Use of Bioengineering Techniques for Revegetation of Riparian Areas: Colomac Mine Remediation Project, NWT

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2012 RPIC Federal Contaminated Sites National Workshop

2 May 2012

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Colomac Mine – mid 1990s

Tank Farm

Steeves Lake shoreline
**Steeves Lake Shoreline Remediation**

- Contained and capped 750 meters of impacted shoreline
- Fish habitat compensation required under the *Fisheries Act*
- Included revegetation of shoreline and riparian areas
Steeves Lake Shoreline Remediation

Steeves Lake berm construction

Placement of infill
Steeves Lake Shoreline Remediation

Placement of peat layer

2011 - Aerial view of completed sediment cap
Revegetation Areas

Steeves Lake Shoreline

Rock berm trench

Infill/cap
Revegetation Areas

Truck Lake channel and shoreline

Steeves Lake

Truck Lake
Revegetation & Bioengineering

- Bioengineering training provided on-site
  - Soil bioengineering techniques for riparian restoration
  - Natural processes for restoration of disturbed sites
Revegetation Plan

- **Objective** – use natural processes
  - Establish pioneering species
  - Facilitate natural recovery and succession

- Soil bioengineering recommendations and techniques incorporated into revegetation approach

- Consultant contracted to help develop and implement revegetation plan
Revegetation Plan

• **Planning questions**:  
  – Which species for initial cover?  
  – How to establish these species?  
  – What is the end land use?  
  – What about maintenance?

• **Solutions: focus on ecology of site**  
  – Identify limiting factors to natural recovery  
  – Identify natural conditions for recovery

1 – Polster 2009
Revegetation Plan

- Plan outline:
  - Plant selection
  - Revegetation prescriptions
  - Methods
  - Implementation
  - Quality control
  - Contingencies
  - Monitoring and maintenance

Steeves Lake shoreline cap As-Built w/ vegetation overlay
Revegetation Methods

Revegetation materials collected and prepared on site
Revegetation Methods

Collect Wetland Sedges

Cut Willow Stakes

Collect Alder Seed
Revegetation Methods

Planting willow stakes using ‘Live Gravel Bar Method’
Revegetation Methods

Planting willow stakes using ‘Live Gravel Bar Method’
Revegetation Methods

- Making sites ‘**rough and loose**’ improves the natural recovery of sites

- De-compacts soils
- Creates micro-sites for seeds to lodge in and germinate
- Cost-effective way of preventing erosion
Revegetation Methods

Live willow staking

Transplanting wetland sedges
Revegetation Methods

Transplanting sedge plugs can be an effective way of establishing wetland vegetation on disturbed wetland sites.
Revegetation Methods

Alder cone

Alder seed separated from cones

Seeding - Alder is a natural nitrogen-fixing pioneer species
Revegetation Methods

- Seeding
  - alder
  - native grass seed mix
Revegetation Monitoring Plan

• Monitoring:
  – *Fisheries Act* Authorization requirement
  – Annual monitoring for 5 years post-construction

• Purpose:
  – evaluate and verify success of revegetation
  – establish framework and protocols to assess revegetation over time

• Objectives:
  – pioneering species – success rates
  – natural succession trajectory

Alder seedlings - Aug 2011
Revegetation Monitoring Methods

**Quantitative**
- Measure plants (willow and sedge)
- Vegetation plots (seeded and planted areas)
  - Establish transects
  - 100m² circular plots
  - 1m² square plots
- Estimate surface coverage
  - Overall seeding and planting areas
  - Within vegetation plots

**Qualitative**
- Photographic record
- Assess health of plantings
- Document other pioneering species
Revegetation Monitoring Results

2011 (Year 1 of 5)

- Preliminary assessment
  - Observations and counts
  - 2 vegetation plots
  - Photographic record

- Recommendations for comprehensive monitoring program
Revegetation Monitoring Results

Steeves Lake Shoreline Trench

Success Rates:
- Willow cuttings - 69%
- Alder – 80%

Before - 2010

After - 2011
Revegetation Monitoring Results
Steeves Lake Shoreline Infill

Success rates:

- ‘Rough and Loose’ Test Plot
  - Willow cuttings – 91%

Before - 2010

After - 2011
Revegetation Monitoring Results

Steeves Lake Shoreline Infill

Success rates:

- Seeding – 60%
- Wetland sedges – 100%

Before - 2010

After - 2011
Revegetation Monitoring Results

Truck Lake channel

Success rates:
- Willow cuttings – 44%
- Wetland sedge – 75%
- Seed mix – 60%

2011
Revegetation Monitoring Results

Truck Lake Shoreline

Success rates:

• Willow cuttings – 8%
• Alders – 0%

2011 - Truck Lake west shoreline
Revegetation Monitoring Results

2006- Baker Creek plantings w/ conventional grass seed cover
less growth in 5 growing seasons

2010- Steeves Lake plantings
rough and loose – natural processes
1 growing season
Recommended Revegetation Monitoring

• 1\textsuperscript{st} cycle - Annually late summer for first 5 years
• 2\textsuperscript{nd} cycle - Every 5 years for 25 years
• Photographic documentation

Vegetation plots along transects
  – 100m\textsuperscript{2} circular plots
  – 1m\textsuperscript{2} plots on shoreline trench

100m\textsuperscript{2} circular plot
Lessons Learned

Incorporate revegetation early in the planning process

*not as an afterthought!*
Lessons Learned

Use expertise

at all stages in process
Lessons Learned

Build restoration into remediation

lasting benefits to ecosystem
Lessons Learned

Community involvement

*build capacity and sense of ownership*
Lessons Learned

Use natural processes
cheap, easy, and effective approach
to restoration
Summary of Key Points

- Think beyond conventional revegetation methods
- Use natural processes to your advantage
- Work with existing on-site conditions, site-specific focus
- Make a plan early
- Use experts to plan, implement and monitor
- Build capacity
- Monitor and maintain
Acknowledgments

- Melissa Munger – Aboriginal Affairs and Northern Development Canada
- David Polster - Polster Environmental Services Ltd.
- Public Works and Government Services Canada
- On-site engineers - AECOM
- Colomac Mine Remediation Contractor – Tlicho Engineering and Environmental Services Ltd. (TEES) and Aboriginal Engineering Ltd. (AEL)
Questions?