

Rapids in bedrock rivers: morphological characteristic, distribution, and flow dynamics



Subcategories

Control
The underlying factor which forces the rapid
(*bedrock vs sediment*)

vs

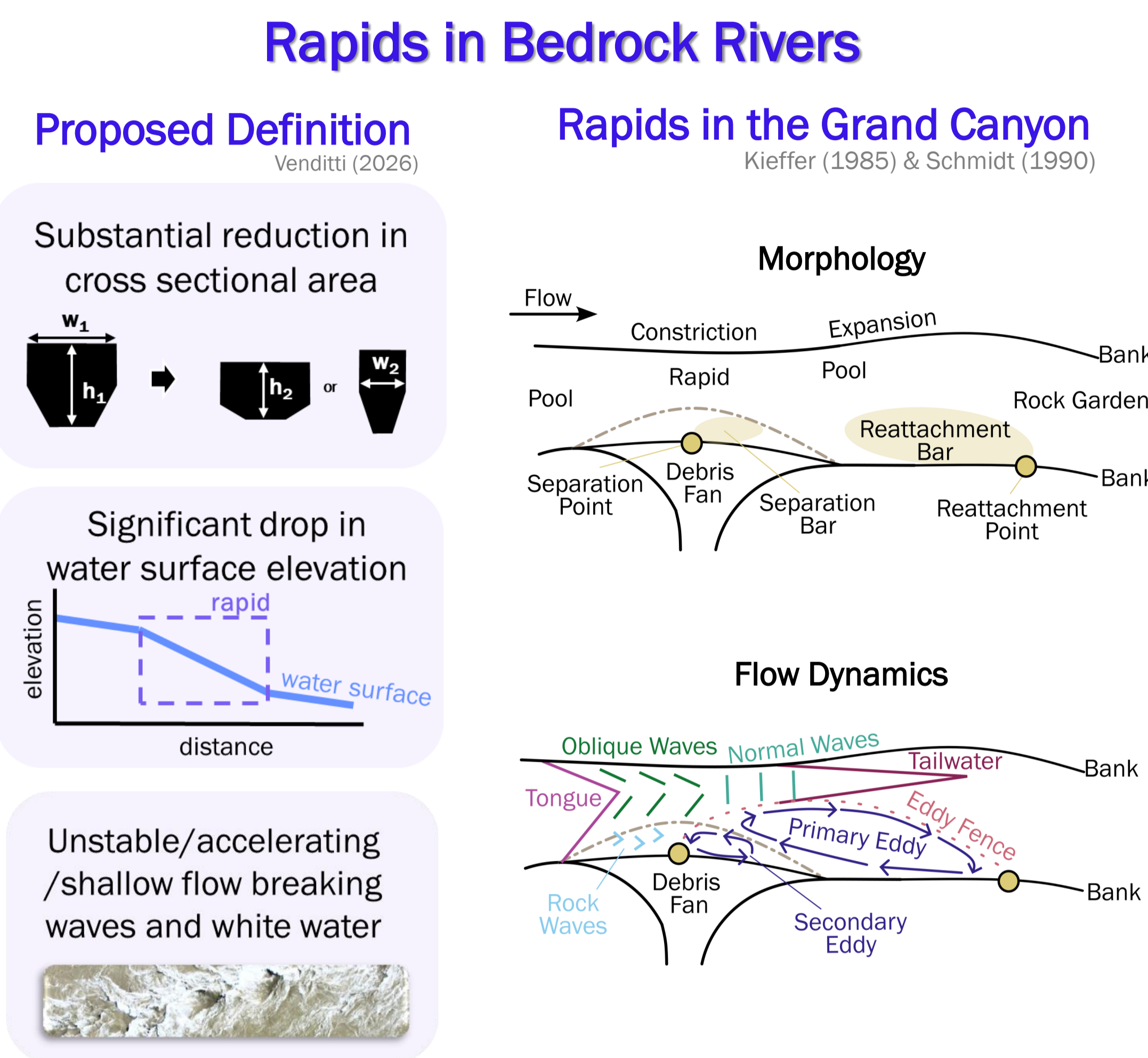
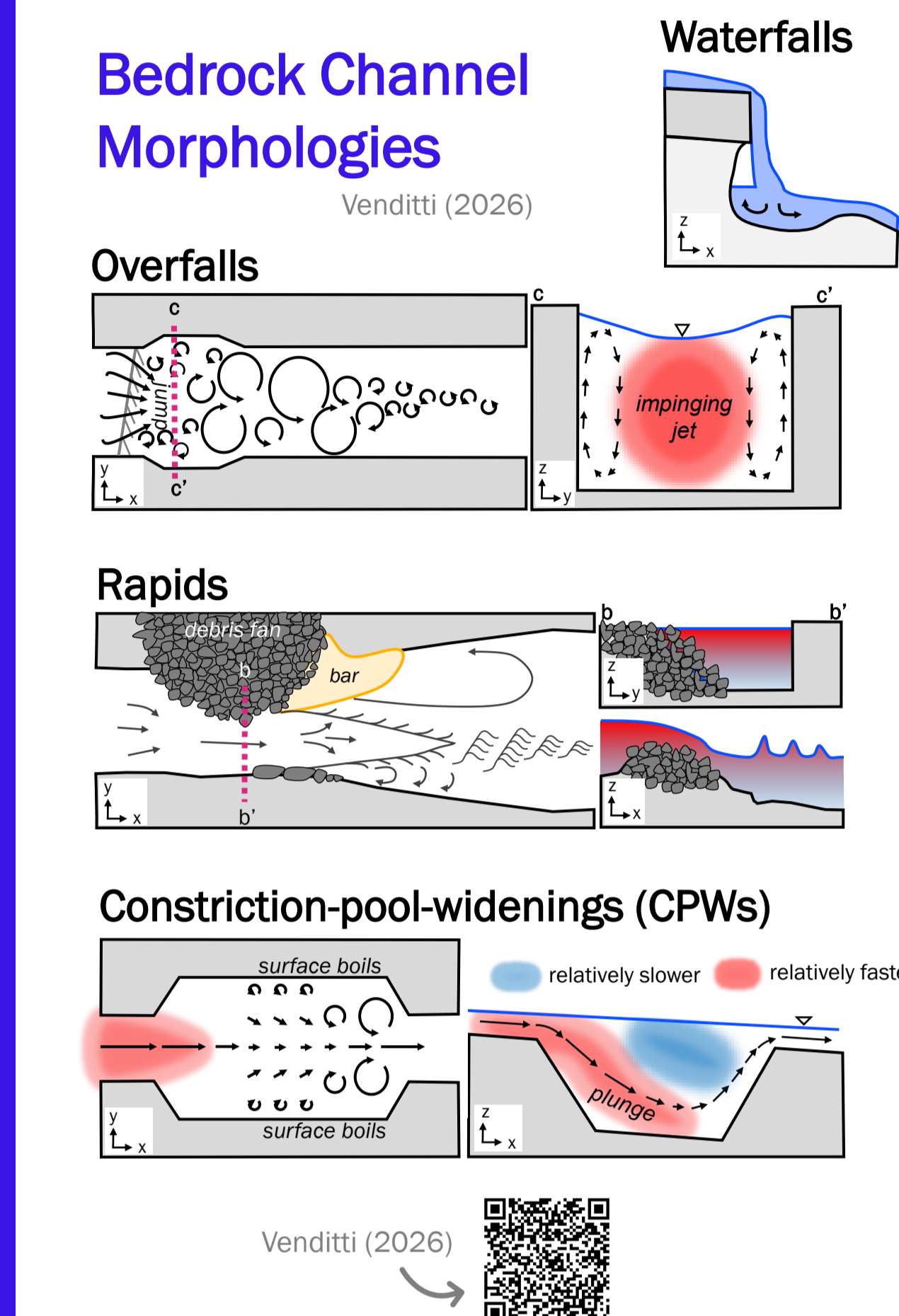
Type
The way in which the control constricts the channel area
(*constriction vs step*)



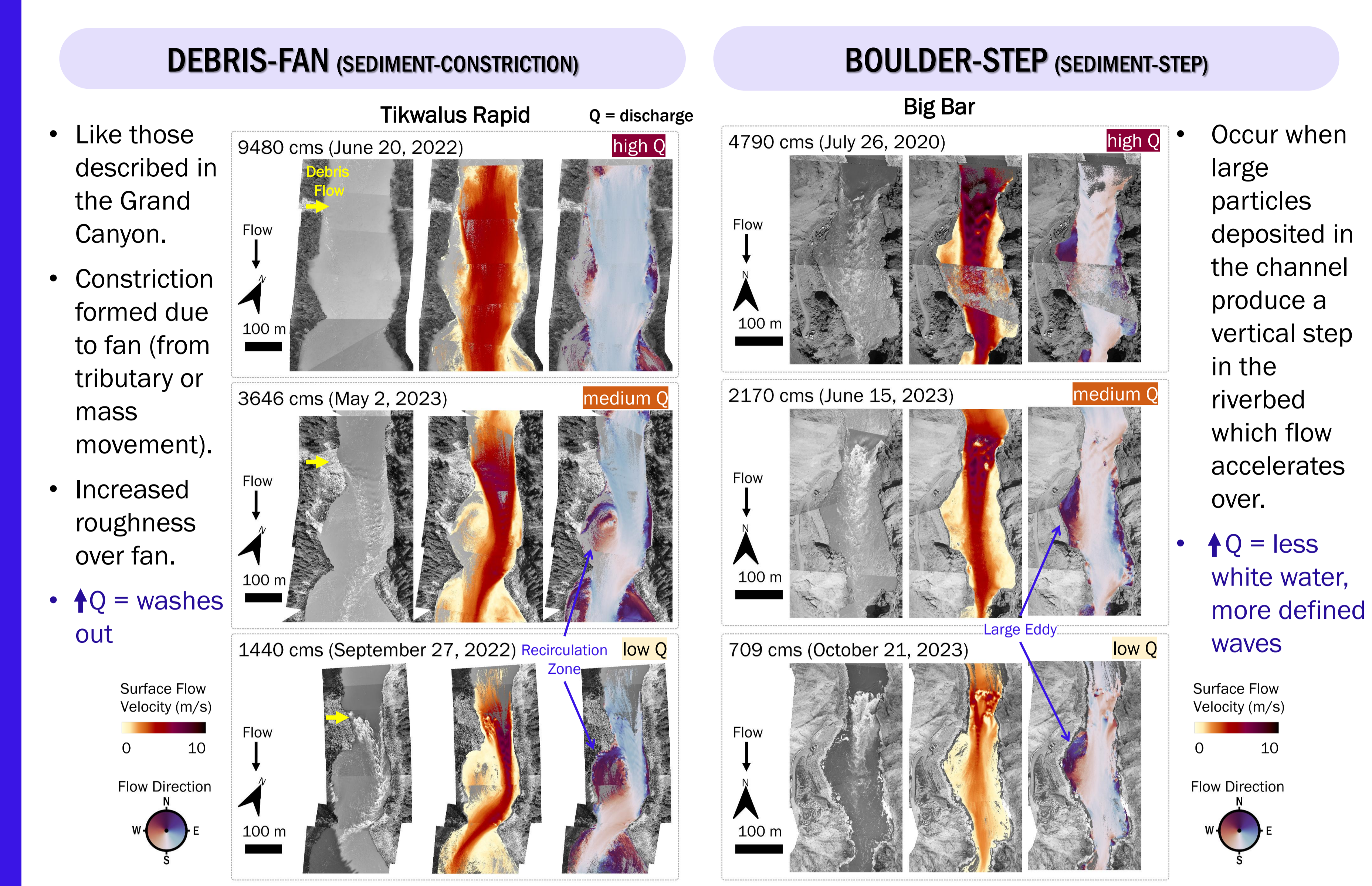
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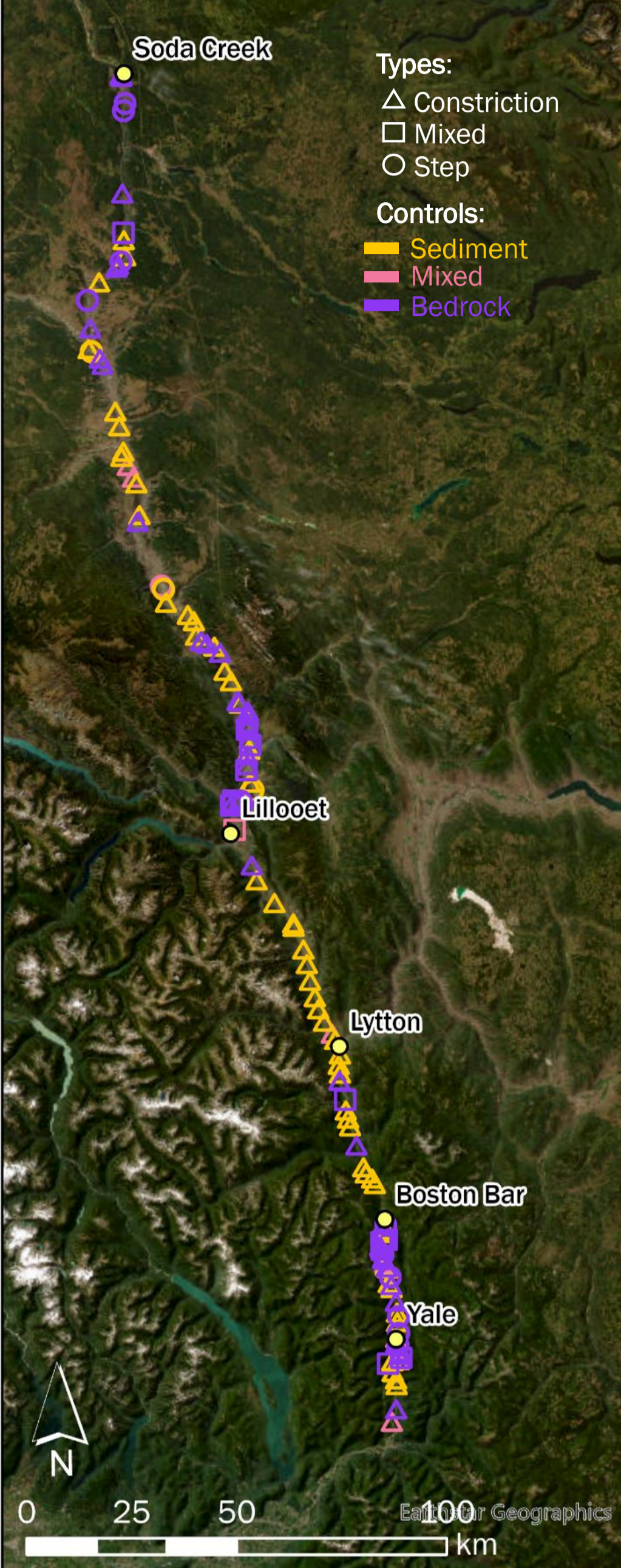
Background



Results

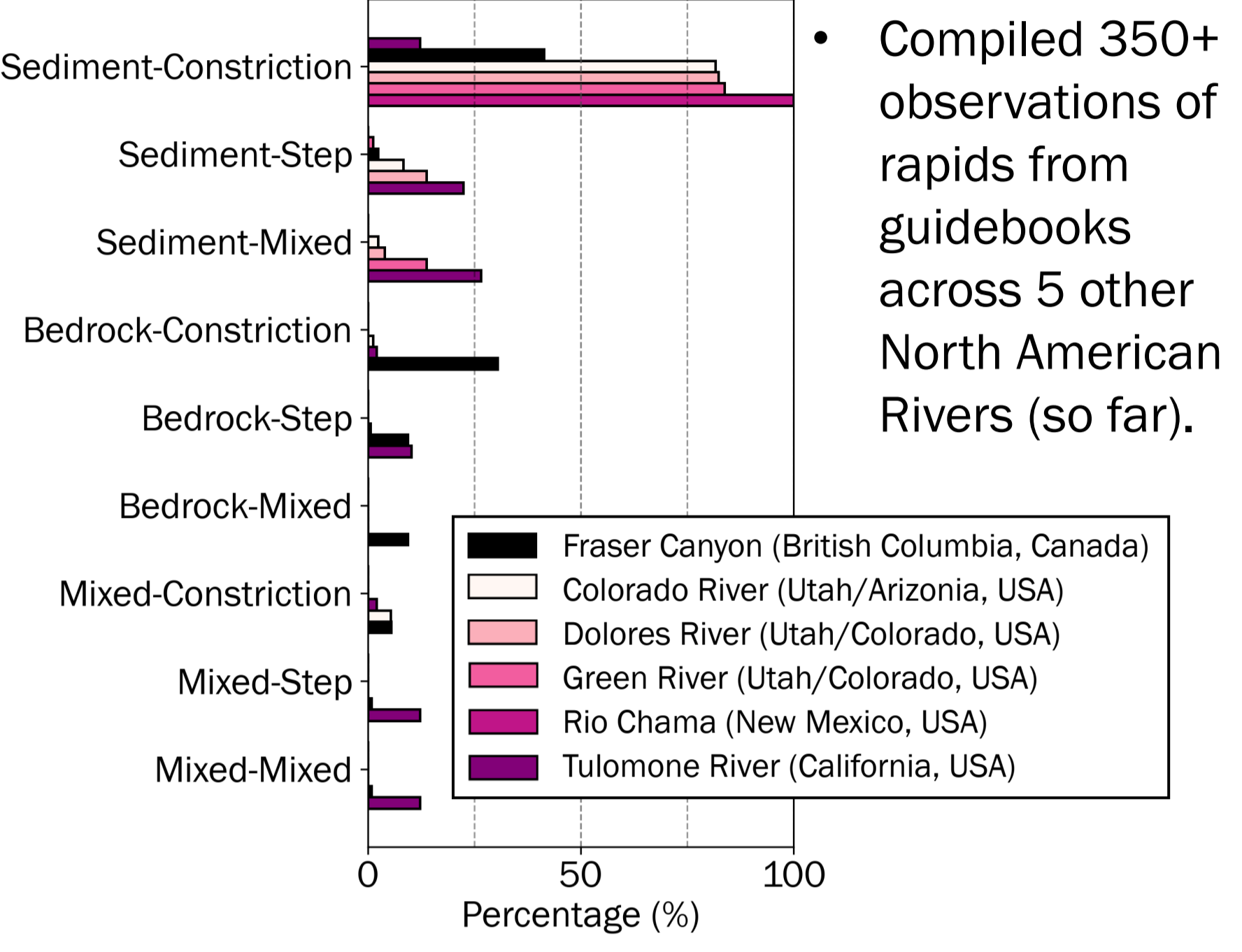


Rapids in the Fraser Canyon



- Rapids are common and diverse in the Fraser Canyon: 128 mapped representing all subcategories.
- How does this compare to other rivers?

Rapid Subcategories in Different Rivers



Problem Statement

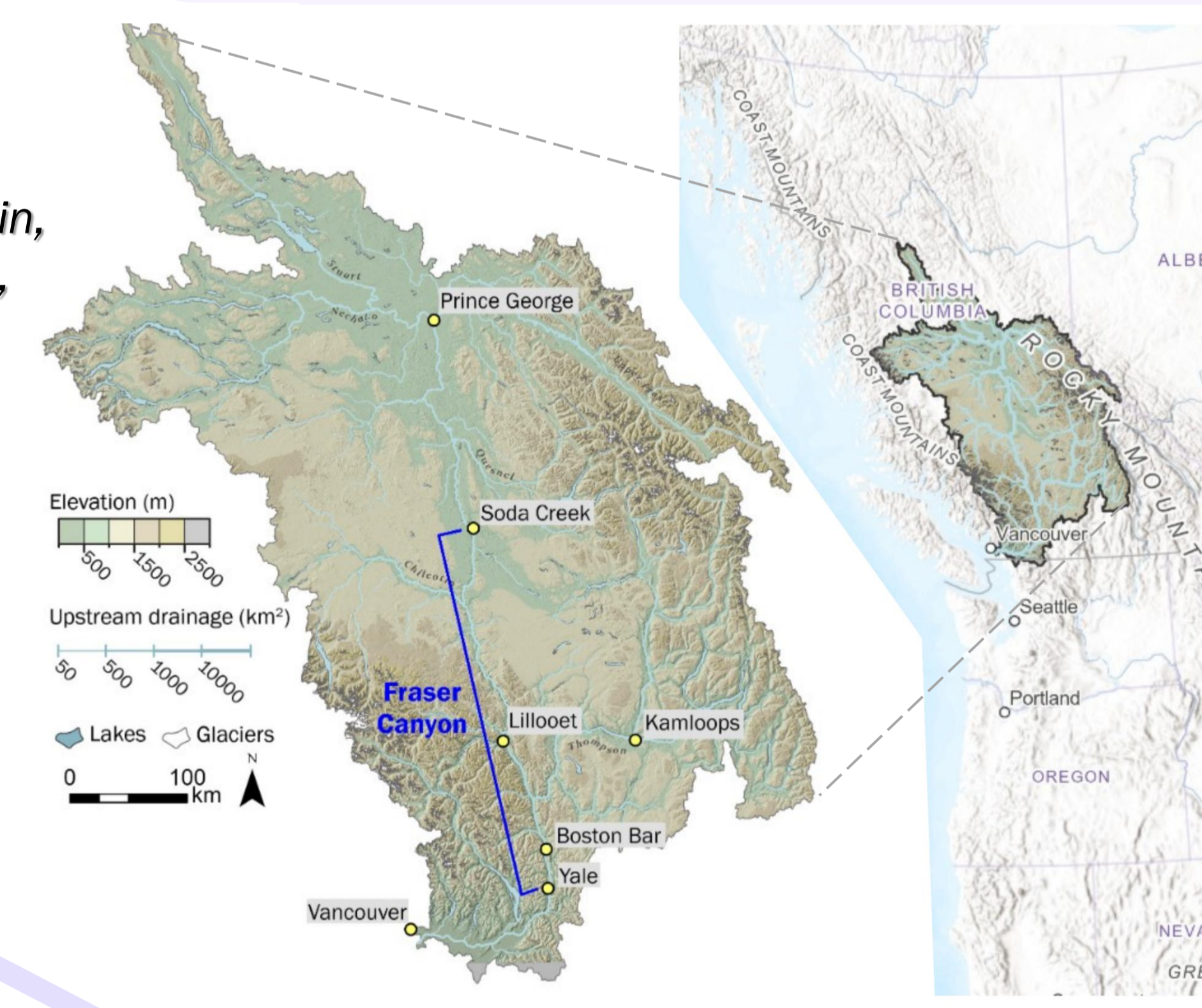
- We know the most about rapids in bedrock canyons in the Grand Canyon and Western United States (e.g. Leopold, 1969; Dolan et al., 1978; W. L. Graf, 1979; Howard & Dolan, 1981; Kieffer, 1985; Schmidt, 1990) however, there are many types of rapids in other bedrock bound rivers...
- How frequent are different types of rapids? How do different rapid morphologies vary with discharge?

Hypothesis

- Subcategories of rapids are connected to the processes/settings that form them.
- Local flow features display different discharge dependence depending on subcategory.

Study Site

- The Fraser Canyon
- 375-km bedrock influenced reach made up of a series of discrete bedrock canyons.
- Undammed with a baseflow of ~1000 cms and ~8420 cms mean annual peak flow.
- Diverse rapid morphologies are observed!



Datasets & Resources

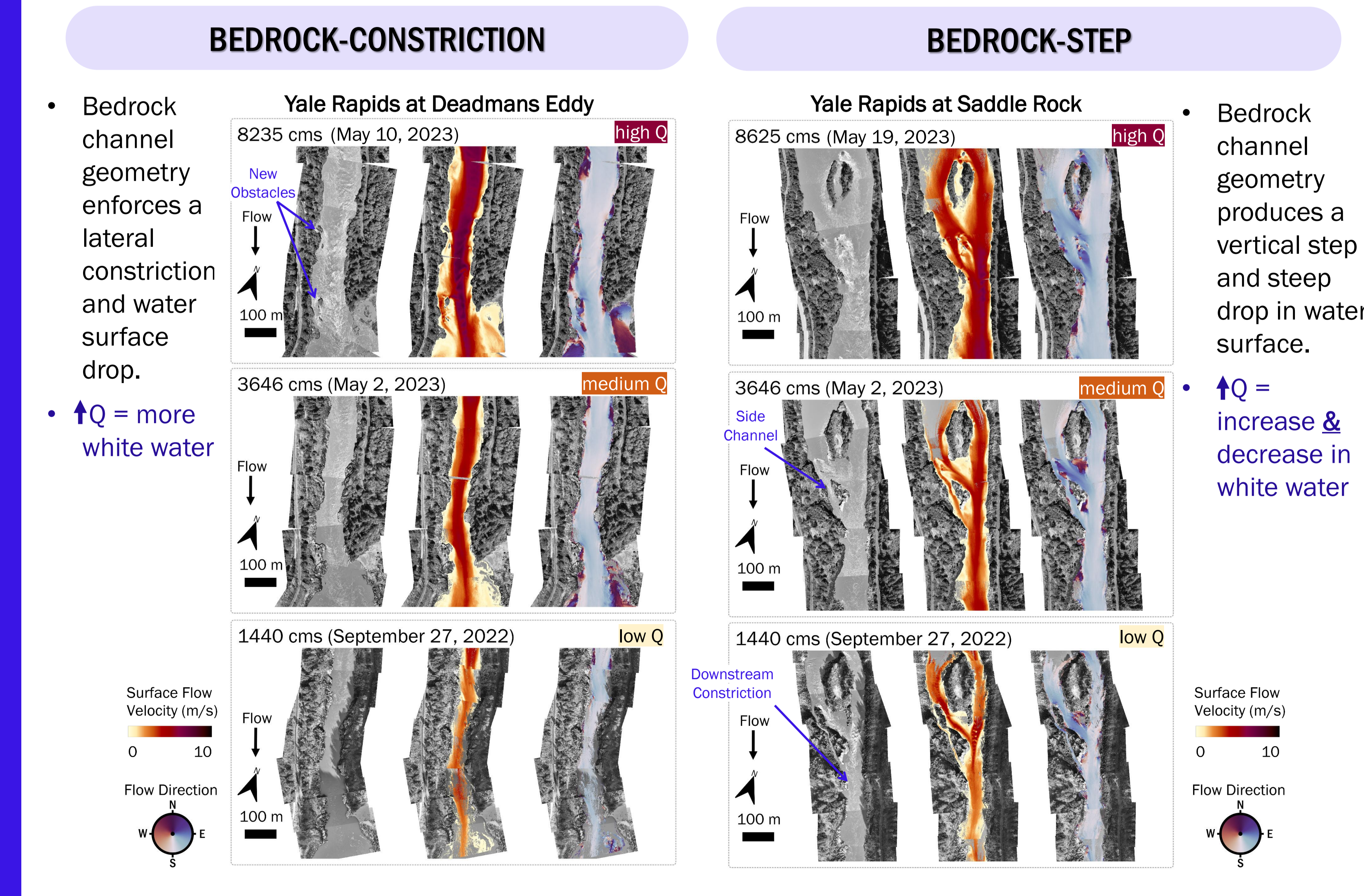
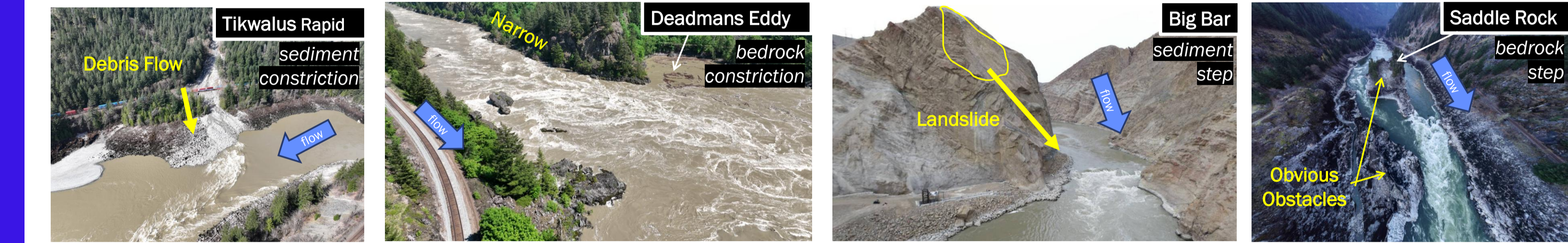
Velocity (PIV & ADCP)

Topography (MBES, SfM LiDAR)

Local Knowledge Holders

Indigenous Groups

Rafting Guides



Next Steps

- What causes the observed differences between rapid subcategories, and what controls their distribution?
- Distribution of Subcategories
 - Map rapid locations and their subcategories in more bedrock rivers.
 - Look for patterns in spacing/local channel characteristics (e.g. geology, water surface slope, Froude number).
- Flow Dynamics
 - Map flow features where we have repeat high resolution imagery.
 - Model changes with discharge in HEC-RAS.
 - Conduct flume experiments to constrain morphological thresholds for the development of rapid flow dynamics.

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