Use of Physical Habitat Data to Estimate Channel Vulnerability: Example from the Dry Creek Watershed

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Background

- Assess the vulnerability of Secret Ravine (SR) to erosion
- Test and troubleshoot the Channel Vulnerability Calculator
  - Originally developed as a hydromodification management tool for Contra Costa county
  - Evaluate the Calculators usefulness as a tool for watershed assessment, utilizing data collected with the PHAB protocol
Background on Secret Ravine Creek

- Remnant populations of fall-run chinook salmon
- Rapid urbanization
- Documented sedimentation and turbidity problems
Exceedances of turbidity criteria 2005-2006 water year

Each bar represents an exceedance in turbidity for a 1 hour (blue), 7 hour (red), or 24 hour (yellow) period.

Gaining a better understanding of this type of data - one important reason for this project
Evaluate the use of the Calculator for assessing watershed conditions

- Gives a quantitative measure of bank stability
- Key metric: erodibility ratio (ER) estimates water’s erosive force against resistance of bed & bank materials
- Most data needed already collected under the March 09 revised protocol:
  - Particle size/pebble count
  - Gradient
  - Bankfull metrics
    - Bankfull = height water reaches along the bank associated with a 1-2 year storm event
Materials and Methods

- Supplemental Field measurements
  - floodprone width
  - channel width at bed

- GIS data
  - Watershed area calculation
Channel Vulnerability Calculator

Critical shear stress dependent on d50 and substrate type

Erodibility Ratio = avg. boundary shear stress / critical shear stress

Avg. boundary shear stress = (gradient) * (hydraulic radius) * (unit weight water)
Results

- **Mean ER = 52**
  - Suggests a highly erodible system

- **Site 5**
  - ER = 185
  - Likely caused by sediment starved pulse flows from local irrigation canal

- **Site 7 and 16**
  - Two lowest erodibility ratios
  - Two highest d50
  - Site 7 most favored salmon spawning site

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ER = Boundary Shear Stress / Critical Shear Stress (threshold)
Checking the Accuracy of Bankfull Measurements

- Calculation of ER requires accurate measurements of:
  - Bankfull width and depth
  - Gradient

- Method to validate bankfull measurements:
  1. Calculate bankfull discharge based on bankfull measurements
  2. Obtain Q2 data from an independent source i.e., local flood control agency
  - If greater than 30% difference, potential error in measurements
Ongoing work on the Calculator

- Add instructions
- Add Q2 and d50 worksheets
- Develop ranking system for ER
Conclusions

• PHAB data can be used in the Calculator to produce new information on habitat conditions.

• The Calculator suggests Secret Ravine is a highly erodible system
  - Further analysis is ongoing
Key reference

Further Information
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Questions/Comments?
Further steps in SR assessment

- Collect additional field data on bankfull measurements where we found discrepancy in internal validations
- Examine relation between sources of stress and erodibility ratio
  - Impervious Cover
  - Geology
  - Pulse flows
  - Denuded banks