Measuring Effectiveness of Culvert Replacement: A Case Study Measuring Change in Structure and Function after Implementation of the Carpenter Creek Restoration Project, Kitsap County WA

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Measuring Effectiveness of Culvert Replacement: A Case Study Measuring Change in Structure and Function after Implementation Phase 1 of the Carpenter Creek Restoration Project

Betsy Cooper, Joleen Palmer, Cindi Nevins
Stillwaters Environmental Center
Salish Sea Conference
May 1, 2014
Importance of Puget Sound
Lowland Streams

Carpenter Creek /Appletree Cove System

2312 acre System includes:
1886 ac Carpenter Creek drainage
39 ac pocket estuary-high marsh complex
102 ac peat/sphagnum bog
426 ac Kingfisher/Crabapple creek drainages
Stillwaters-Initiated Watershed Planning in Carpenter Creek

• Place-based Environmental Center with Education & Restoration Focus
• Chinook Listing and Salmon Recovery
• Collaboration Initiated
• Watershed Studies Begun
• Funding Sought for Marsh Preservation and Projects
Volunteer Watershed Characterization

• Monitoring began in 2000 – grew to include:
  – Monthly water quality (8 sites)
  – Monthly bird survey (5 sites)
  – Yearly Freshwater Benthic Invertebrate survey (2 sites)
  – Vegetation survey
  – Habitat survey
  – Wildlife survey
  – Fish survey in scour holes
Volunteer - Driven Road to Recovery – Culvert Replacement Project

- Lobbied for Property Acquisition
- Engaged ACOE in 206 Feasibility Study
- Engaged Local, State, Federal Electeds
- Rallied Community Support
- Secured Federal and SRF Board Funding
- Collaborated with County To Complete Design and Construction
US Army Corps Of Engineers
Project Objectives

Section 206 Project (Phase 1&2)

- Restore Natural Tidal Hydrology
- Reclaim Historic Intertidal Habitat
- Remove Fish Passage Barriers
- Reduce Scour Hole Features and Deposition of Fines
- Reduce Fragmentation of Shoreline and Upstream Habitats
Phase 1  Carpenter Creek Restoration

Pre-Project Conditions
10 ft. Culvert
Scour Holes; Flow Restricted

Project Completed  Feb 2012
Culvert Replaced with 90 ft Bridge
Naturalizing Flow Pattern
(photo – June, 2012)
Stillwaters Phase 1 Post-Construction Monitoring Program

- Continued pre-bridge efforts and added:
  - Vegetation Survey (1 lobe of pocket estuary)
  - Tidal Height Monitoring (1 hobo; bi-monthly data retrieval)
  - Terrestrial Insect Collection (8 locations; 3 sampling events/yr)
  - Fish Presence (multiple seine events and in-water observation)
  - Neuston Tow (yearly)
  - Photo Log (on-going)
  - Sediment Characterization Study (33 samples multiple years)
Sediment sampling was performed in June 2011 and June 2012. Analysis of sediment data indicated significant changes in substrate type had occurred within 4 months of the culvert being removed.
• 5 transects
• 33 quadrats
• 1 sample per quadrat
• Sample from top 4 inch of sediment
• Sample approx. 600 ml
• Same locations sampled pre-post bridge
Sample Collection and Analysis

- **Samples collected** in quadrat with “mighty grab” or with shovel depending on substrate
- Samples were bagged, labeled and stored for analysis
- **Analysis performed** at Stillwaters by trained volunteers under supervision
- **Size fractions measured:**
  - > 4mm – cobble/pebble
  - > 2mm – granule
  - > 0.5 mm – coarse sand
  - > 0.25 mm – med sand
  - > 0.06 mm – fine/very fine sand
  - < 0.06 mm - silt
Size Fraction Comparison

- 2011 #5 mesh (cobble/pebble)
- 2012 #5 mesh (cobble/pebble)

- 2011 Fine Silt
- 2012 Fine Silt
Sediment Analysis Findings

- Analysis method can be effectively replicated by multiple volunteers with reasonable precision.
- Significant changes observed after 4 months of culvert removal.
- Significant changes observed both within and between transect.
- Most transects exhibit increase in smaller size fractions as compared to pre-bridge conditions.
- One transect exhibited larger sediment sizes – new thalweg.
- Post-project silt fraction required significantly longer to settle.
Other Observations – Ripe for Study!

• Quantity of marine detrital material larger than expected.
• Eelgrass establishment in new thalweg.
• Sediment changes in Appletree Cove.
• Freshwater creek channels incising.
• Bird usage areas changing.
• Large schools of salmonids observed in estuary.
• Suspected sand lance nesting.
• Ghost shrimp/crab populations changing.
• Sand Dollar colony changes.
• LWD recruitment.
• Overall effect of Phase 2 implementation.
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Questions ?