Something's Fishy

Image Sources: Casey Kramer

Australian Water School

Something's Fishy Webinar

May 11th, 2021

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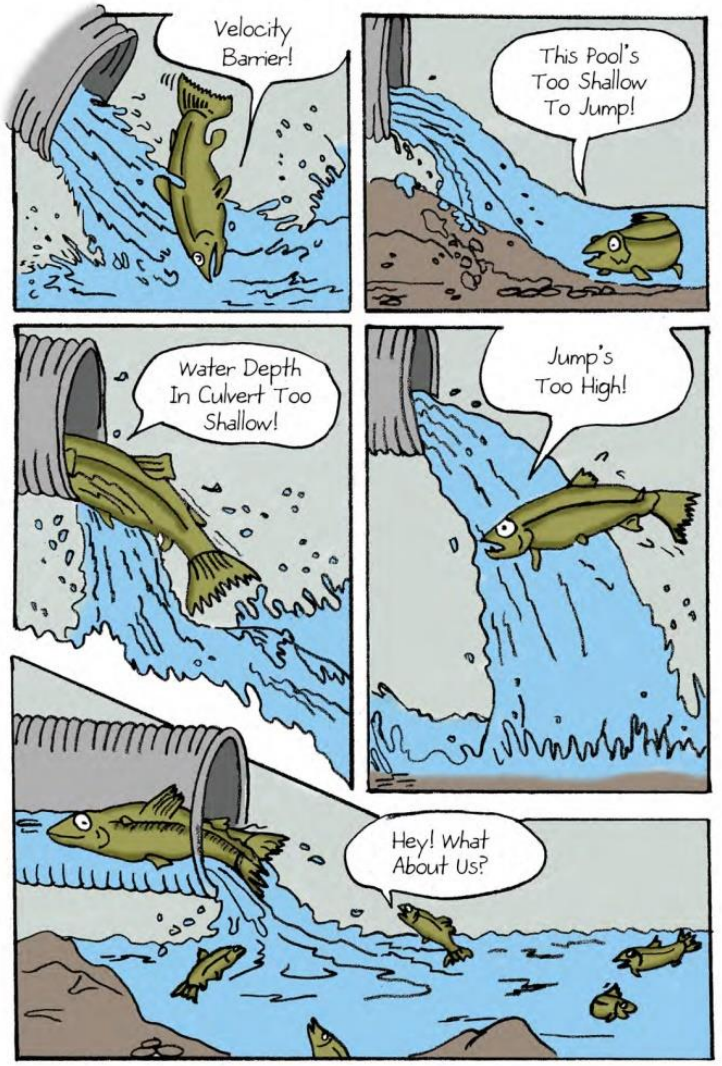
NATURAL WATERS

Overview

- Type of Project
- Geomorphic Setting
- Watershed and Reach Characteristics
- Species of Interest
- Various Water Crossing Design Guidelines
- Importance of Understanding Applicability and Limitations
- Selecting the Most Appropriate Hydraulic Model
- Examples of Installations
- Monitoring Protocol to Assess Effectiveness



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Type of Project

- Prior to a water crossing design or hydraulic modeling, the designer should clearly identify the type and goals of the project, for example:
  - Fishway Design
  - Aquatic Organism Passage Design
  - Stream/River Restoration (Geomorphic Design)
  - Natural Barrier Removal Design
  - Etc.

Image Source: Casey Kramer

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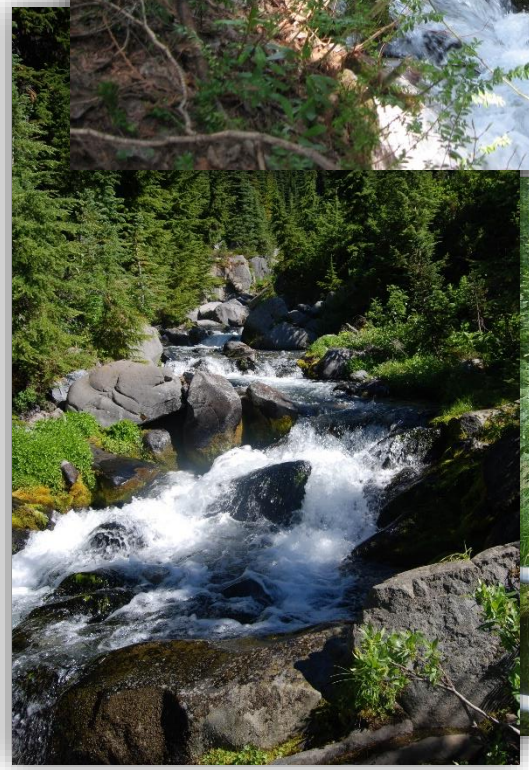
Geomorphic Setting



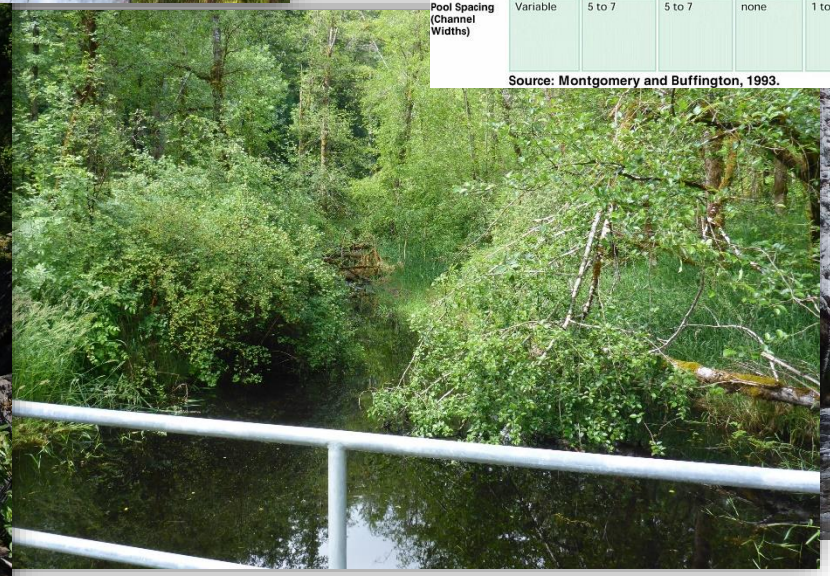
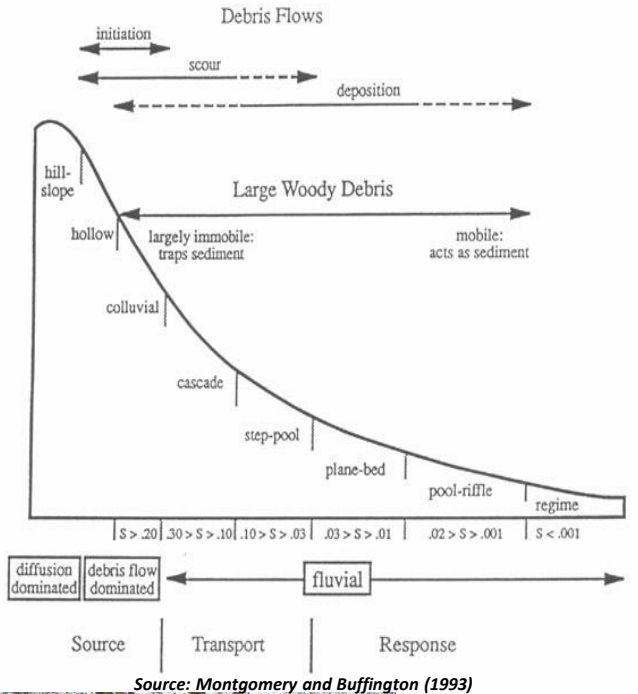


Image Sources: Casey Kramer

	Braided	Regime	Pool-Riffle	Plane-Bed	Step-Pool	Cascade	Bedrock	Colluvial
Typical Bed Material	Variable	Sand	Gravel	Gravel, cobble	Cobble, boulder	Boulder	N/A	Variable
Bedform Pattern	Laterally oscillary	Multi-layered	Laterally oscillary	None	Vertically oscillary	None	•	Variable
Reach Type	Response	Response	Response	Response	Transport	Transport	Transport	Source
Dominant Roughness Elements	Bedforms (bars, pools)	Sinuosity, bedforms (dunes, ripples, bars) banks	Bedforms (bars, pools), grains, LWD, sinuosity, banks	Grains, banks	Bedforms (steps, pools), grains, LWD, banks	Grains, banks	Boundaries (bed & banks)	Grains, LWD
Dominant Sediment Sources	Fluvial, bank failure, debris flow	Fluvial, bank failure, inactive channel	Fluvial, bank failure, inactive channel, debris flows	Fluvial, bank failure, debris flow	Fluvial, hillslope, debris flow	Fluvial, hillslope, debris flow	Fluvial, hillslope, debris flow	Hillslope, debris flow
Sediment Storage Elements	Overbank, bedforms	Overbank, bedforms, inactive channel	Overbank, bedforms, inactive channel	Overbank, inactive channel	Bedforms	Lee & stoss sides of flow obstructions	•	Bed
Typical Slope (m/m)	S < 0.03	S < 0.001	0.001 < S and S < 0.02	0.01 < S and S < 0.03	0.03 < S and S < 0.08	0.08 < S and S < 0.30	Variable	S > 0.20
Typical Confinement	Unconfined	Unconfined	Unconfined	Variable	Confined	Confined	Confined	Confined
Pool Spacing (Channel Widths)	Variable	5 to 7	5 to 7	none	1 to 4	< 1	Variable	Variable

Source: Montgomery and Buffington, 1993.



Source: Montgomery and Buffington (1993)

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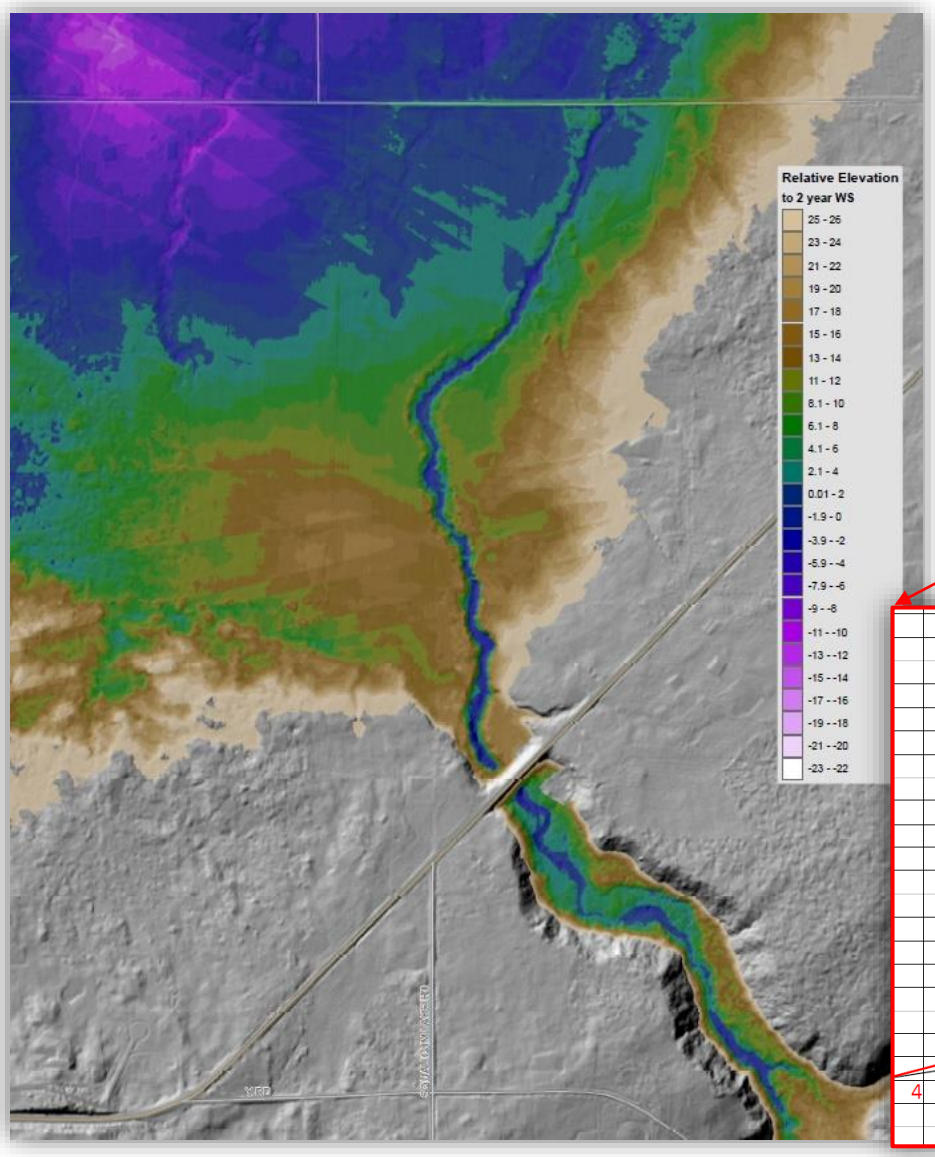
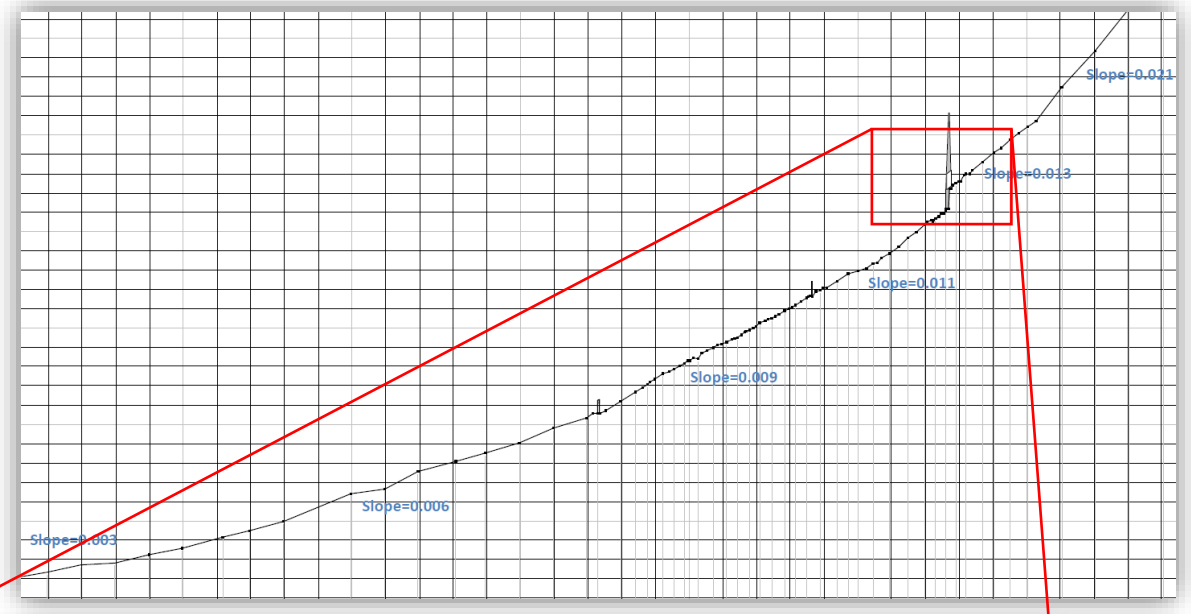
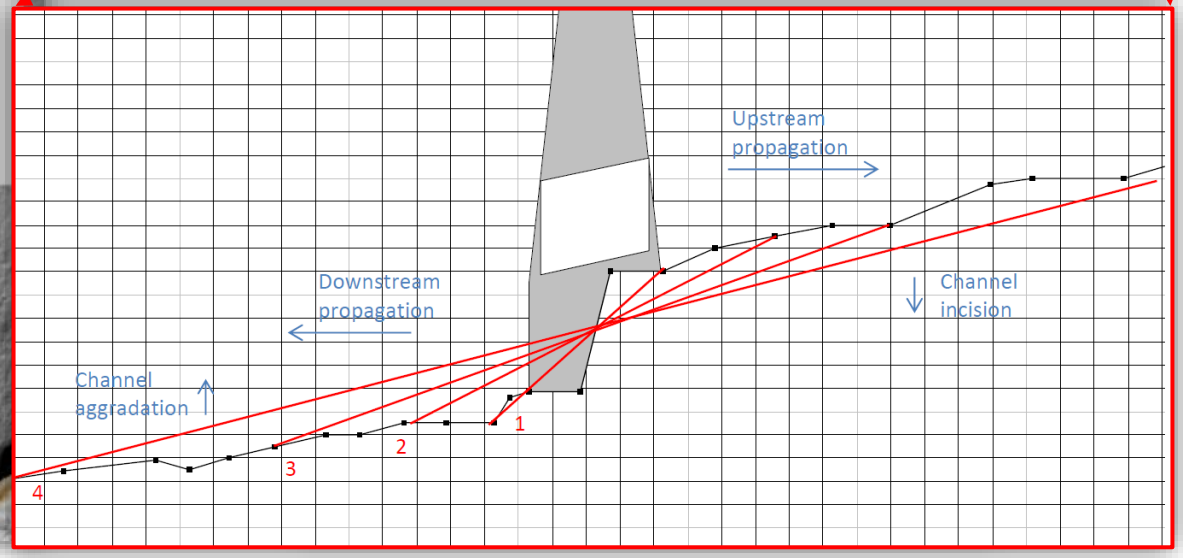
Geomorphic Setting







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Species of Interest

Image Source: Kevin Cass

Image Source: Charlie-Summer

Image Source Bill Byrne

Image Source: Jeremy Monroe

Image Source: Ryan Hagerty

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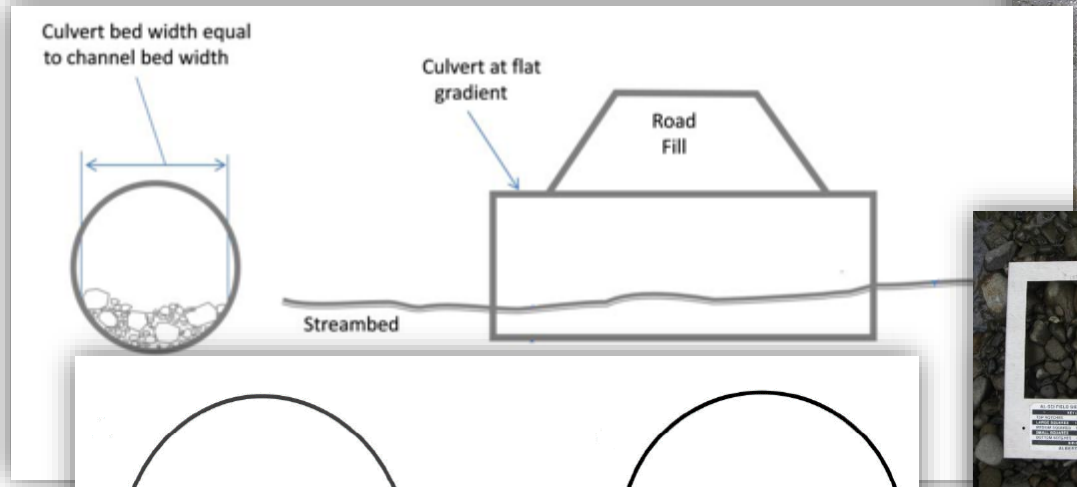
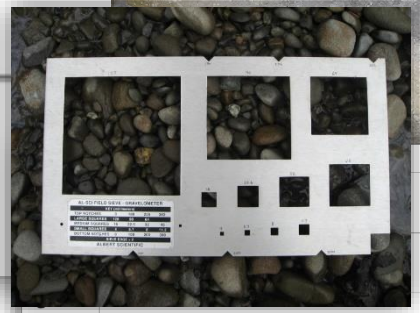
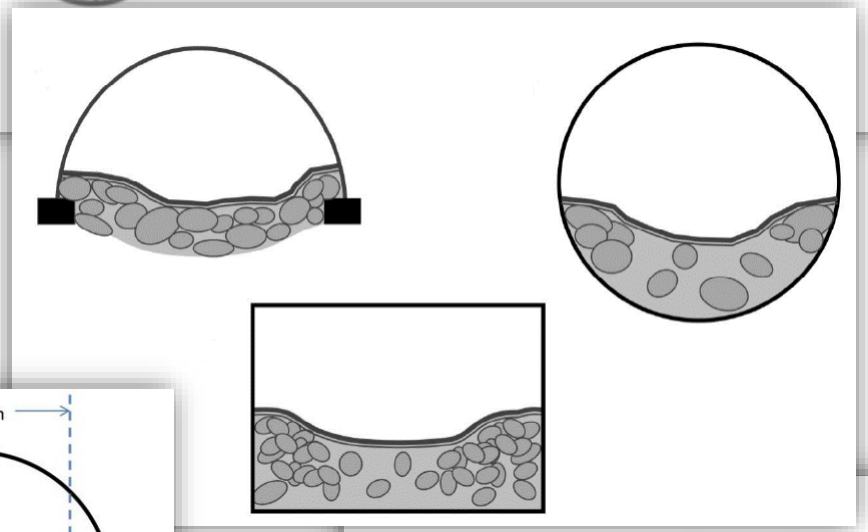
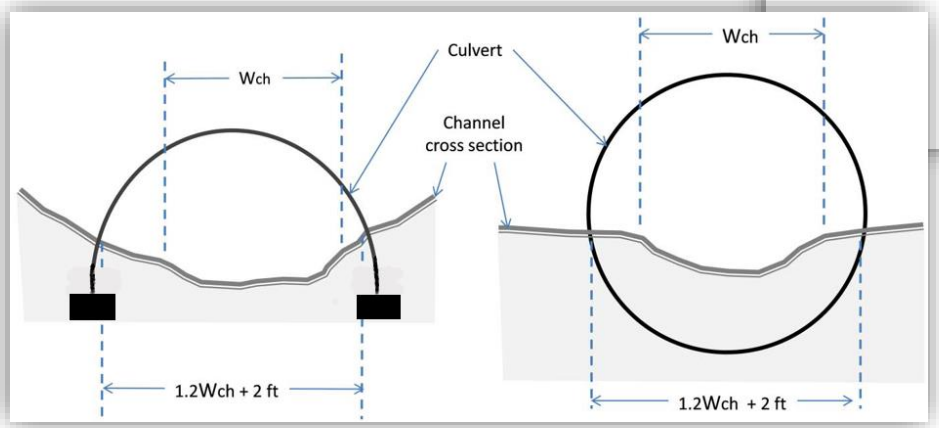
Various Water Crossing Design Options

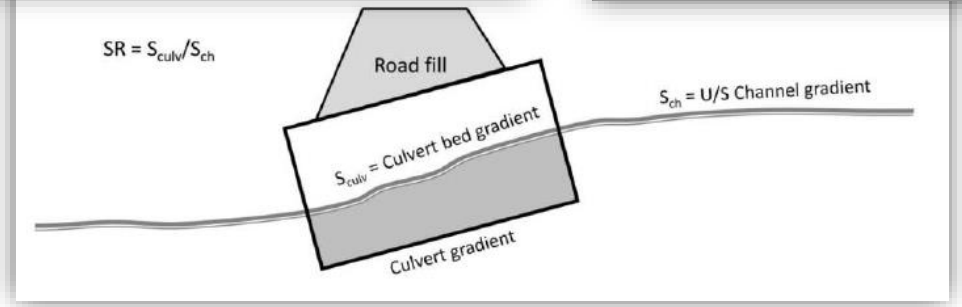
- No Slope
- Hydraulic Design
- Stream Simulation
- Bridges











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Importance of Understanding Applicability and Limitations

- Designers need to understand key assumptions of fish passage methods
- Applicability and limitations for each method may include:
  - Overall Philosophy
  - Stream Morphology
  - Type of Species
  - Hydraulic Characteristics
  - Etc.

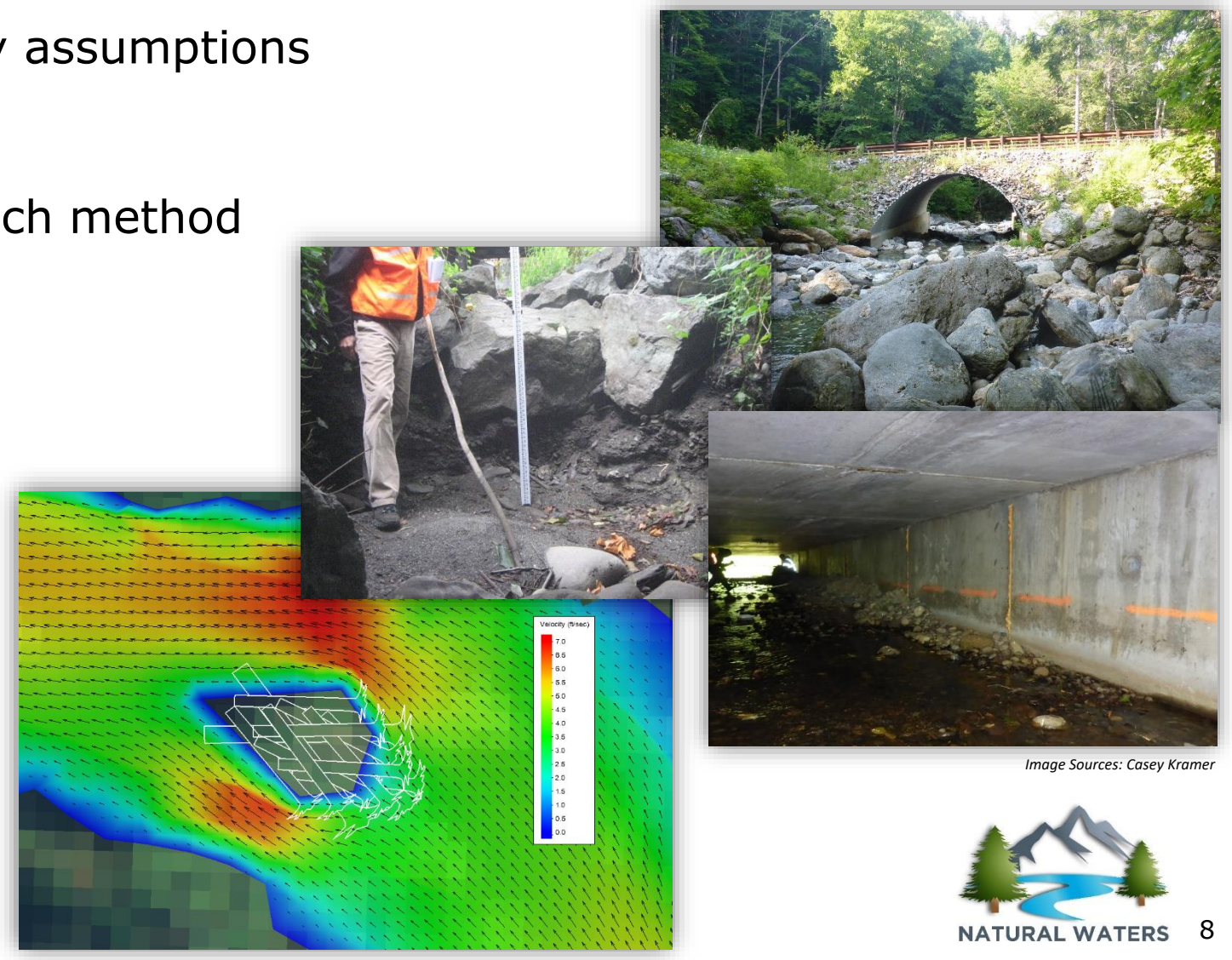

Image Sources: Casey Kramer

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Selecting Most Appropriate Hydraulic Model

- Some of the key questions in model selection should be:
  - What are the key hydraulic processes observed at the project site?
  - What hydraulic characteristics are required to demonstrate successful fish passage?
  - What resolution is needed to adequately represent hydraulic processes necessary for the selected fish passage methodology?

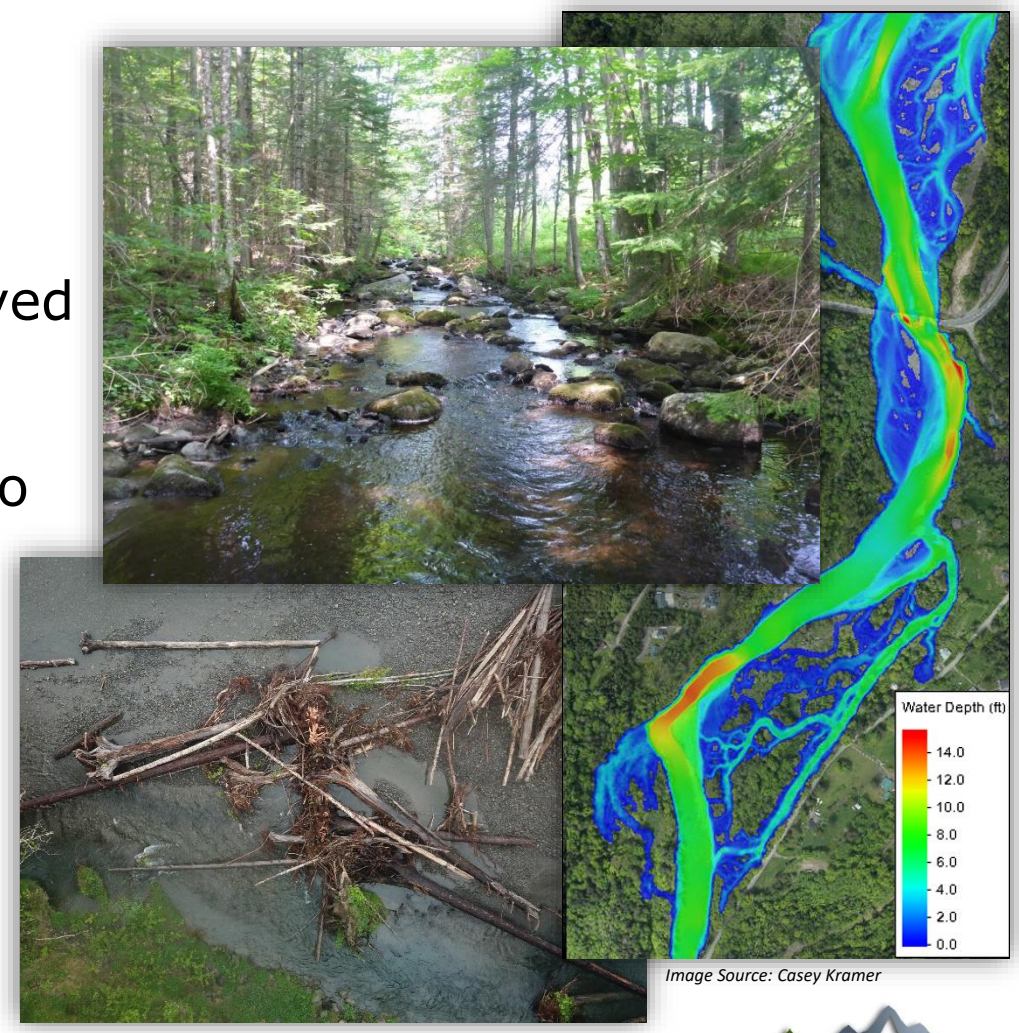

Image Source: Casey Kramer

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Examples of Installations

Before - 4 Foot Box Culvert

After - 20 Foot 3-Side Structure

Chum salmon upstream

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Examples of Installations

Before – 10.5 Foot Culvert

After - 65 Foot Bridge

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Examples of Installations

Before – 12 Foot Culvert

After - 26 Foot Bridge

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Examples of Installations

Before – 8 Foot Culvert

After - 17 Foot 3-Sided Structure

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Monitoring Protocol to Assess Effectiveness

- FHWA Western Federal Lands and WSP are developing standardized monitoring protocol
- Robust monitoring data sets are desired to study effectiveness of different design approaches
- Monitoring protocol criteria:
  - Applicable to all aquatic organism passage design crossings
  - Worldwide application - all stream types and all species of concern
  - Flexibility on seasonal / flow conditions

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Conclusions

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