Harris Park Metropolitan District (HPMD)

Bailey, Park County, Colorado

Dam #1
Flume Installation Completion Report

DAMID: 800106 State Project #: C-1008B

Project Engineer for HPMD Dam #1 Repair:
JDS/Hydro Consultants, Colorado Springs, Colorado

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Completion Report prepared by Elizabeth Steffens, P.E.

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Section 1 – Background

1.1 General Information

The Harris Park Metropolitan District is the owner and operator of the Harris Park Dam #1 and Harris Park Dam #2. Dam #1 is currently classified as a Significant Hazard Dam which stores a reservoir covering approximately 11 acres with a normal storage capacity of 90.9 AF. According to Colorado Division of Water Resources (DWR) Dam Safety Branch (DSB) records the dam was constructed in 1955. Dam #1 is located on Elk Creek. Water is released through Dam #1 via a 24" CMP (recently CIPP-lined) low level outlet and a service/emergency spillway. The CIPP lined 24" outlet has a maximum capacity of 66.5 cubic feet per second (cfs), and the spillway has a maximum capacity of 169 cfs. Water that is released through Dam #1 outlet combines with the service spillway and Tate Creek just downstream from the dam. There is currently not a measurement device installed to monitor flows from Dam #1.

1.2 Project Intent

The Division of Water Resources issued a revised order on April 4, 2017 requiring that Harris Park Metropolitan District construct a release monitoring station in Elk Creek downstream of Dam #1 for water rights purposes. In response to the States order, HPMD planned for the construction of a Parshall flume downstream of the confluence of flow from the outlet, spillway, and Tate Creek and equipped with an electronic data logger to continuously record flow data for DWR representatives to access.

Section 2 – Bidding

2.1 Bidders

There were four contractors that bid on Lower Dam #1 Flume Installation: Tezak Heavy Equipment from Canon City, CO, American West Construction from Denver, CO, Frontier Environmental Services, LLC from Arvada, CO, and PCL Construction, Inc. from Denver, CO. Based on the low bid and experience, American West Construction was awarded the contract to construct the Lower Dam #1 Flume Installation. AWC employed multiple subcontractors to perform specialized project tasks, such as concrete construction (Aguilera Concrete) and surveying (Zenith Land Surveying, Inc.).

2.2 Bid Package

The bid package consisted of bidding documents, contract documents, technical specifications, and construction plan set. The construction plan set included:

Cover Sheet
C1 – Site Plan
C2 – Parshall Flume Plan and Profile
C3 – Inlet Line and Stilling Well Details (Parshall Flume)
C4 – Parshall Flume Structural Details
C5 – Parshall Flume Structural Details
C6 – Structural Notes

Section 3 – Construction

3.1 Pre-Construction

A pre-construction meeting occurred on July 8, 2020 at the project site and representatives from JDS-Hydro, HPMD, American West Construction, and the State Engineer's Office were present. Elements which were discussed at the pre-construction meeting were the construction schedule and working days, site access and staging areas, testing, submittals, project meetings, coordination with inspections, pay applications, and creek diversion during construction.

3.2 Construction Summary

American West Construction mobilized to the Site on August 3, 2020. Construction timeframe for the flume installation occurred from September 23, 2020 until October 19, 2020. Construction observation was performed primarily by HPMD personnel with JDS-Hydro performing inspections for key elements of the design. HPMD and JDS-Hydro were in close communication throughout the duration of the project regarding construction observations. Material testing was provided by the Owner. Concrete testing was performed by Ground Engineering. The construction of Lower Dam #1 Flume Installation was performed in the fall of 2020. The project has been completed with general conformance to the approved plans and specifications.

3.2.1 Dewatering/Water Diversion

AWC installed concrete barriers and steel plates upstream of the flume to serve as a creek cofferdam. A sump pump was installed upstream of the cofferdam and pumped water around the flume construction area and into the downstream channel. To prevent injury from downstream users with senior water rights, all water was bypassed during construction. In addition, a second sump pump was installed within the excavation area throughout construction to maintain the water level below the work area during construction.

Sump pump for creek cofferdam

Creek Cofferdam

Construction of cofferdam

Creek Cofferdam

Construction of sump

Preparation of Work Area

Placing rock for sump

Preparation of Work Area

Installing steel plates

Preparation of Work Area

3.2.2 Flume Construction

A 4-foot Parshall flume encased in concrete was constructed in Elk Creek downstream of the dam outlet, spillway, and Tate Creek convergence. An 18-inch PVC stilling well was installed adjacent to the flume and equipped with a float wheel, cable, and counterweight connected to a stage discharge recorder (SDR). The SDR transmits recorded data via cellular service to the State's real-time streamflow site (HydroBase). The system is powered by a solar panel and battery.

Forming flume

Flume Construction

Placing concrete for footers

Flume Construction

Removing forms for footers

Flume Construction

Placing fill around footers

Flume Construction

The 4-foot Parshall flume is constructed of ¼" galvanized steel plate and cast in concrete with six (6) ¾" all thread. A Stevens Water Type C staff gauge was installed directly opposite of the stilling well penetration with level marks in hundredths of feet. A penetration for a 2" Sch 40 galvanized steel inlet pipe was cast into the flume for connection to the stilling well. The flume location was changed due to property line concerns and proximity to existing phone line/pedestals adjacent to the creek. The flume was moved 15.75-ft upstream and the stilling well location was adjusted accordingly.

Preparing subgrade for slab

Flume Construction

Installing rebar for slab

Flume Construction

Pouring slab

Flume Construction

Finishing slab

Flume Construction

The approved 4,500 psi concrete design mix was used for the entrance and exit wing walls/footers and flume encasement concrete. The footers were poured on October 1, 2020 and forms were stripped the following day. The slab was poured on October 6, 2020 and then the flume was placed on the following day. The wing walls and flume encasement concrete were poured on October 10, 2020. 28-day test cylinder breaks exceeded the design mix strength of 4,500 psi.

Installing rebar and forming

Flume Construction

Installing rebar and forming

Flume Construction

Final touch-ups on flume concrete

Flume Construction

Placing backfill around flume

Flume Construction

Compacting backfill

Flume Construction

Completed flume installation

Flume Construction

Water flow through flume

Flume Construction

3.2.3 Stilling Well Construction

The stilling well was constructed of 18" PVC pipe with a 24" x 24" x 12" galvanized steel enclosure box. The enclosure box houses the SDR equipment. A 1" conduit is buried a minimum of 2-ft and traveling approximately 60-ft to the northwest where are 2" steel pipe serves as a mast for the solar panel. A weather-proof box is connected to the mast and houses the cellular equipment and battery. The solar mast was originally to be located directly on the stilling well but due to cellular reception and sunlight needs this equipment was moved to the location described above. All the readings in the SDR are uploaded to the State's real-time streamflow site (HydroBase) hourly.

2" Sch 40 galvanized steel inlet pipe

Stilling Well

Electrical conduit to solar mast

Stilling Well

18" PVC stilling well

Stilling Well

Stilling well cover / SDR equipment enclosure box

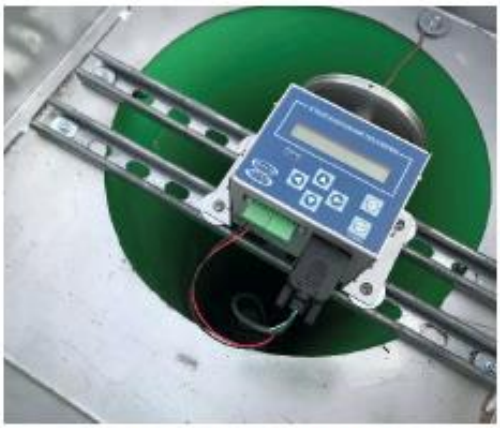
Stilling Well

90 degree sweep at base of mast

Stilling Well

Installing 2" mast pipe

Stilling Well



SDR equipment installed in stilling well

Stilling Well

Completed mast with solar panel and equipment

Stilling Well

3.2.4 Service Spillway Staff Gauge

A 4-ft staff gauge was installed on the north wall of the spillway approximately 2-ft downstream of the spillway wingwall/sidewall transition. The staff gauge was secured to a steel plate welded to anchor bolts which were drilled and epoxied into the sidewall. A Stevens Water Type C staff gauge was installed with level marks in hundredths of feet.

Installing support for staff gauge

Spillway Staff Gauge

Installed staff gauge

Spillway Staff Gauge

Installed staff gauge

Spillway Staff Gauge

Section 4 – Project Deviations and Final Walkthrough

4.1 Project Deviations

A summary of the project deviations includes:

- Installed weep holes in the concrete face at the dam outlet adjacent to the toe drains.
- Solar panel mast was relocated approximately 60-ft north of the flume. Solar panel, mast, and SDR equipment were provided by Harris Park using a grant from the State and installed by HydroLogik.
- Flume location was shifted 15.75-ft upstream due to concerns with property boundaries and existing phone line/pedestals
- Flume invert adjusted based on the new location and existing channel grade (which was higher than depicted on the plans).

4.2 Final Walk-Through

A final walk-through occurred on October 19, 2020 and included all necessary parties involved. Observations made during the final walk-through included:

- Slight inversion in the bottom of the flume which is evident when the water level is very low in the flume. It is suspected this was caused when vibrating the concrete beneath the flume. See photo below.

- The ramp leading to the flume does not meet the 4:1 requirement due to the limitations of the channel elevation/slope.
- Spillway staff gauge installed per plans. However, Water Commissioner noted this may need to be relocated closer to the end of the spillway to obtain an accurate reading due to turbulence at the spillway entrance.

All areas disturbed by construction activities were returned to their original condition or better.