, 2018 Construction Phase 2 Drawing set address the canal concrete rehabilitation in the transition zone and is based upon the following existing conditions:
  - Existing rebar is exposed along the transition area
    - Proposed first 10 feet will need to be retrofitted to match the proposed Headworks Replacement subfloor
    - Existing slab is 14" thick at the point where the recent canal lining project intersects the transition area
  - Significant spalling on the walls
    - Proposed a new cap beam for approximately 100 feet of the transition area
    - Cap will stabilize the wall, prevent further degradation of the wall, and retain the soil behind the wall and provide the required freeboard
  - The design was also finalized based upon:
    - Reducing the visual impacts of these proposed improvements (for cultural permitting needs)
    - Reclamation surveys and concrete coring to obtain field data of the canal transition walls and slab

#### Task 4 – Replace the Radial Gates at the Canal Station 22 Spillway (Project #5)

- Coordinated with Reclamation surveyor to obtain field data of the walls and slab to determine condition of the concrete and dimensional properties of gate bays.

## **POGG1 2017-873**

- Conducted a HEC-RAS hydraulic analyses to determine the capacity of the existing structure.
- The data and information and modeling determined that this structure will provide the necessary capacity (conservatively ~1,600 cfs) to spill the canal water to the Colorado, if needed. Future work associated with this project will evaluate two gate type options; radial and slide and consider operational advantages of each, and modifications that may be required. Additional hydraulic analysis will be performed should one option require construction which would reduce the discharge area.

### **Schedule**

This project is 100% complete.

### **Budget**

The costs accrued through July 23, 2018 are \$145,114.

### **Attachments**

- GVWUA Construction Phase 2 Drawings (Electrical, Headworks and Canal Transition)
- Station 22 Hydraulic Memo