

Some Principles of Restoring Channel and Floodplain Systems

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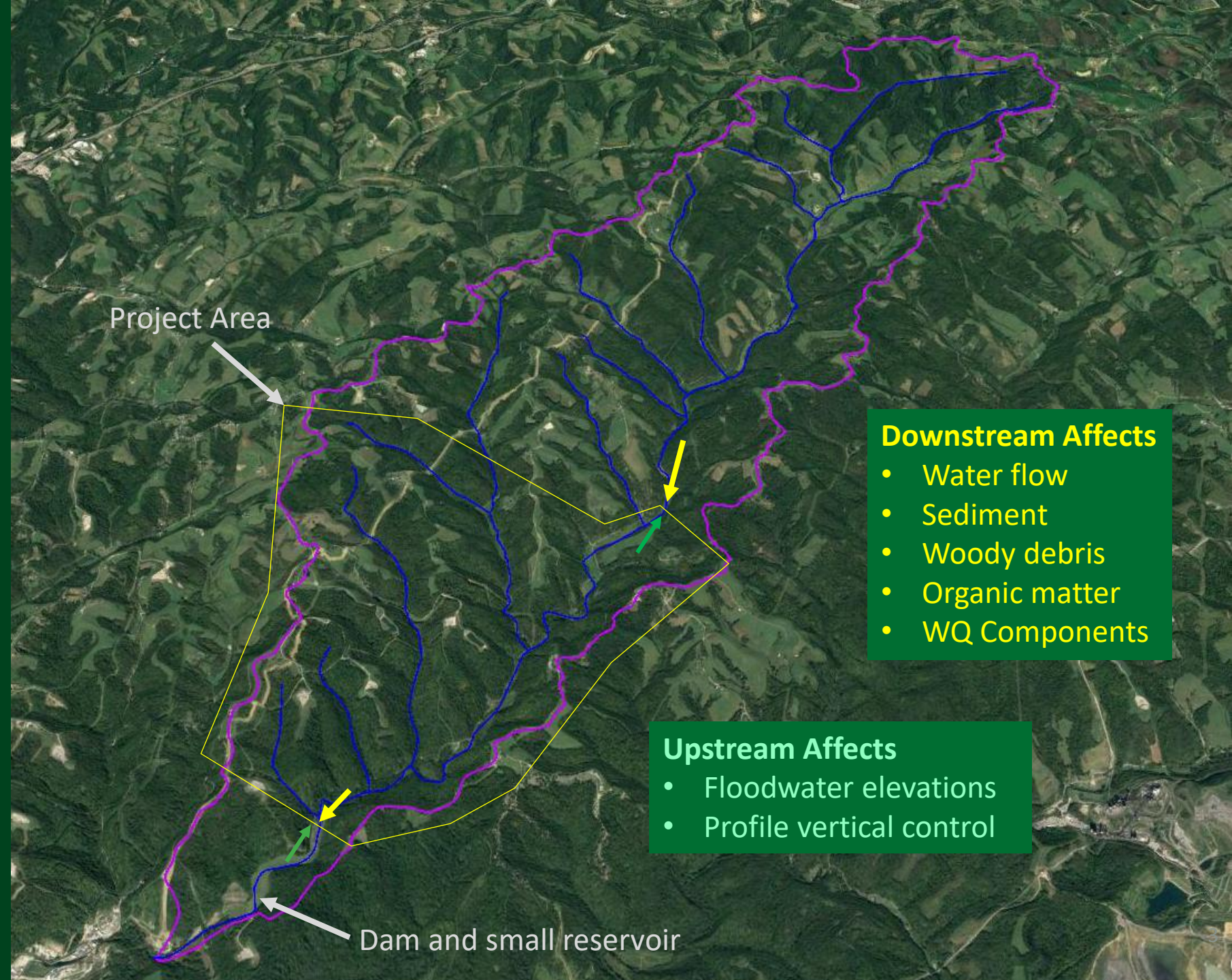


Some Principles of Restoring Channel and Floodplain Systems

- **Watershed Perspective and Channel-Floodplain Network**
- **Functional References**
- **Current conditions and function loss**
- **Channel-Floodplain Systems Design**
- **Channel-Floodplain Dynamics**

Watershed Perspective and Channel-Floodplain Network

- How will the watershed and upstream network affect the project?
- How will the project affect the upstream and downstream channel networks?
- Design Limitations
- Transition Design



Project Area

Downstream Affects

- Water flow
- Sediment
- Woody debris
- Organic matter
- WQ Components

Upstream Affects

- Floodwater elevations
- Profile vertical control

Dam and small reservoir

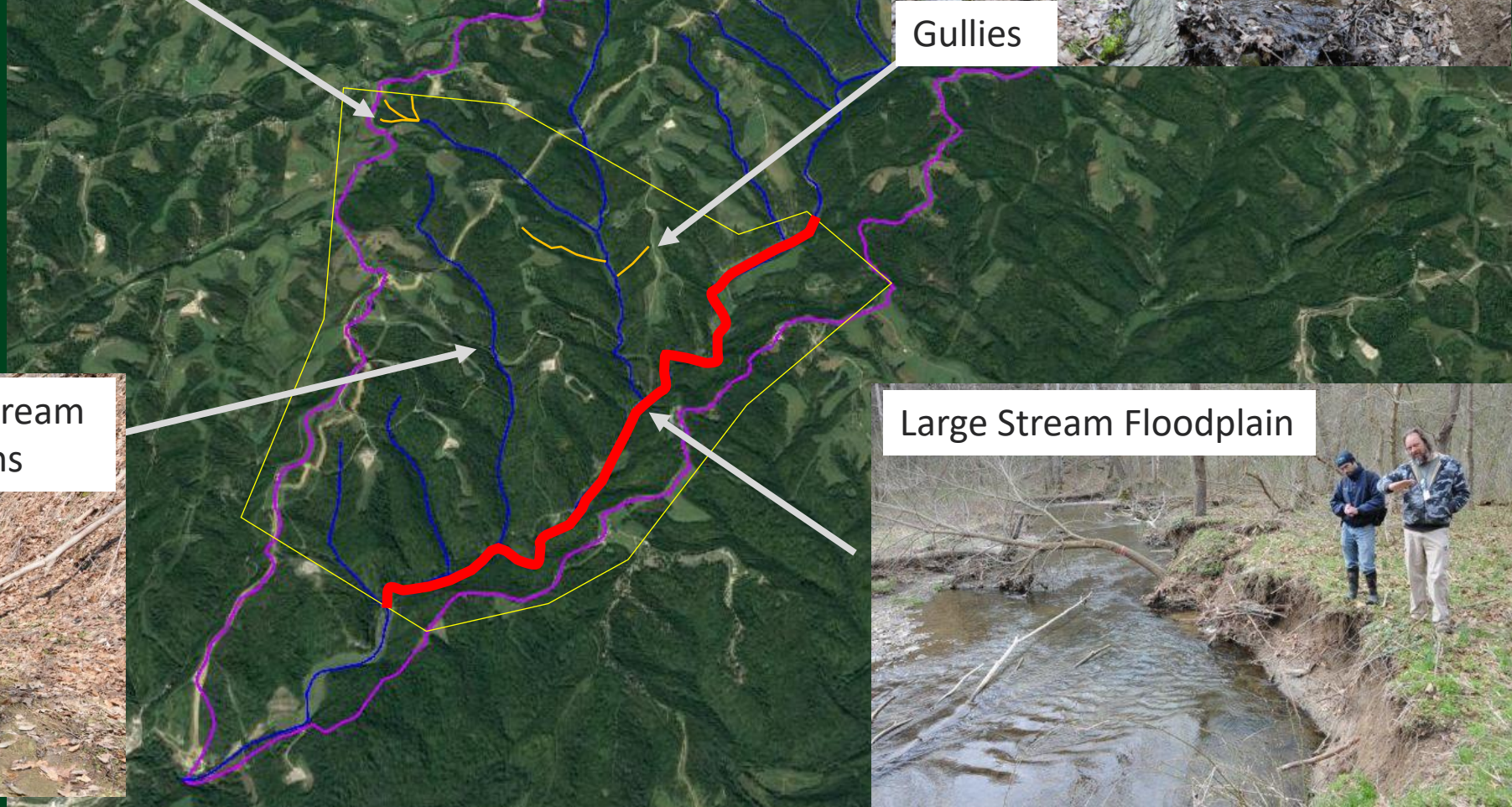
Watershed Perspective and Channel- Floodplain Network



Gullies



Gullies



Smaller Stream
Floodplains

Large Stream Floodplain



Historical Functional Reference Low Stress, High Groundwater, and Retentive System

- Low bank height
- Frequently inundated floodplain
- Channel connectivity to groundwater aquifer
- Floodplain vegetation root access to groundwater
- Infrequent substrate movement
- Retention of LWD and organic carbon



Floodplain Soils

**Cobble/
Gravel
Bed**

Bedrock

Impairment Channel-Floodplain System

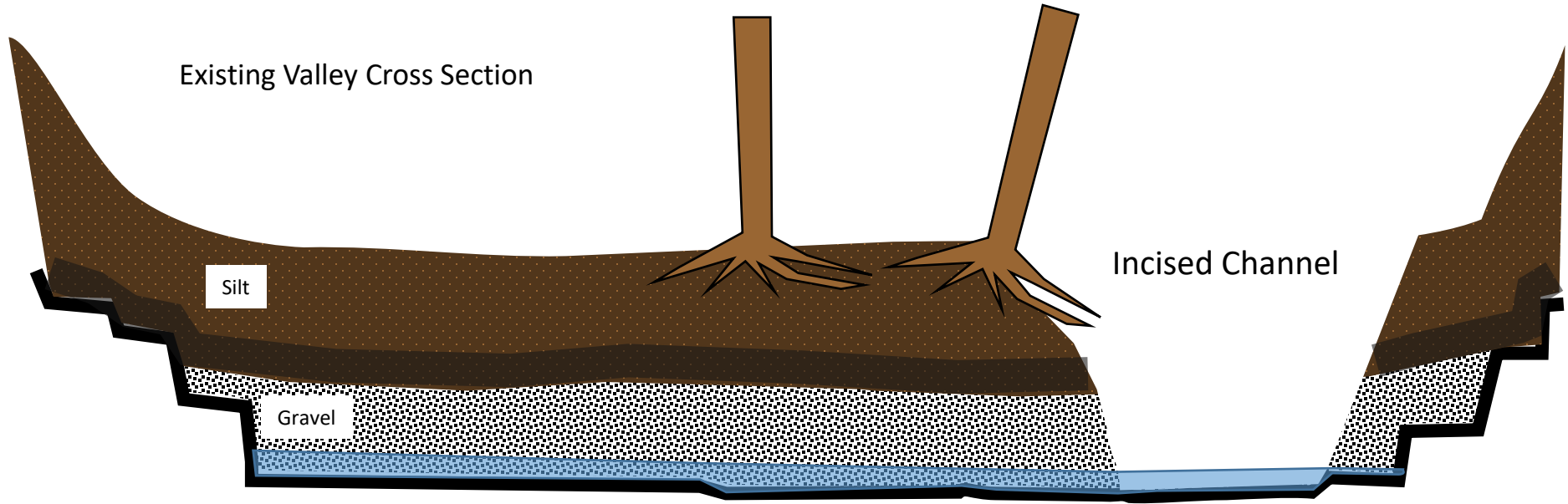
High-Stress Export System

- Incised Channel – High banks
- Scoured bedrock, frequently mobilized channel bed material, minimal retention of organics.
- Poor connectivity of channel to floodplain – infrequent flooding
- Poor habitat and habitat diversity
- Poor connectivity of the channel to the valley groundwater system
- Dry floodplain - No rootzone saturation

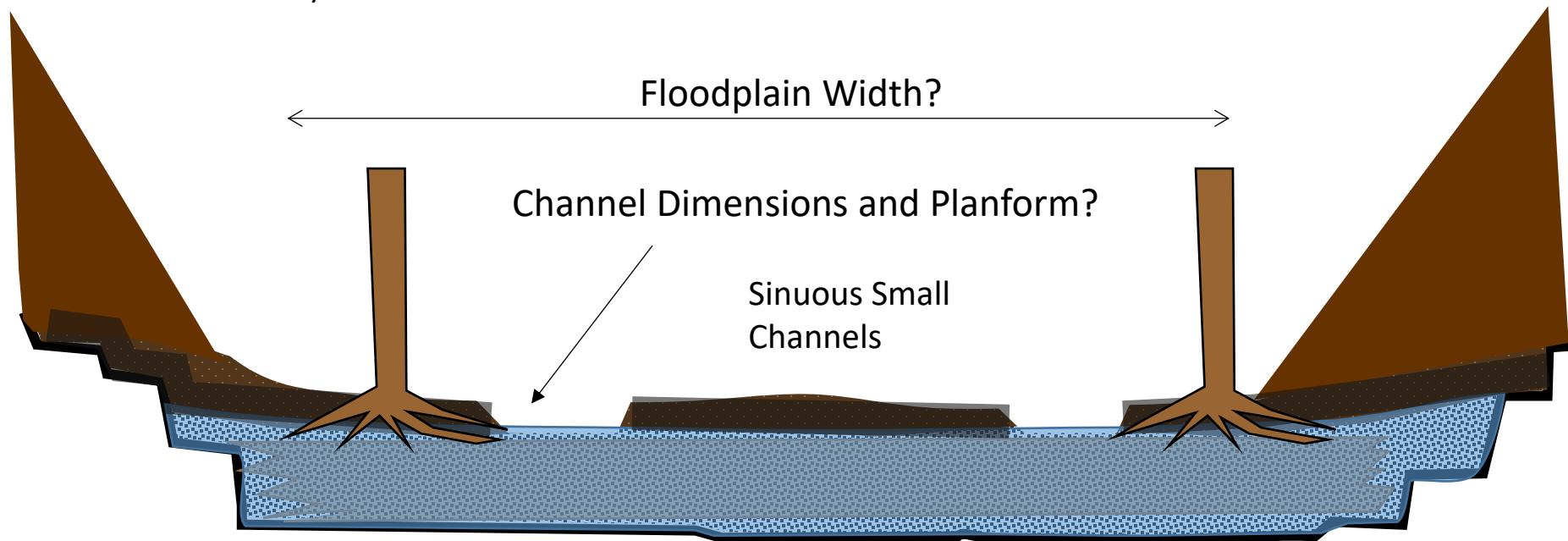




Existing Valley Cross Section



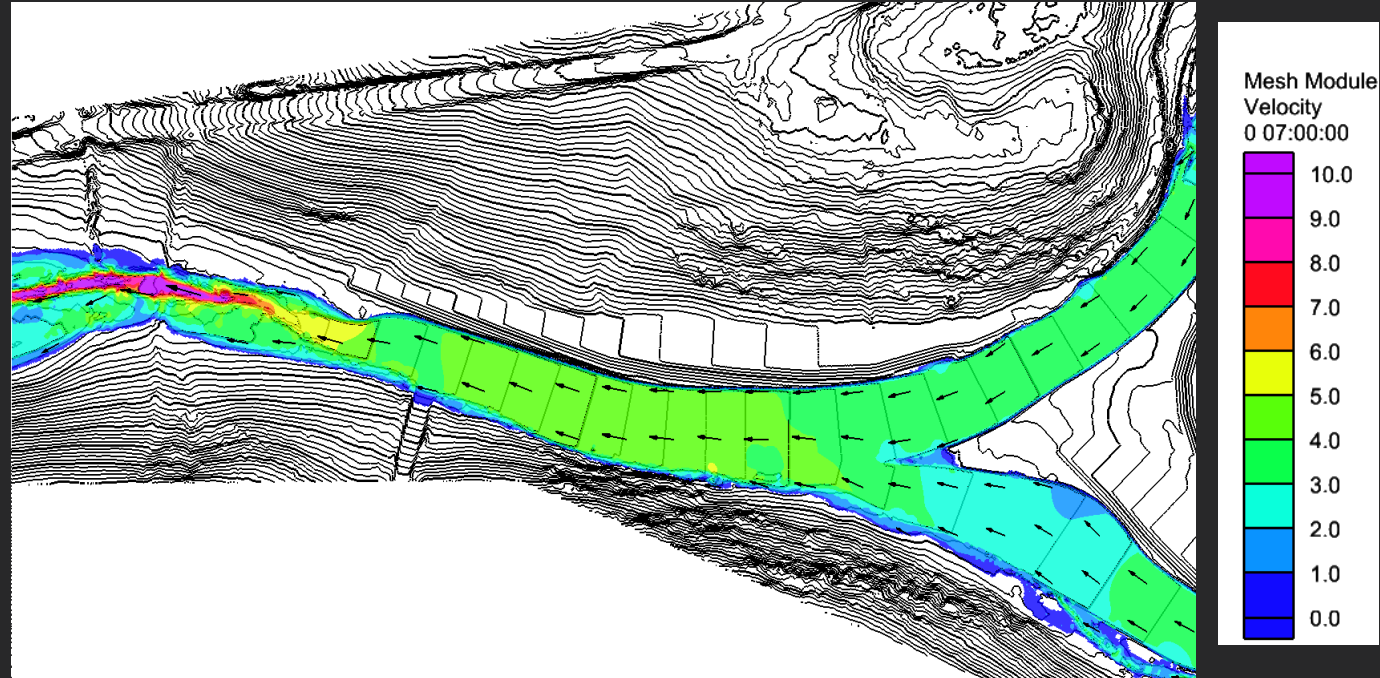
Restored Valley Cross Section

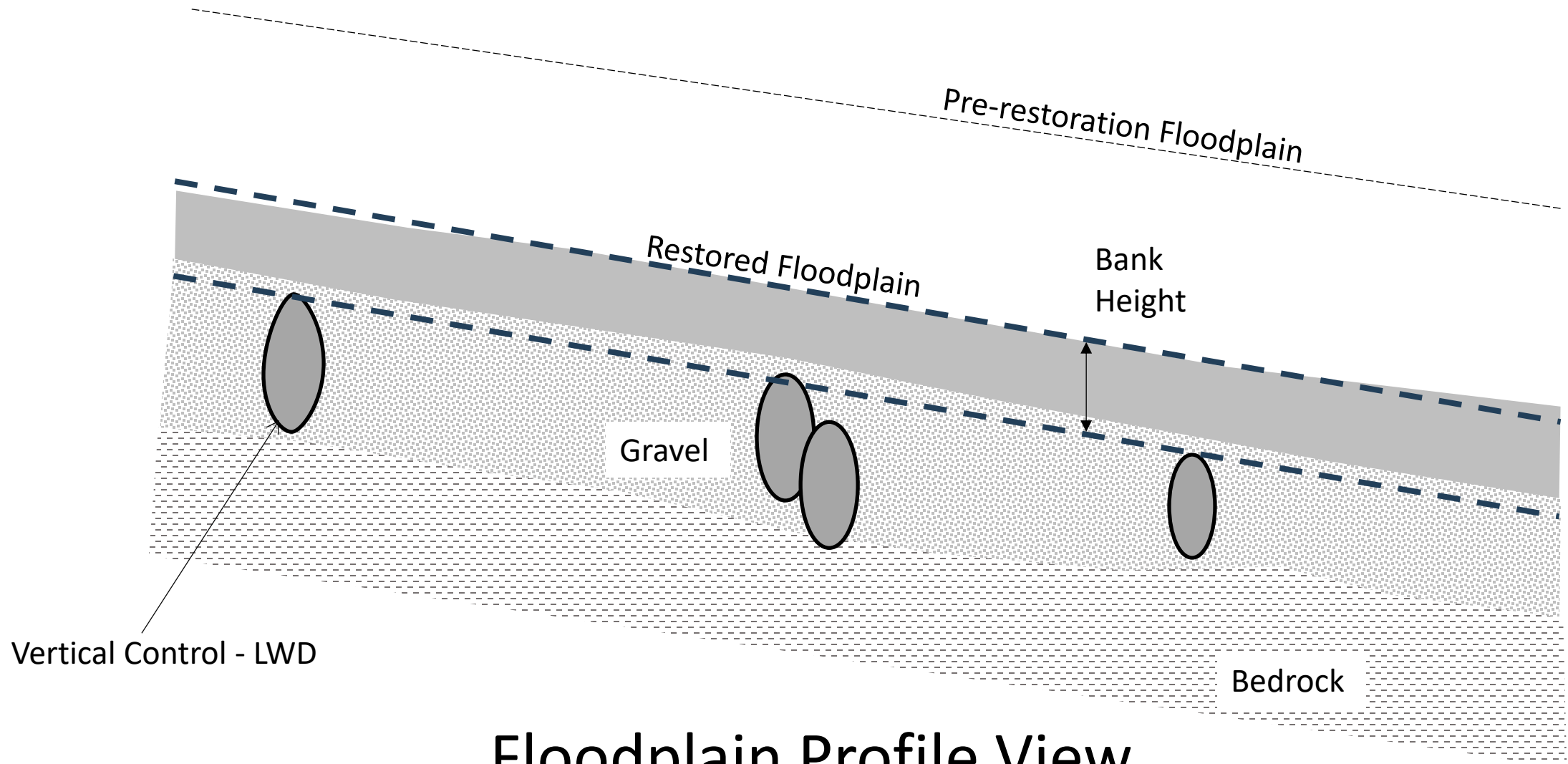


Floodplain Design

2D Hydrodynamic Model

- Floodplain width: based on the modeled 100-yr velocity patterns and magnitudes, and the type of profile controls.
- Floodplain Profile: Floodplain surface should parallel the surface of the gravel basal layer about one channel depth above.
- Cross-floodplain vertical control should be located at approximately the surface of the basal gravel layer.



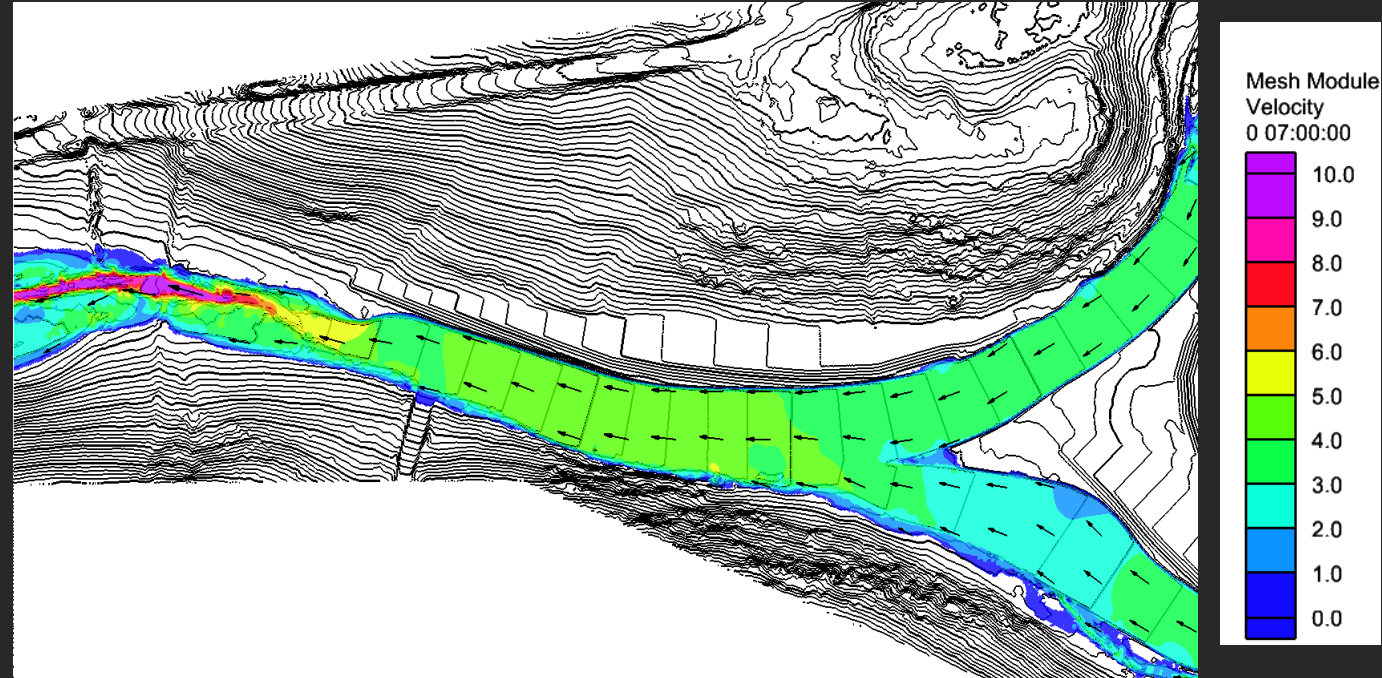


Floodplain Profile View

Floodplain Design

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2D Hydrodynamic Models



Self-Forming Channel Design

- Method 1: Initial Baseflow Channel – construct an initial sinuous baseflow channel and allow it and other channels to form and adjust with vegetation growth and floodplain woody debris
- Method 2: Stage Zero - place large density of woody debris on the surface of the floodplain and allow the channels to form around the placed debris. Very similar to stage zero restoration in Oregon.



Self Forming Channel Design

Method 1: Initial Baseflow Channel

- **Baseflow channel dimensions on the measured smallest channels at the same watershed size.**
- Sinuous channel across the valley with straight reaches angled to the valley CL. Planform sinuosity based on velocity thresholds and profile controls.
- Max Velocity Analysis: 2D Models at 2, 10, and 100 yr flows



Self Forming Channel Design

Method 1: Initial Baseflow Channel

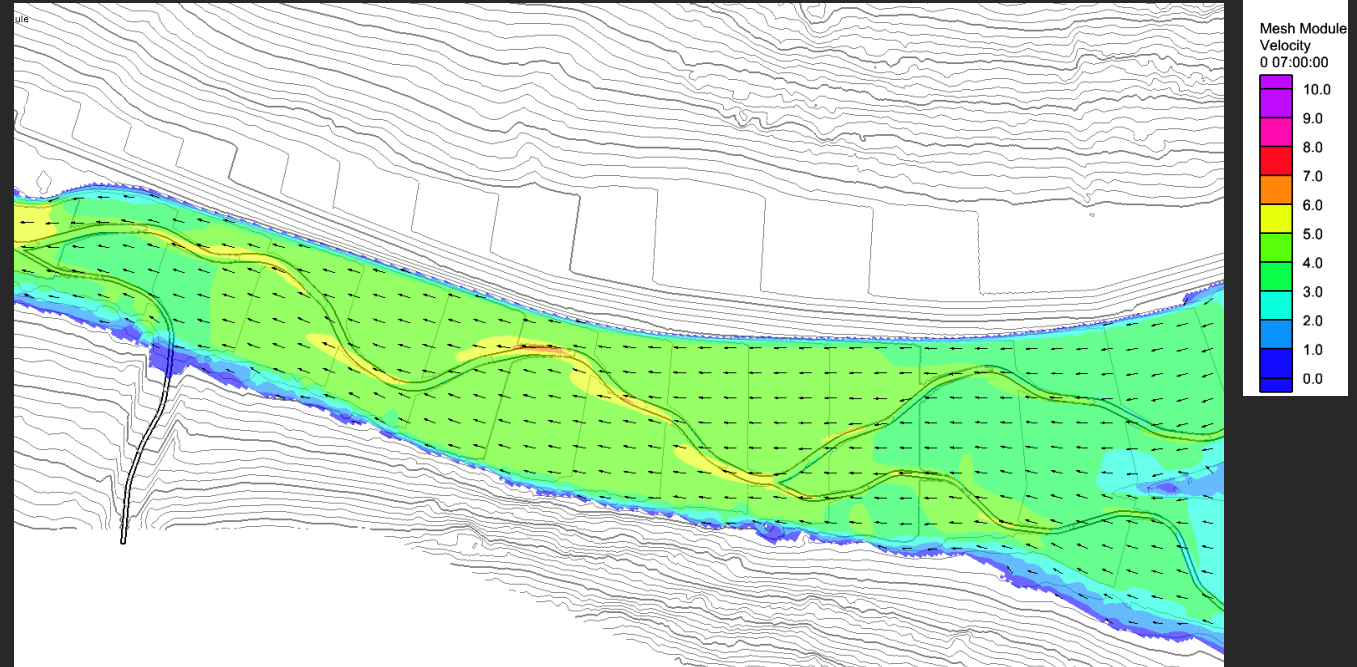
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Self-Forming Channel Design

Method 2: Stage Zero Approach

- Profile control wood subsurface
- Dense surface wood
- Allow channels to self form around surface wood



Ecological Objectives



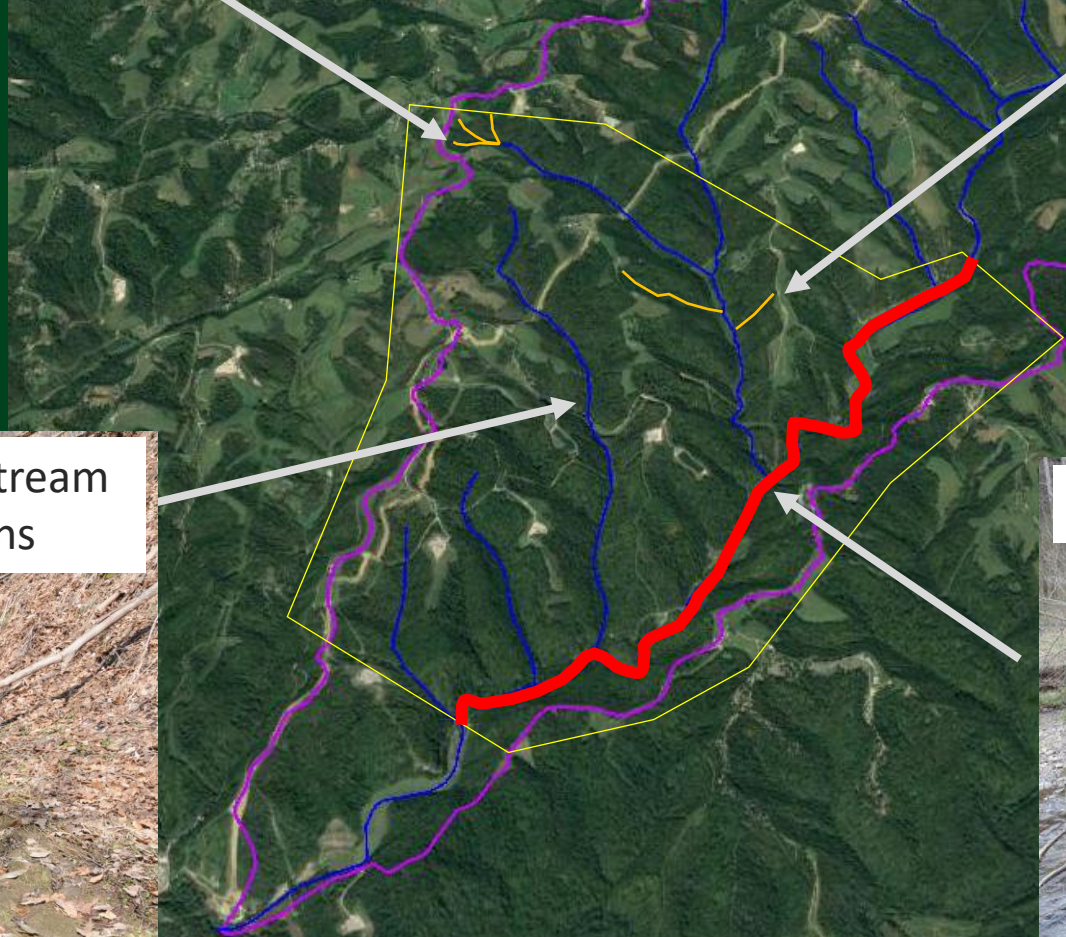
Watershed Perspective and Channel-Floodplain Network



Gullies



Gullies



Smaller Stream Floodplains

Large Stream Floodplain



Gully Restoration Functional Reference

- Stable substrate
- Retention of WD and particulate carbon
- Enhanced groundwater storage and increased baseflow flows downstream
- Interaction of live plants (roots) with stream flow and hyporheic zone
- Stable hillslopes near the channel with maturing trees



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Typical Headwater Gully

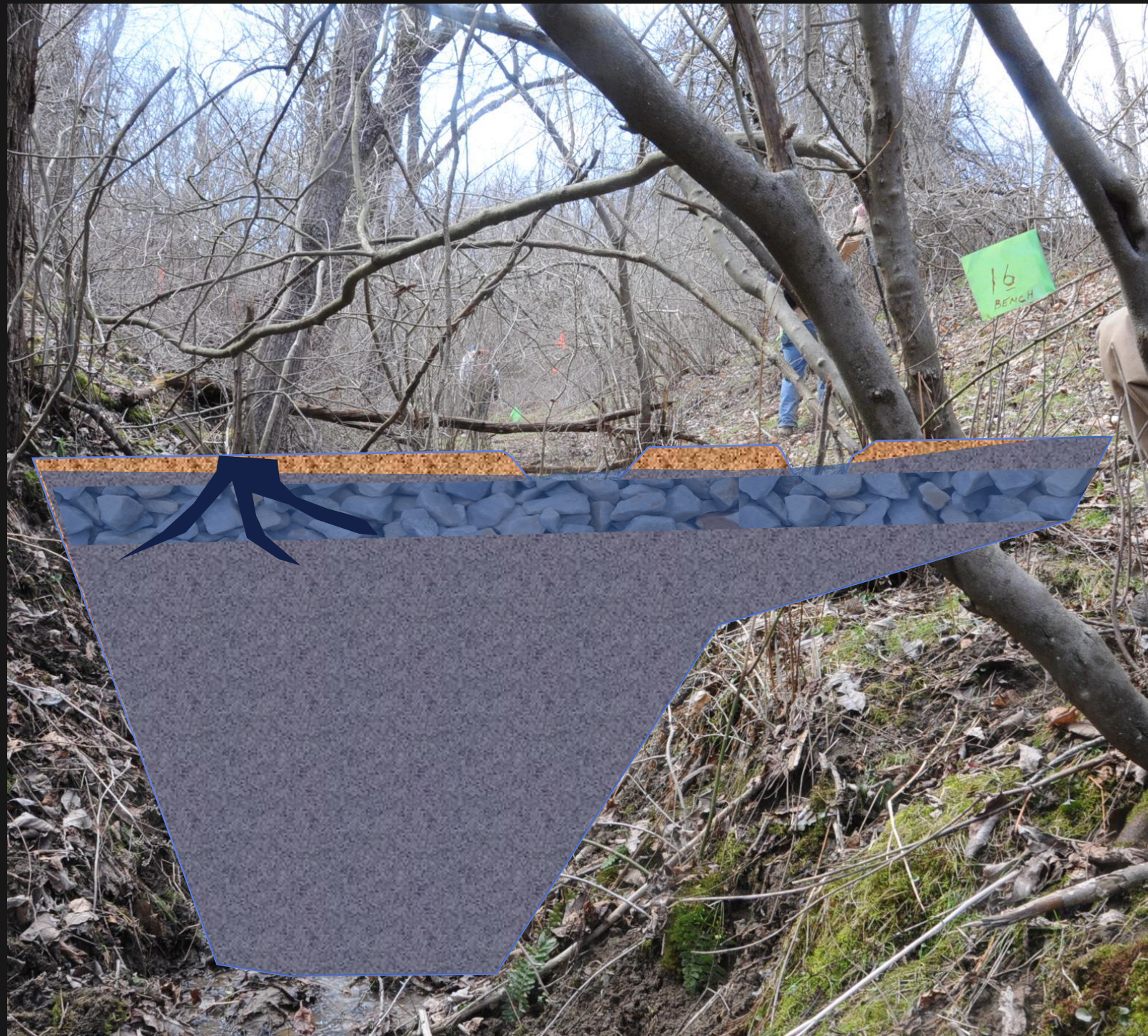
- Unstable substrate
- Rapid export of particulate carbon
- Reduced groundwater storage and a reduced baseflow flows downstream
- Little interaction of live plants (roots) with stream flow and hyporheic zone
- Steep and unstable hillslopes near the channel with few mature trees



Design Objectives

Restore:

- **Stable substrate**
- **Retention of WD and particulate carbon**
- **Enhanced groundwater storage and increased baseflow flows downstream**
- **Interaction of live plants (roots) with stream flow and hyporheic zone**
- **Stable hillslopes near the channel with maturing trees**



Design Objectives

Restore:

- Stable substrate
- Retention of WD and particulate carbon
- Enhanced groundwater storage and increased baseflow flows downstream
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- Stable hillslopes near the channel with maturing trees



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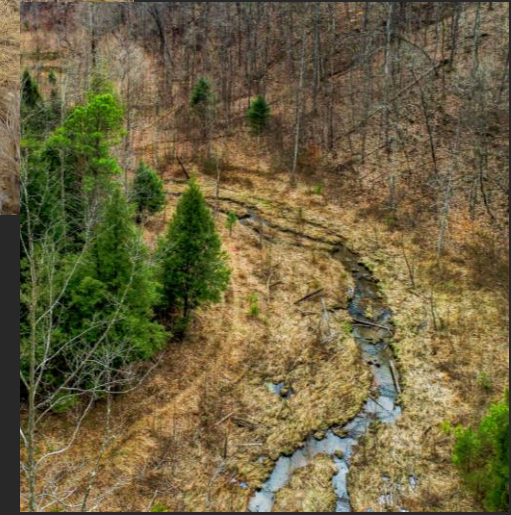
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Channel-Floodplain Systems Dynamics

- Initial floodplain stabilization with wetland vegetation
- Tree fall from hillslopes
- Beaver dams and abandonment
- Local scour around obstructions and dams



Applicability

- Sediment load needs to be low
- Contributing watersheds generally less than 10 sq miles although many of the concepts apply to larger watersheds
- Streams and floodplains are different in glaciated areas of the state: glacial till and outwash
- May not apply to valleys of soluble bedrock – limestone valleys