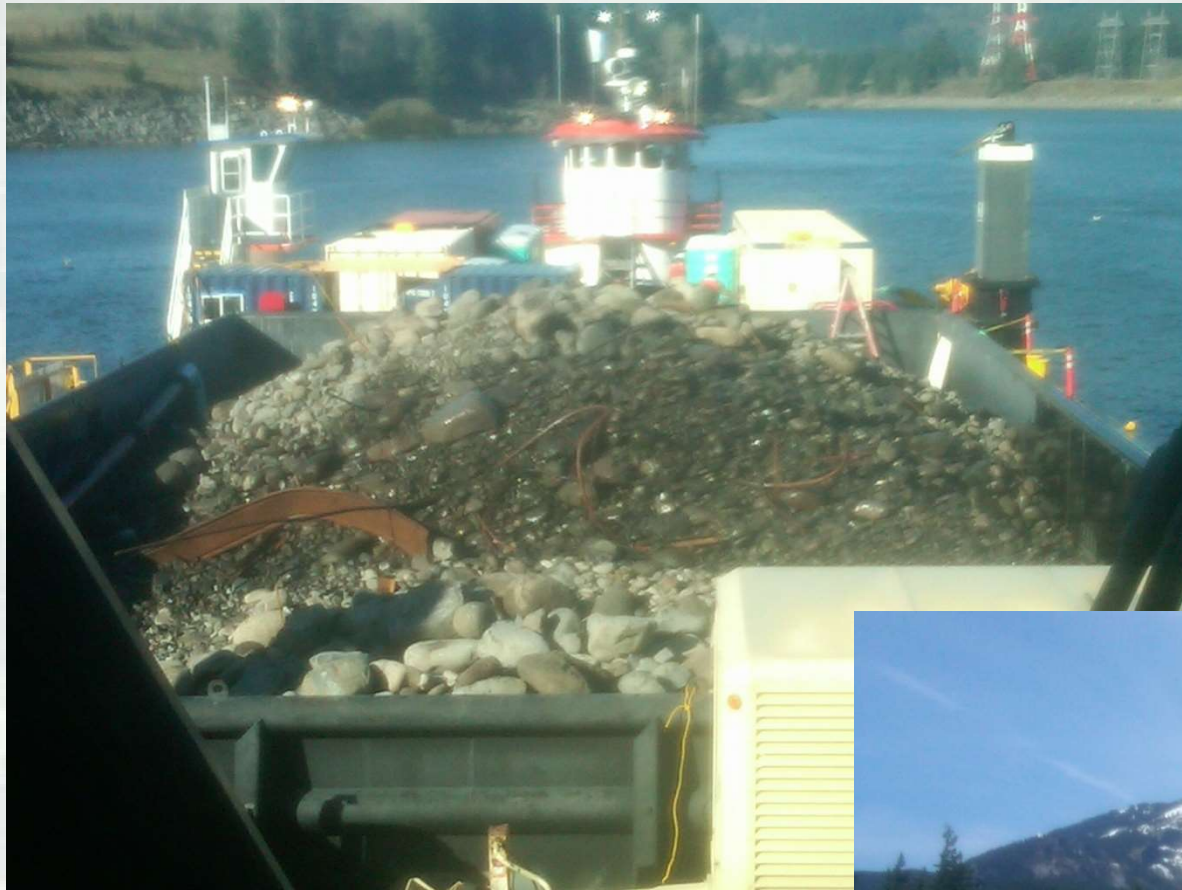


Bonneville Spillway and Rocks

Laurie Ebner
05 December 2018





Outline

Why – the physics

Do We Care

Why now

Definitely have had some rocks

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Bonneville Spillway

- History
 - ▶ Project built in the 30's
 - ▶ Largest Flood 1948
 - ▶ South half of spillway repaired in 1954
 - ▶ 14 foot (elevation) flow deflectors added in the 70's (Bays 4-15)
 - ▶ 7 foot (elevation) flow deflectors added in 2002 (Bays 1-3, 16-18)
- Annual Surveys Conducted since 2006

Yes history is important and in particular the additions of flow deflectors.



Why the Physics

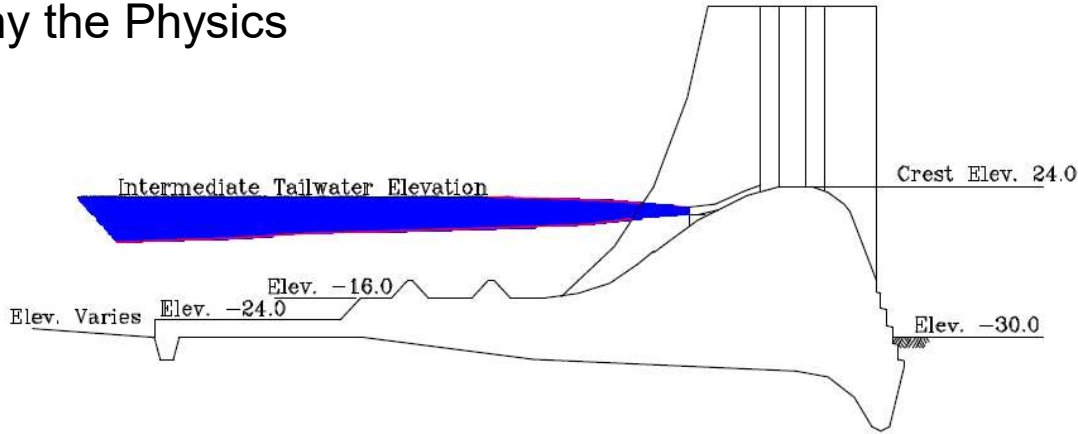


Figure 4. Cross-section of Skimming Flow

Flow Deflectors Cause Flow to Move Upstream

In 2011 flows were almost 20,000 cfs per bay.

Don't override until 25,000 cfs per bay

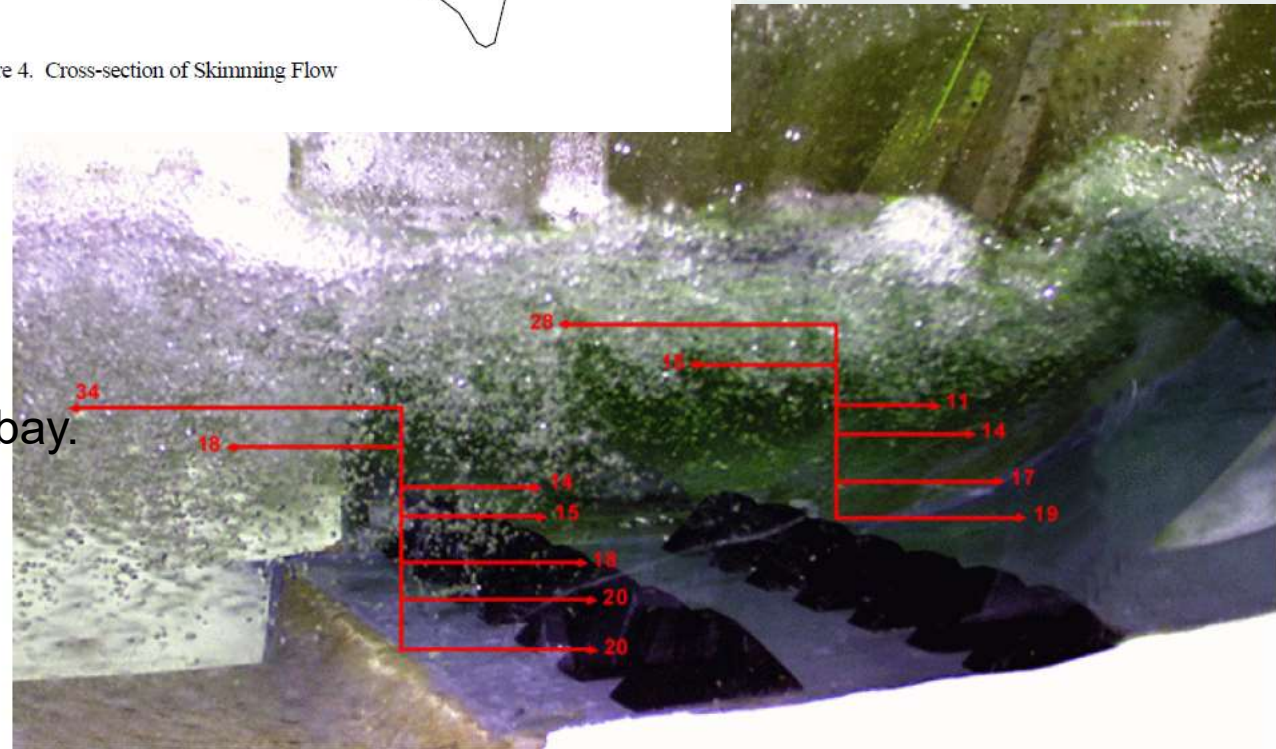
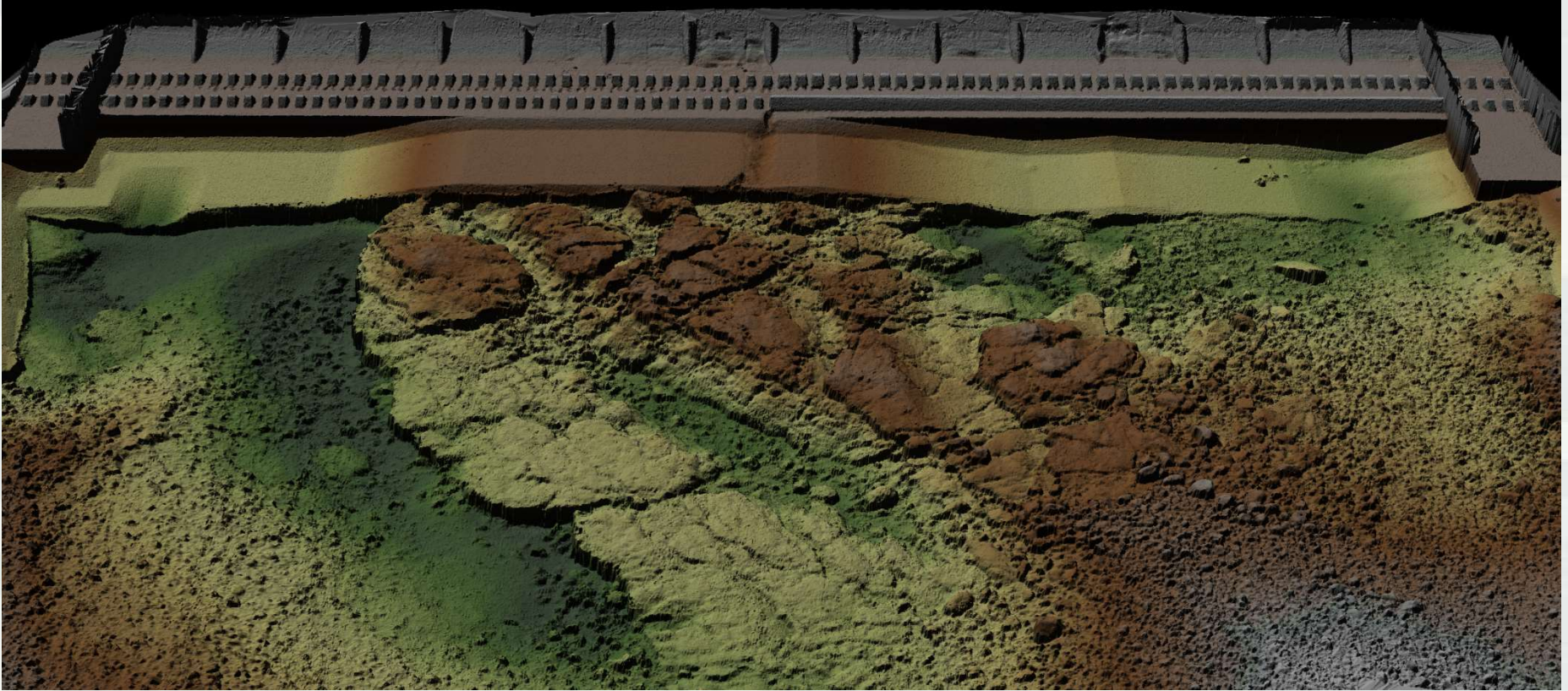


Figure 15. Skimming Surface Jet, Modified Bonneville Deflector, 6,700 cfs/bay, 1-1/2 bays, TW el -21.0, HW - 74.0

The Ramps



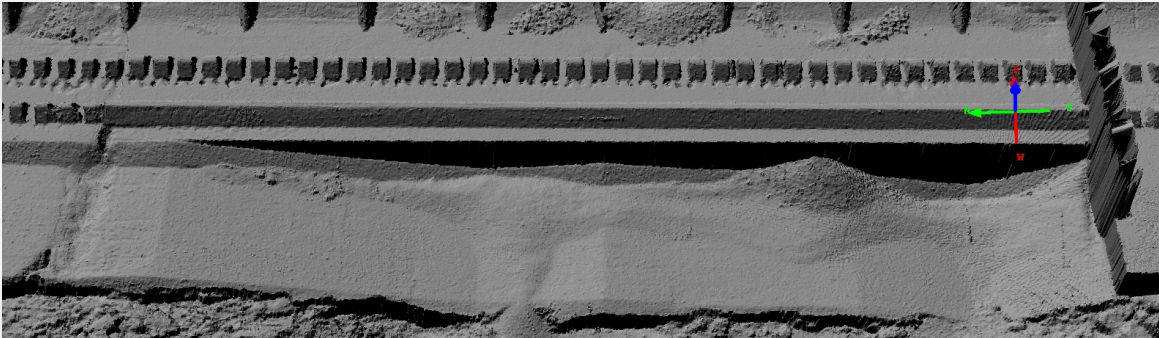
Spillway General Model



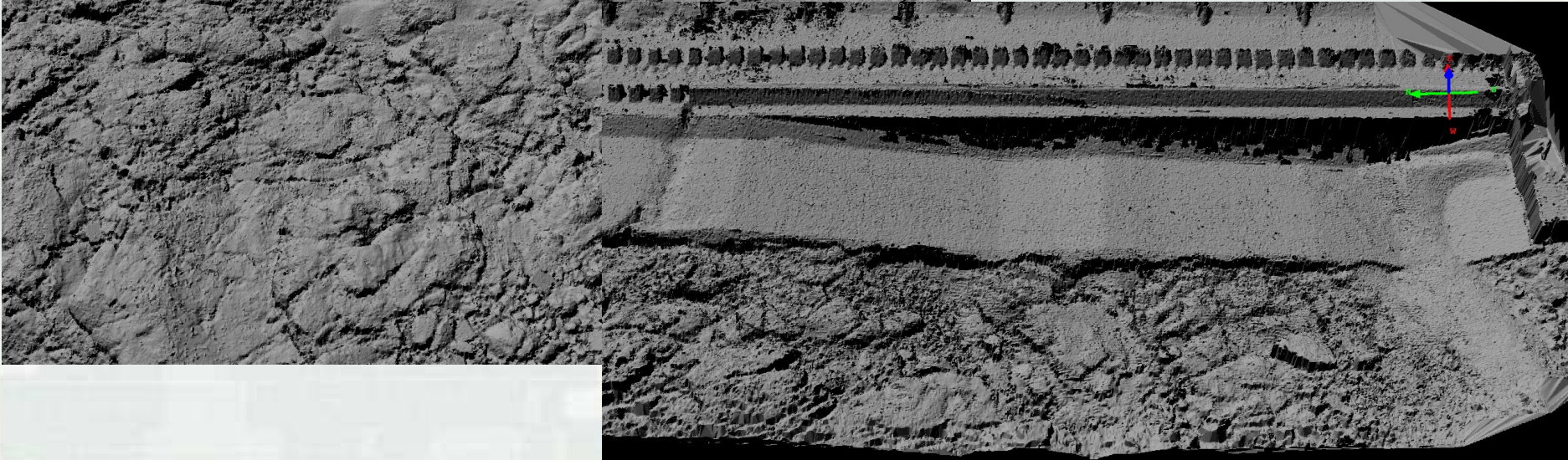
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Flushing Spill



Before



After

Do We Care

Why is Rock Removal Critical?

- **Ball Milling**

- ▶ Ball milling occurs when foreign debris enters a stilling basin and continually “churns up” the concrete as it sees flow
- ▶ Major problem at many dams although not likely to cause a failure unless damage remains unchecked
- ▶ Importance of routine inspections

- **History of Ball Milling**

- Dworshak
- Bonneville



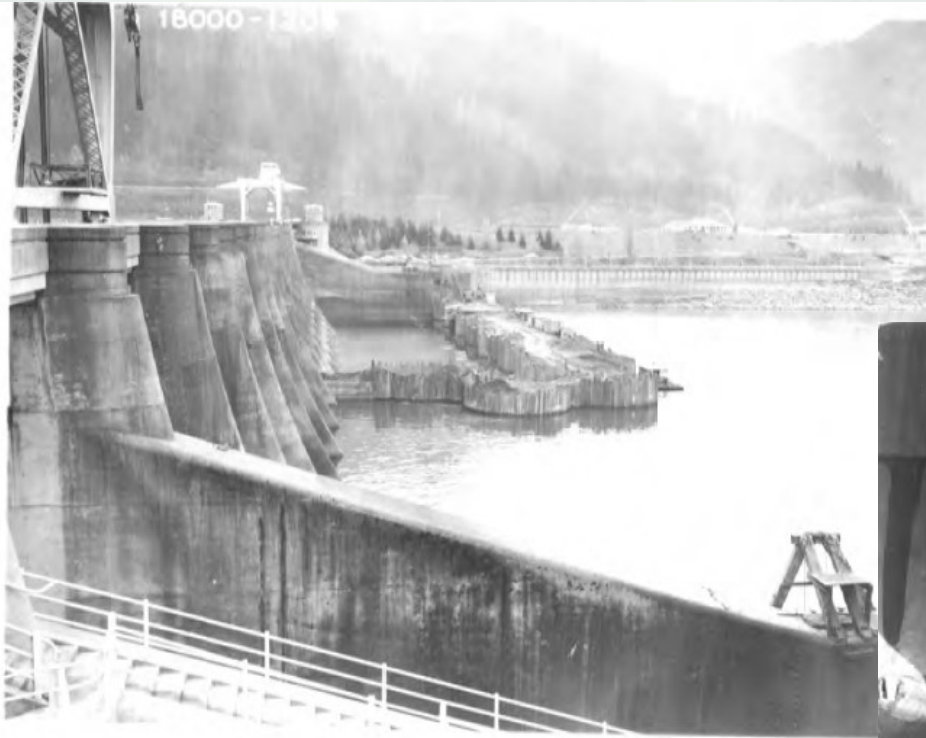
Historical Issues

Stilling Basin Erosion

- Dworkshak Dam – picture taken in 1974

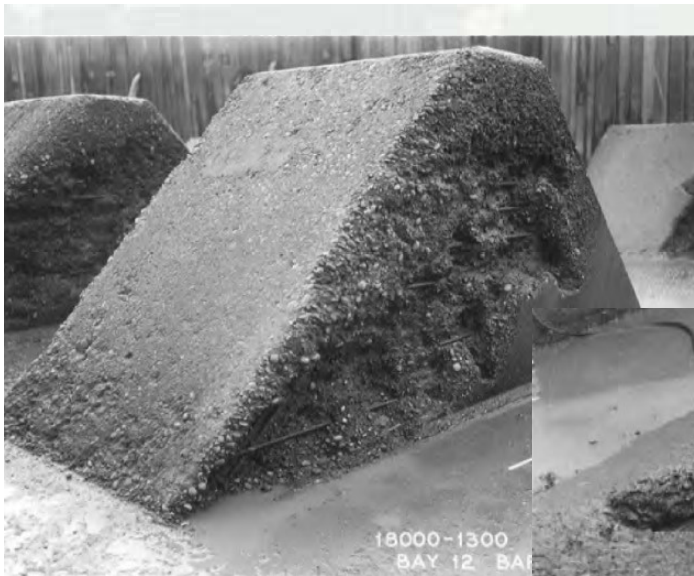


- Bonneville - 1954



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18000-1300
BAY 12 BAF



18000-1213 11-23-54
BAY 10 - BAF. 1, 2, & 3 US



18000-1277 11-24-54
BAY 15 JUST BACK OF
BAF. 2 US ROW



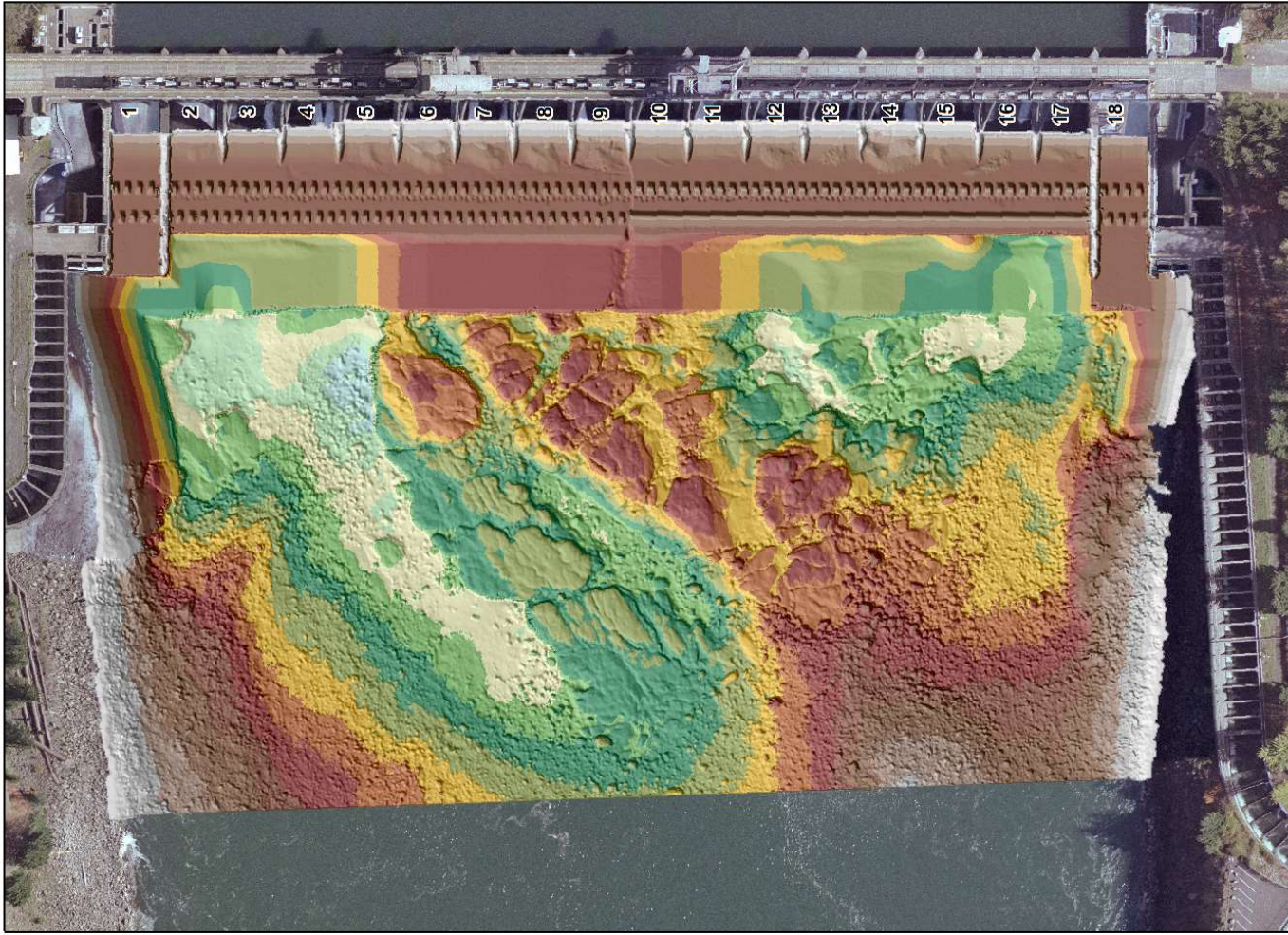
18000-1275 11-24-54
BAY 11 BAF. 1 US



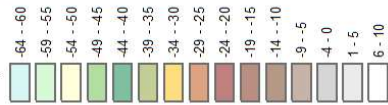
18000-1224 11-23-54
BAY 15 - BAF. 2 US

But Why Now

Bonneville Dam Spillway Stilling Basin



Elevation
(Feet, NGVD29)



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13



US Army Corps
of Engineers
Portland District



BUILDING STRONG®

Are we done?

- 2011 high flows – got ROCKS
- 2012 average flows with few hours of high flows – got ROCKS
- 2017 got ROCKS
- 2018 got ROCKS



Bonneville Spillway

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The History is Important – Potential Hypothesis

1948 flood pushed material downstream but not out of the Bonneville Spillway Channel

Flows since then have been causing the material to move upstream along the edges

Survey results suggest about 3000 cubic yards of loose material on either side that could continue to move upstream (we have removed approximately 1000 cubic yards so far)



Questions

