SOURCE TO STREAM 2024 Conference

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HOSTS

Presented by:

Toronto and Region Conservation Authority

In association with:

Lake Simcoe Region conservation authority

Credit Valley Conservation inspired by nature

Channel Design, Erosion Mitigation Measures and Implementation Approaches:

Adaptive Management since the 1990s

Mariëtte Pushkar, M.Sc., P.Geo
Chris Cummings, CAN-CISEC
Jeff Prince, P.Eng

Source to Stream Conference

March 27, 2024

Outline

- Context
- Design
- Construction
- Monitoring
- Key Lessons Learned
- What next?

Shoemaker Creek
Kitchener

We did the best we knew then, and now that we know better, we strive to do things better

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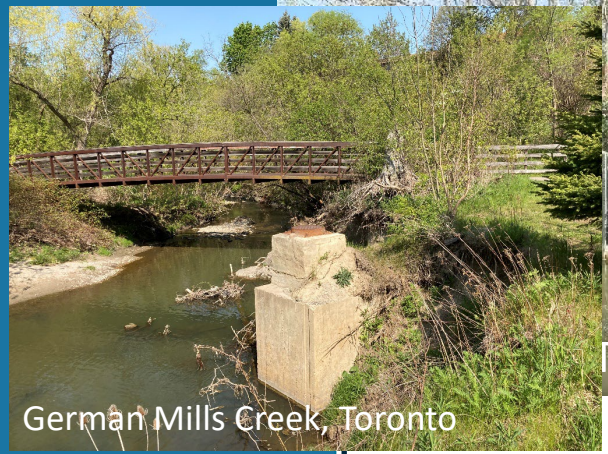
Background/Context

- Natural Channels Initiative
  - Conferences
  - Document (2002)
- In the 1990s
  - EXPOSED infrastructure
  - City-wide assessments
  - Today:
    - Exposing infrastructure
    - Proactive protection

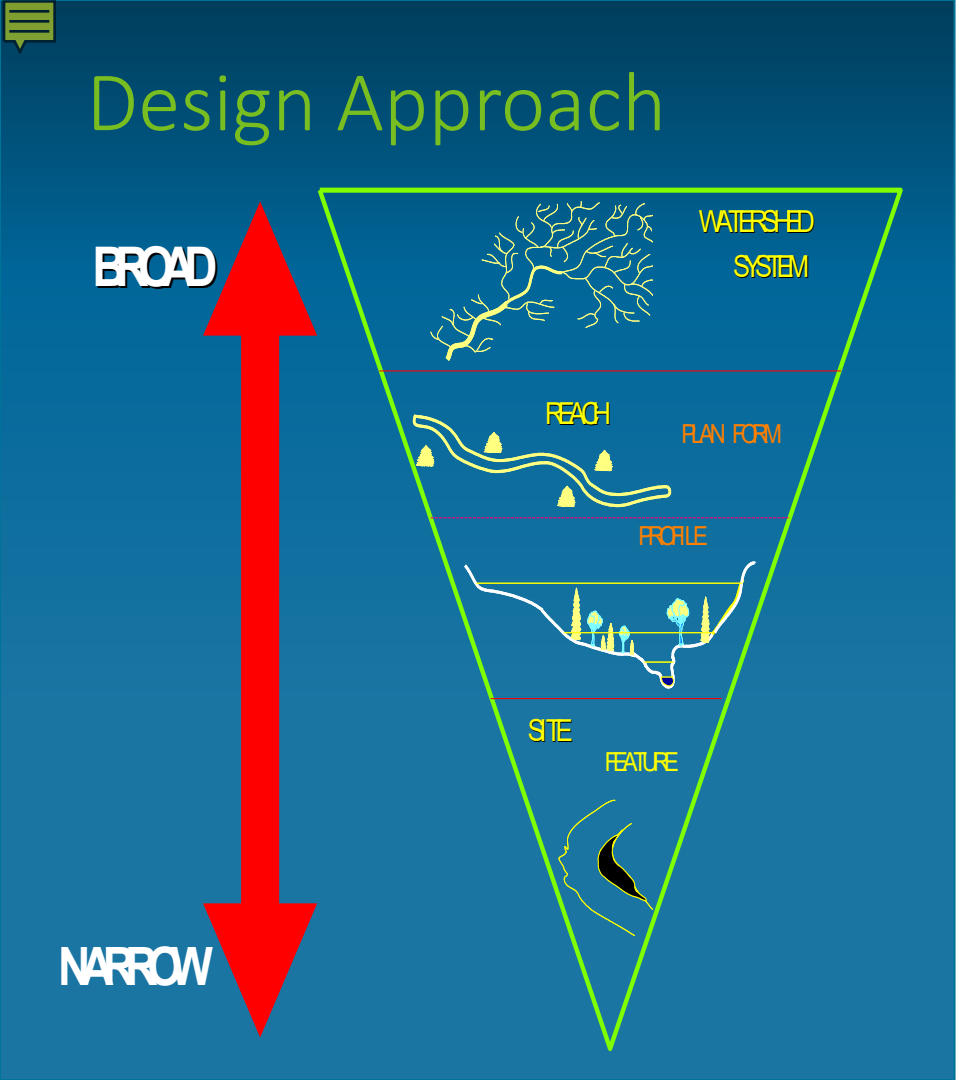

Highland Creek, Toronto


onto


German Mills Creek, Toronto


Tillsonburg

Design Approach



- Spatial Context
  - Local -> Reach
  - Local vs systemic
- Erosion Mitigation
  - Overprotect
  - Protect what needs to be protected

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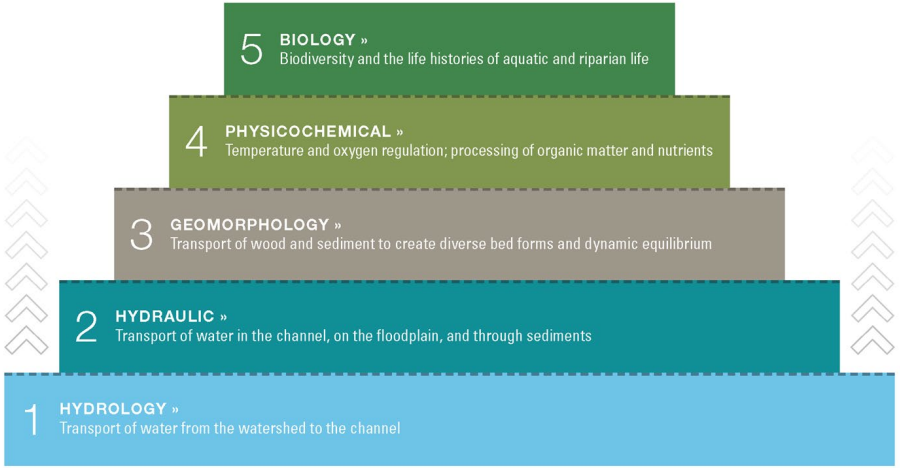
Design Methods

- Tools and analyses
- Site understanding
- Hydro-geomorphic analyses
- Discuss with others
- Learn onsite:
  - Construction support
  - Monitoring

Stream Functions Pyramid

A Guide for Assessing & Restoring Stream Functions



Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. *A Function-Based Framework for Stream Assessment and Restoration Projects.* US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006.

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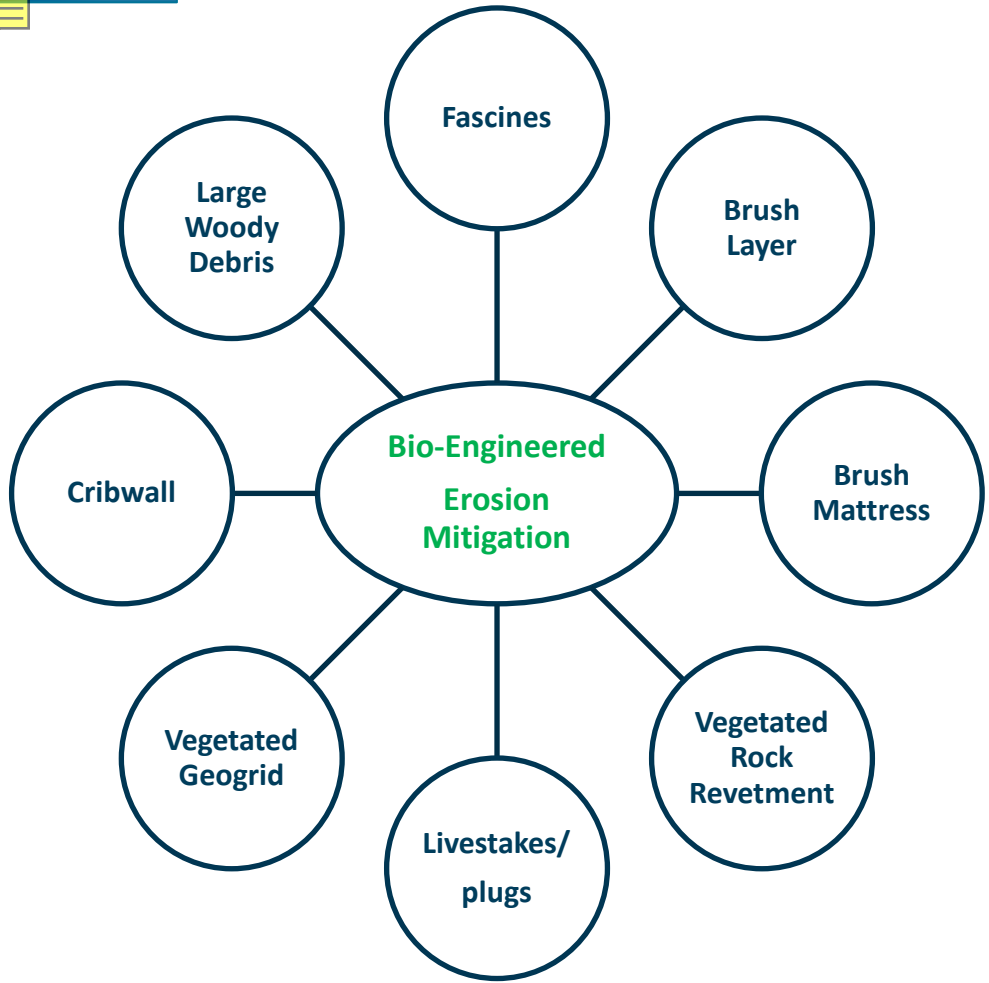

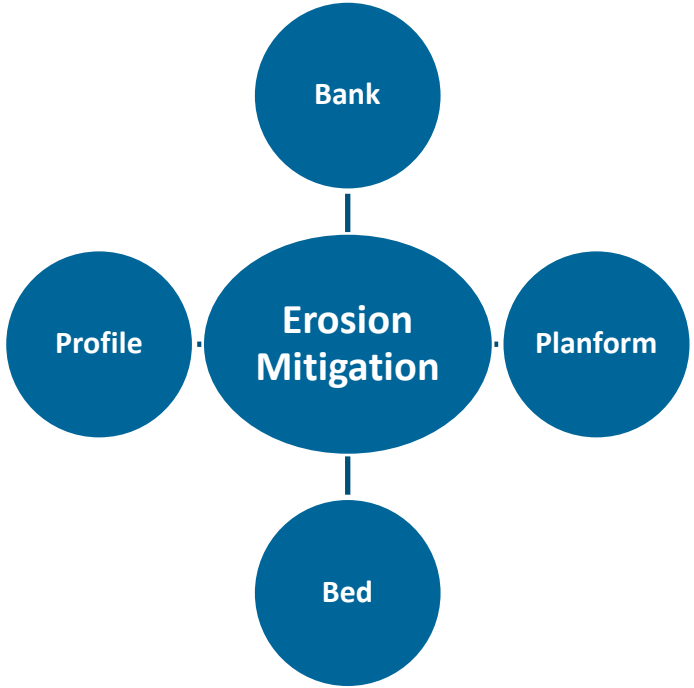

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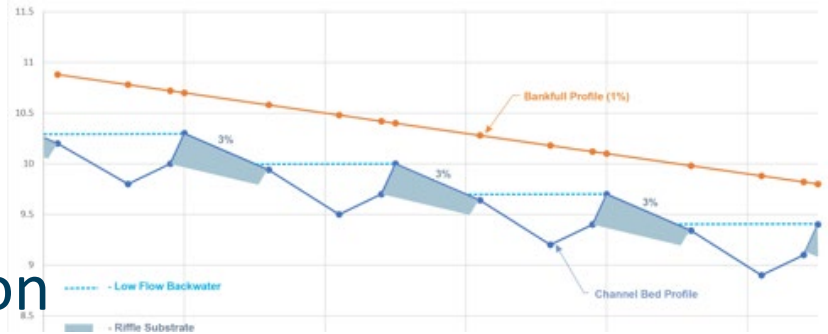
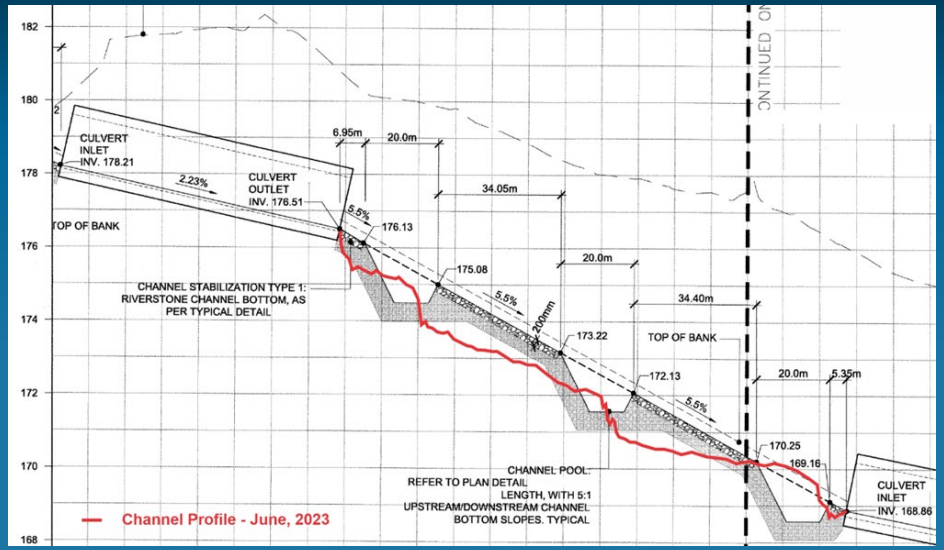
Design - Profile

- Continuity of form
- Consider hydraulic influence/function





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Floodplain Design and Revegetation

- Corridor Design
  - Landscaped vs naturalized
  - Soil types and conditions

Restoration

- Different combinations and permutations
  - soil, wood, stone
- Risk management
  - time to site stabilization, erosion control, seasonal constraint

Objective:

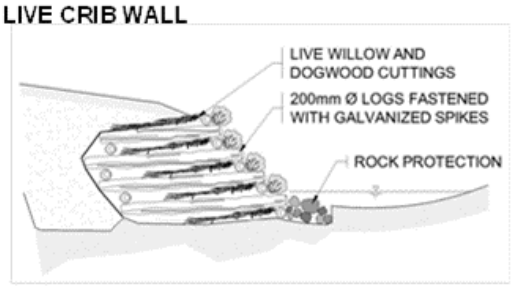
Mimic natural setting and function

West Indian Creek – During Construction

West Indian Creek – Three Years Post- Construction

Crib wall

- Goal:
  - softer, temporary structural support and vegetation enhancement
- Applicability:
  - suitable light and moisture
  - decay in about 10 years (not true in S. Ontario!)
  - limited height



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Crib Walls

- Common problems:
  - Dead vegetation (loss of light conditions as new vegetation grows surrounding the site)
  - Beaver browse
  - Loss of soils/stone
  - Empty crib boxes
  - Undercut

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Crib Wall

- Adjusted construction:
  - Fill box with soil mixed with stone
  - Wrapped soil with geotextile in box
  - Rock toe
  - Live stake and brush layers
- Alternatives:
  - Vegetated revetment
  - Vegetated geogrid


Humber River, Toronto


Schneider Creek, Kitchener

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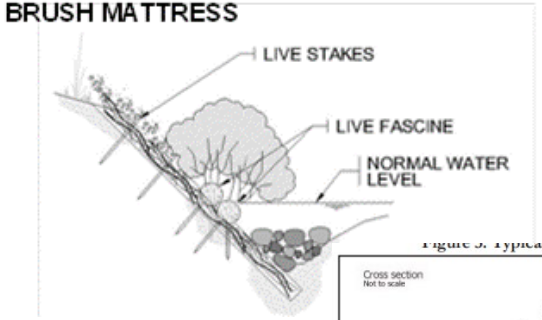
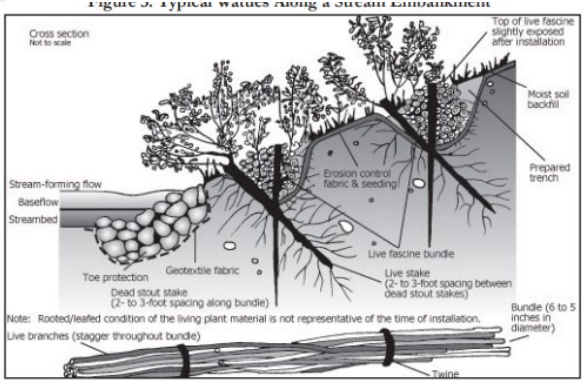
Brush Mattress

- Goal:
  - Naturally enhance bank stability
- Application:
  - Suitability really depends on situation
  - Requires grubbing of existing ground (which removes existing root networks, exposes/loosens soil)
  - Constructability challenges – labour intensive
  - Function can also be accomplished:
    - with potted plants/live stakes
    - coir mat and seed/live stakes

Fascines

- Goal:
  - Bundles of dormant branches provide protection of the erosion risk area
- Reality
  - Season for construction
  - Constructability
  - Potential failure – detach from ground / desiccation
- Learned
  - The location is critical, and difficult to implement to have the intended success





We have moved away from the use of fascines and brush mattress and toward brush layers and live stakes …

- Complexity / labour intensity
- Success rate
- Amount of raw materials required

Brush Layers/ Vegetated Revetment

- Goal:
  - Naturalize the bank
- Application:
  - Brush layer planted in between lifts (rock, wrapped soils)
  - Dormant cuttings vs potted plants
  - Placement/care at the transitions, live stakes
- Learned:
  - Construction season –- density/ spacing varies by stock type (dormant cutting vs potted)

Live Brush Layer – Robinson Creek (Before)

Live Brush Layer – Robinson Creek (After)

Vegetated Rock Revetments – Potted stock

Vegetated Rock Revetment –
During Construction

Vegetated Rock Revetment –
After Construction

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Materials

- Geotextile
  - Banks
  - Planting beds
- Stone shape and size
  - Roundstone
  - Angular or subangular
  - Gradation
- Use of hardware in channel

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Construction

- Site preparation and design layout
- Industry experience
  - collaboration between designer and contractor
- Implementation support
  - Contractor experience
  - Field fit support

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Erosion and Sediment Control

- Product
- Scale of placement
- Work in dry vs wet
- Decommission
  - *who decides when it is time?*

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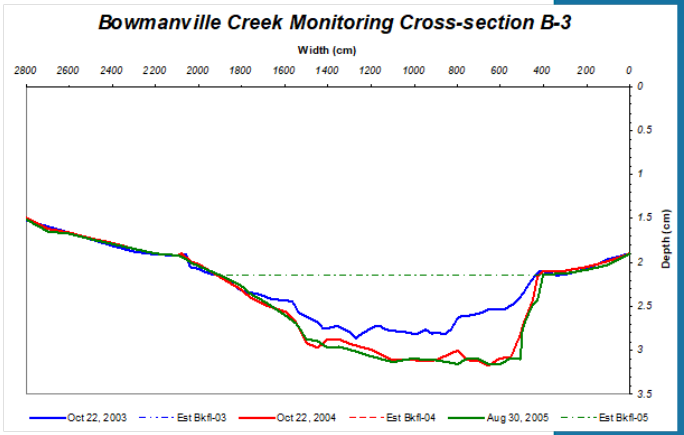
Monitoring – Learn from Doing

- Necessary to learn and improve
- Mechanism
  - agency permits/approvals
- Allow for adaptive management



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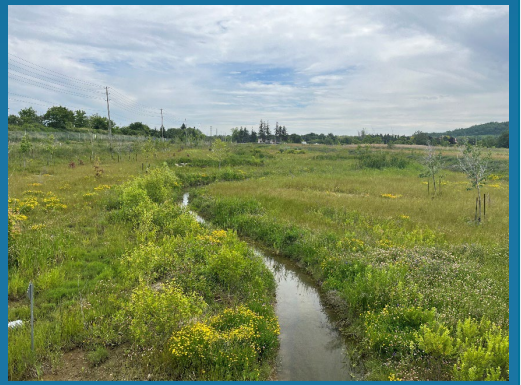
Lessons Learned Along the Way

- Ask questions
- Listen and learn from others
  - Contractor, experienced
  - Other disciplines/integrate
- Learn from doing
  - Improve design and construction methods
- Personal curiosity
  - Create opportunity to re-visit projects

Biggest Lessons Learned?

- Things do go ‘wrong’
- We have to adapt
- Have patience



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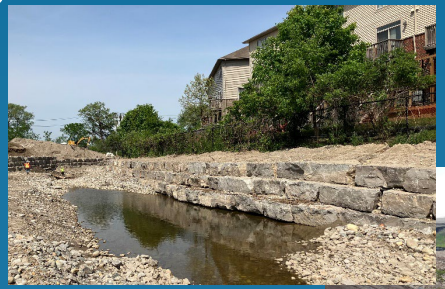
Other Approaches and Opportunities

- Root Wads
- Lunkers
- Stream training
- Wetlands
- Woody debris
- Vegetated soil blocks



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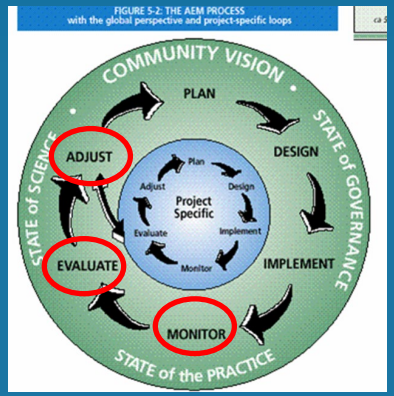
What's Next?

- Continue to learn, be open to, and look for opportunities
- Try new things
  - Monitor
  - Evaluate
  - Adjust




Joshua Creek, Oakville

Questions?

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