

2020 BON Spillway Apron ROV Inspection Report

Inspection date: 12/02/2020;

Inspection conducted for: NWP Small Projects Team;

ROV Inspection by: NWP Office of Dive/ ROV Operations and Safety;

Inspection location: Bonneville Dam, Cascade Locks, OR;

Desired inspection targets: Verification of rock debris in spillbays and structural defects;

ROV and Sonar description:

The BON spillway and apron structures were inspected using a Deep Ocean Engineering Phantom XTL remotely operated vehicle (ROV). Visual inspection was conducted using the installed high-resolution camera and documenting on HDD. Sonar imaging was conducted utilizing a BlueView 2D multi-beam sonar as well as a Tritech SeaPrince Sector/ Polar Scanning sonar.

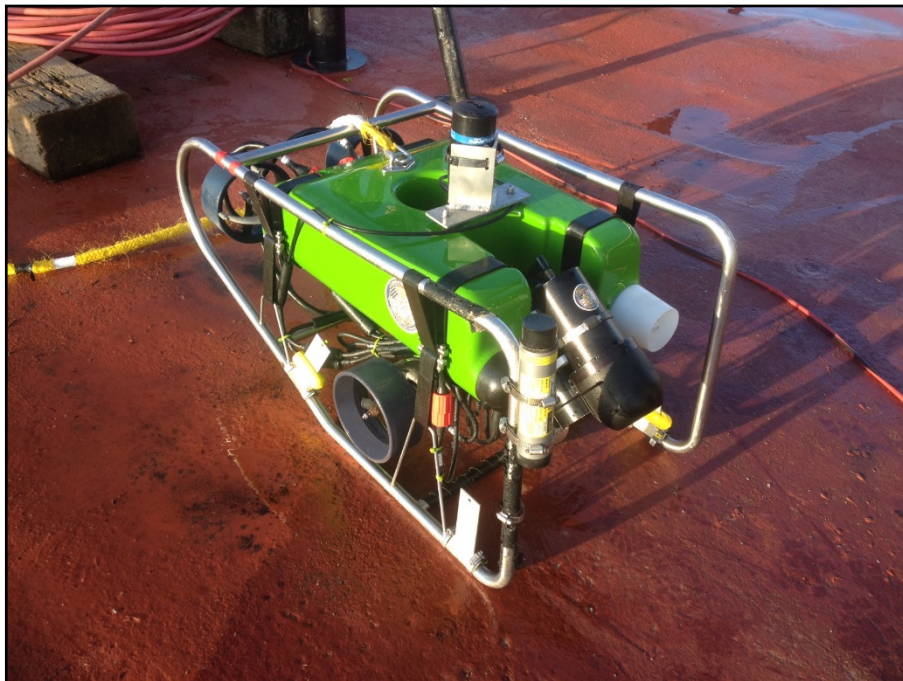


Figure 1 Deep Ocean Engineering Phantom XTL ROV



Figure 2 BON Spillway. Red boxes indicate approximate area of inspection coverage.

Project description and inspection findings:

The Bonneville spillbay ROV inspection was conducted to verify recent bathymetric hydro-survey data. The plan was to inspect all spillbays, apron and baffle block structures to determine rock pile locations, size and pile extent. The weather experienced on 2 December presented challenges that prevented the inspection of the entire structure. Winds on the day of the inspection were forecasted 25-35 mph with gusts of +40 mph from the east. The inspection proceeded as planned as the downstream location was somewhat protected from the east wind. Once on location, due to the gusting winds, we were only able to capture sonar imagery of Bays 1-6 and Bays 16-18. The vessel was unable to stay on-station in the area between Bays 7 and 15.

The following items were found during the ROV inspection:

- Bay 1 is clear of rocks and no structural deficiencies were found;
- Bay 2 has a small rock pile approximately 4' x 6' consisting of small 2-4" diameter round river rock. There is also a boat propeller and outboard motor lower unit laying in the pile;
- Bay 3 through 6 was found to be clear of rocks but there is significant apron surface erosion between the spillbays and the first row of baffle blocks. There is also significant erosion and scour at the downstream corners of ALL baffle blocks in the most upstream row. Some erosion holes are up to 2-3' wide and +1' deep with exposed rebar;

-Bays 7 through 15 were not imaged due to the +40 mph wind gusts affecting this area;

-Bay 16 was difficult to image due to the wind but appears to be clear of rock;

-Bay 17 has the largest pile of rock in it. The pile is approximately 1-3 ft. high at it's highest point but this is difficult to accurately determine as the pile slopes uphill along the base of the ogee. It is primarily comprised of 6-8" or smaller round river rock. Only a few rocks were noted to be in the +10" range. The pile is approx. 20' long by 15' wide. There is significant ogee, construction joint and apron surface erosion in the area of the rock pile and continuing up the ogee. Exposed rebar was noted throughout the eroded areas and some of the eroded areas were filled with rock as well. The bottom in this area appears to be more degraded than from previous inspections but there is not as much rock noted as in past years;

-Bay 18- most of the bottom is clear of rock, but the apron & ogee surface is significantly eroded with exposed aggregate. Initially on the sonar image, it appears as if it has small rock spread all over it but once the bottom is in view of the ROV camera, the erosion is noted. There is a pile of small rock and gravel near the base of the ogee, but it is small in diameter and the rock size is very small as well. It appears as if it could be a pile of the eroded aggregate from the apron surface. Some of the eroded areas on the ogee were also found to be filled in with woody debris;

Video imagery below highlight areas of interest found during the inspection.



Figure 3 Small rock pile found in Bay 2 along with a boat propeller and outboard lower unit.



Figure 4 Bay 2 Rock pile with outboard motor lower unit.



Figure 5 Bay 2 Small rock pile and propeller.



Figure 6 Bay 17 rock pile.



Figure 7 Another image of rock in Bay 17.



Figure 8 Image of Bay 17 rock pile showing relative rock sizes.



Figure 9 Bay 17 erosion and exposed rebar.



Figure 3 Bay 17 eroded area filled in with rock.

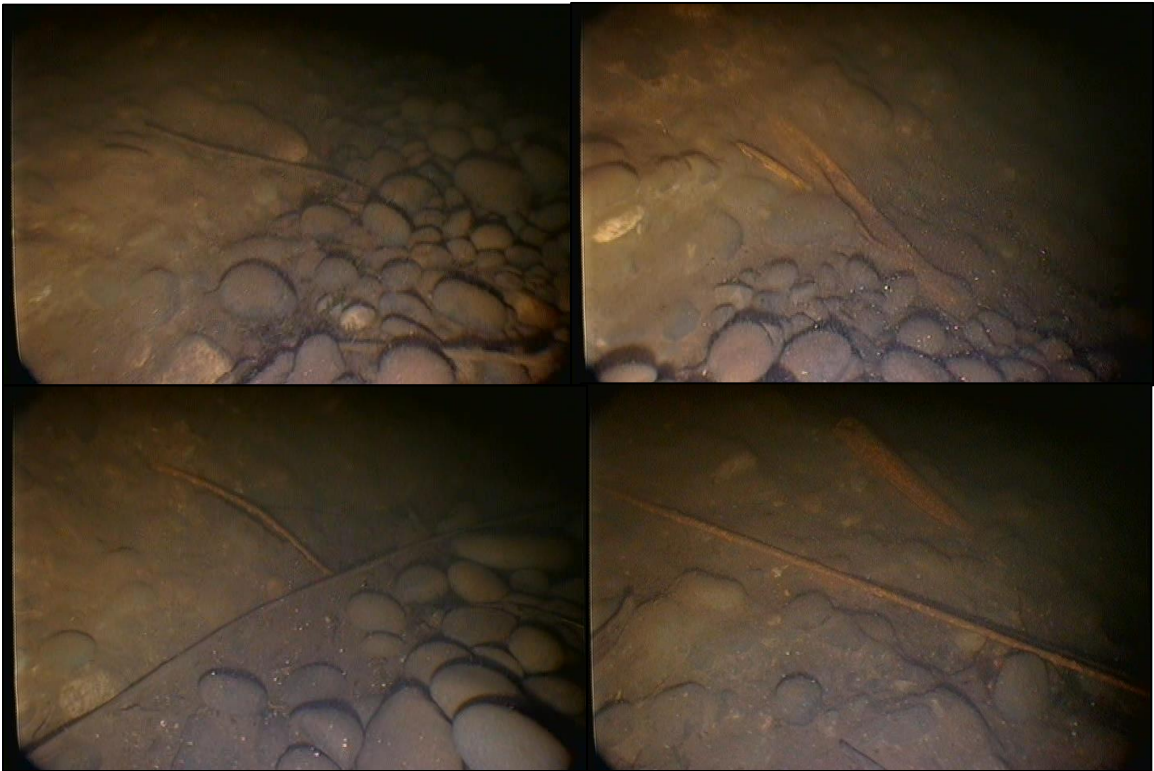


Figure 11 Additional images of erosion and exposed rebar in Bay 17.



Figure 4 Images of apron erosion in area just upstream of baffle blocks in Bay 18.



Figure 13 Additional image of Bay 18 erosion at base of the ogee.



Figure 14 Bay 18 construction joint and apron erosion.



Figure 15 Small rock pile in Bay 18 Approx. 5-6' in dia., <10" high .



Figure 16 Additional image of small rock in Bay 18.



Figure 17 Woody debris in eroded area of Bay 18 ogee.

Sonar imagery below highlight areas of interest found during this inspection. Yellow arrows in sonar imagery indicate direction of water flow for image reference.

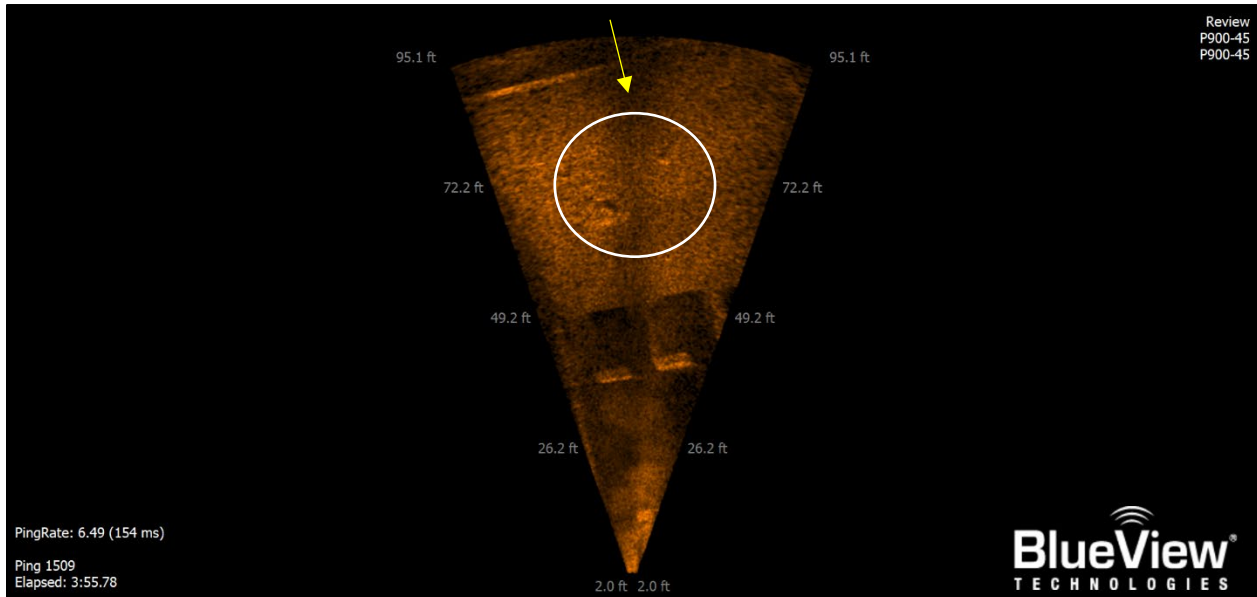


Figure 18 White circle indicates small diameter pile of rock and debris in Bay 2.

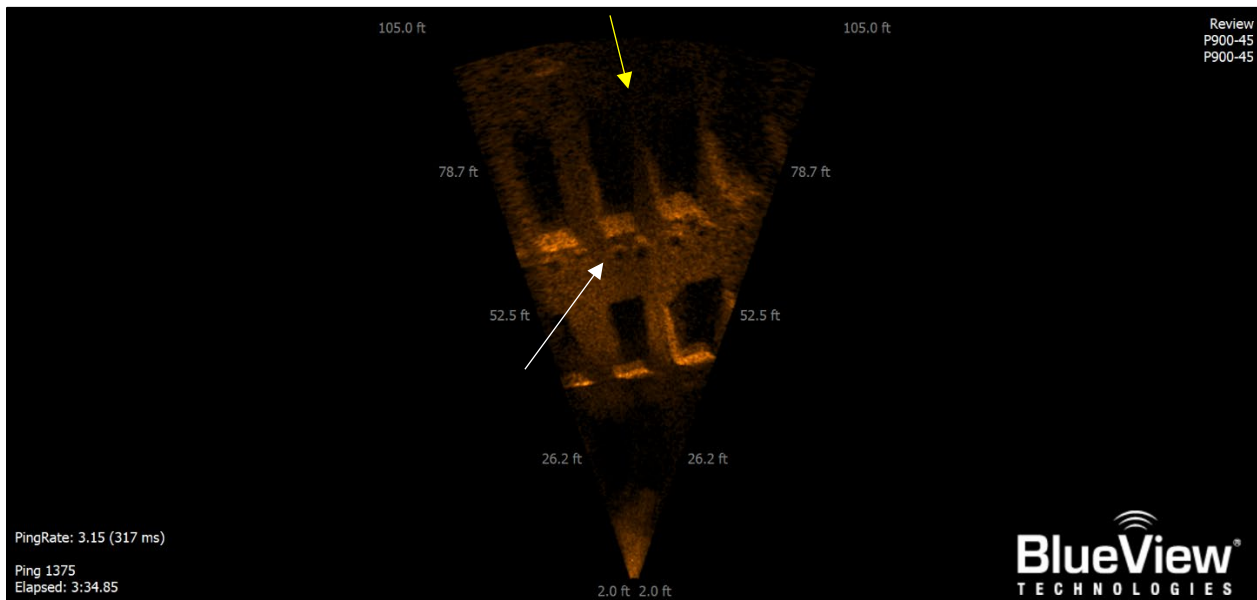


Figure 19 White arrow indicates eroded areas downstream of the first row of baffle blocks. This is found across the entire apron.

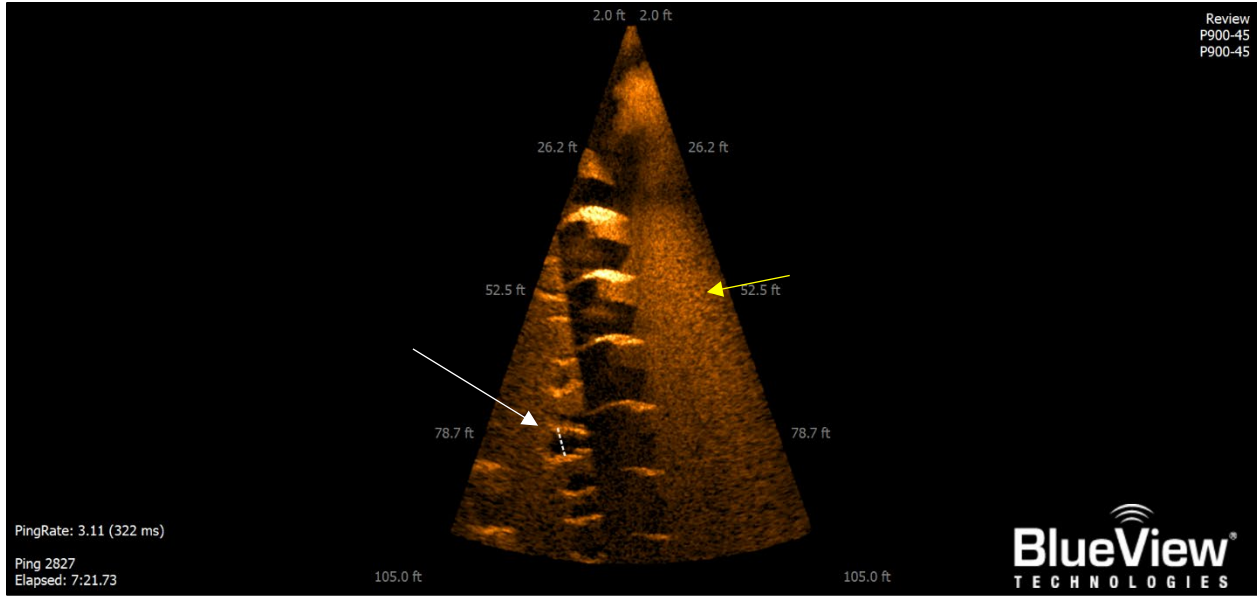


Figure 20 Additional imagery showing erosion holes downstream of the baffle blocks. This is at Bay 3. White arrow indicated eroded area 3-4' wide.

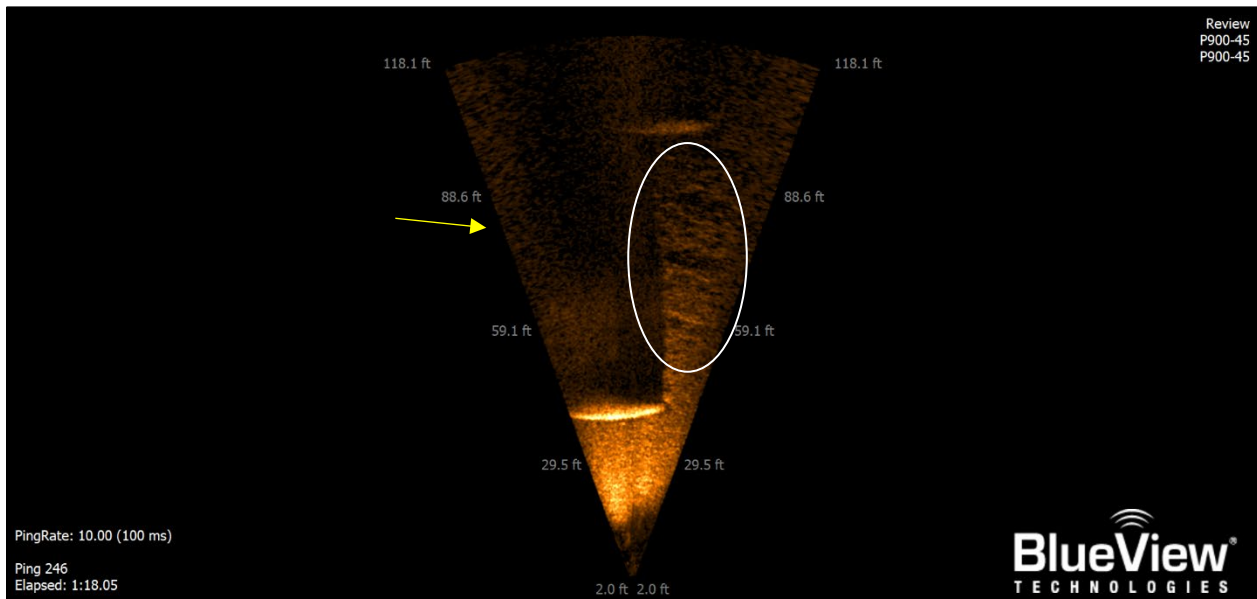


Figure 21 Imagery showing eroded areas of the apron at Bay 5.

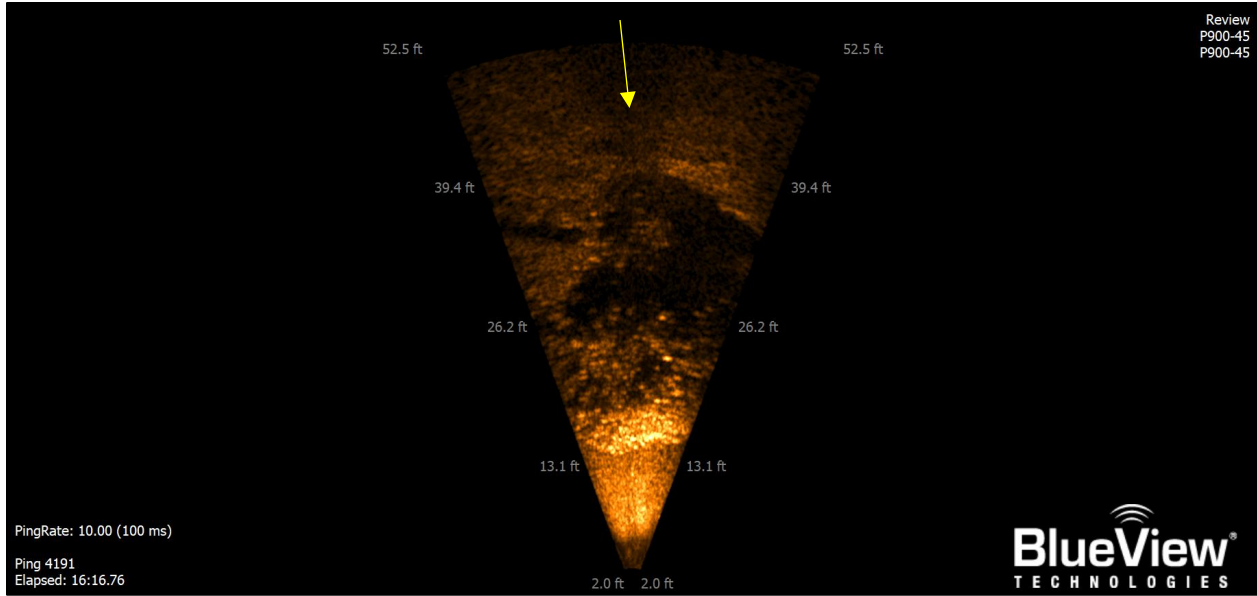


Figure 22 Rock pile at Bay 17, approx. 20' x 15'.

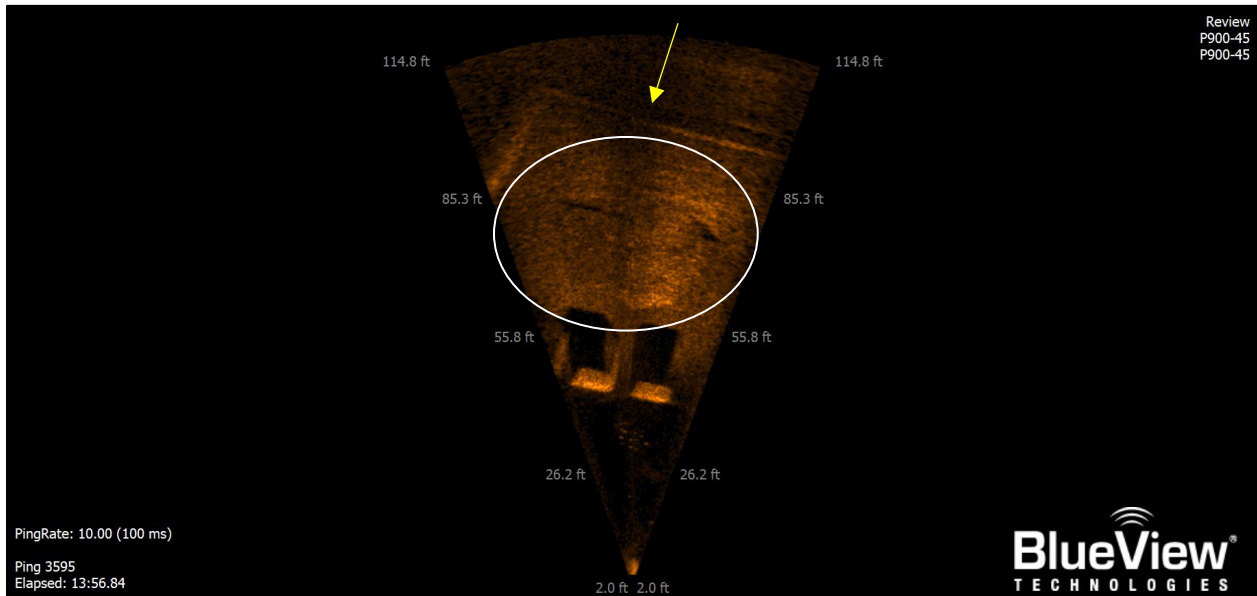


Figure 23 Bay 17 rock pile. Shadows on each side are eroded areas. The eroded area is approx. +30' wide.

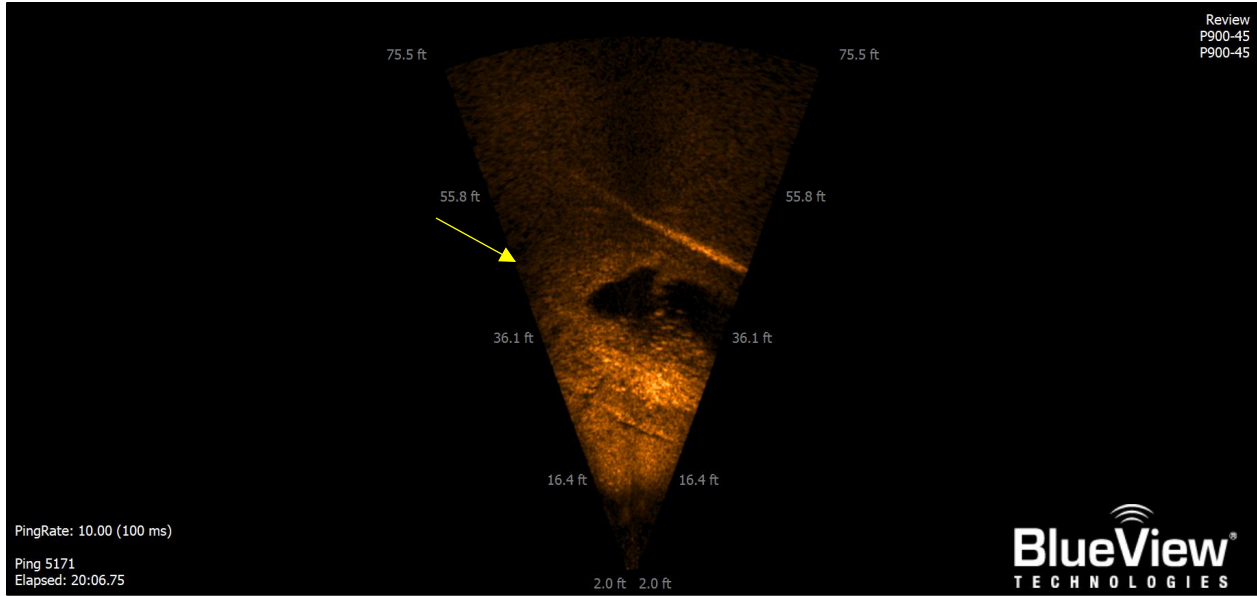


Figure 24 Imagery showing Bay 17 rock pile and eroded construction joints. Solid line at the upper portion of the image is the Bay 17/18 dividing wall.

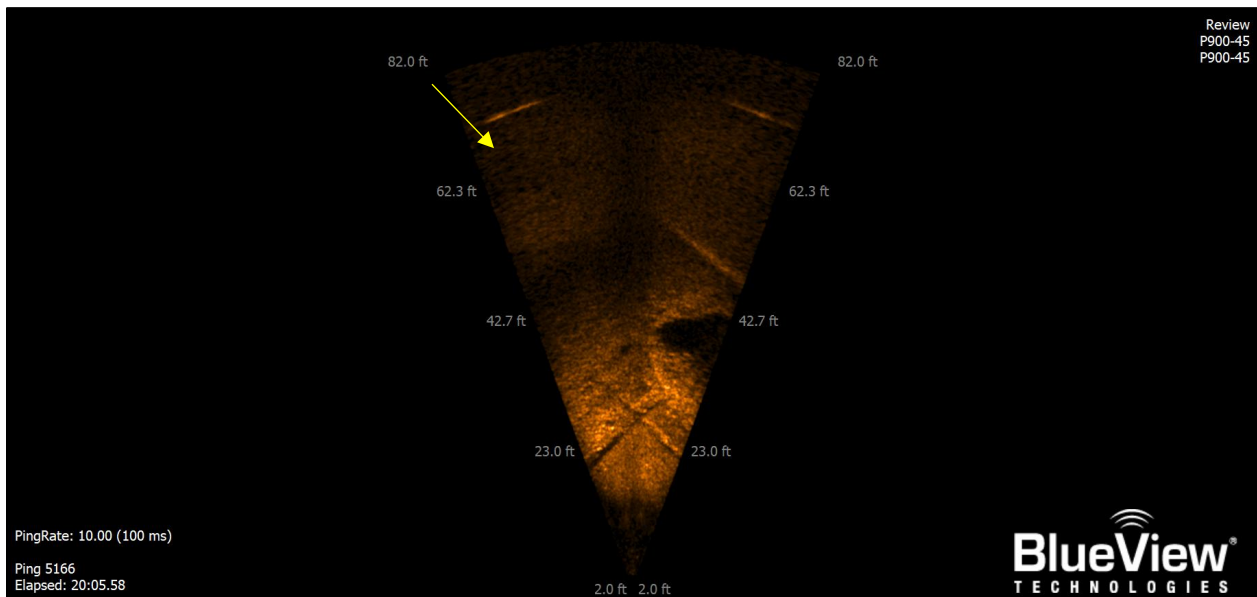


Figure 25 Additional imagery of Bay 17 construction joint erosion and rock pile.

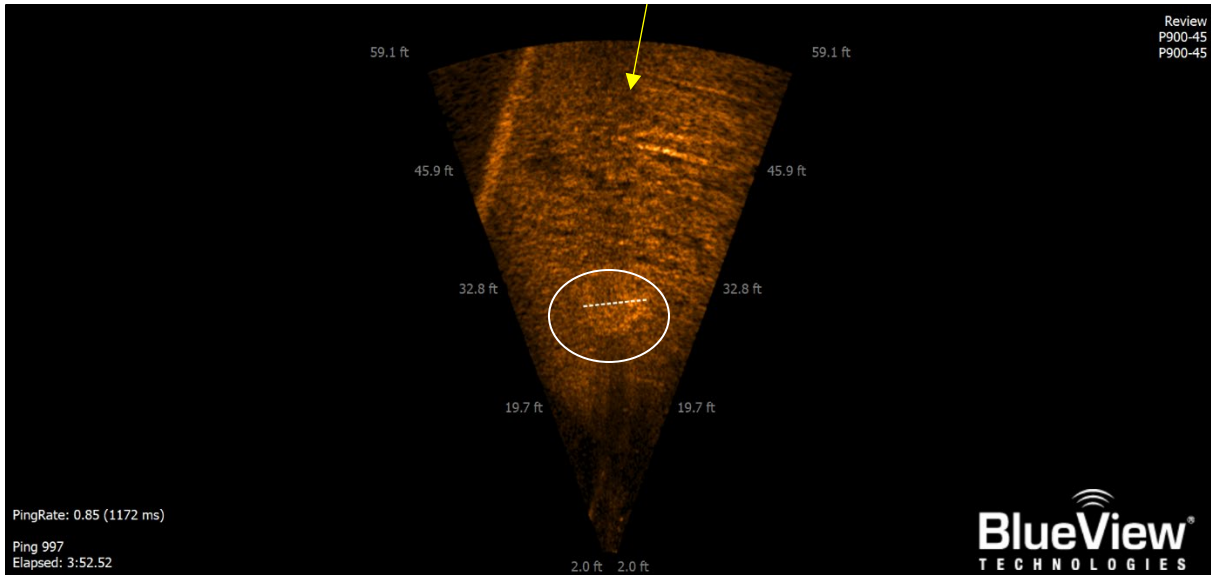


Figure 26 Image of Bay 18 showing very small rock pile and significant erosion of the apron surface. The shadows in the mid to upper area of the image is the eroded surface. White circle indicates the small rock pile location.

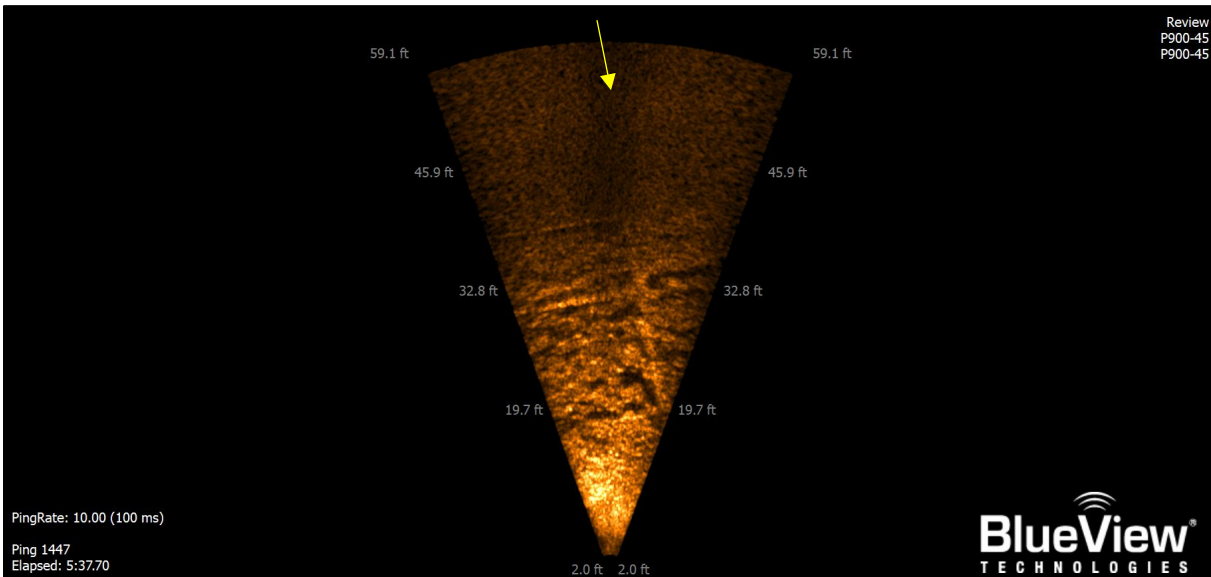


Figure 27 Sonar image of Bay 18 eroded surface and construction joints. Shadowing in the image indicates the rough, worn surface.

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