

RECLAMATION

Managing Water in the West

TR-2019-06

Platoro Outlet Pipe Inspection

Date(s) of Travel: November 4 -5,
2019



U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Hydraulic Investigations and Laboratory Services Group
Denver, Colorado

BUREAU OF RECLAMATION
Technical Service Center
Denver, Colorado

TRAVEL REPORT

Code: 86-68560

Date: November 20, 2019

To: Manager, Hydraulic Investigations and Laboratory Services Group
From: Josh Mortensen

Subject: Platoro Outlet Pipe Inspection

1. Travel period: 4 – 5 November 2019
2. Places or offices visited: Platoro Dam, Platoro, CO
3. Purpose of trip: To inspect the condition of the interior of the outlet pipe and coating as part of its two-year inspection schedule. The outlet pipe may have been exposed to severe hydraulic conditions such as cavitation, abrasion, or extreme turbulence during 2019 operations. This report is a follow up to the field test that was completed in August of 2019 [1].
4. Synopsis of trip: Josh Mortensen drove down on Monday the 4th and on the 5th inspected the outlet pipe and then returned to Denver. At Platoro Dam he was met by the dam operator, Nathan Coombs, of the Conejos Water Conservancy District who also inspected the interior of the outlet pipe. Anthony Vigil from Reclamation's Albuquerque Area Office was also present and aided in the safety procedures and JHA.

Overall the condition of the interior of the outlet pipe and coating (Polyurethane applied in 2010) appeared to be good. There were no signs of cavitation damage around the manholes (Figures 1 and 2) and the expansion joint. Throughout the length of the main 56-inch conduit and upstream end of the bifurcation there were sections where the slimy film on the pipe wall had been removed and the white surface of the coating was exposed (Figures 1 and 2). Light abrasion or scuffing was apparent on the coating surface of some sections (Figure 3). According to Nathan, exposed sections of coating were new since the previous inspection about 2 years ago. They appear to have been caused by flow laden with sediment or debris.

The right leg of the bifurcation was in good condition with little exposed coating surface and no apparent damage or removal of the coating.

The left leg of the bifurcation was also in good condition except for two areas where the coating had been removed and bare pipe was exposed (Figure 5). The coating removal of both areas was initiated at a pipe joint recessed away from the flow 64 inches upstream from the leaf of the jet flow gate. There was not a recessed pipe joint in the right leg of the bifurcation. The first area was at the invert of the pipe and was approximately 10-inch wide by 12-inch long. The second was near the invert on the right side and was approximately 18-inch wide by 12-inch long and

appeared to have been there longer than the first due to accumulation of rust nodules (Figure 5).

While the root cause is unknown, coating damage may have initiated in the small gap of the pipe joint where proper surface preparation is difficult to achieve and where corrosion between the coating and metal is most likely to exist. Any initial weakness due to corrosion or cracking in the coating may have been exasperated by flow conditions triggered at the recessed pipe joint (i.e. cavitation or extreme turbulence). Once initial damage has begun, high velocity flows can penetrate the underside of the coating and produce uplift pressures causing it to peel or pop off the pipe. Photos in Figure 6 indicate that this is what likely happened. Care should be taken to identify and repair any initial cracking along other areas of the pipe joint besides the two main damage areas when future repairs are made.

A similar but more extreme case of coating failure at a pipe joint occurred at Flatiron powerplant in 2015 [2]. Cracking in the coating (same polyurethane coating as Platoro) started in a pipe joint due to corrosion. At an average pipe velocity of only 20 ft/s flows penetrated the underside of the coating and peeled off a significant amount of the coating along a full section of pipe. For Platoro, Figures 7 and 8 show discharge and associated average pipe velocities over the past two years [3] and [4]. During this period the bifurcation was exposed to average velocities over 20 ft/s for a total of 14 days, assuming equal flow through both legs. While 20 ft/s is not usually considered extreme, it is likely sufficient to generate uplift forces capable of removing coatings with an initial crack, corrosion, or defect.

5. Conclusions and Recommendations: The overall condition of the interior outlet pipe and coating was good. Minor abrasion along the length of the main 56-inch pipe and transition to the bifurcation was apparent but still in good condition. An inspection of the bathymetry near the intake may be worthwhile to determine if sediment and debris could be entrained at high flows and cause further abrasion damage. If needed, a scanning sonar inspection could be performed TSC without dropping reservoir levels.

Two areas were found in the left leg of the bifurcation where the coating had been peeled off. These areas should be repaired before the peak discharge season to prevent further damage from high velocity flows. TSC's Materials and Corrosion Lab can assist in specifying appropriate repair materials and procedures.

6. Action correspondence initiated or required: N/A

7. Client feedback received: N/A

8. References

- [1] Bureau of Reclamation, "Platoro Outlet Pipe Vibration Test, TR-2019-05," United States Department of the Interior, Denver, CO, 2019.
- [2] Bureau of Reclamation, "Flatiron Penstock Inspection 2015," United States Department of the Interior, Denver, CO, 2015.
- [3] Colorado Division of Water Resources, "Colorado Surface Water Conditions," [Online]. Available: https://dwr.state.co.us/surfacewater/data/detail_tabular.aspx?ID=CONPLACO&MTYPE=DISCHRG. [Accessed 8 November 2019].
- [4] Bureau of Reclamation, "Water Operations: historic data," [Online]. Available: <https://www.usbr.gov/rsvrWater/HistoricalApp.html>. [Accessed 8 November 2019].

cc:

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SIGNATURES AND SURNAMES FOR:

Travel to: Platoro Dam, Platoro, CO

Dates of Travel: 4 – 5 November 2019

Names and Codes of Travelers: Josh Mortensen 86-68560

Author:

Josh Mortensen, P.E.
Hydraulic Investigations and Laboratory Services Group

Date

Reviewed:

Allen Skaja, Ph.D., Technical Specialist
Materials and Corrosion Laboratory

Date

Noted and Dated by:

Robert F. Einhellig, P.E., Manager
Hydraulic Investigations and Laboratory Services Group

Date

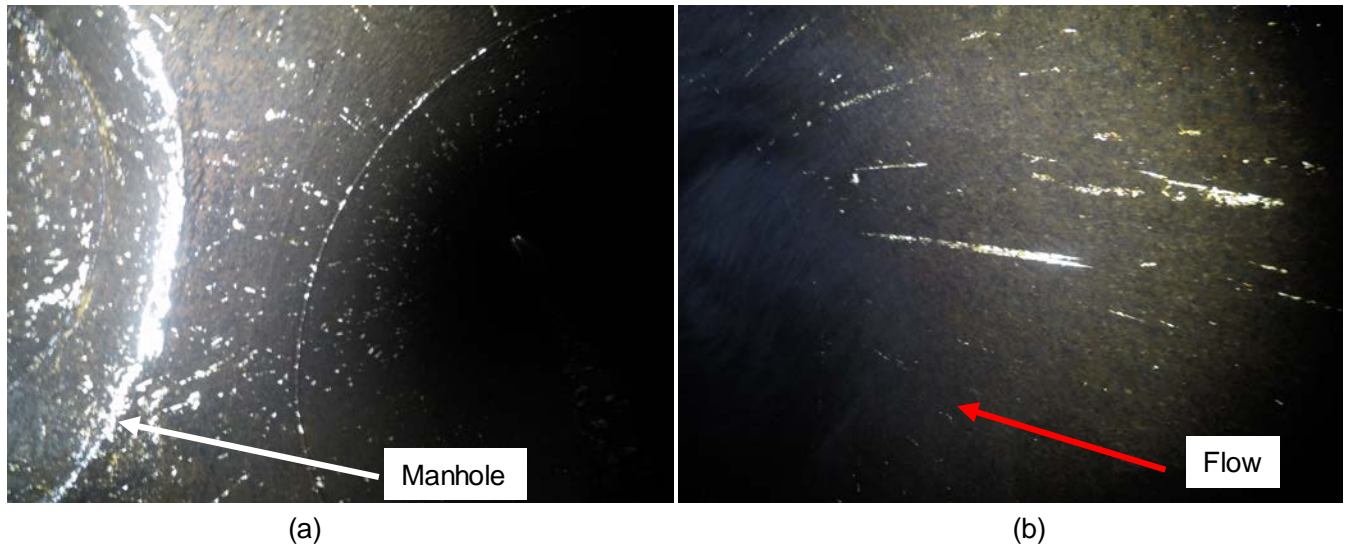


Figure 1 Photos of the upstream manhole (a) and upstream portion of the conduit (b), looking downstream. White markings are where the slimy film has been removed by flow or sediment and the coating is exposed.

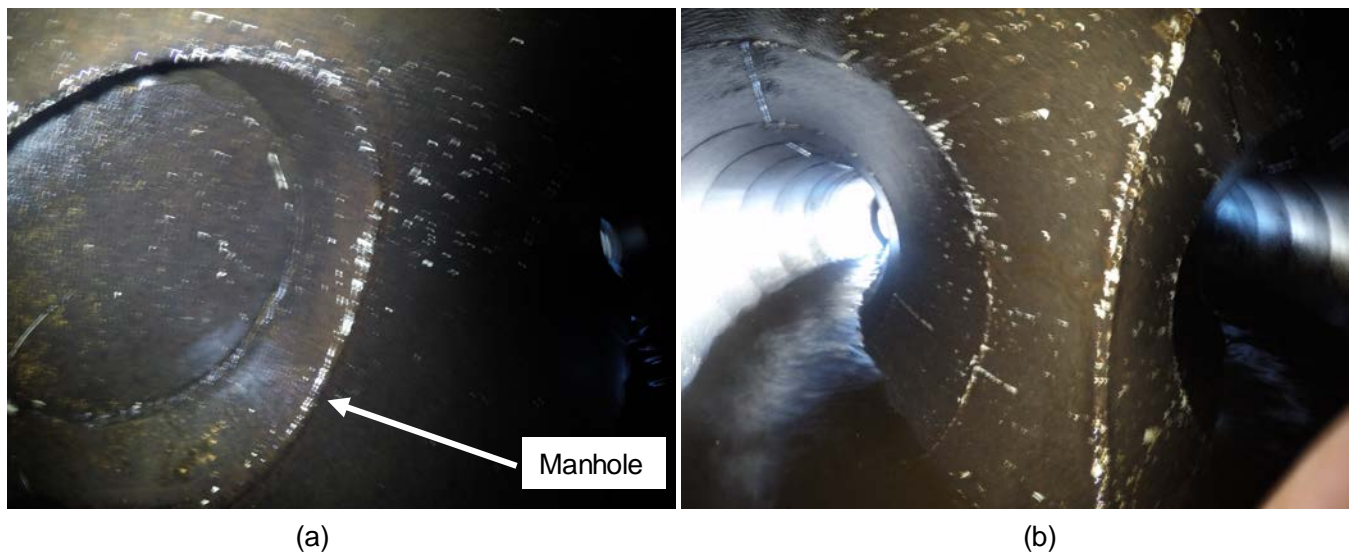


Figure 2 Photos of the downstream manhole (a) and the bifurcation (b), looking downstream.



Figure 3 Close up photo of exposed coating, approximately midway along the main pipe length. Minor abrasion is shown on the coating surface.

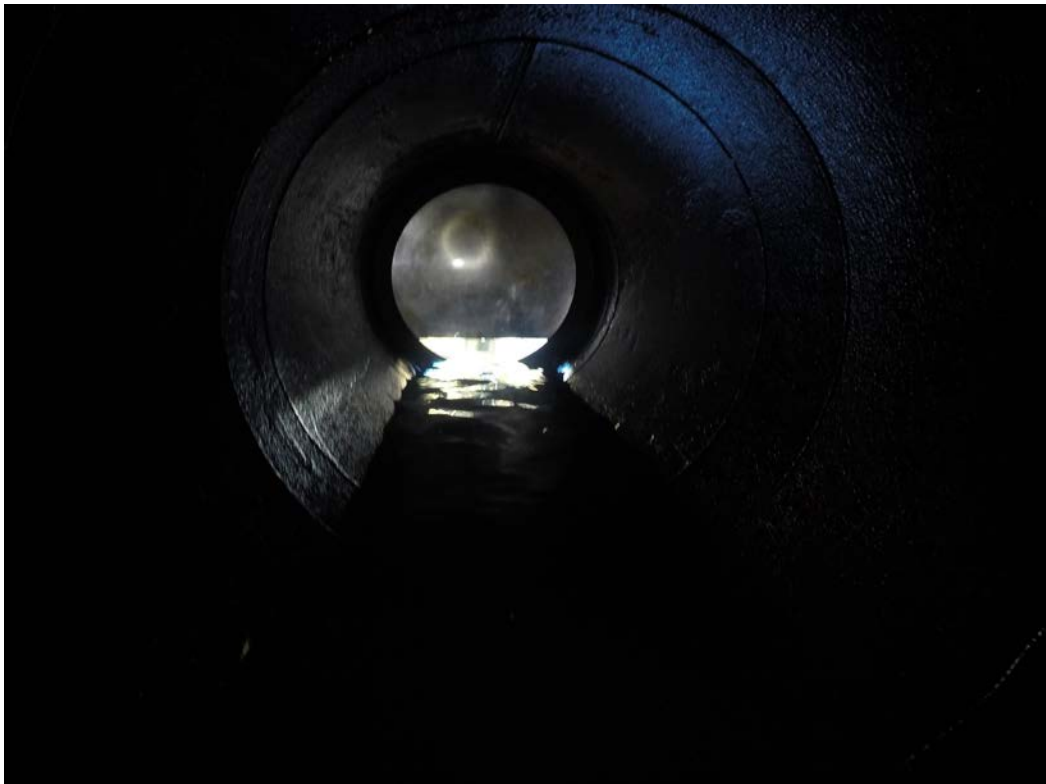


Figure 4 Photo of the right bifurcation looking downstream to the jet flow gate. No coating damage was seen in the right leg of the bifurcation.

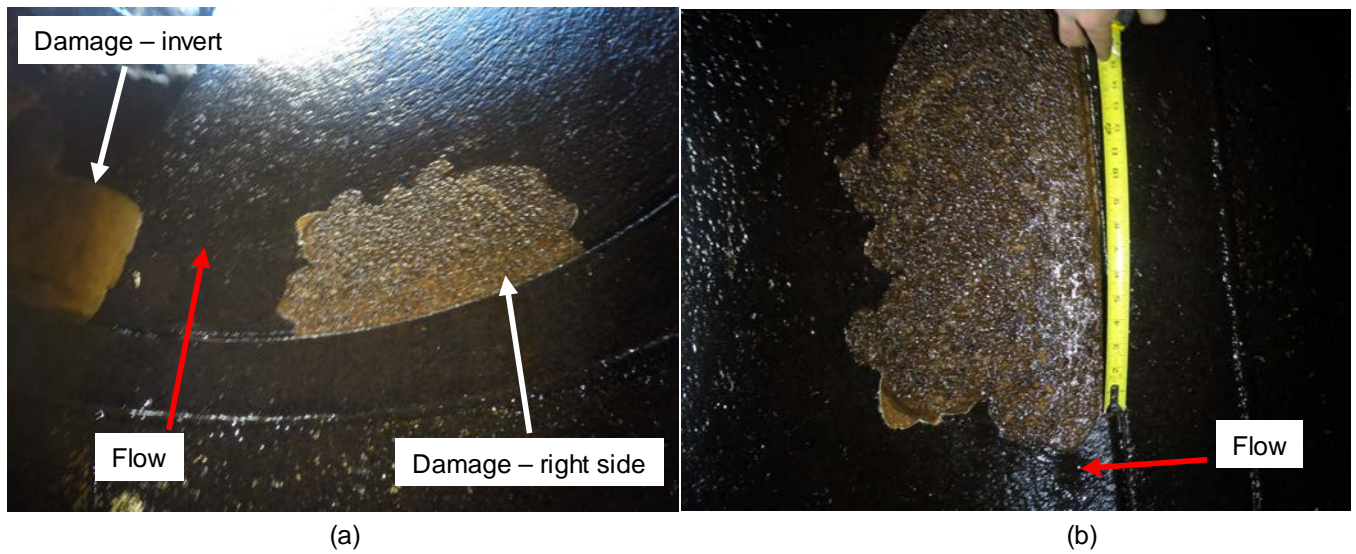


Figure 5 Photos of damage areas near the invert and right side of the left leg of the bifurcation looking downstream (a) and of the right side looking perpendicular (b). Both damage areas initiated at a pipe joint located 64 inches upstream from the jet flow gate leaf.

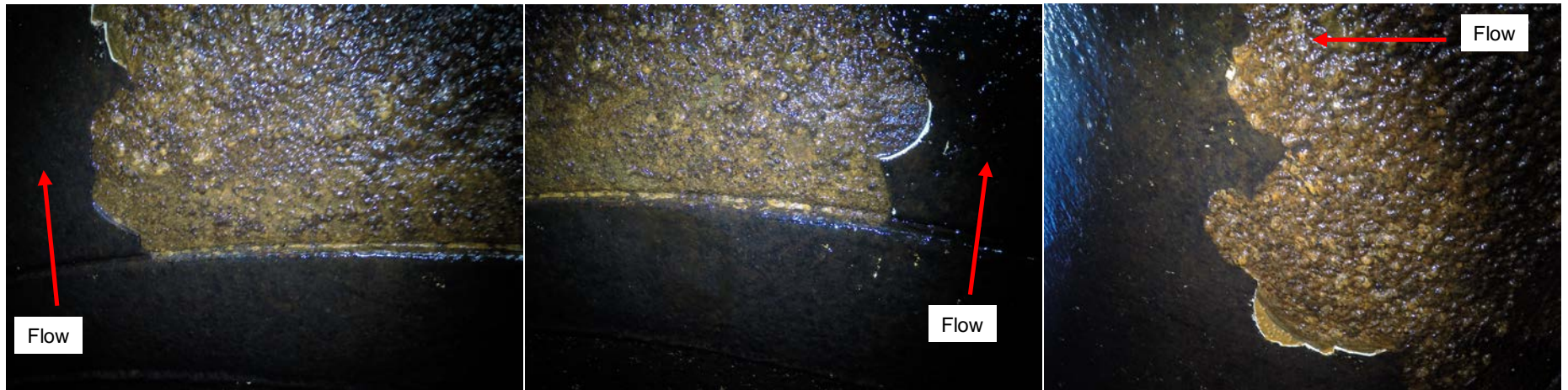


Figure 6 Photos of the damage section near the right side of the invert in the left leg of the bifurcation. The coating, which appeared to be approximately 1/8-inch thick, had been peeled off. The coating will likely continue to be stripped off by high velocity flow until repaired.

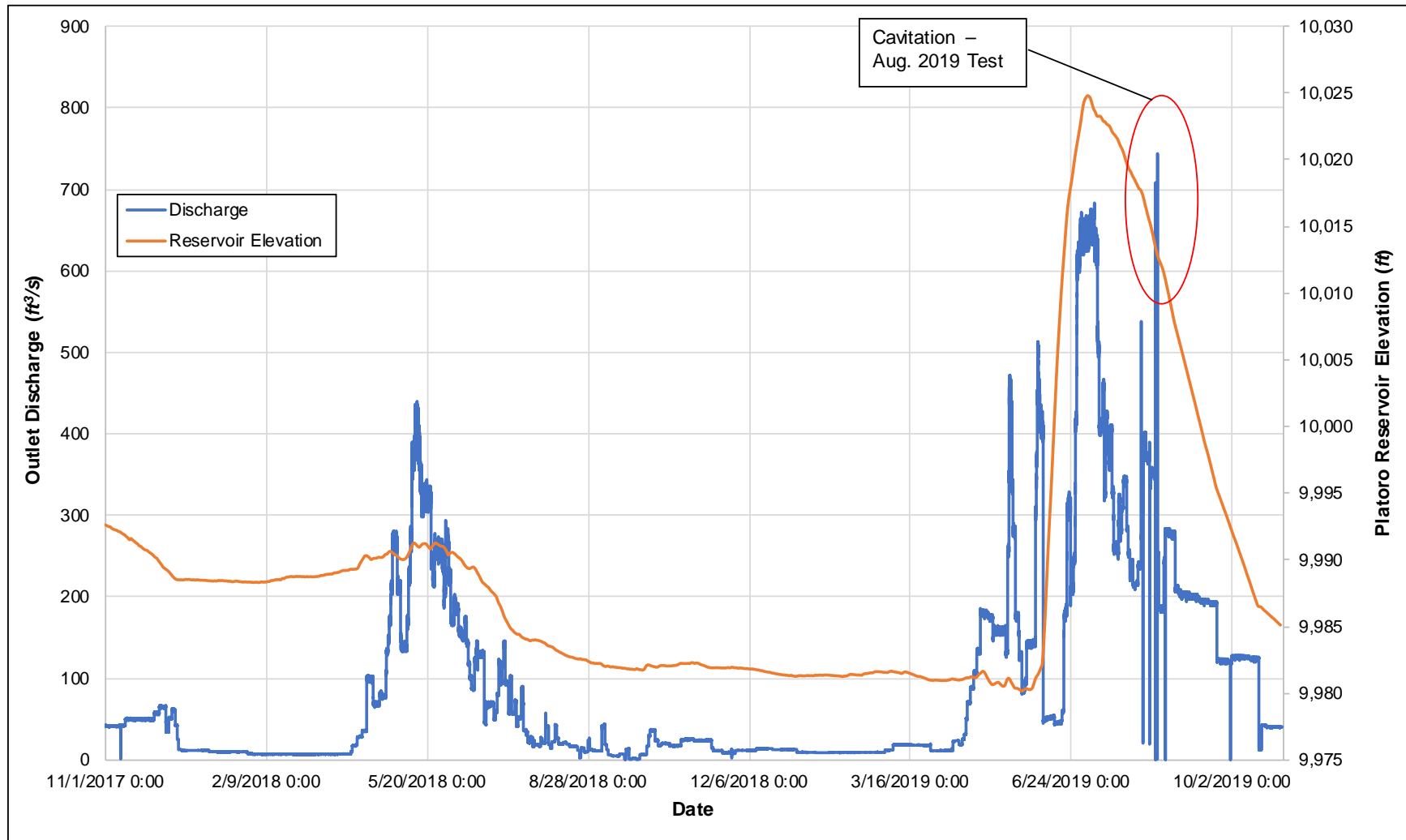


Figure 7 Discharge and Reservoir Elevation data since November 2017. Discharges over $630 \text{ ft}^3/\text{s}$ were corrected according to flow differences identified in the river gaging station and pipe flow meter during the Aug. 2019 test [1].

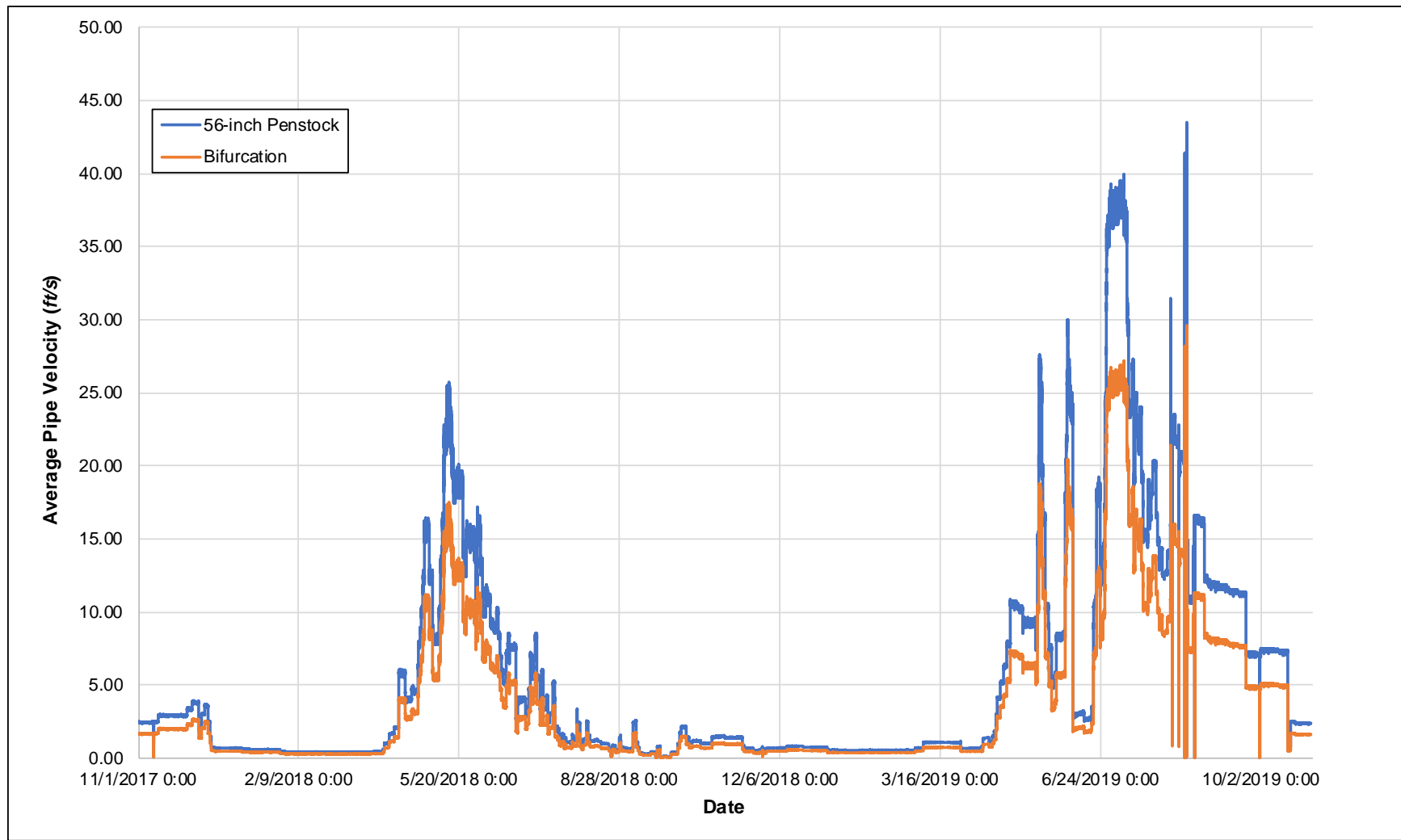


Figure 8 Average velocities in the 56-inch outlet pipe and the 48-inch bifurcations since the previous internal outlet pipe inspection.