GEOMORPHIC SOLUTIONS

Effective Planning and Installation: Sediment and Erosion Control, Bioengineering and River Training

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Toronto and Region International Erosion Control Association
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How DYNAMITE *streamlines streams*

Straightening of Pequest River in New Jersey by CCC workers stopped its yearly [illegible] right. Note temporary dam at left to provide volume of water for scouring blasted channel.

Explosion of dynamite charge by propagation excavates new channel.

Immediately after explosion, water is entering new channel, whose banks will be smoothed and "stream-lined" by the speedier flow of water.

CROOKED STREAMS are a menace to life and crops in the areas bordering on their banks. The twisting and turning of the channel retards the flow and reduces the capacity of the stream to handle large volumes of water. Floods result. Crops are ruined. Lives are lost. Banks are undermined, causing cave-ins that steal valuable acreage.

In many instances straightening out a stream has doubled its capacity for disposing of run-off water.

DYNAMITE may be used most efficiently and economically in taking the kinks out of a crooked stream. The dynamite is loaded along the length of "cut-off" channel. When fired, the dirt and other debris is heaved high in the air and is scattered over the adjoining territory—leaving practically no spoil-banks. In addition to the material actually thrown out, much dirt is loosened and is later scoured out by the water which rushes swiftly through the straightened channel.

Du Pont Dynamite has straightened many thousands of miles of crooked streams. Du Pont engineers have worked for years to develop the best blasting methods for the cleaning out and straightening of streams. All their data is in a 48-page book, "Ditching with Dynamite." It is for your use. Write for it.

Dynamite can help you do other jobs, too. It can help you build highways, dams; fight soil erosion; work quarries. Du Pont has an explosive for every purpose.

DU PONT

E. I. du Pont de Nemours & Co. Inc.
Explosives Department
6107 du Pont Building
[illegible]

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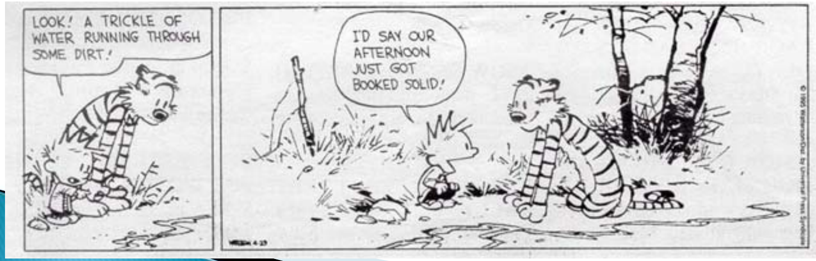
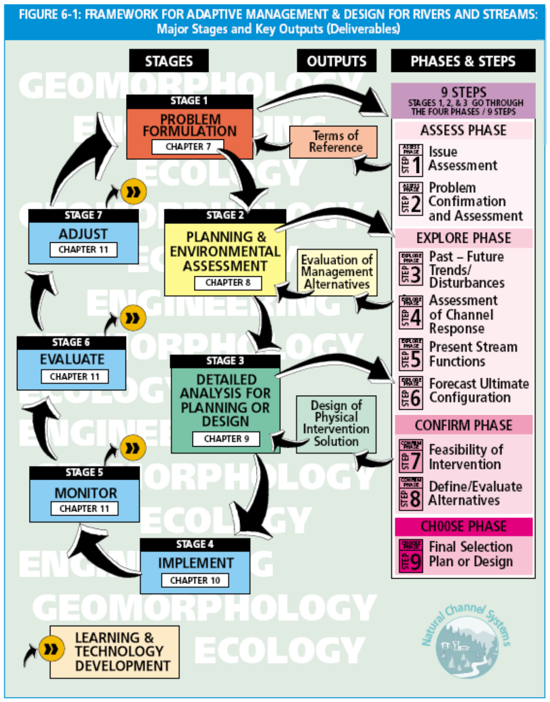
Presentation Outline

- Project cycle
- Mitigation
  - Isolating the work area
  - Construction phasing
  - Erosion and sediment control
- Bioengineering and river training examples
- How things fail – what should we look for and how should it be addressed?



Key Points of the Talk…

- Success is in the details
- A good design will not work with poor implementation
- Proper implementation requires co-operation between the designer, inspector, contractor and Agency staff
- Monitoring and willingness/ability to address minor deficiencies is essential for successful erosion control and bioengineering



Adaptive Management Framework for River Design

MNR, 2002
Adaptive Management of Stream Corridors in Ontario

Mitigation

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Defined as: "Actions taken during the planning, design, construction and operation of works and undertakings to alleviate potential adverse effects"

DFO, 1986 – Policy for the Management of Fish Habitat

The Easy Solution

Isolating the Work Area and Construction Phasing

During construction

Post-construction

- Corrugated steel plate
- Small stream
- Limited access
- Sand bed


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Metre Bags

- Long deployment
- Large creek
- Potential for ice damage

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Plan your phasing, including access carefully

Sediment and Erosion Control

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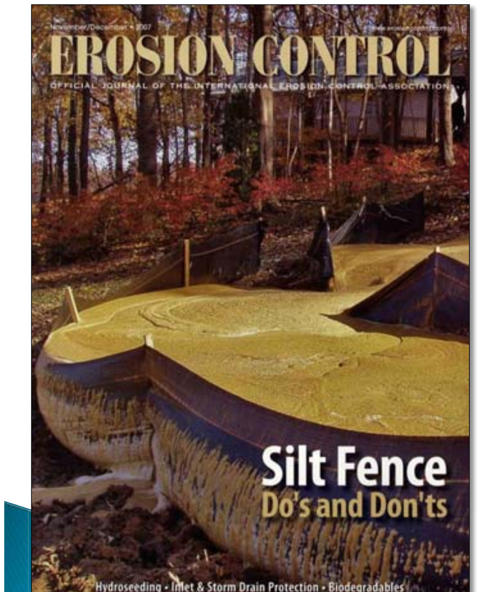

- Isolating the works from the creek
- Multiple barriers
- Expect the unexpected
- Monitor and maintain

Sediment and Erosion Control

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- Appropriate method for the site and soil
- Must be installed correctly
- Key is to stop entrainment and erosion
- Leave as much vegetation standing as possible
- Minimize disturbance to the site
- Mitigation once materials are entrained is difficult
- Needs to function as anticipated
- Needs to be monitored and maintained
- Needs to be modified when it isn't working
- Needs to be removed when job is complete


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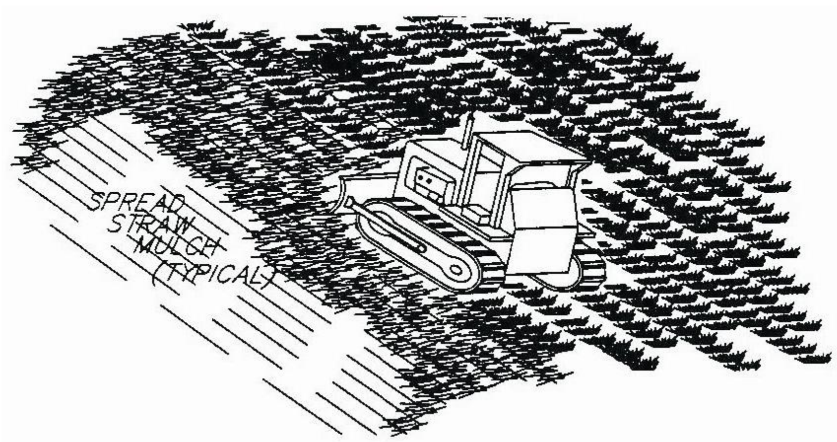
Images from Filtrexx.com

Crimped Straw



Vegetation can establish under bridges

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Expect the unexpected

Bioengineering and River Training

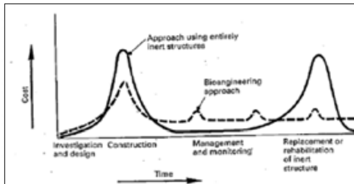

Figure 43. Illustrations of different expenditure profiles and maintenance (implied) of inert structures and bioengineering treatments. (from Coppin and Richards, 1990)

Cascades/Vortex Rock Weirs/ Rocky Ramps/Riffles

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- Grade control features
- Locally dissipate energy
- Create pools and backwater
- Mimics naturally occurring features in relatively stable channels
- Riffles in lower gradient and moderate energy systems
- Cascades/vortex rock weirs in higher energy, steeper systems
- Usually integrated with bank treatments/bioengineering

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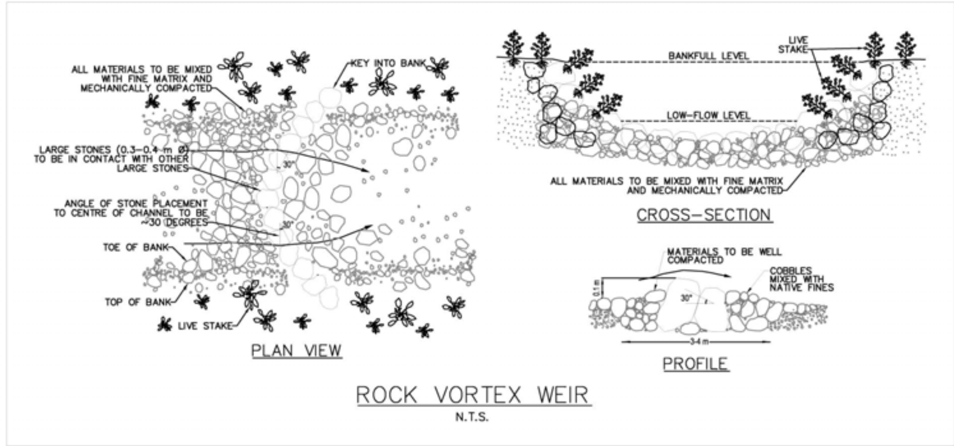
Vortex Rock Weir



Examples of Vortex Rock Weirs

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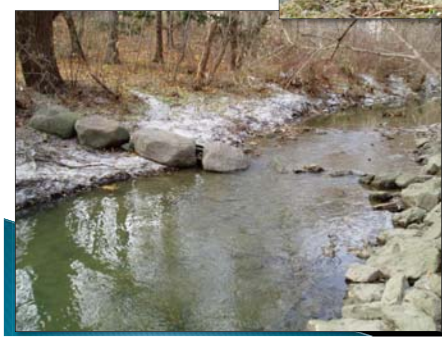
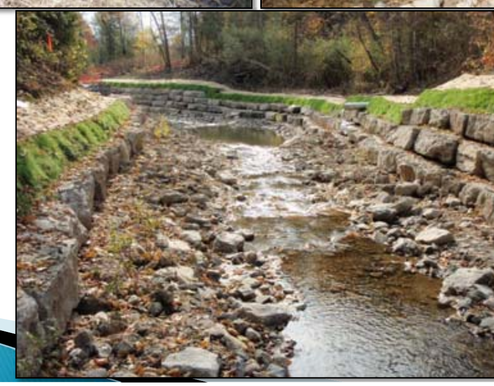
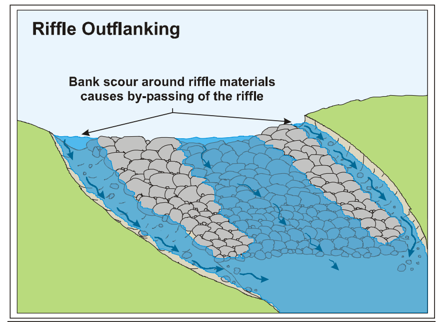
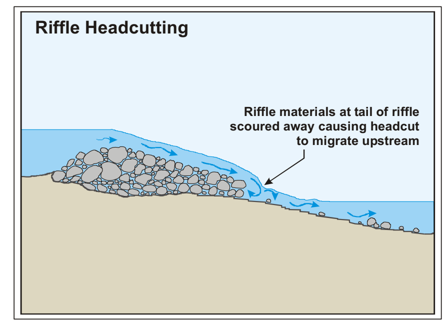


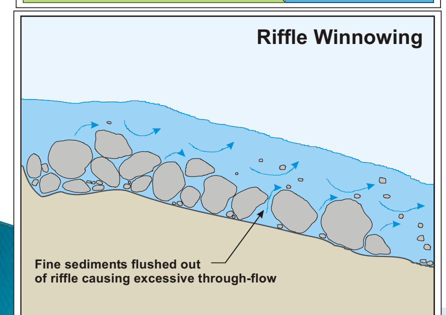


Riffles

How Do Installed Riffles Fail?







Villard and Parish, 2004; Villard and Ness, 2006

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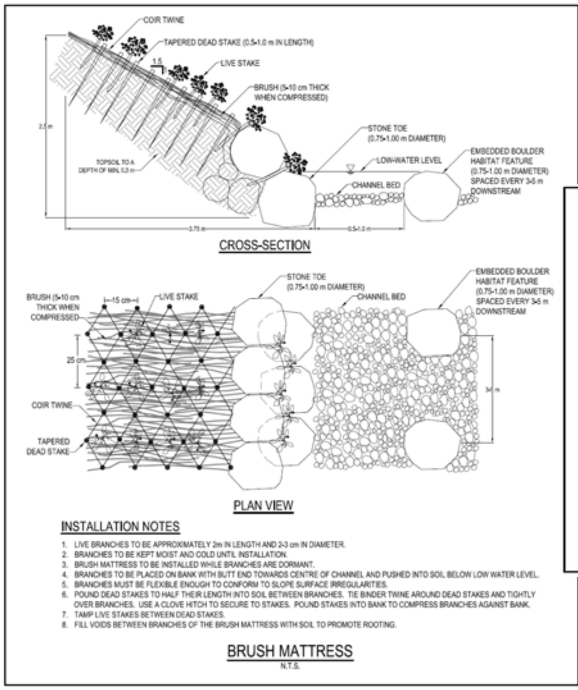
Vegetation Encroachment

Bioengineering

- Hard solution with ecological advantages
- Usually involves inert and vegetation components
- Relies on strength of vegetation, as well as inert components
  - Stronger together
- Vegetation also provides roughness and resistance to flow
- Vegetation success is integral to stability of the bioengineering
- Does not reach maximum stability until vegetation has been established
- Needs monitoring and maintenance <u>initially</u>
- Examples:
  - Brush mattressing
  - Vegetated stone mattressing
  - Cribwall



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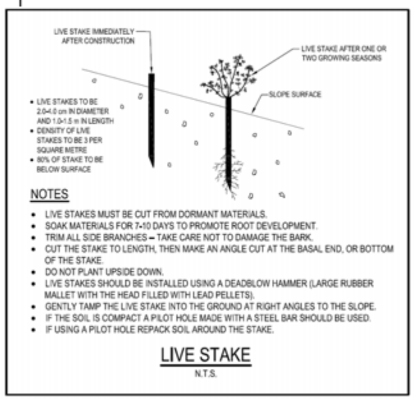

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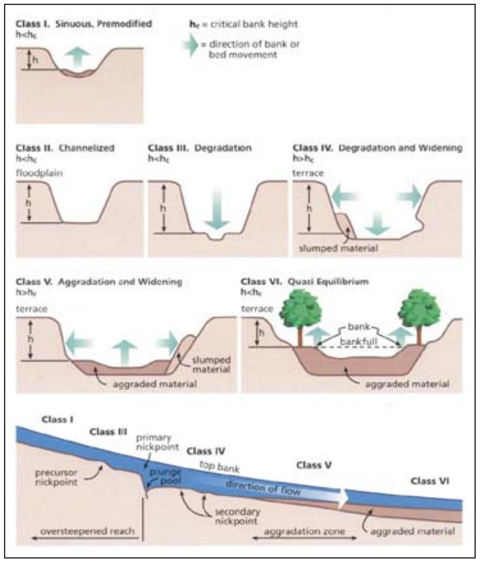
When and How Will Bioengineering Fail?

- There are numerous factors that can affect the life span of a bioengineering
- One of the most important factor is stream stability, if the creek is moving/adjusting more rapidly, it can outflank or undercut these treatments will have shorter life spans

Downs Model

- Downs classifies based on adjustment processes and changes in channel form



More Quantitative Methods to Estimate Lifespan

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- Life span can also be calculated as a probability of survival over a given period (such as the bioengineering has an 80 percent chance of lasting 20 years)
- This is calculated on the structures survivability of a given return storm event
- We assess this based on the resisting strength of the structure or materials compared to the force associated with a given return event
- It is easily tied to available hydraulic modeling
- This is the starting point for predicting the life span of bank structures

What Do We Miss?

- Unfortunately it would not address other factors in failure such as:
  - Loss of vegetation
  - Undermining or outflanking
  - Mechanical failure
  - Chemical and mechanical weathering

This is where monitoring comes in…

Vegetated Cribwall

Lynde Creek at Taunton Road

Vegetated Cribwall

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Lynde Creek at Taunton Road

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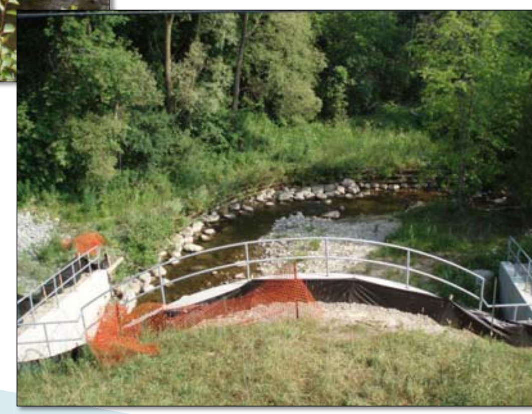

Compromised Vegetated Cribwall

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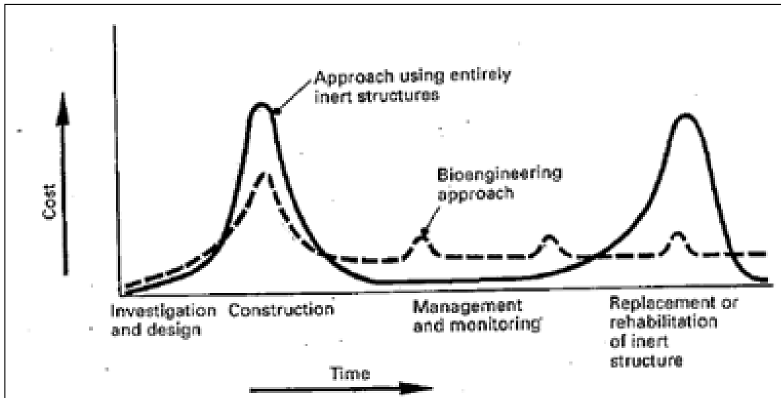

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