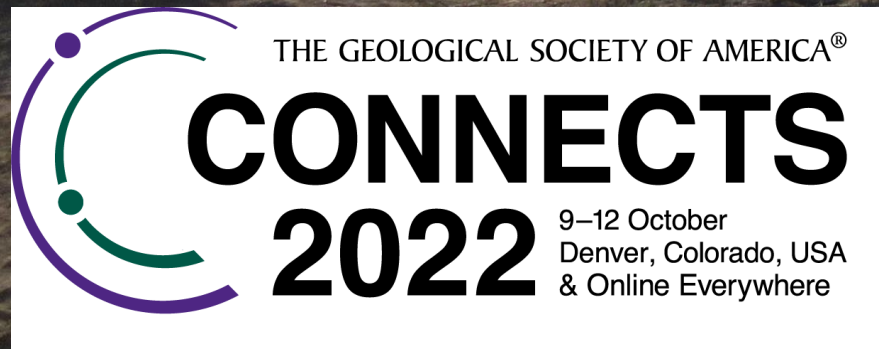


Preservation and destruction of cultural material by large Columbia River floods: Geoarchaeological evidence from the Hanford Reach

Presented by Benjamin J. Deans

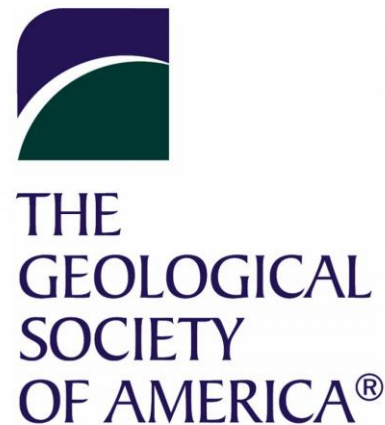


Co-authors:
Lisa L. Ely
Steven Hackenberger



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- NSF/GSA Graduate Student Geoscience Grant #13204-21, which is funded by NSF Award #1949901;
- GSA Geoarchaeology Division's 2021 Claude C. Albritton, Jr. Award; and
- School of Graduate Studies and Research, Central Washington University, Ellensburg, WA

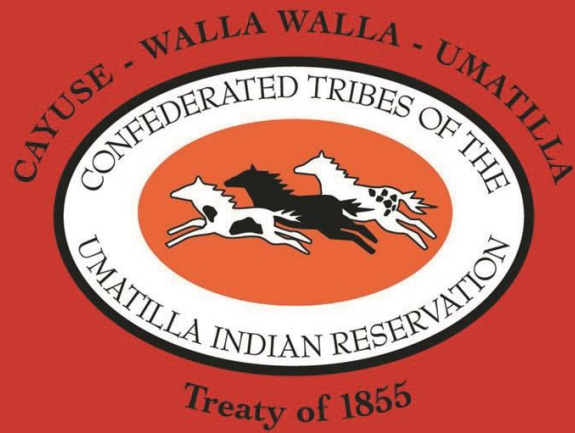
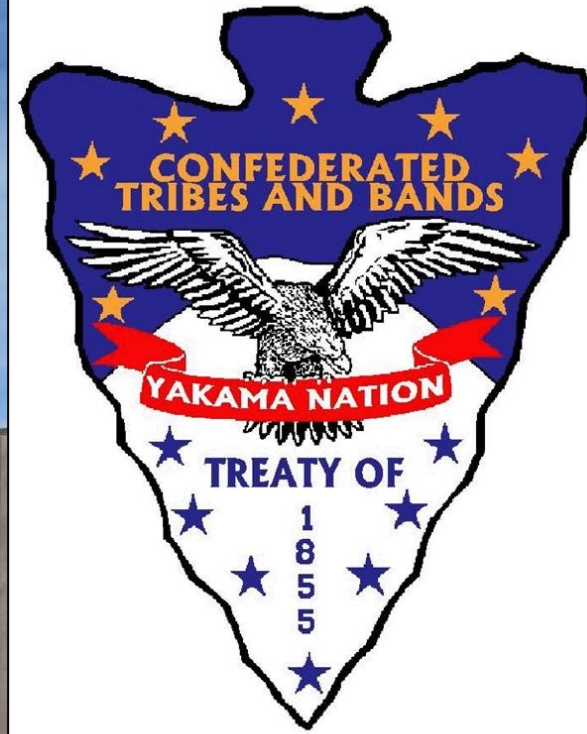


What to expect...

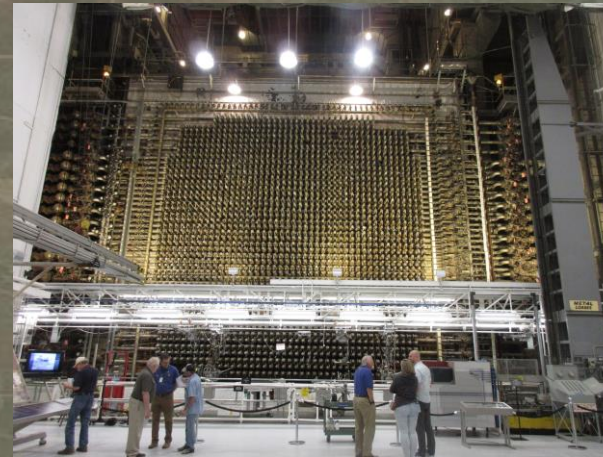
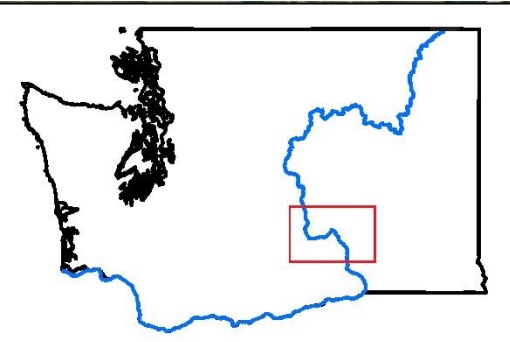
- Stewards of the land
- The Hanford Reach
- Research question
- Objectives
- Terraces, excavations, and floods
- Areas of erosion and deposition
- Conclusion



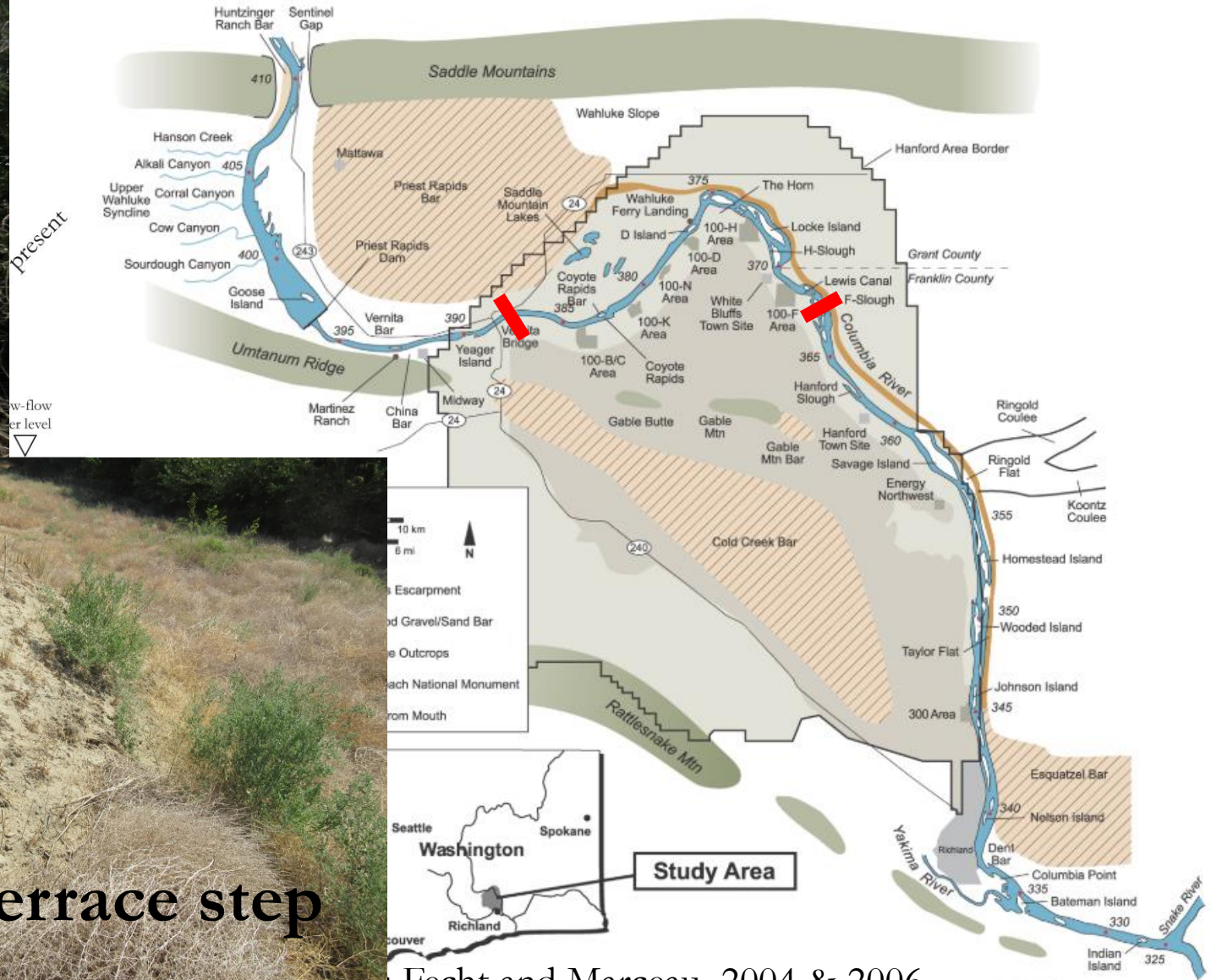
Stewards of the land



The Hanford Reach

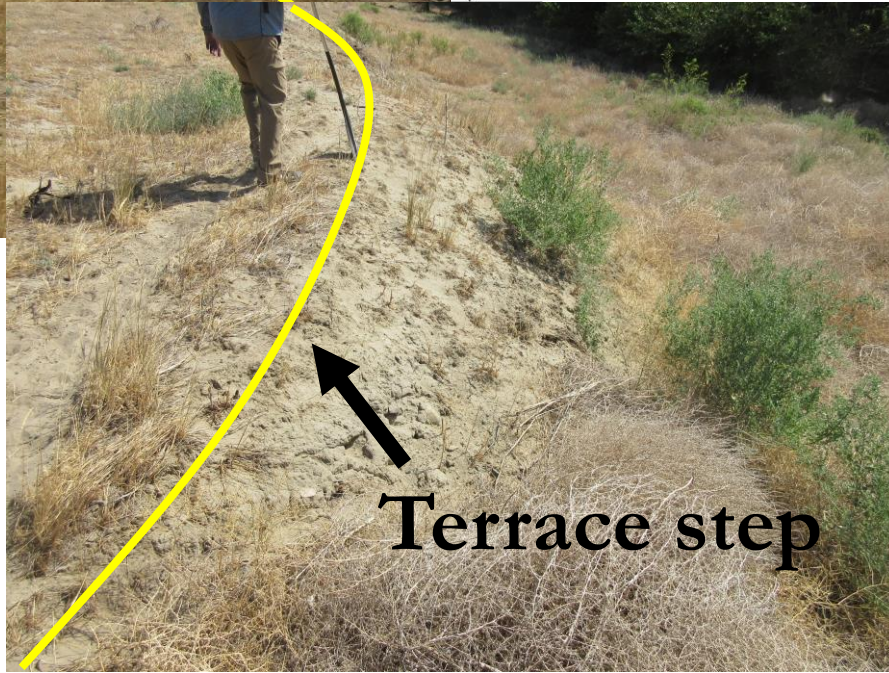


The Hanford Reach



present

low-flow
water level



Terrace step



Fecht and Marceau, 2004 & 2006

Research Questions

1. Long occupational history

2. Big River

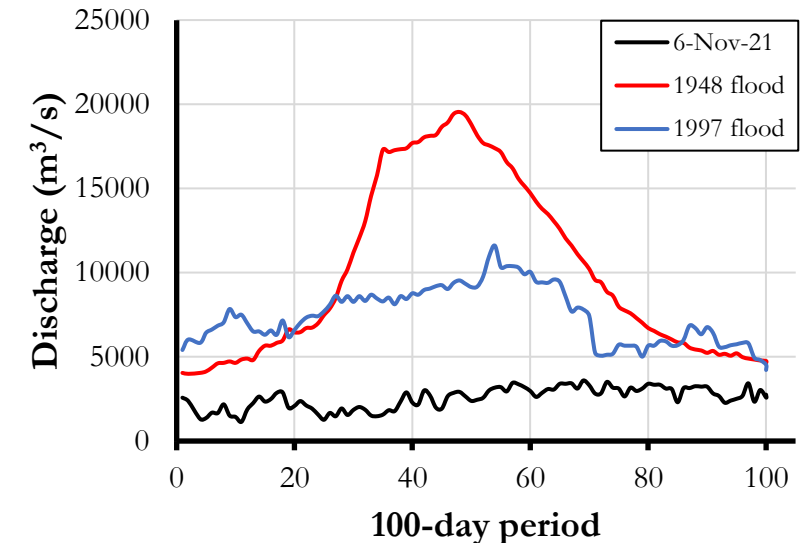
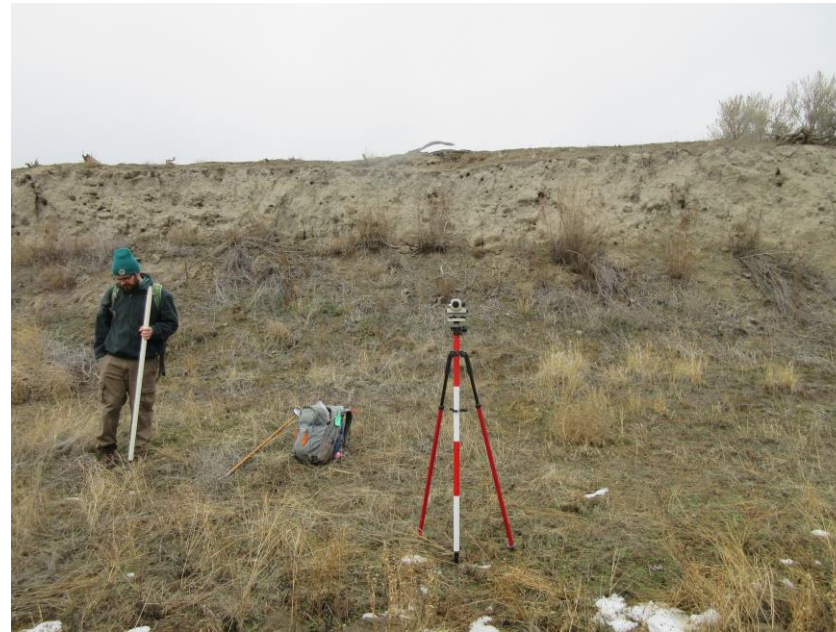
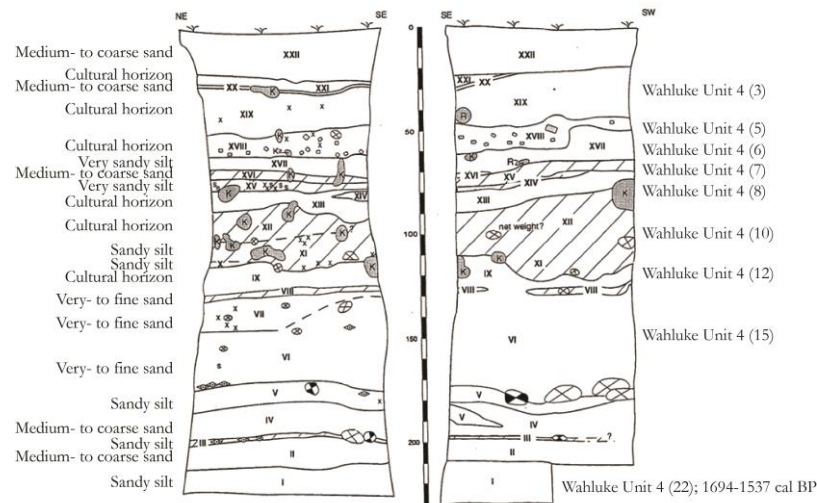
Are large floods acting to preserve or erode through time, and if so, where?

What can historic events tell us about the past and future?

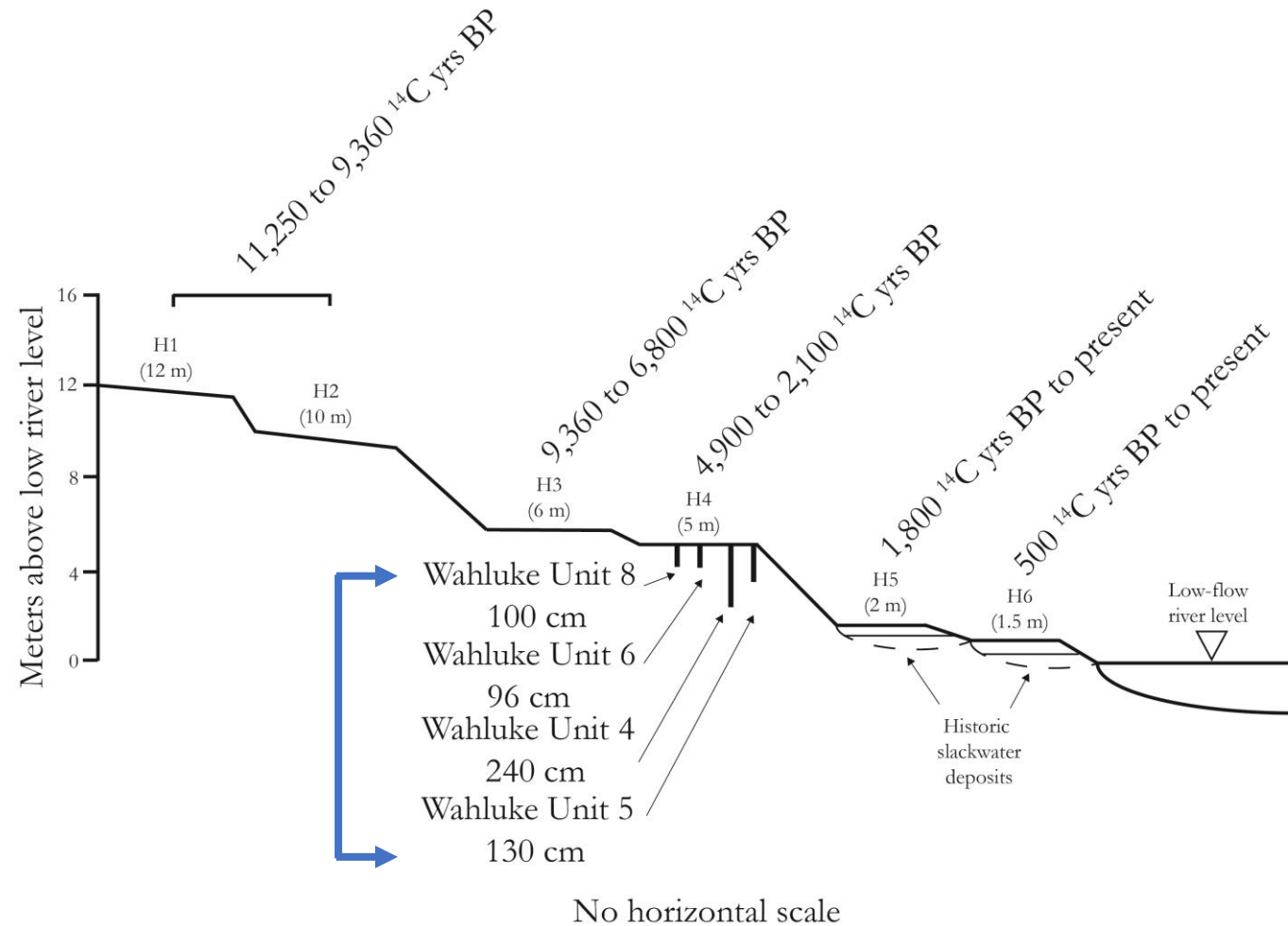


Objectives

1. Reinterpretations of stratigraphy and grain-size analysis from previous archaeological excavations
2. Elevation surveys of fine-grained deposits
3. Hydraulic modeling of historic Columbia River floods

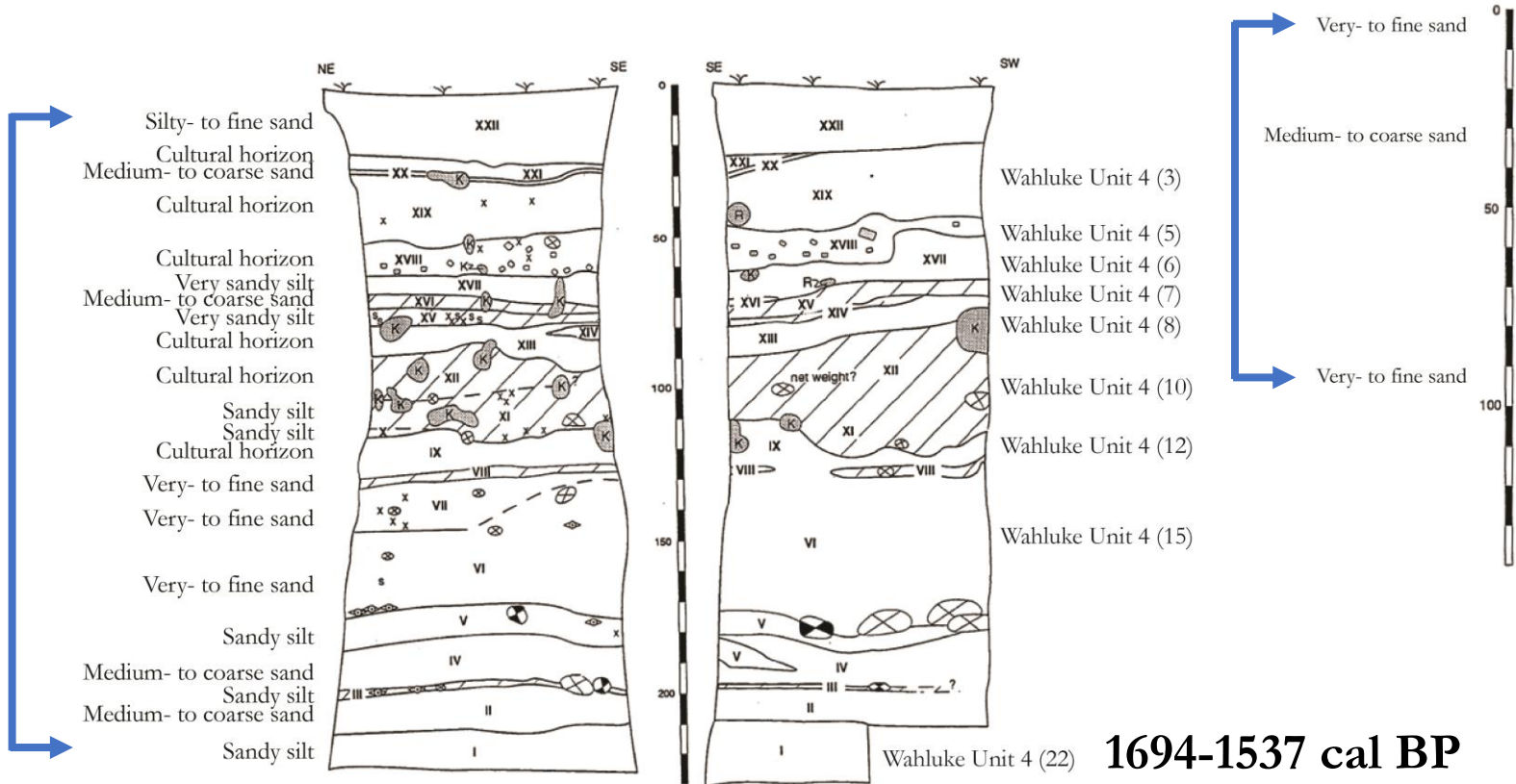


Objective 1: Excavation stratigraphic reinterpretations and grain-size analysis



Objective 1: Excavation stratigraphic reinterpretations and grain-size analysis

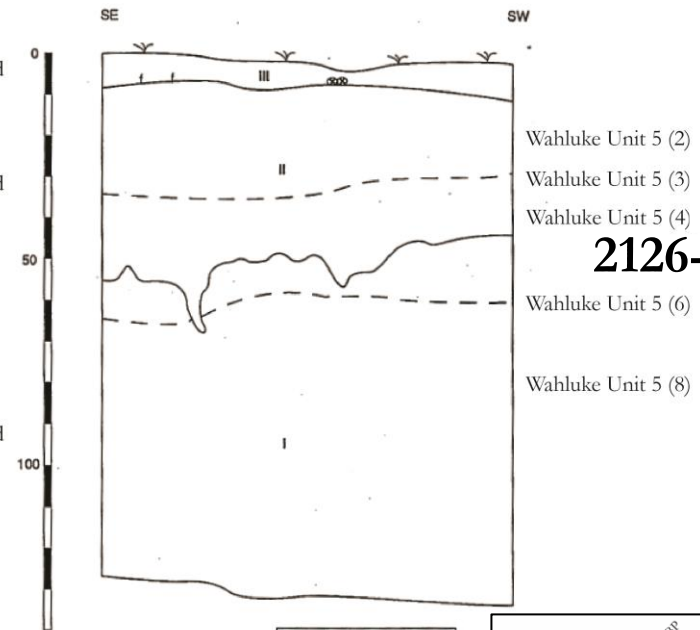
Shoreline →



Wahluke Unit 4

1694-1537 cal BP

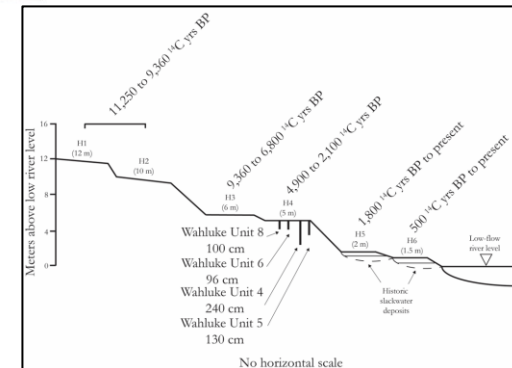
Wahluke Unit 5



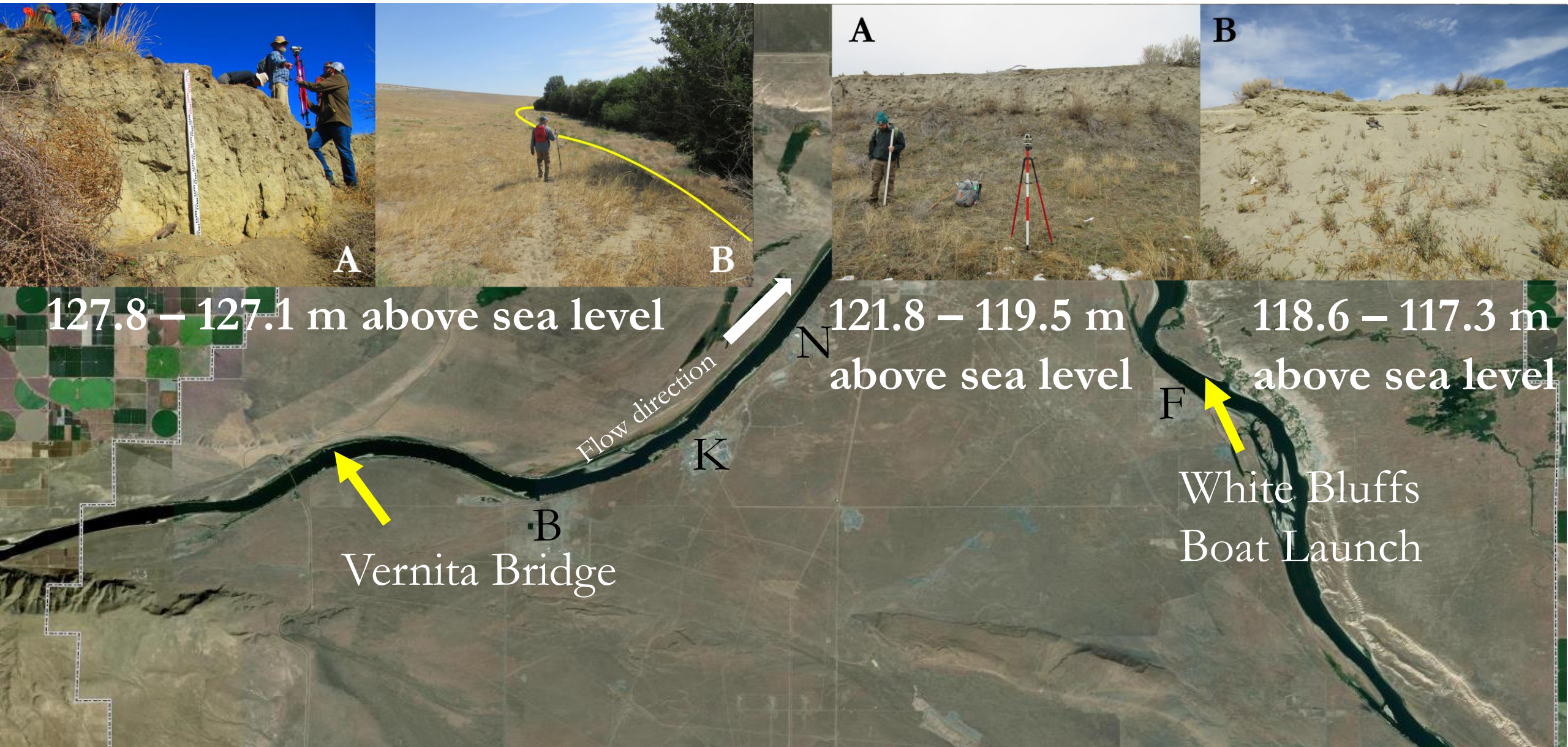
Wahluke Unit 5 (2)
Wahluke Unit 5 (3)
Wahluke Unit 5 (4)
Wahluke Unit 5 (6)
Wahluke Unit 5 (8)

2126-1993 cal BP

EXPLANATION	
x	charcoal
⊙	krotovina
⊗	cobble
⊕	fire-cracked rock
⊖	fish bone
⊘	shell
⊙	flake
⊙	mottled earth
⊙	root
⊙	stained earth



Objective 2: Elevation surveys



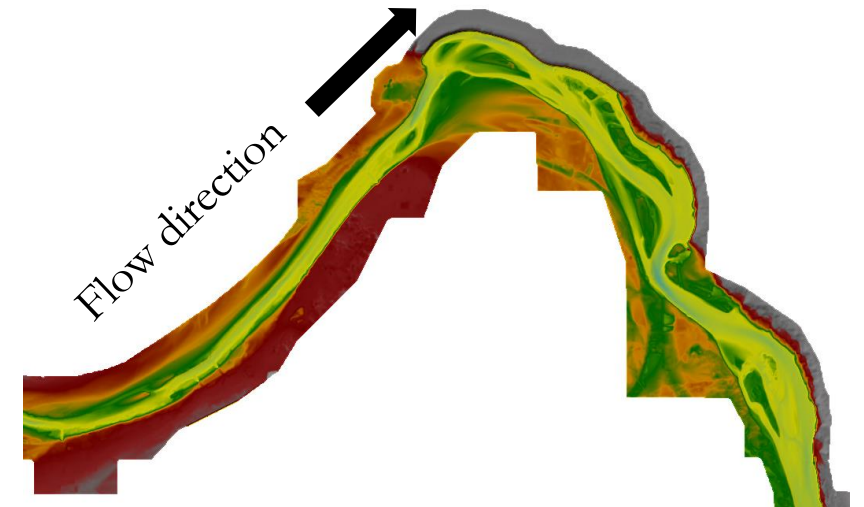
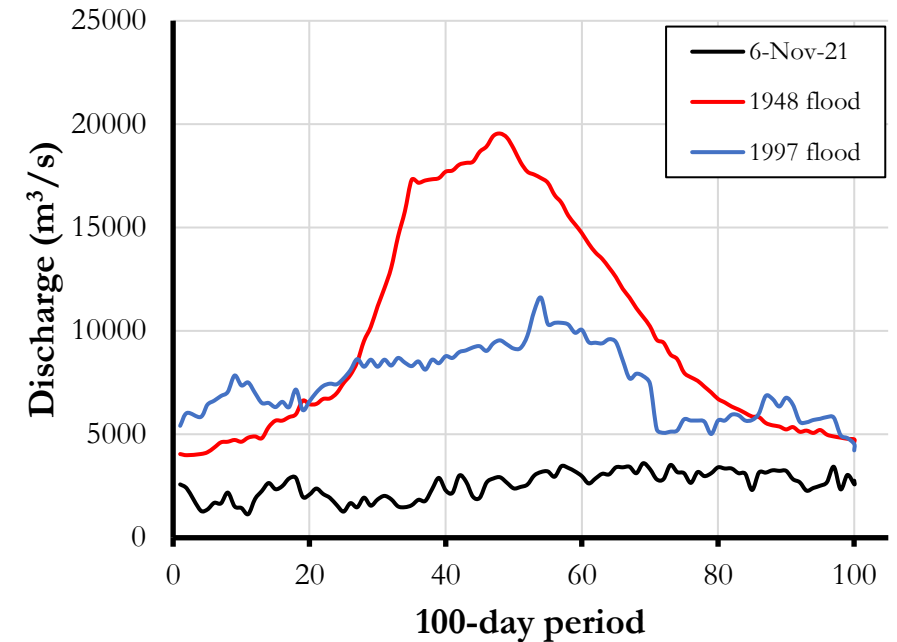
Objective 3: Two-dimensional modeling

Hydrologic Engineering Center River Analysis System (**HEC-RAS**) two-dimensional modeling inputs:

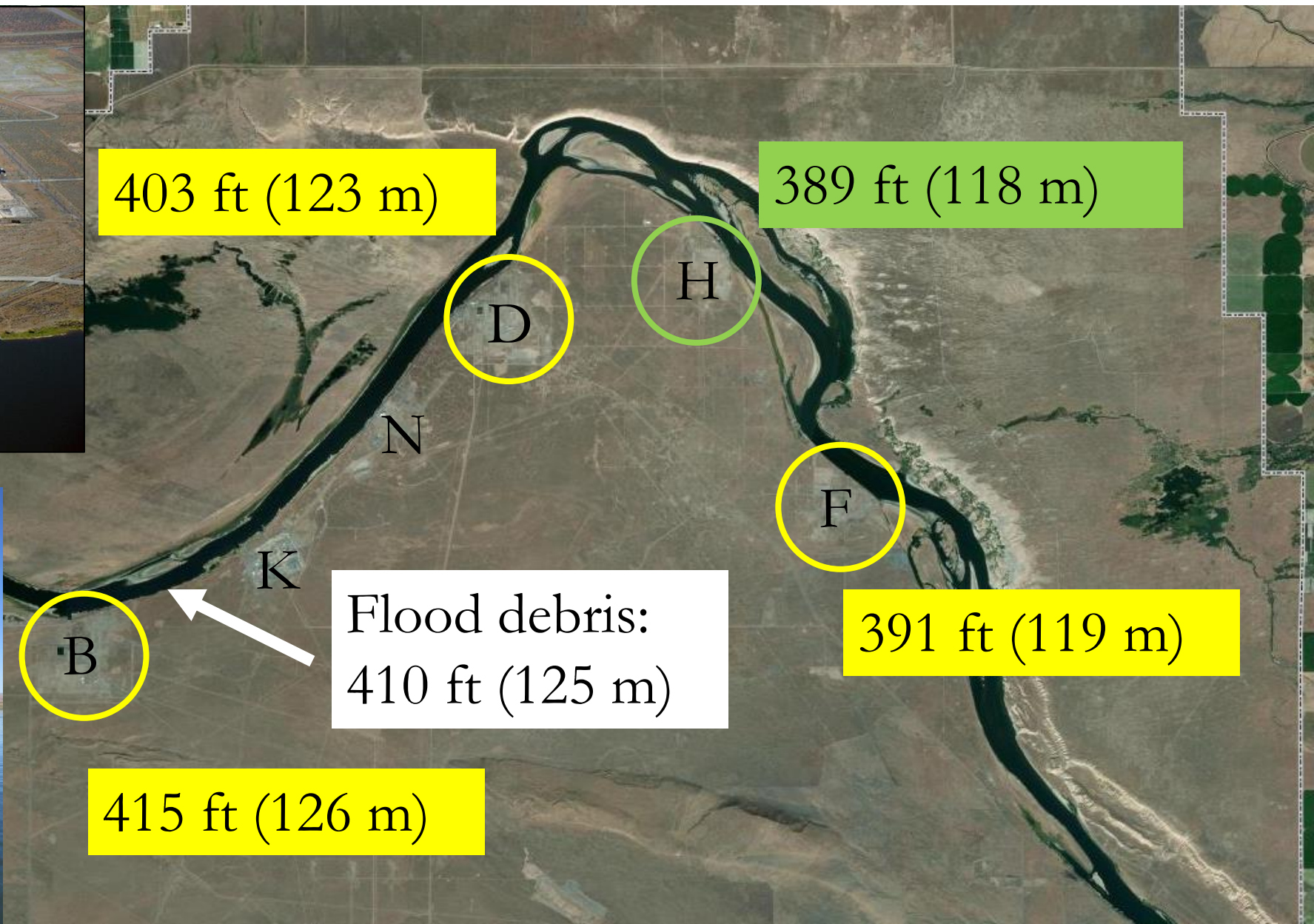
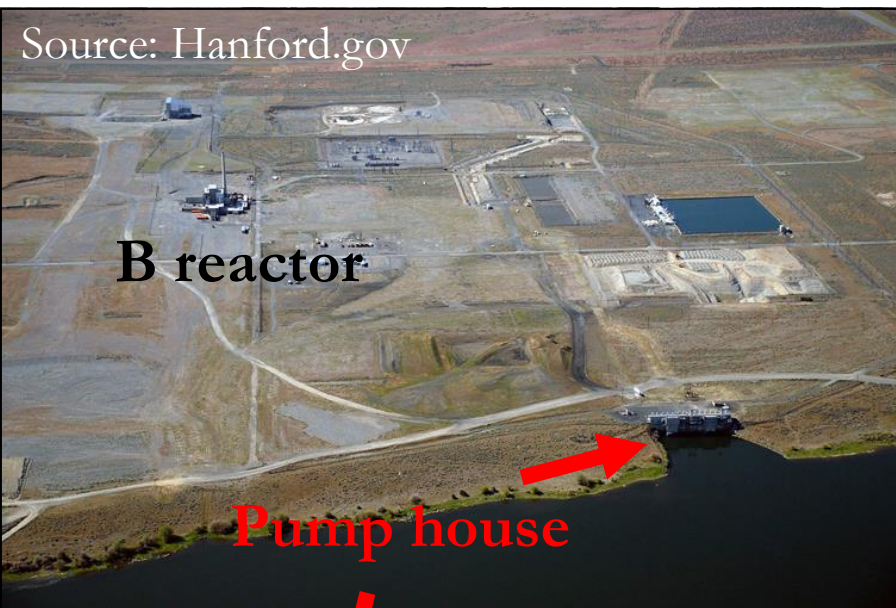
- 1948/1997 flood hydrograph used to simulate a 100-day period prior/during/after flooding
- LiDAR topographic data
- Estimated roughness coefficient (Manning's n)

HEC-RAS two-dimensional modeling outputs:

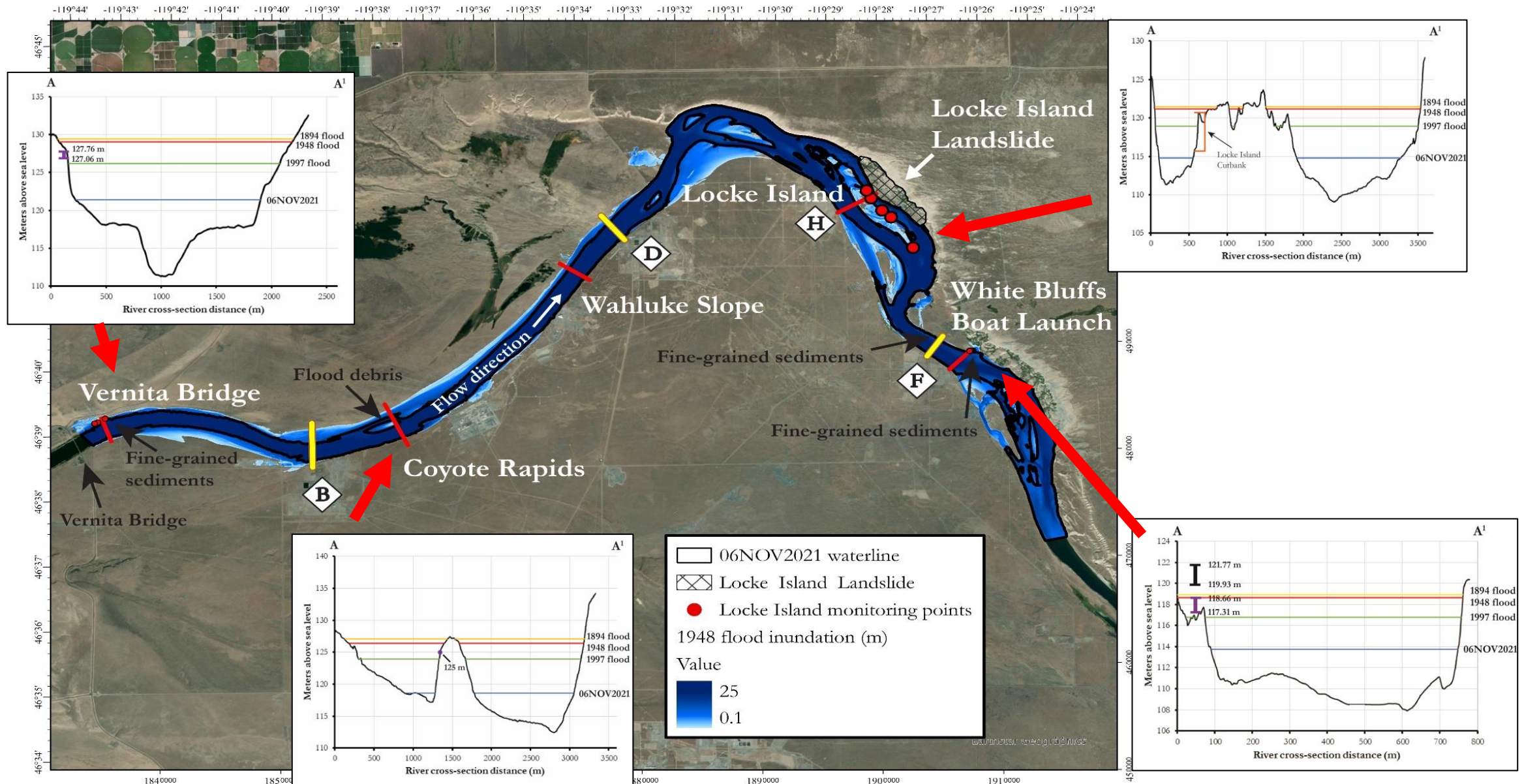
- Water surface elevations
- Flow velocities
- Particle tracing model



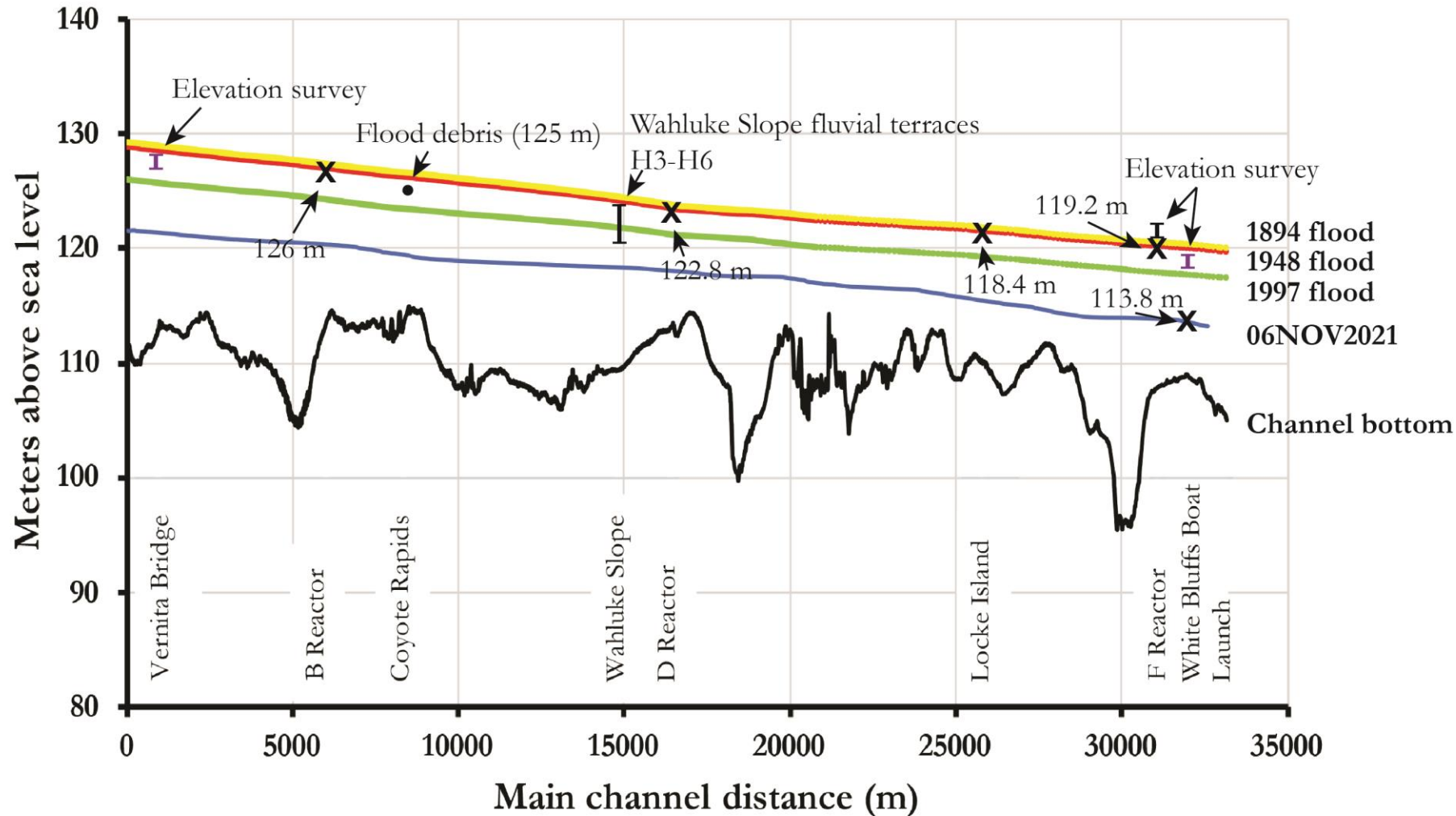
Calibration: 1948/1997 flood high-water mark



Hydraulic modeling



Hydraulic modeling: Summary



Maximum depth change:
+7.8 m

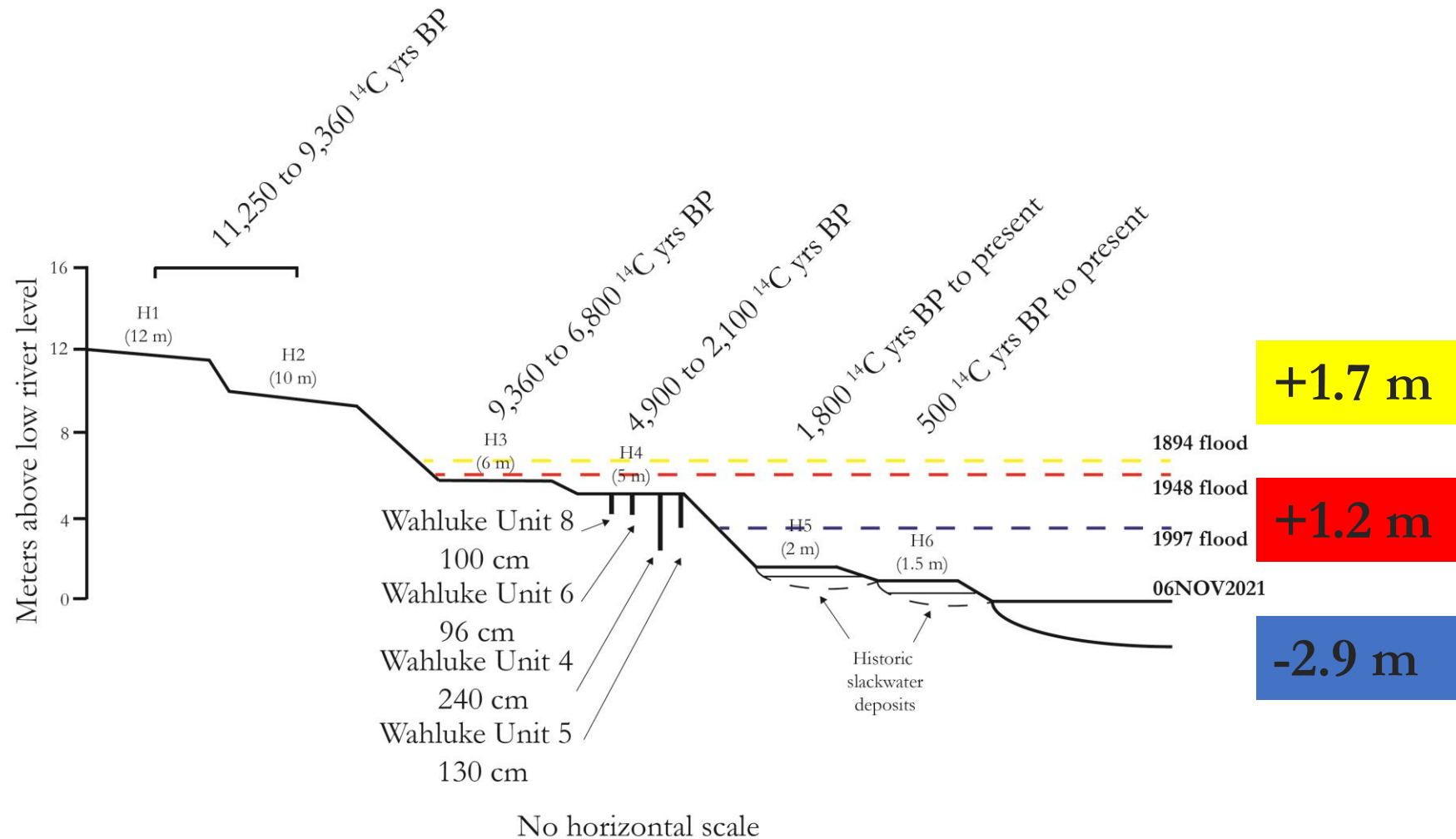
Maximum velocity:
2.0 m/s

Wahluke archaeological sites were inundated by 1894/1948 floods.

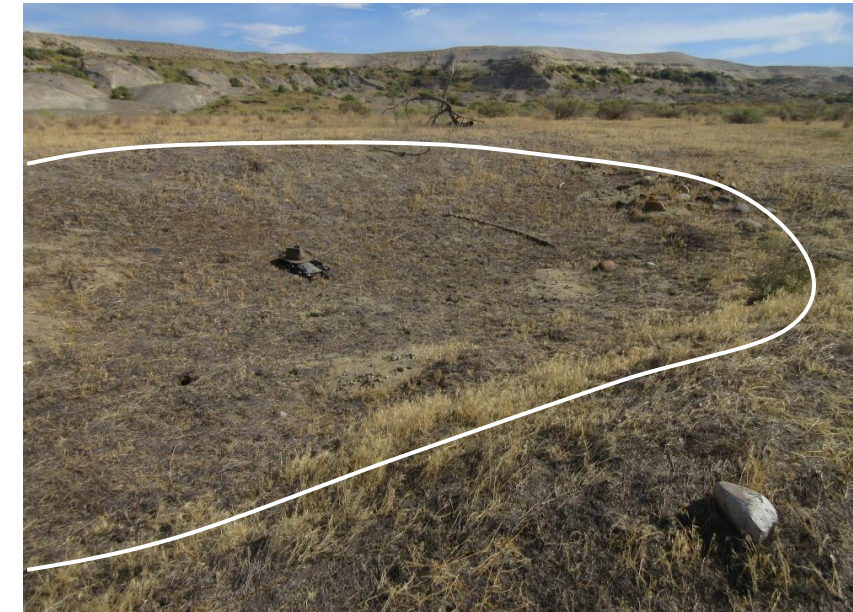
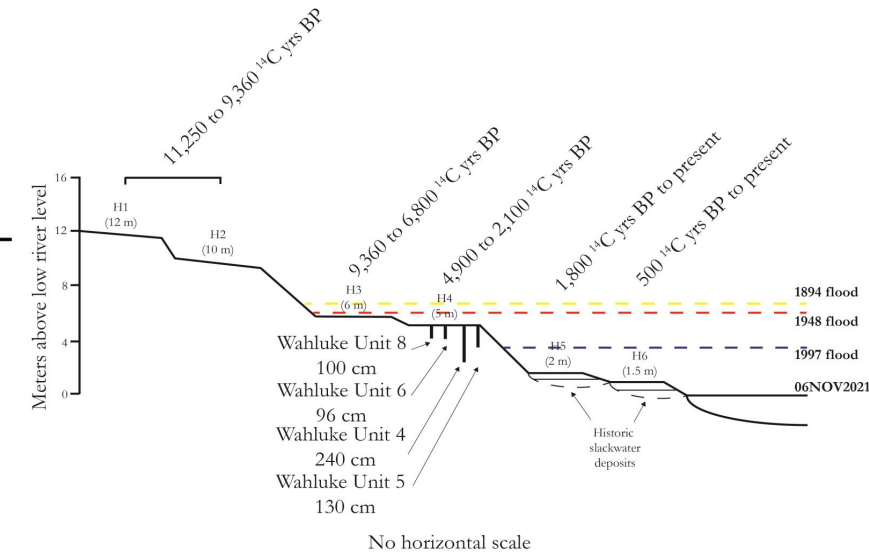
Only one surveyed terrace was not inundated by simulated 1894/1948 floods.

Flood debris was deposited by the 1894/1948 flood.

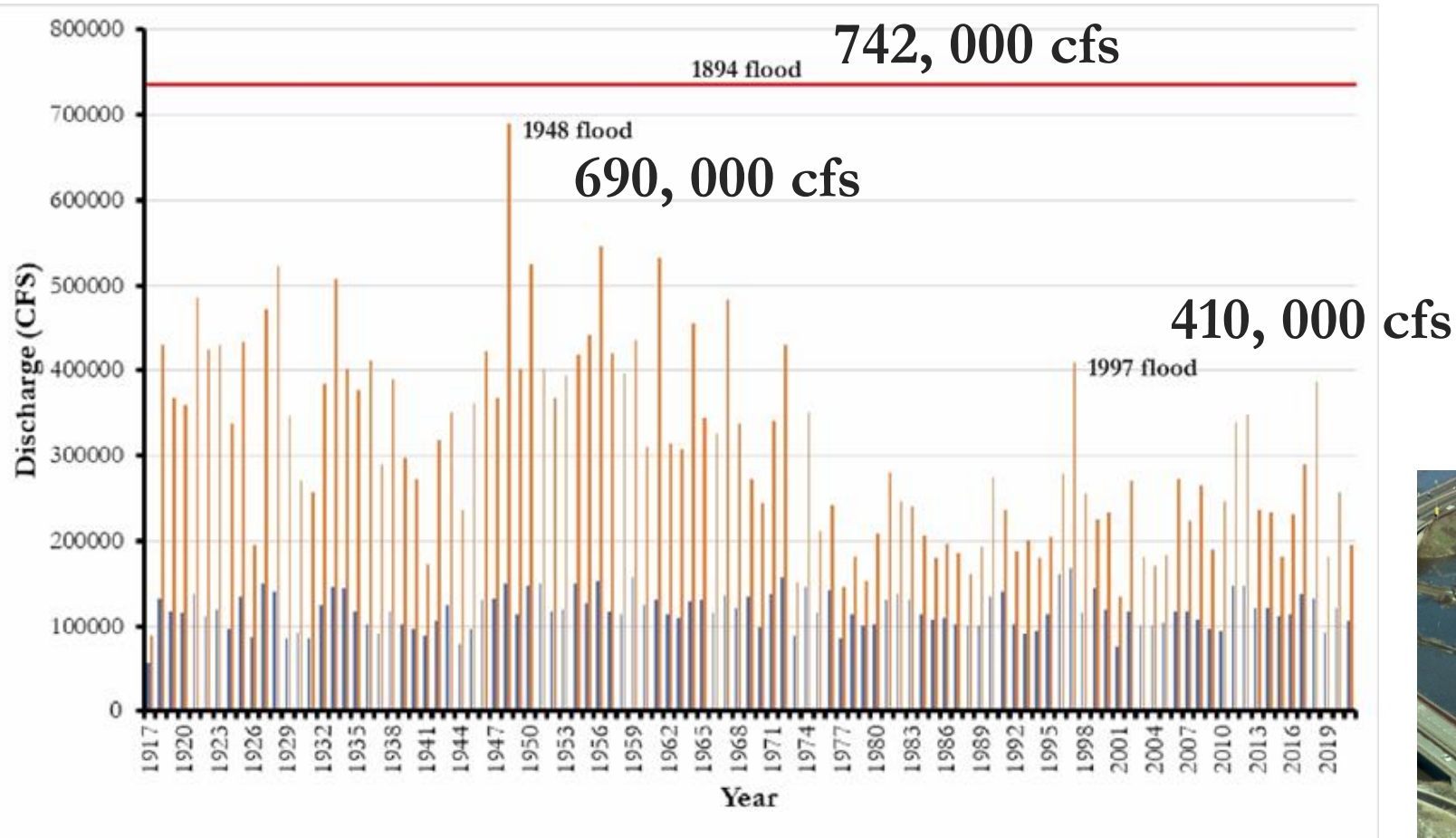
Terraces, excavations, and floods



Terraces, excavations, and floods



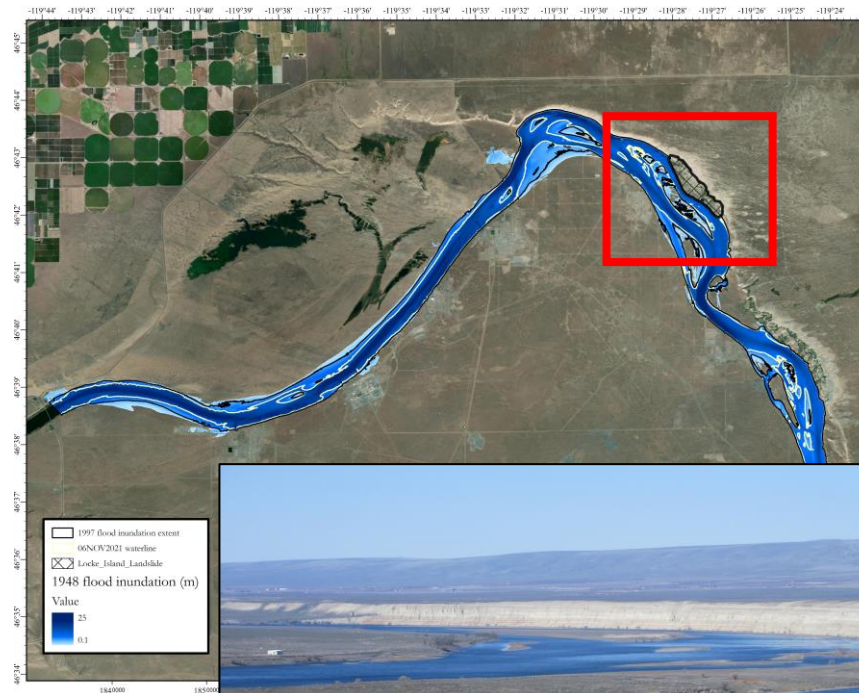
Areas of erosion and deposition



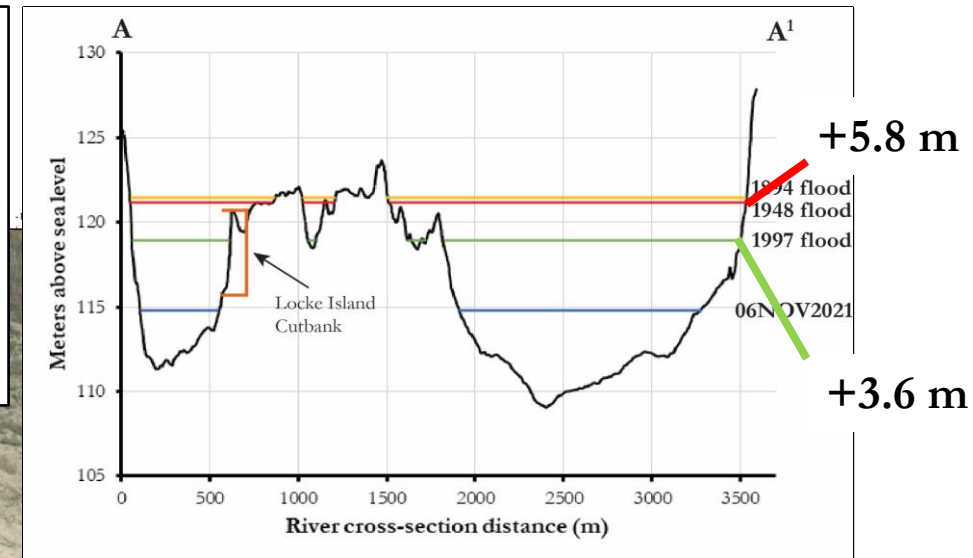
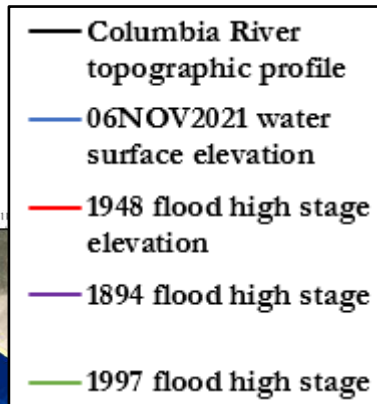
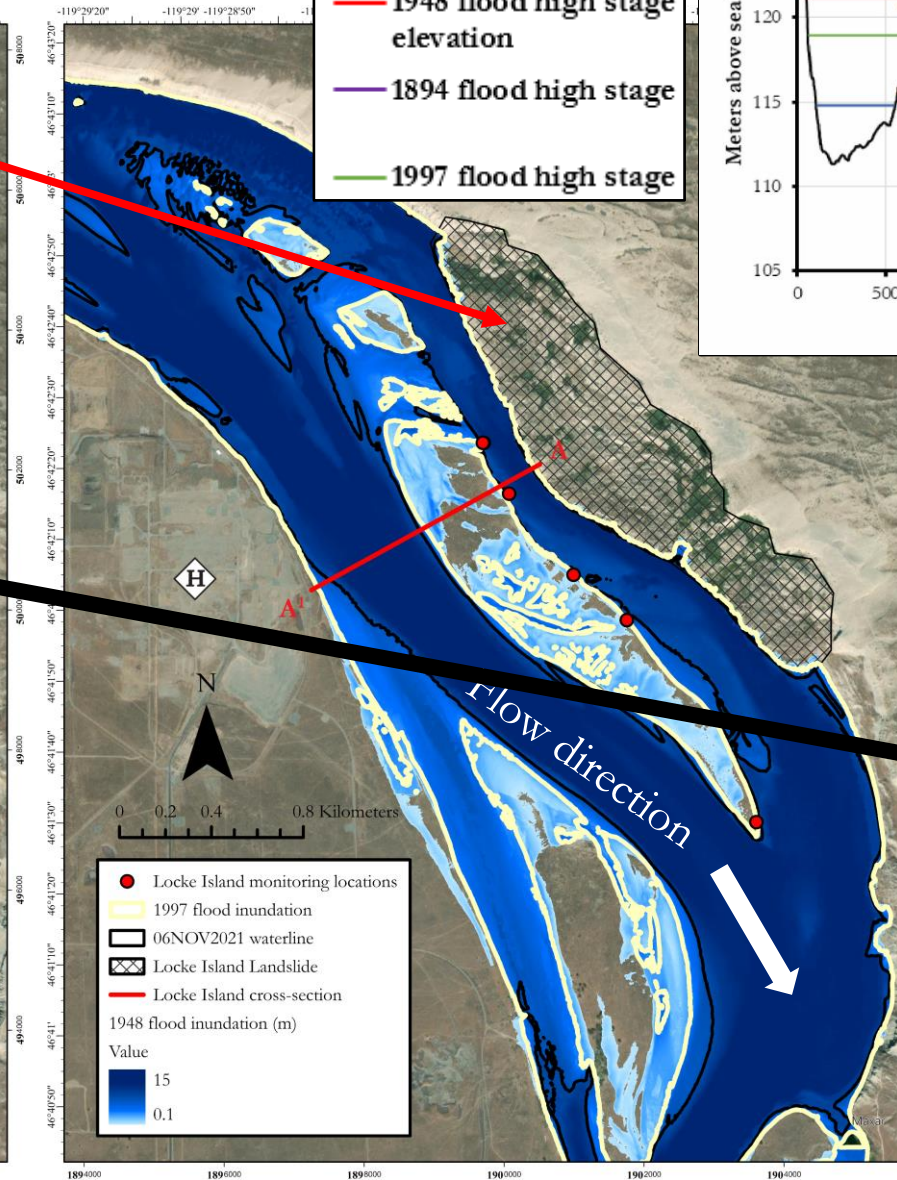
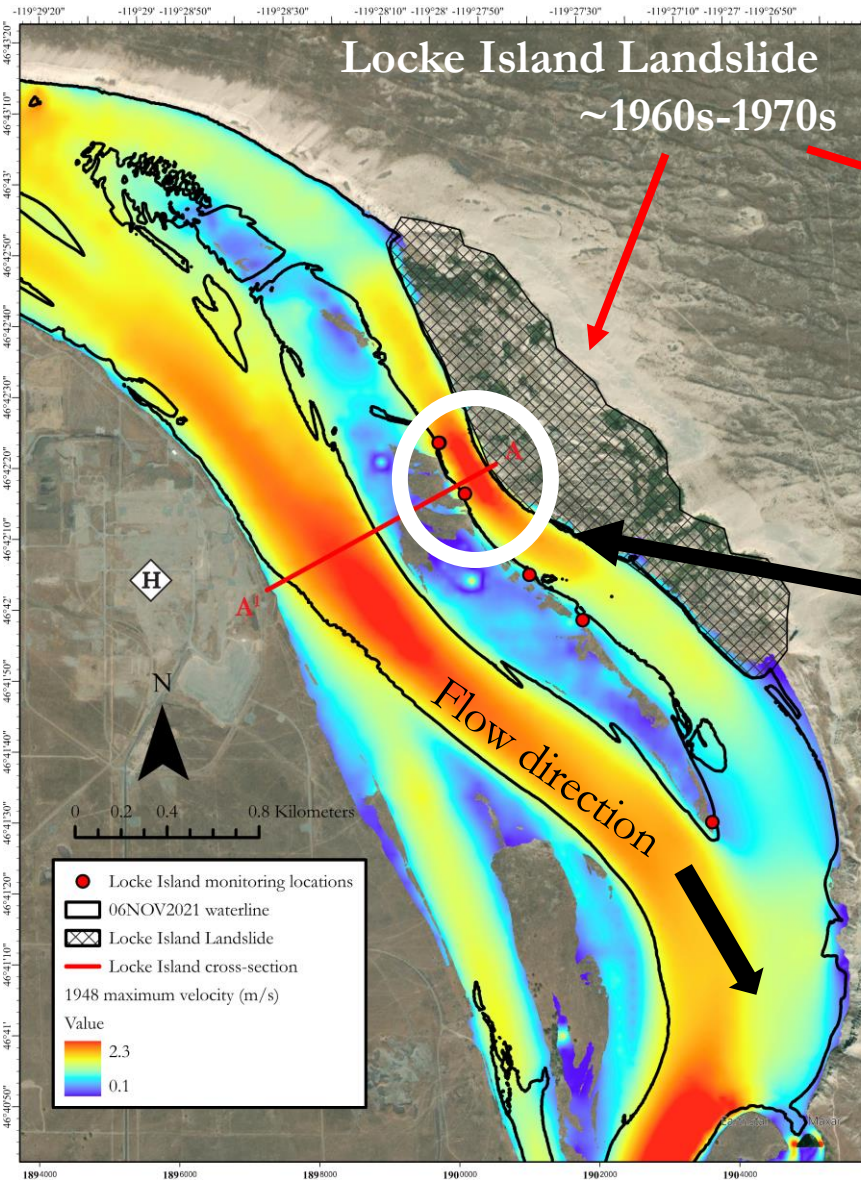
100-year floods estimate: 445,000 cfs
500-year floods estimate: 520,00 cfs

Locke Island

- Placed in the National Register of Historic Places (National Register) in 1976
- “The best preserved and largest known remaining housepit site in the entire Columbia Basin.” (Rice, 1968)
- Supervised by the Confederated Tribes of the Umatilla



Locke Island



1997

Specific stream power
566 W/m²

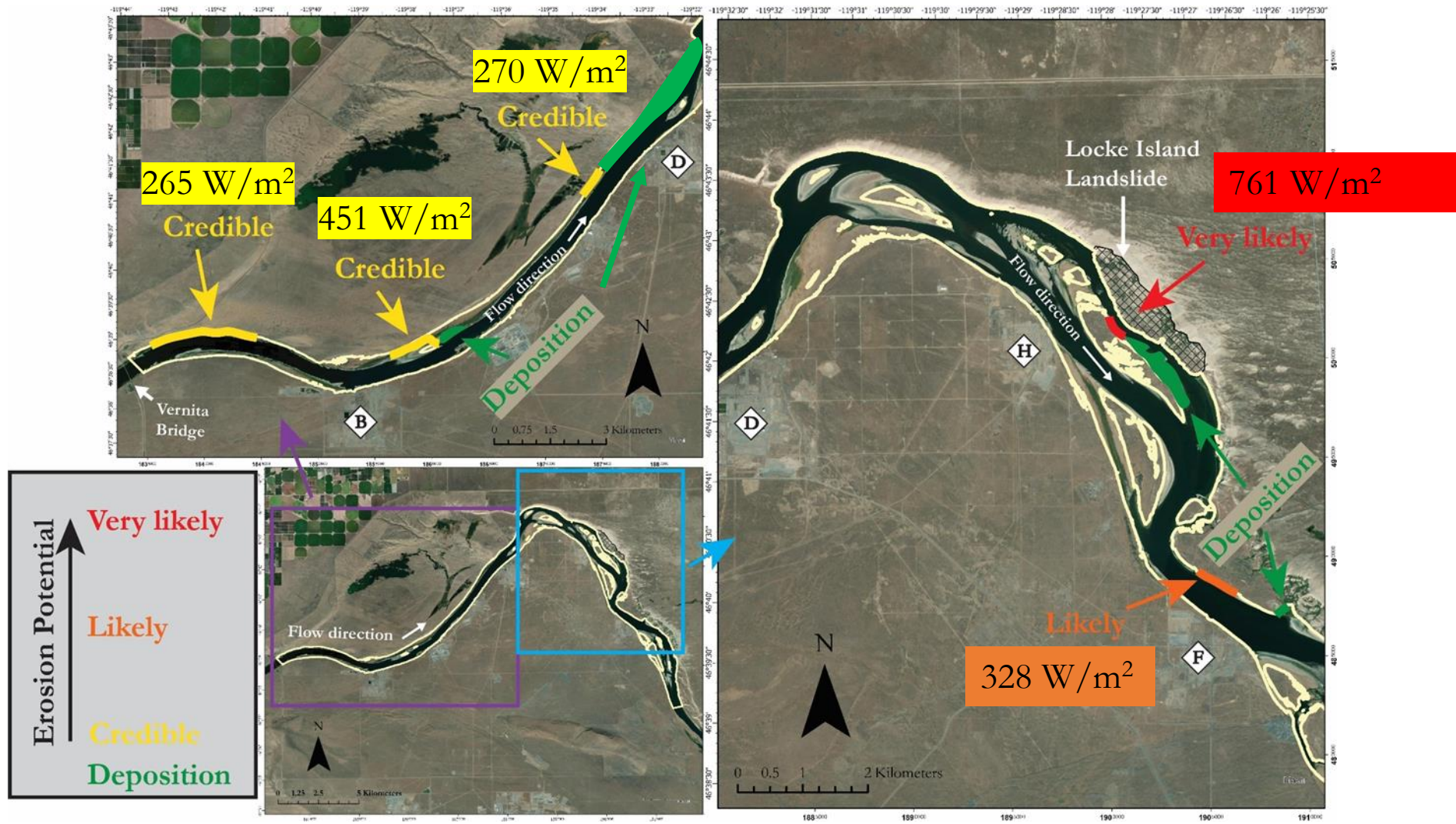
Bed shear stress
453 N/m²

1894 and 1948

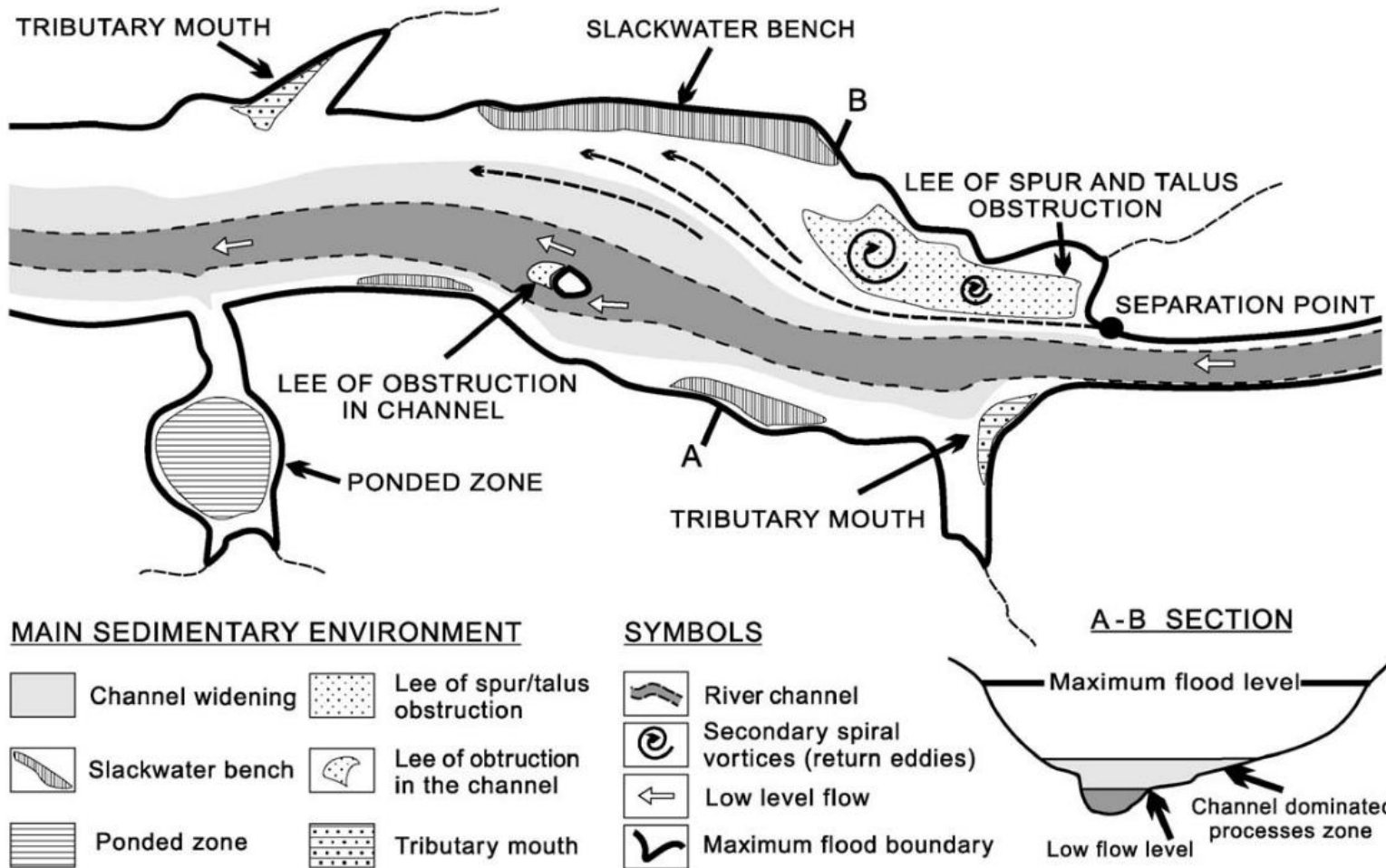
Specific stream power
703 and 761 W/m²

Bed shear stress
566 and 556 N/m²

Areas of erosion and deposition



Slackwater flood deposits

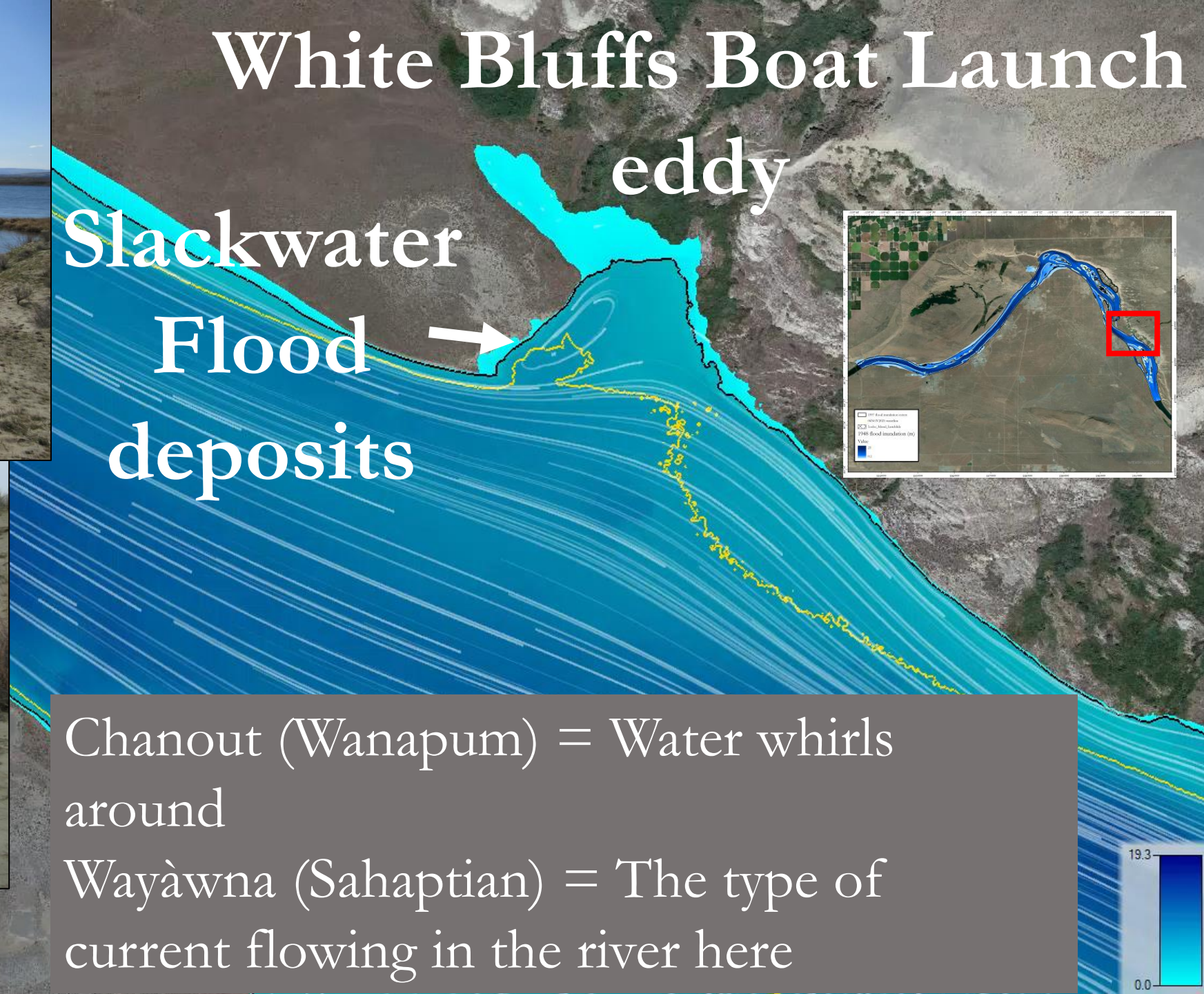


Source: Benito et al., 2003

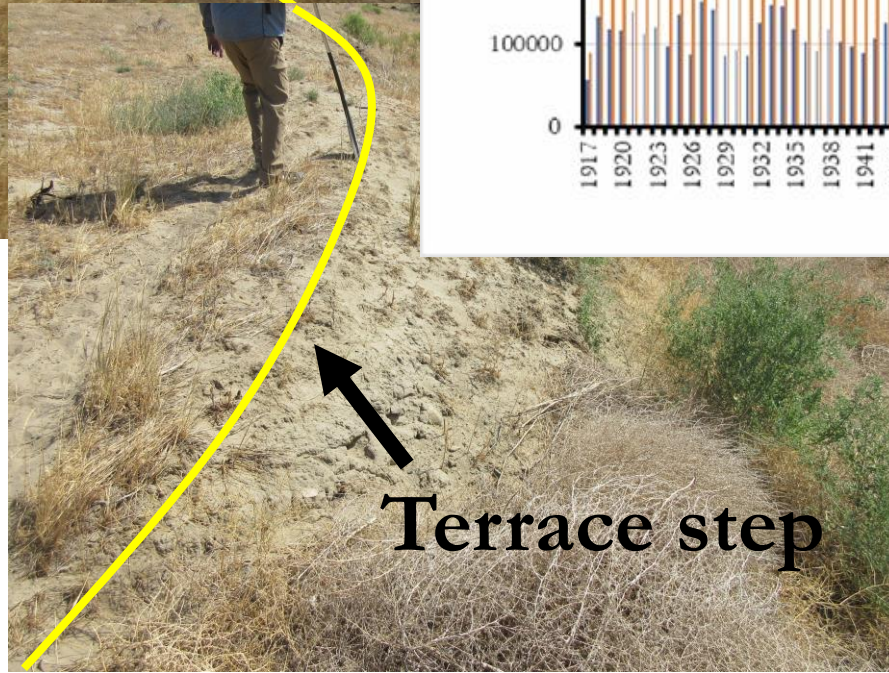
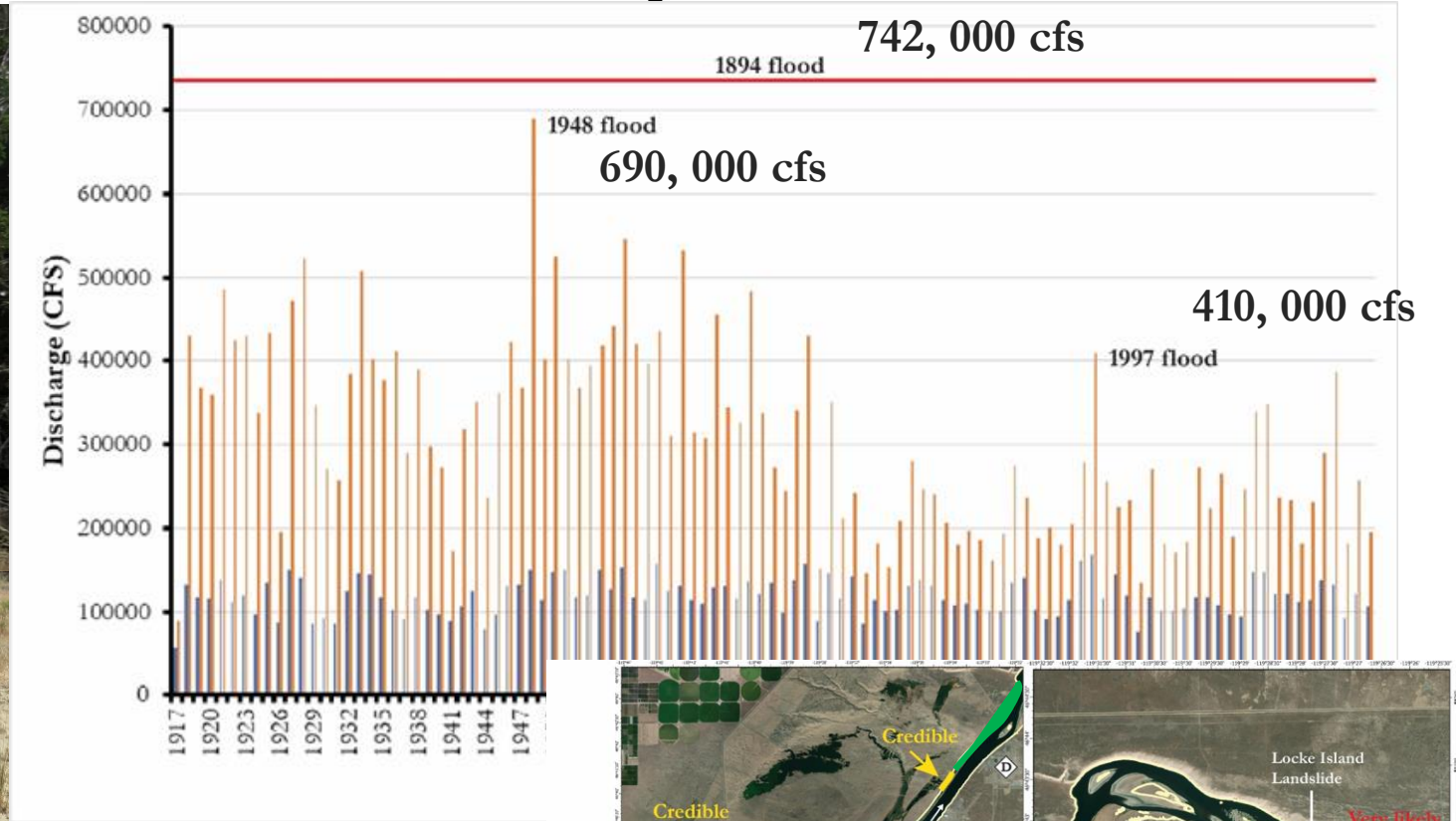


Source: Allen, 2020

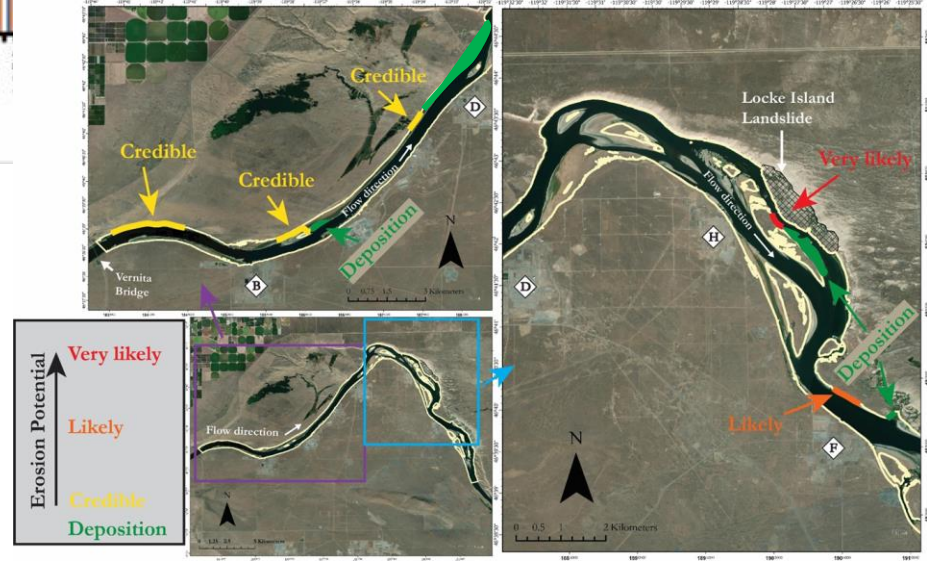
- Back-flooded tributaries
- Downstream of channel obstacles
- Channel margins
- Alcoves
- Eddy formations



Areas of erosion and deposition



Terrace step



Research Question

1. Long occupational history
2. Big River

Are large floods acting to preserve or erode through time, and if so, where?

Both, dependent on channel morphology and flood discharge.

What can historic events tell us about the past and future? Present-day floods are now focused on erosion and can no longer help preserve cultural material



Acknowledgments

- Karl Fecht
- Thomas Marceau
- Jonathan Meyer
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- Dawson Miller
- Nathan May
- Rose Ferri
- James O'Connor
- Tessa Harden
- Bruce Bjornstad
- Lu Chester



“...Other great rivers add power to you
Yakima, Snake, and the Klickitat, too
Sandy Willamette and Hood River too
So, roll on, Columbia, roll on...”

Woody Guthrie, 1941

