Grade Control and Fish Passage in Urban Stream Enhancement

Matthew Brennan, P.E. – Senior Water Resources Engineer

Herrera Environmental Consultants, Portland, Oregon

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In developed/developing watersheds,

- Sediment Supply \((Q_s)\) **decreases**, and
- Peak Discharge \((Q)\) **increases**.

Therefore, Channel Slope \((S)\) **decreases** through channel incision.
Channel Incision/Downcutting

Channel Evolution

Headcut Migrates Upstream
Channel Incision/Downcutting

Channel Evolution
Channel Incision/Downcutting

Potential Impacts

Loss of Floodplain/ Off-Channel Connectivity

Loss of Aquatic Habitat Quality and Complexity

Loss of Fish Passage

Exposure/Threat to Infrastructure
Channel Incision/Downcutting

Design Approach

Grade Control

Reverse or Prevent
Further Incision

Use Natural Materials
Case Study - Johnson Creek at Tideman Johnson Park

Project Definition
Exposed Sewer Pipe in Channel Bed

Objective - Aggrade Channel and Rebury Pipe

Risk Assessment - High
Johnson Creek

Engineering Design

Grade Control Structures
Composed of Engineered Large Wood Structures
Complex Structural Stability Calculations
Assume 100-year Flow Conditions for Design

Sewer Pipe

Large Wood Grade Control Structures
Johnson Creek

Constructed 2006

- Buried Sewer Pipe
- Large Wood Grade Control Structure
Johnson Creek

Performance

Extreme Flow - December 4, 2007
Case Study – Upper Tryon Creek at Foley Balmer Natural Area

Project Definition
Channel Avulsion, Headcut Migrating Upstream

Objective – Halt Headcut, Redirect Flow

Risk Assessment - Low

2.5-foot Headcut
Flow Direction
Upper Tryon Creek

Engineering Design

Abandoned Meander Channel

Install Woody Debris Jams in Avulsion Channel

Basic Stability Calculations to Estimate Burial Depth

Headcut Avulsion Channel
Upper Tryon Creek

Constructed in 2007

View Upstream at Avulsion Channel Structure
Conclusions

Many Design Options for Engineered Grade Control

Appropriate Level of Design and Analysis – Dependent on Assessment of Risks

Formal Guidelines for Assessing Risk Would be Helpful in Scoping of Design Projects