



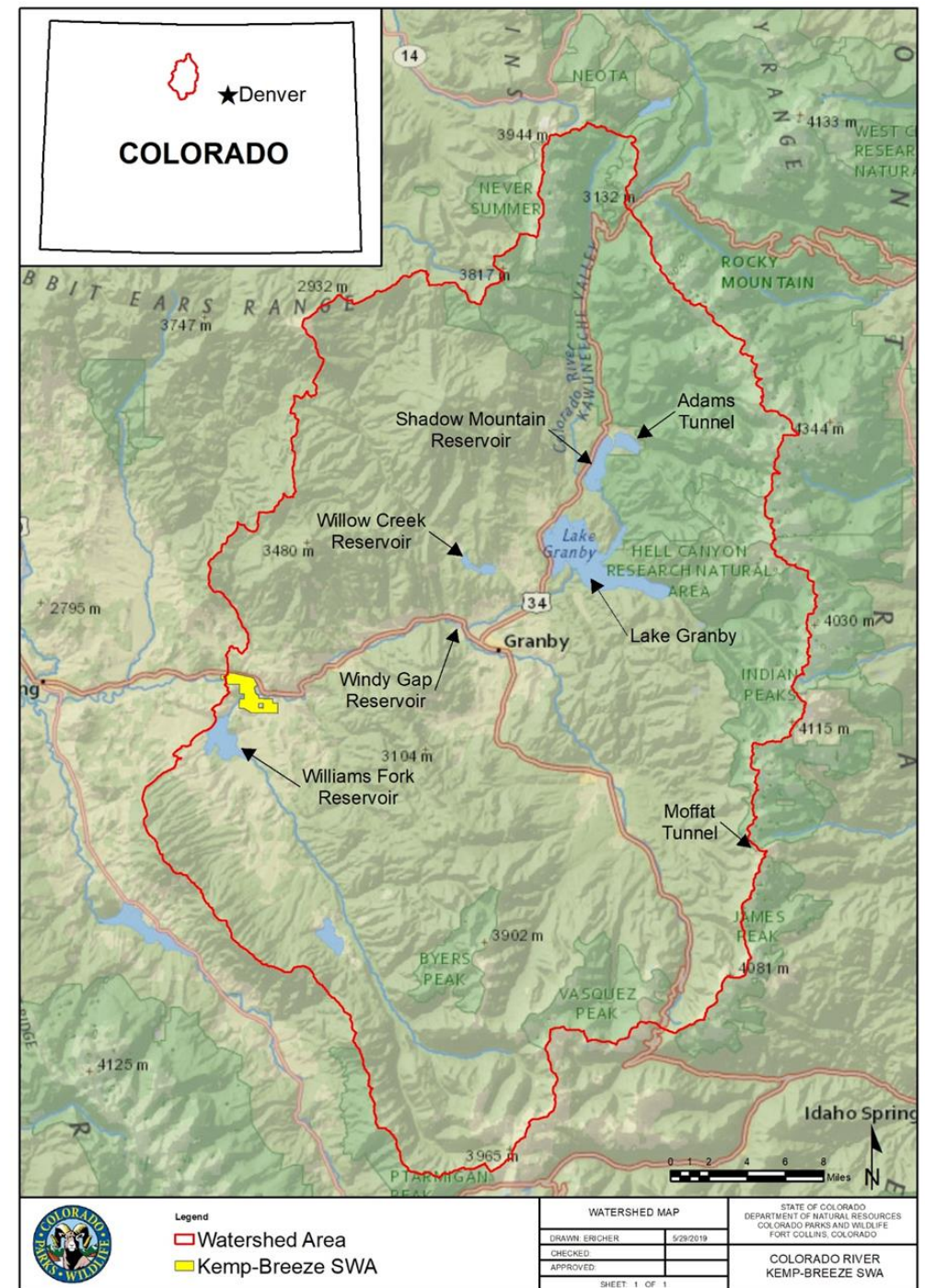
Kemp-Breeze Aquatic Habitat Project Colorado River

Eric Richer and Johannes Beeby



Project Background

- Fish and Wildlife Mitigation and Enhancement Plans
 - Windy Gap Firming Project
 - Moffat Firming Project
- Degraded aquatic habitat
 - Salmonfly
 - Mottled Sculpin
 - Trout
- Habitat Project
 - 16.7 miles
 - Budget = \$4.5-7.5 million
 - Kemp-Breeze State Wildlife Area (1.5 miles)



Preconstruction

Q 1.5 = 1,300 cfs

Slope = 0.3%

Width = 155 ft

Sinuosity = 1.1

D50 = 110 mm (cobble)

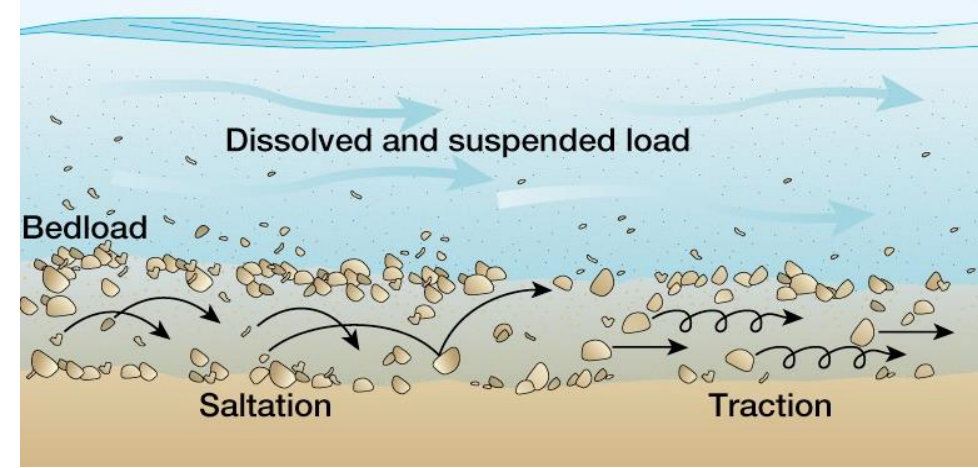
Q effective = 4,500 cfs

Project Goals

- Improve sediment transport processes
- Improve floodplain connectivity
- Restore and enhance riparian corridors
- Improve habitat for Mottled Sculpin and Salmonflies
- Improve the quality and diversity of trout habitat
- Restore benthic macroinvertebrate populations

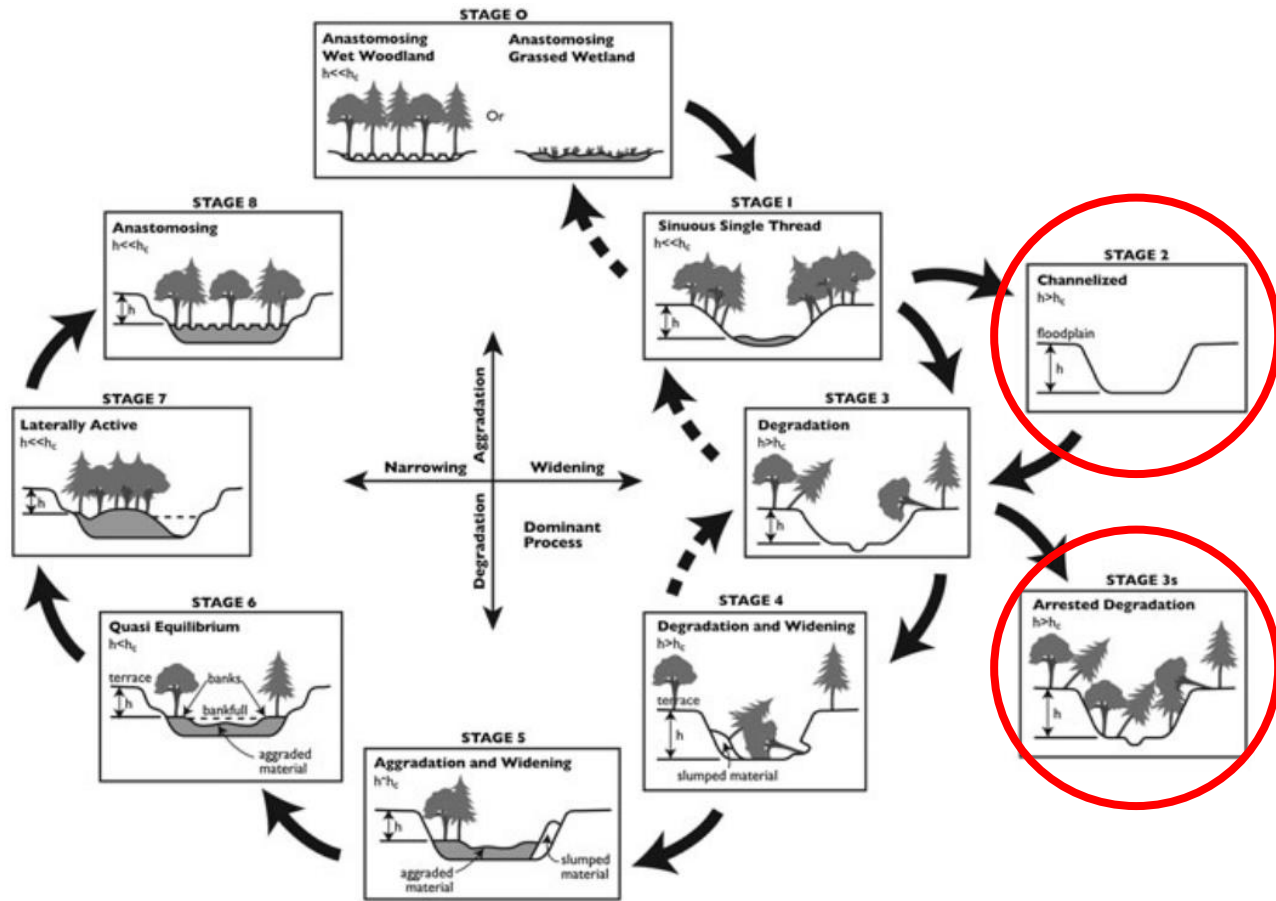
Objectives

- Increase sediment transport capacity and competence by manipulating channel dimensions
- Decrease the prevalence of fine sediment and reduce embeddedness within riffle habitats
- Increase the frequency of flushing flow events in riffle habitats under the future flow regime by manipulating channel dimensions
- Activate floodplains with a frequency of 1-3 years under the future flow regime
- Increase the density of native riparian vegetation along streambanks and floodplains to increase flood resilience and improve wildlife habitat
- Increase the density of Mottled Sculpin and Salmonflies within the project reach
- Increase trout population biomass (lbs/acre) and quality (# of fish > 14"/acre)
- Increase Rainbow Trout reproduction (fry density) and recruitment (adult density)
- Increase habitat suitability and diversity for Rainbow Trout, Brown Trout, and Mottled Sculpin by improving instream hydraulics
- Increase the abundance, distribution, and diversity of benthic macroinvertebrates



Stream Evolution Model

Geomorphology



Ecosystem Benefits



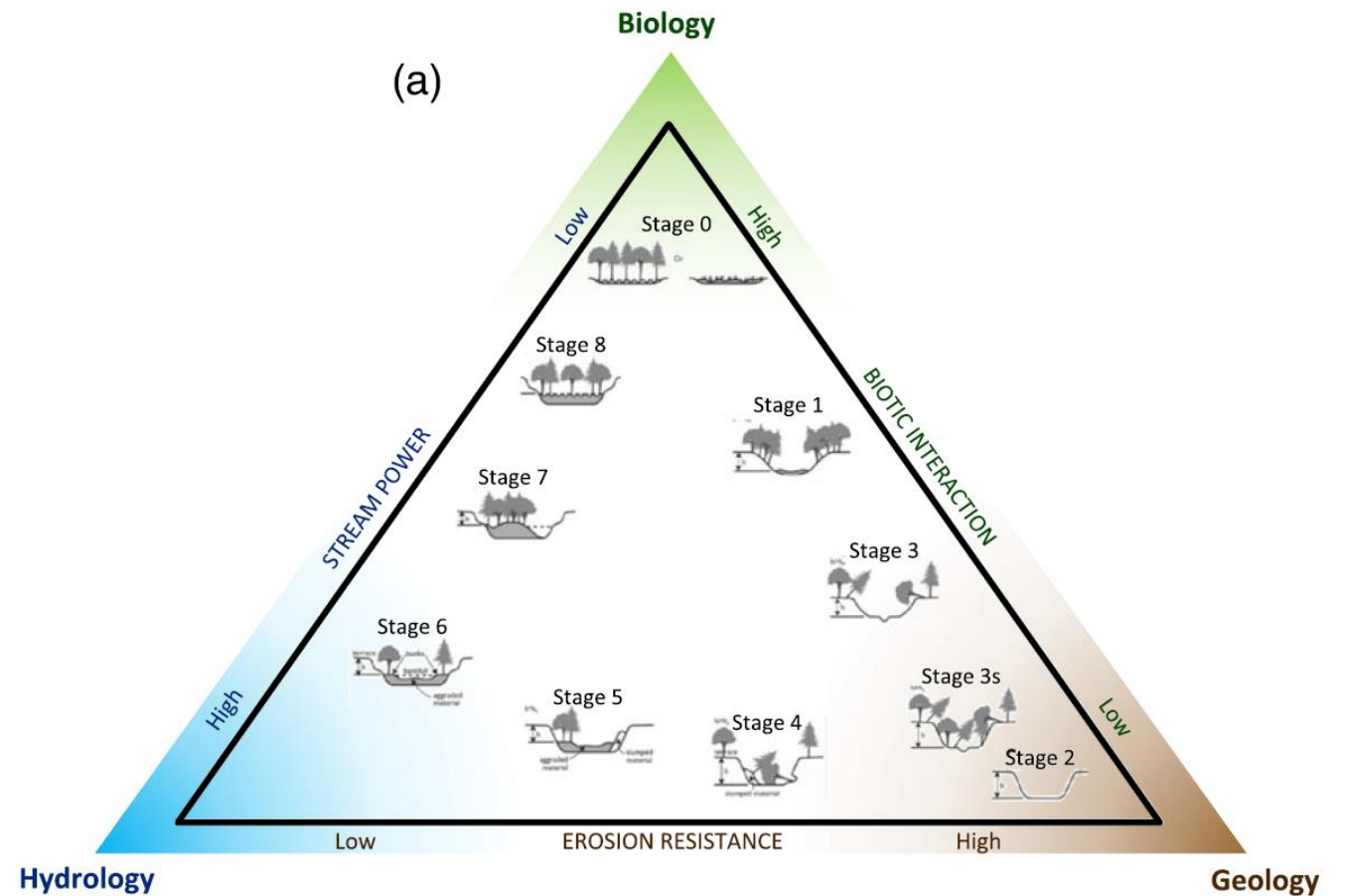
Historical Aerial Comparison



Process Domains

- Geology
 - Sediment supply
 - Channel armoring
- Hydrology
 - Flow regulation
 - Decreased peak flows
 - Stable baseflows
- Biology
 - Loss of wetlands
 - Decreased wood supply
 - Decreased beaver activity

Stream Evolution Triangle



Design Criteria

- Channel narrowing
- Riffle habitats
- Bedform and habitat diversity
- Riparian vegetation
- Large woody material

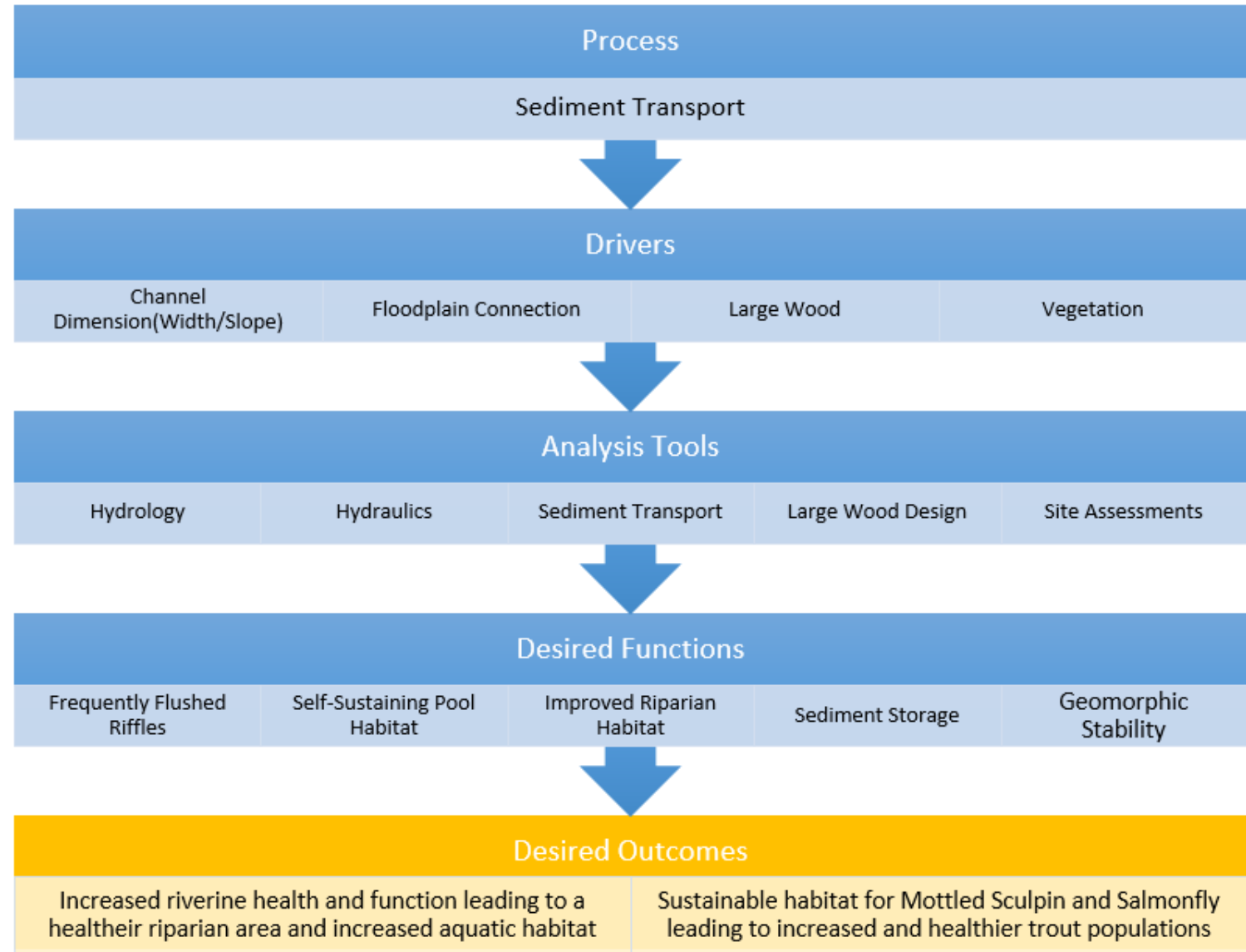


CONSIDERATIONS WHEN SELECTING RESTORATION APPROACHES AND TREATMENTS

When selecting a restoration approach and treatment, water managers and restoration practitioners weigh the following factors. Passive recovery and low-tech active recovery projects fall toward the left and middle of these spectrums, while high-tech active recovery work is on the right side.



Restoring Sediment Transport Processes



Active Restoration

Treatments

- Channel narrowing (multi-thread and single)
- Riffle grading/de-armoring
- Floodplain connection
- Large wood structures

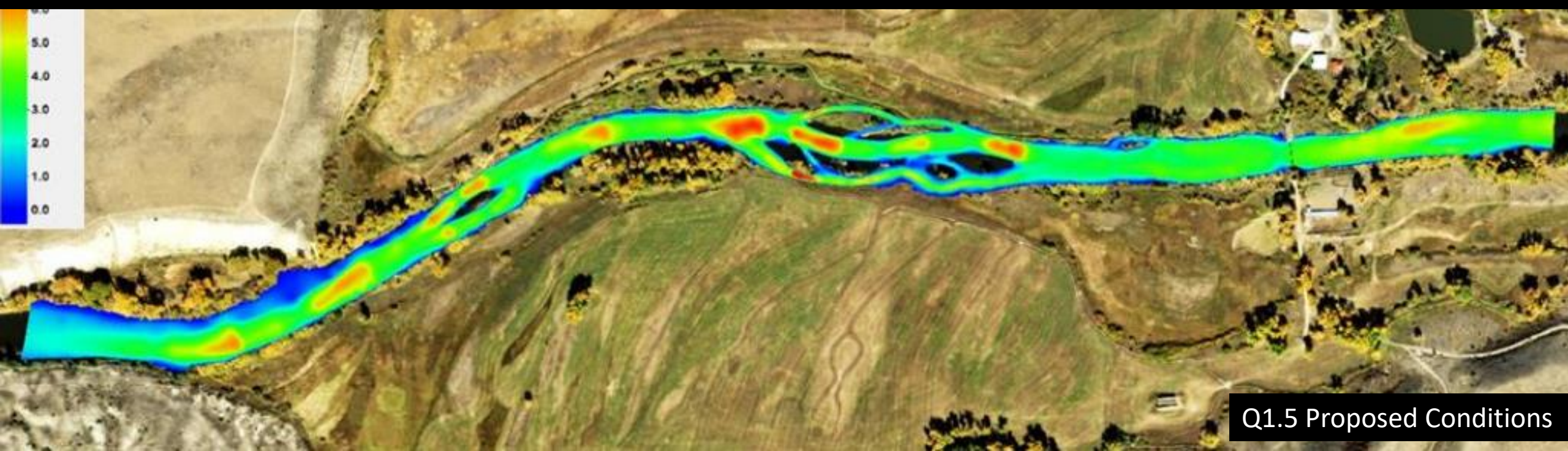
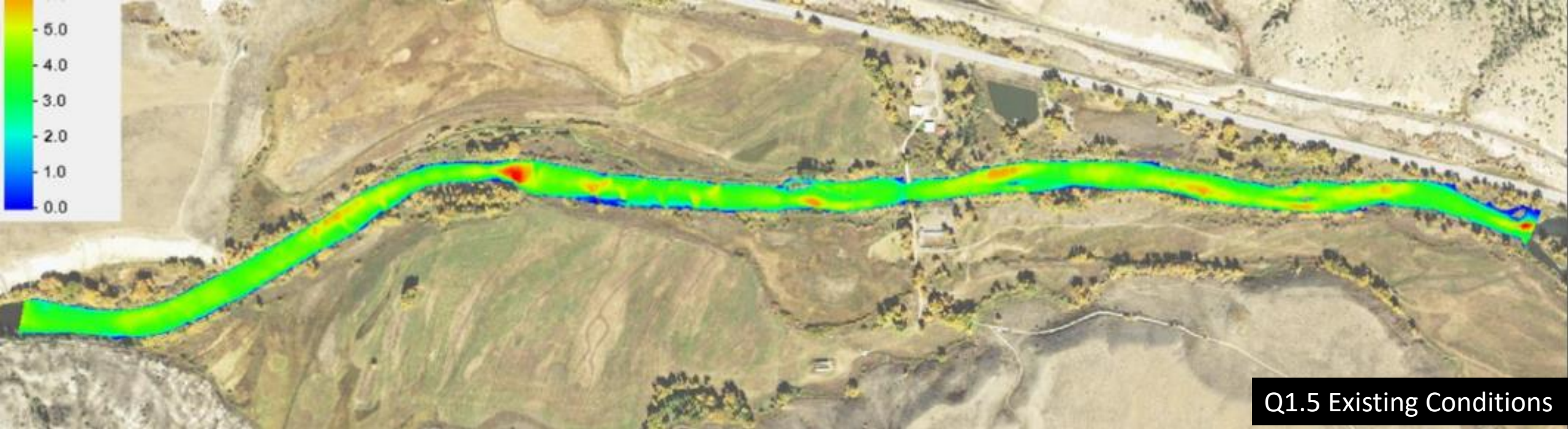
Quicker results/ more effort in short-term/ less uncertainty

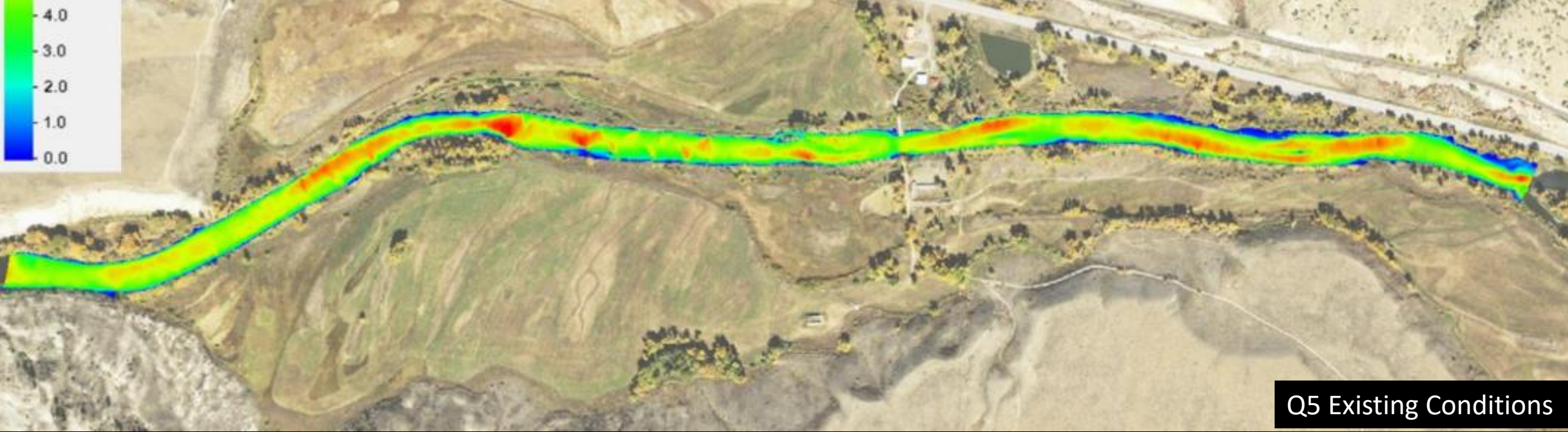
Passive Restoration

Treatments

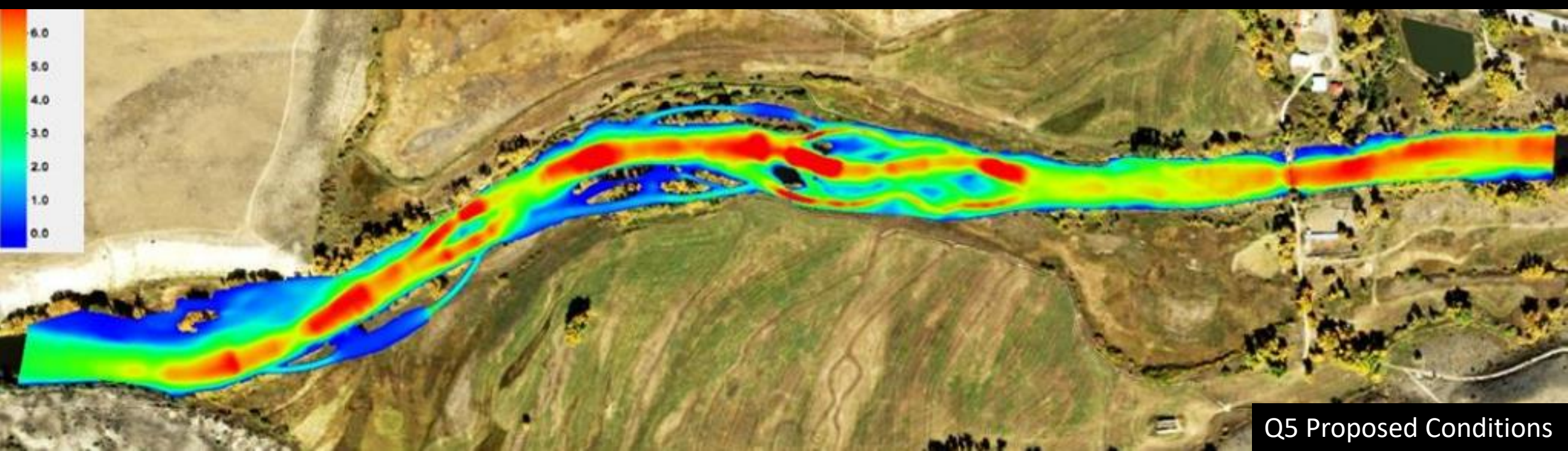
- Large wood structures
- Gravel augmentation (longer-term)
- Adaptive management

Slower results/ more effort in long-term/ greater uncertainty





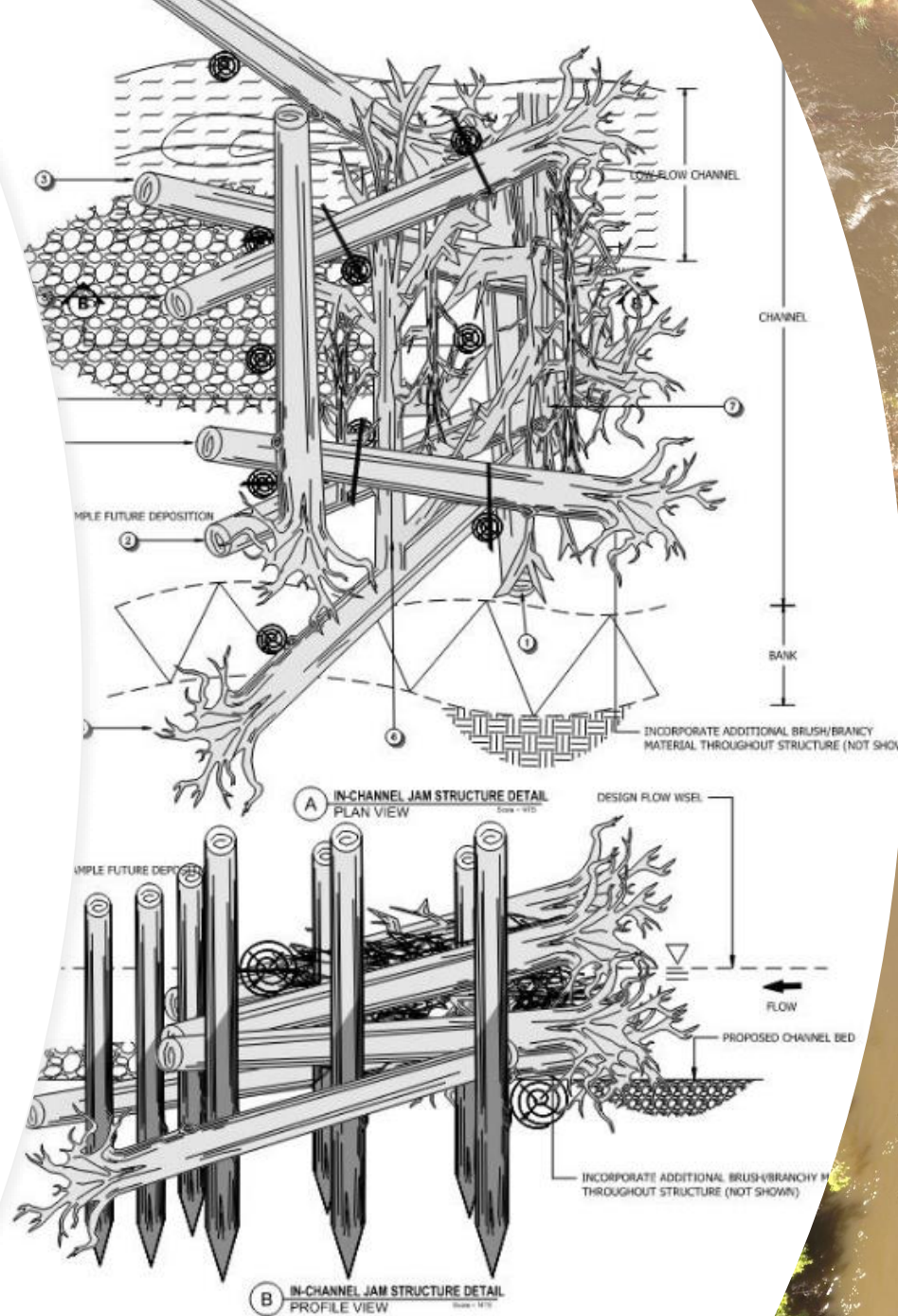
Q5 Existing Conditions



Q5 Proposed Conditions

Wood Structures

- Channel narrowing and riffle flushing
- Complex habitat
 - Pool Scour
 - Overhead cover
 - Diverse velocity and depth regimes
- Sediment storage
 - Bar and island formation
- Bank erosion for sediment supply



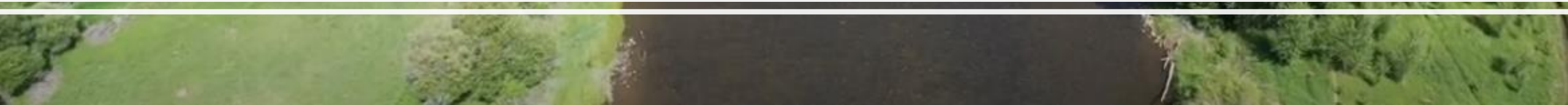
Gravel Augmentation

- To provide sediment supply through time
- Channel narrowing through time
- Reduce bed armoring by supplying full gradation





Drone Videos



A photograph of a rocky, sandy ground with several green plants growing in the crevices. The word "Questions?" is overlaid in white text in the center.

Questions?