Investigating Changes to Bed Shear Stress in a Semi-Alluvial Channel Through a Mild Winter

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Presentation Outline

- Introduction/Background
- Research Motivation
- Research Objectives
- Study Reach Description
- Field Methods and Data Collection
- Findings and Conclusions

Flow and Boundary Conditions

Catchment Scale

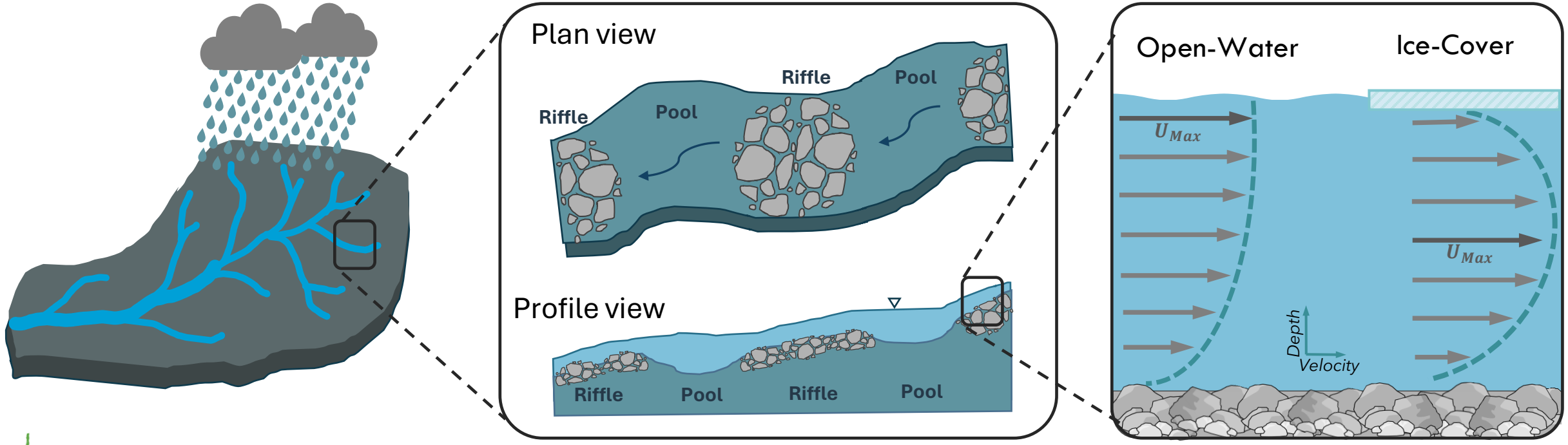
- Seasonal climate
- Runoff events
  - Rain-on-snow
    (Myers et al. 2023)

Reach Scale

- Geomorphic Units
  - Streamwise flow variability
    (Crowder & Diplas, 2000; Golpira, 2022)

Bed Scale

- Velocity depth profile
- Bed shear stress
  - Bed roughness & ice-cover
    (Smith et al., 2023; Chaitanya & Patel, 2024)



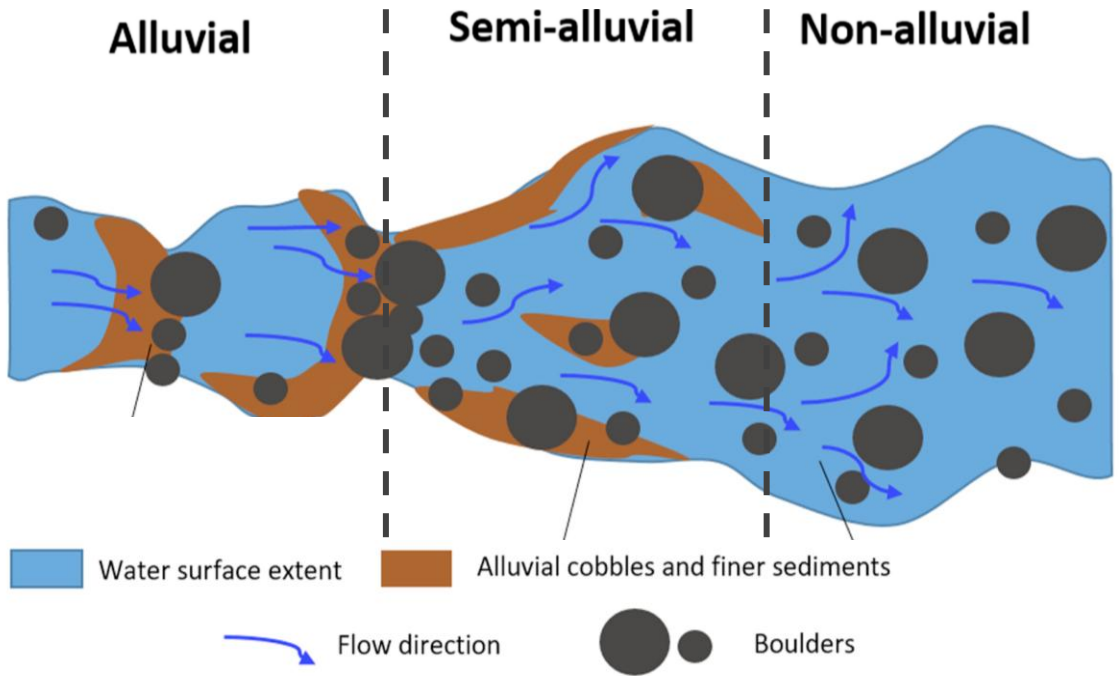
Research Motiviation

Hydrodynamic Research

- Predominantly experimental and modelling
- Field-based data are required for validation

Semi-Alluvial Channels

- Prominent throughout southern Ontario
- Underepresented in hydromorphodynamic research
- Rapid transition in surface roughness



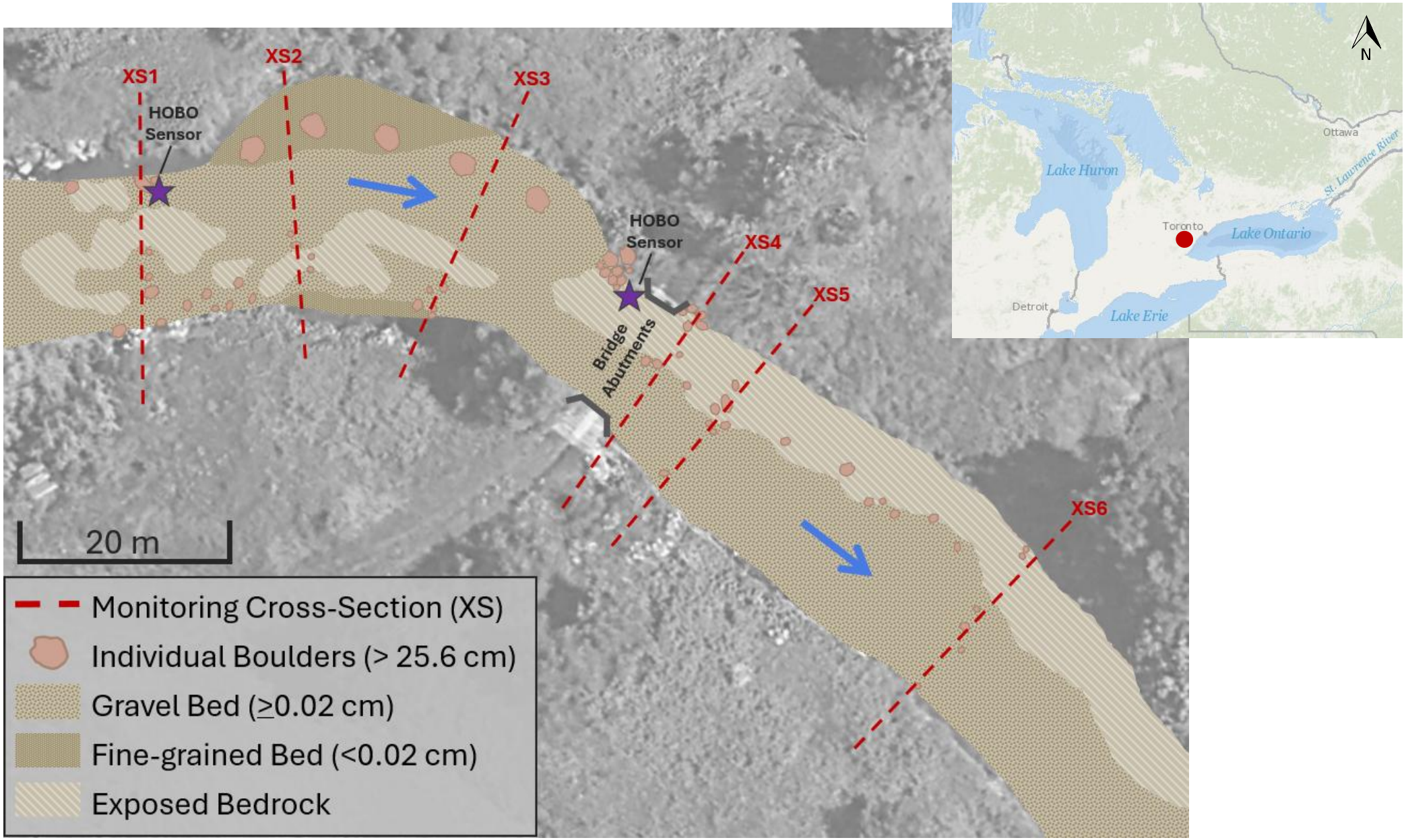
Morphodynamics of boulder-bed rivers (modified from Mason & Polvi, 2023)

Research Objectives

- Examine changes in velocity and bed shear stress in varying winter flow conditions

- Evaluate related changes over varying boundary conditions

Study Reach



Study reach in Sixteen Mile Creek

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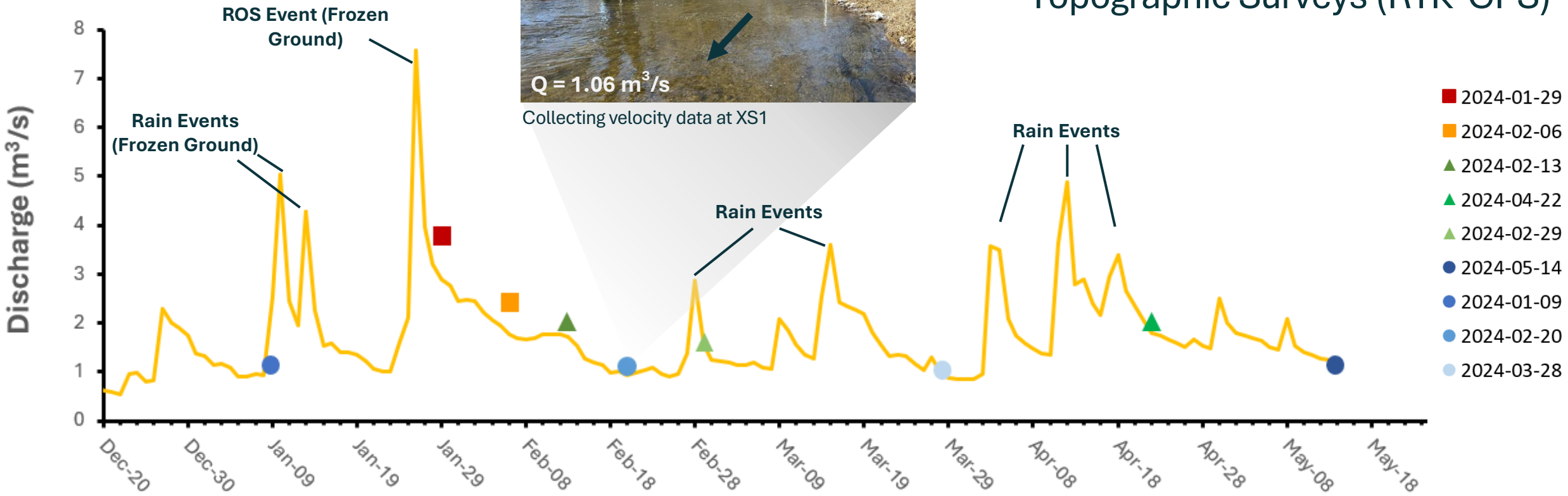
Field Methods and Data Collection

Performing a topographic survey

Collecting velocity data at XS1

- Continuous Monitoring
- Velocity Data (ADV)
- Morphological Characteristics (Pebble counts, Facies mapping)
- Topographic Surveys (RTK-GPS)



Daily discharge data from the WSC station in Sixteen Mile Creek

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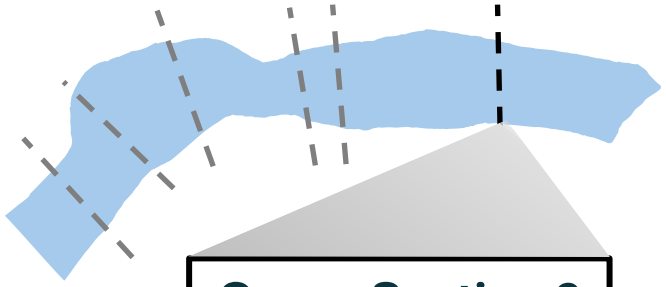
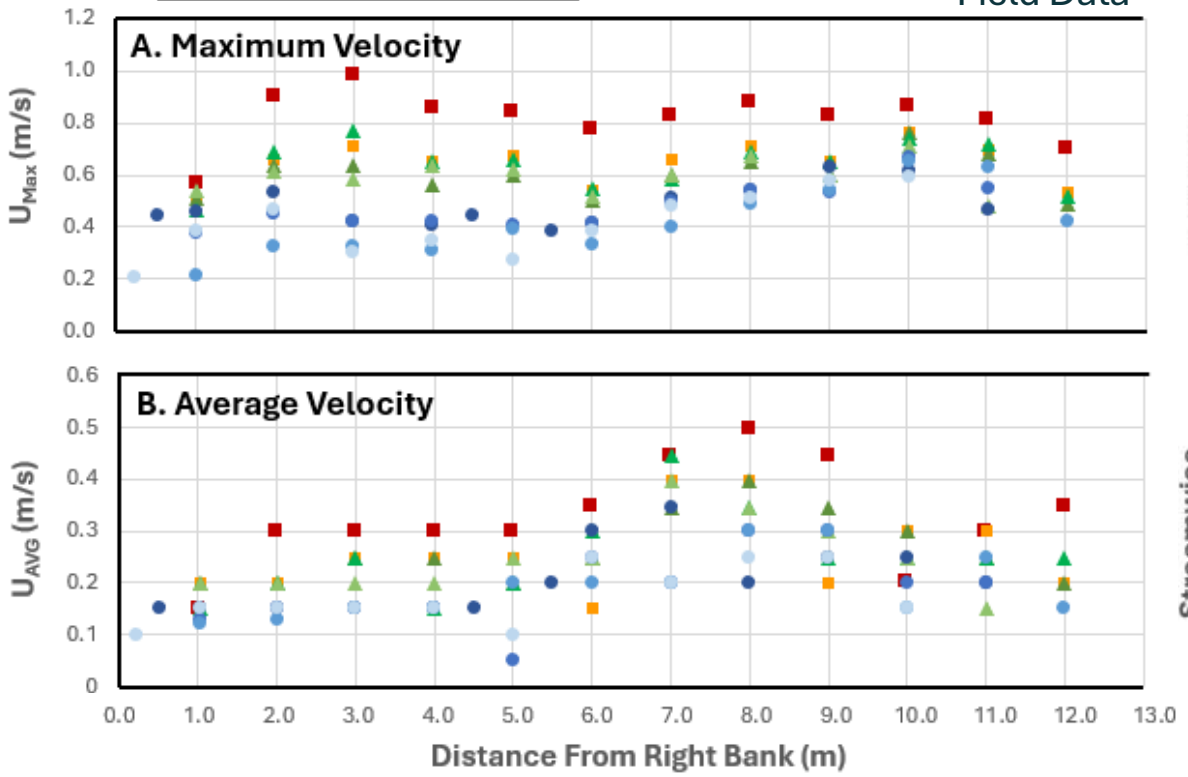
Example of Cross-Section Data

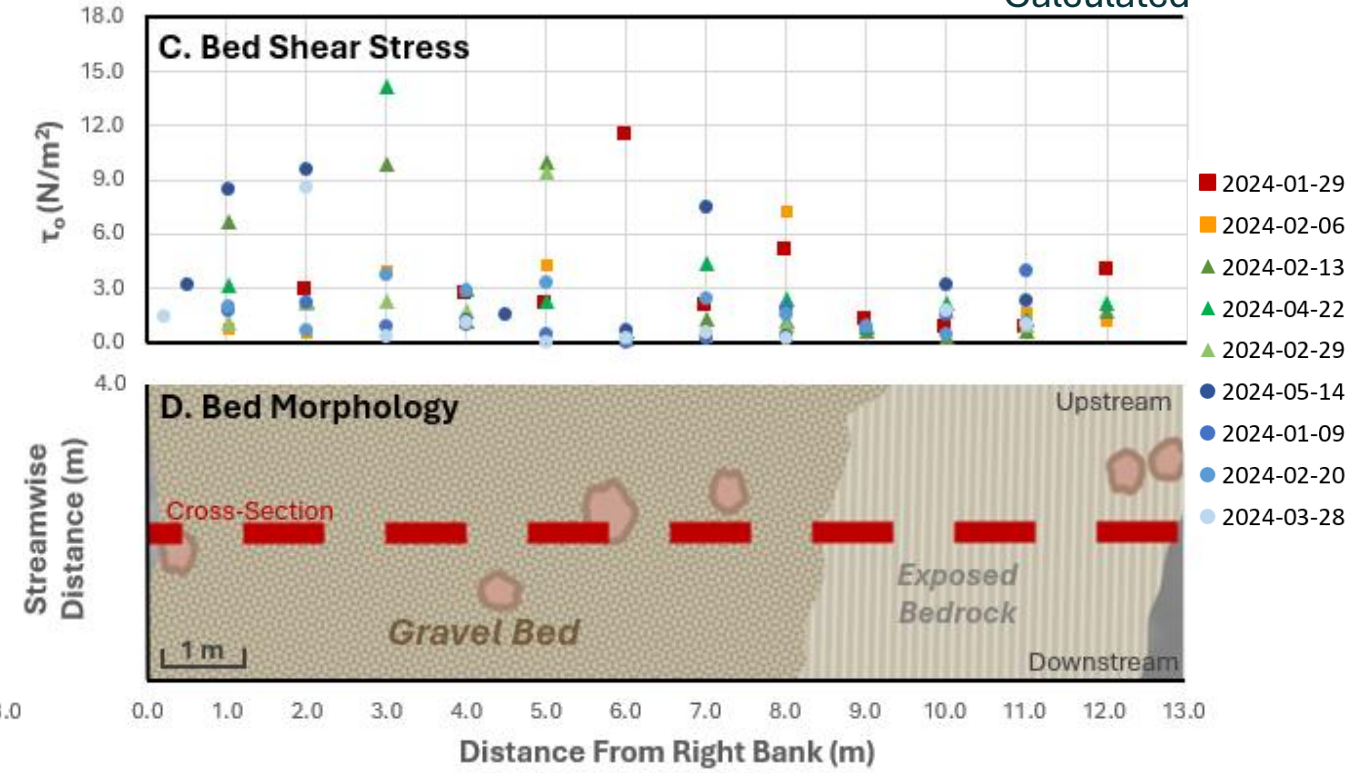


Cross-Section 6

Field Data



Calculated



Cross-section 6 velocity, bed shear stress and morphological characteristics.

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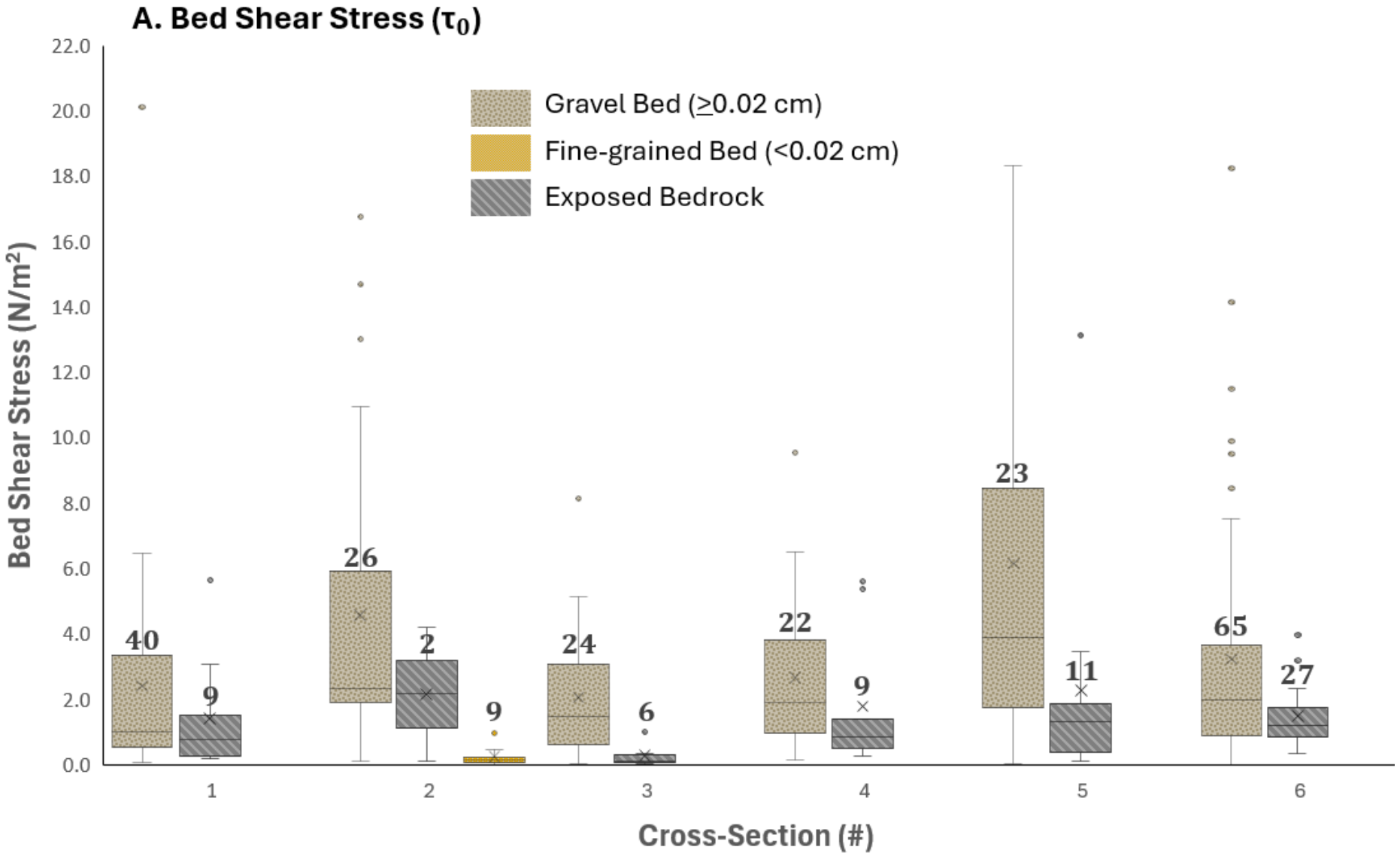
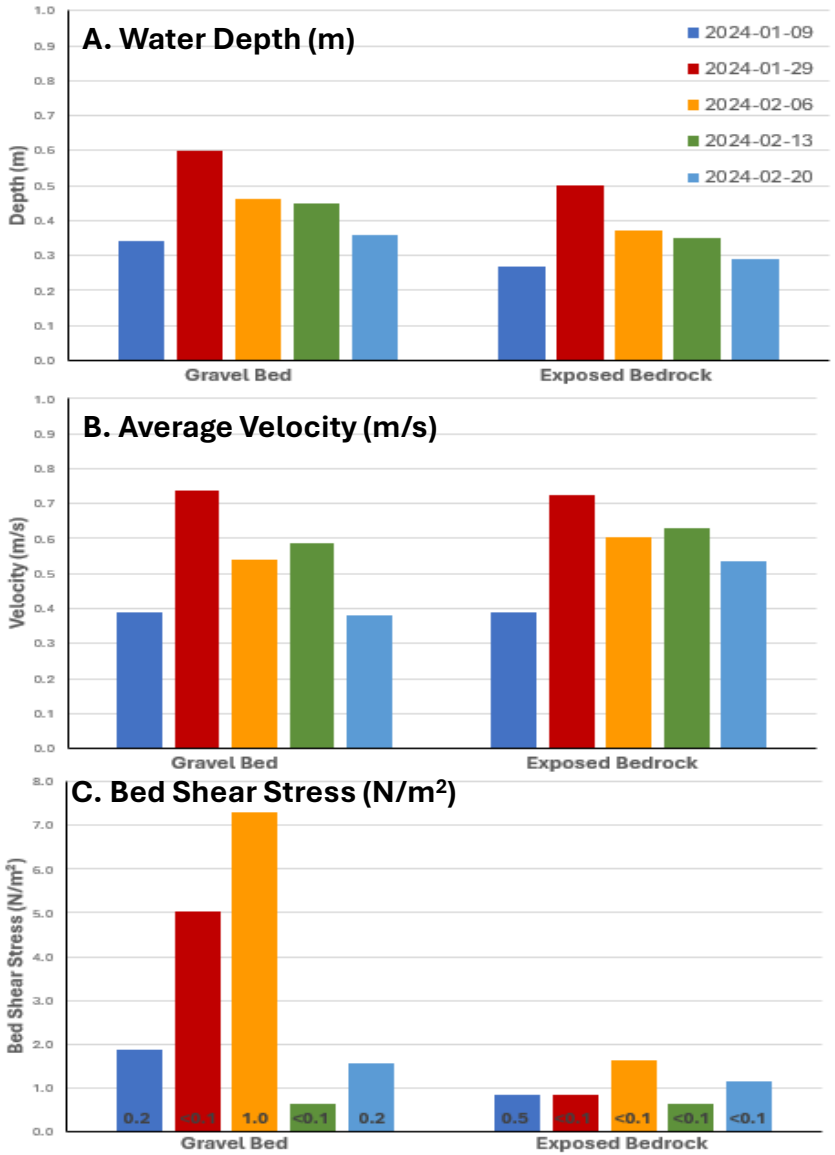
Bed Shear Stress Distribution

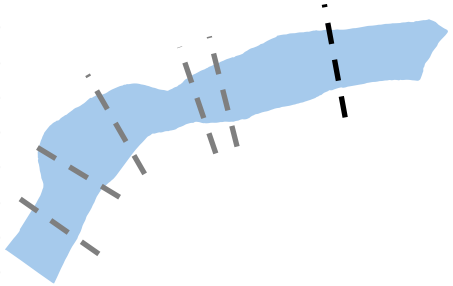


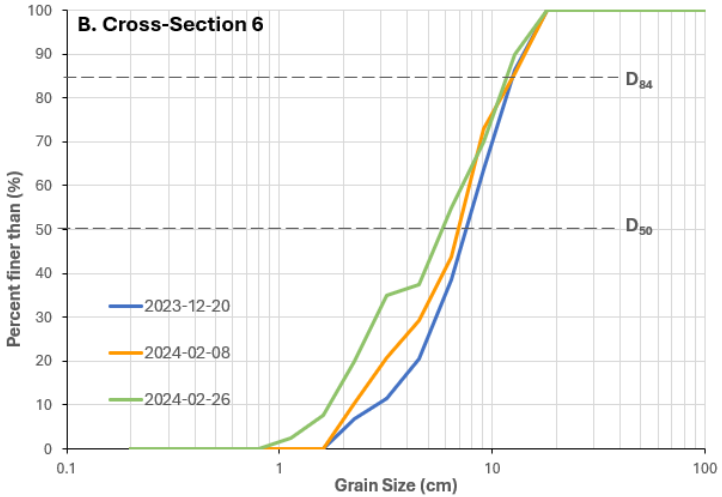
Bed shear stress estimates over various bed types for each cross-section.

Changes in Bed Shear Stress through a Runoff Event

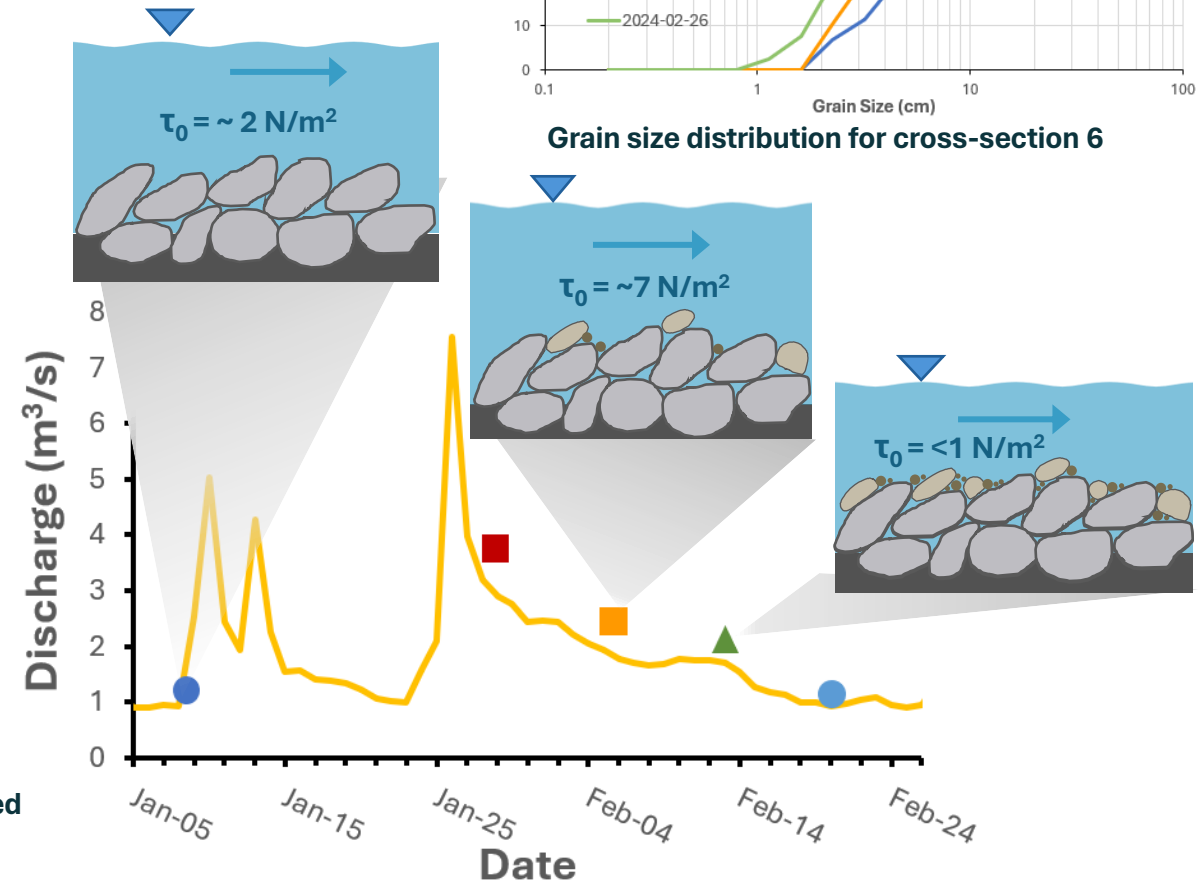


(A) Water depth, (B) average velocity, and (C) estimated bed shear stress over the gravel bed and exposed bedrock for cross-section 6





Grain size distribution for cross-section 6



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Summary and Conclusions

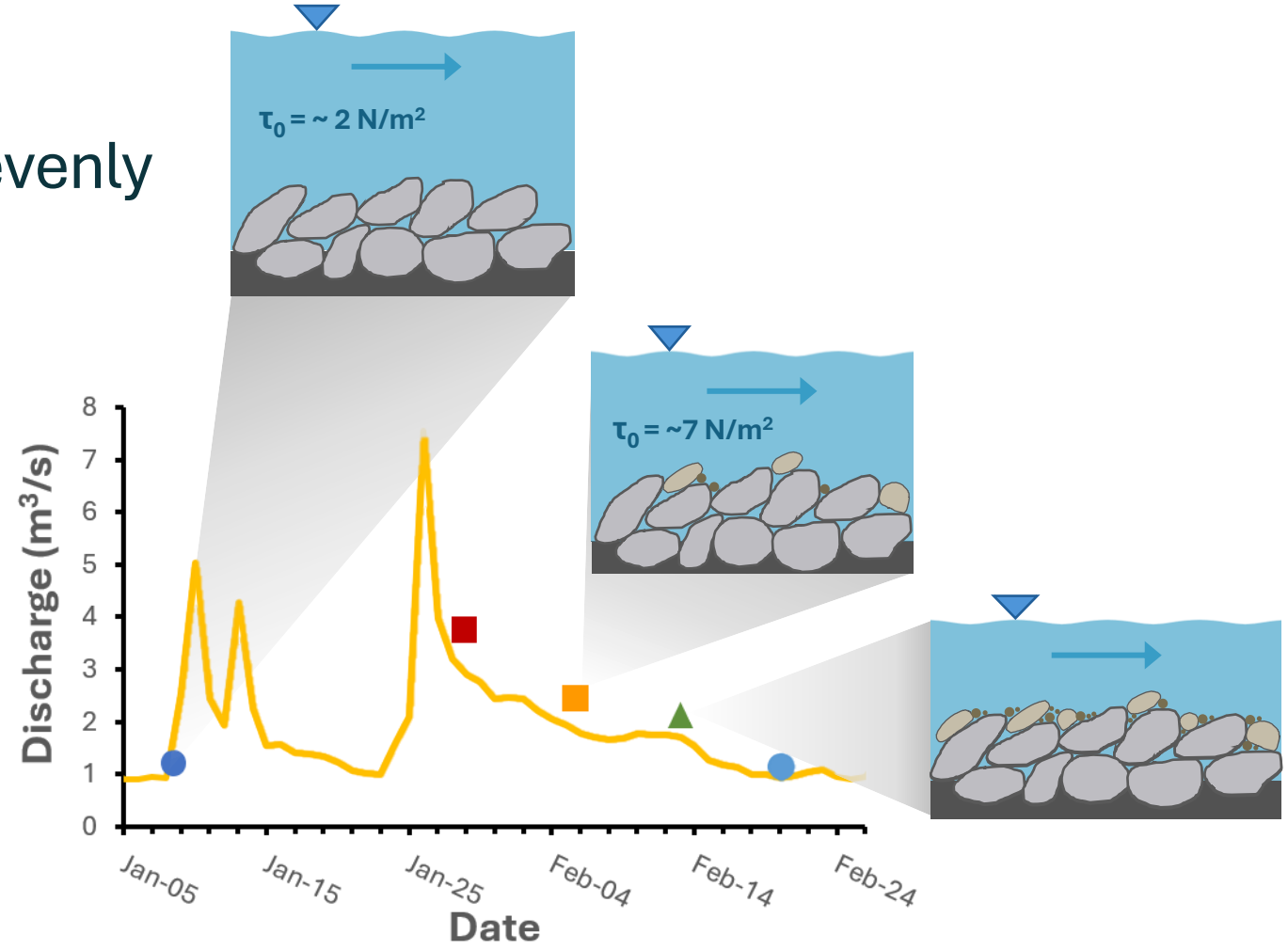
Bed shear stress is distributed unevenly

- Rough vs smooth

Winter runoff events reorganize channel bed

- Gravel infilling

The findings serve as a baseline milder winters



Thank You

Publication Link

References

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