REACH BASED RESTORATION:
SUCCESES AND LESSONS LEARNED FROM DECADES OF ECOLOGICAL RESTORATION

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August 28, 2018
Presentation Outline

• Prioritizing Urban Stream Restoration Projects
• Past and Current Design Techniques
• Identifying Suitable Sites for Natural Channel Restoration
• Feature Project Example: Alfred Khuene Natural Channel Project
• Other Project Examples
• Results
Prioritizing Urban Stream Restoration Projects

Problem:
Multiple channelized/hardened urban stream systems requiring maintenance throughout TRCA jurisdiction

Solution:
Identify and prioritize impaired systems can be restored using natural channel design/principles
Restoration Challenges in an Urban System (end of the pipe)

- Hardened stream features, degrade over time (limited lifespan)
- Not connected to floodplains/incised creek channel
- Uncontrolled storm water inputs
- Lack of vegetation and impervious surfaces
- Flood prone areas and lack of flood storage
- Poor habitat quality
- Poor water quality
Past Design Techniques

- Past focused on fixing end-of-pipe (e.g. erosion) rather than system fixes or reach base restoration
- Spot fixes rather than reach based solutions
- No consideration of upstream and downstream issues (i.e. transferring the root problem)
- Lack of incorporating critical habitat components into designs
- Heavy focus on armouring in areas where a softer approach would be more beneficial
Current Design Techniques

- Dealing with all aspects of the impairment/features not just the impact
- System based approach
- Reconnecting to floodplain
- Reconstructing low flow channel to convey proper flows
- Wetlands and other associated habitat in the floodplain
- Natural cover and soil stability
- Wetlands at storm outlets for water quality
- Floodplain roughness and direction within entire width of floodplain using woody debris, rocks, plantings
- Structural habitat: in-stream and in the floodplain (riffle:pool, bank habitat/protection)
- Incorporating storm water treatment and green infrastructure
Identifying Suitable Sites for Natural Channel Restoration

Site Selection based on:
- IRP and ROP Information
- Flood constraints/opportunities
- Adjacent property and infrastructure constraints/opportunities
- Access constraints/opportunities

Prioritization based on:
- Condition of existing channel (e.g., failed vs. failing concrete)
- Potential for largest habitat gains over current conditions (i.e., going from concrete lined to natural channel with floodplain connectivity and habitat features)
- Proximity to existing habitat to facilitate integrated habitat function (i.e., Connectivity, invertebrates, fish and wildlife)
Prioritizing and Site Selection: Spring Creek Reach Mapping

Priority Reaches: degraded concrete channels where removal will have minimal impact
Feature Project: Spring Creek (Alfred Kuehne)
Phase 1
Feature Project: Spring Creek (Alfred Kuehne) Phase 2
Northern reach: Previously straightened concrete channel, restored to natural channel

Floodplain cut to increase flood storage and reconnect to channel

Phases: 1 and 2

Southern reach: Erosion threatening infrastructure (sewer main) and poor overall stream health

Storm outfall treatment wetland
Feature Project: Spring Creek (Alfred Kuehne)

BEFORE

Straightened concrete channel

AFTER
Use of Woody Material

- Replaces structure loss from clearcutting
- Provides habitat for wildlife
- Can be used for bank protection
- Provides important fish habitat
- Increases surface roughness
Use of Stone Material

- Critical bank projection
- Fish habitat (riffle:pool)
- Hard features control flows (vortex weirs)
- Other floodplain habitat
Use of Vegetation (Bio-engineering)

- Soil stabilization
- Bank Protection
- Overhanging vegetation for food and cover
- Alternative to hardened surfaces
Wetlands and Floodplain Storage

- Increased flood capacity
- Reconnects channel to floodplain
- Provides habitat for wildlife using valley corridor
- Water quality treatment when intercepting uncontrolled storm flow
Other things to consider During Construction (Weather)
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Other Project Examples
Humber Estuary Hooks (Coastal)

Before
Hardened Bank with no habitat structure

After
In water habitat added with bank protection
Heart Lake Shoreline

Before
Degraded Shoreline with failed gabion baskets

After
Restored Shoreline with habitat features, trail, and fishing node
**Restoration Success**

**2010 Pre-restoration:** 92 fish were sampled. Only 2 species

**2013 Post restoration:** 529 fish were sampled. 8 species

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>2010</th>
<th>2013</th>
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<tr>
<td>Blacknose Dace</td>
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<tr>
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<td>Central Stoneroller</td>
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<td>12</td>
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<tr>
<td>Green Sunfish</td>
<td>0</td>
<td>55</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>92</strong></td>
<td><strong>529</strong></td>
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</tbody>
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Toronto and Region Conservation Authority
Thank You!

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Prioritizing Urban Stream Restoration Projects

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**Solution:** Identify and prioritize which ones can be restored using natural channel design/principles
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Application:
• Utilize naturalized channels to satisfy Fisheries Act requirements
• Develop proponent led habitat banking (creating fish habitat where there was none)
Alfred Kuehne Stream Restoration Project

Integrated Restoration Prioritization (IRP) Summary
(The IRP framework gives scores to ~30 ha catchments for their relative impingement compared to other catchments in the same watershed. It is used to prioritize restoration opportunities.)

Aquatic Score = 2
Hydrology Score = 2
Natural Cover Score = 3
Terrestrial Natural Heritage Score = 1
Final Score = 8
Priority = HIGH

City of Brampton Parks:
Kuehne Park North and Kuehne Park South
Restoration Opportunities
Spring Creek Subwatershed, Etobicoke Watershed

Notes:
- Straightened channel does not allow for dispersal of energy, adequate deposition of sediment, or interaction with the groundwater table. Straightening has effects downstream.
- Straightened channel provides poor habitat.
- Channel is characterized by major erosion, failed revetments, and exposed infrastructure.
- Multiple漫 outlets discharge into the valley.
- Habitat: Intermediate Riverine Waterway
- MOEZ Zone: Darlerr Species
- Small Approach identified the area as a historic wetland lost before 1967.

Legend:
EP Erosion Mitigation Structures
- Bridge
- Ditch
- Channel
- Outlet
- Lagoon
- Outfall
- Dam
- Retaining Wall
- Channel Improvement
- Water Body

Disclaimer:
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1976 aerial imagery of what is now Kuehne Park North and South. The channel was straightened between 1976 and 1978.

MNR Verified Wetlands have not been evaluated per CWES and are of unknown type.

Concrete outfall exposed by erosion.

Opportunity to impound and treat discharge from multiple outfalls with the construction of treatment wetlands.

Straightened and hardened channel with failing rip-rap and gabion basket revetments could be naturalized.
Spring Creek Remediation Project

- Spring Creek Pilot Project report completed in 2014 by TRCA, and
- Fluvial Geomorphological Characterization report completed in 2015 by Dr. Paul Villard and the University of Guelph
- Identified reaches within Spring Creek Watershed suitable for Restoration
- TRCA is currently in the process of prioritizing these sites for a 10 year Restoration Plan
- TRCA in early stages of establishing candidate sites for Proponent-led Habitat Banking
Project

Khuene

- Show video
- Examples of what was included
- Site pics before and after
  - Bank treatments
  - In-water treatments
  - Flood plain wetlands
  - Stormwater treatment wetlands
Deliverables

Length of stream
Area of natural cover
Barrier removals
Wetland cover
Next Steps

10 year plan

“Joel’s slides
Restoration Goals and Objectives

Goal:
Protect and restore ecosystem function and health to benefit ecological goods and services.

Objectives

1. Restore **natural hydrologic processes** and aquatic systems by reversing, repairing or mitigating alterations and impairments

2. Restore and/or **increase natural cover** (wetland, riparian, forest, and meadow)

3. Enhance landforms and **restore soil and soil processes** to promote self-sustaining natural communities

4. Maximize size, shape and **connectivity** of natural heritage features