STATE OF THE ART IN OIL SANDS RECLAMATION
REMTECH 2014
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Summary and evaluation of existing work and future reclamation research priorities
Project Objectives

• Determine the “State of the Art” in oil sands and coal mining reclamation practices through a review of several selected reclamation research compilations/reports.

• The main objectives were to:
  • Categorise the research into thematic subject areas (research buckets), and to highlight future research priorities
  • Summarise differences/similarities and overall knowledge gaps noted within the literature
  • Highlight any learnings from coal mine reclamation
  • Bring together mining reclamation practitioners to evaluate and discuss the results
  • Create a summary report that includes the summarised state of the art, workshop findings and the path forward
Ideal Reclamation – Where to set the bar?
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Stable, self-sustaining, locally common boreal forest equivalent to pre-disturbance communities, regardless of the end land use (e.g., forestry, recreation, wildlife and traditional use)
Literature Review

- Theme
- State
- Gaps
- Contribution
- Take aways
Thematic Subject Areas

- Vegetation
- Water
- Biodiversity
- Soils
- Terrain

- Mine planning
- Environmental risk management
- Certification
- Monitoring and reporting
- Climate change
- Adaptive management
- Outcomes v. prescriptions
State of Reclamation - Terrain

Research Buckets

• Landscape design
• Landscape modelling
• Terrain hydrology management
• Terrain stability
• Overburden reclamation
• Tailings sand reclamation
• Soft tailings reclamation

Current State

• The physical aspects are a success, hydrological aspects are progressing
• Geomorphic approach
• Stable landforms are created on “dry” materials
• Capping unsuitable materials
• Tailings pond reclamation completed at pilot scale
# State of Reclamation - Water

## Research Buckets
- Surface water and ground water quality
- Soil pore-water quality
- Water quantity
- Establishment of functional wetlands
- Watershed reclamation

## Current State
- Importance of holistic watershed functioning
- Wetland reclamation in early stages of implementation
- Models to simulate water balance and transmission
- Soil capping configuration promotes infiltration
- Salt water discharge a concern
State of Reclamation - Soil

Research Buckets

• Soil salvage and material handling
• Stockpile management
• Direct placement
• Material balance
• Suitability/capability assessments
• Soil capping prescriptions
• Erosion control
• Creation of microsites
• Soil moisture regime mgt.
• Soil nutrient regime mgt.

Current State

• **Coversoil types/depths developed for target upland moisture/nutrient regimes**
• Creation of microsites using mounding and woody debris
• Direct placement to stimulate soil biological processes and native species re-establishment
• Long-term stockpiling
State of Reclamation - Vegetation

Research Buckets

• Seed collection
• Coarse woody debris
• Agronomic cover crop establishment
• Revegetation
• Fertilization
• Plant water consumption
• Weed management
• Pest management

Current State

• Targets common local ecosite communities
• Native seeds/cuttings collected locally
• Cover crops used to minimise erosion and improve structure
• Weeds and pests sprayed or manually pulled
• Fertilizer applied - effectiveness uncertain
State of Reclamation - Biodiversity

**Research Buckets**

- Biodiversity monitoring
- Vegetation community diversity
- Wildlife habitat diversity
- Criteria of ecosystem performance
- Land conservation offsets
- Traditional ecological knowledge

**Current State**

- **Progress in designing wetlands vs. opportunistic establishment**
- Wildlife habitat not a direct focus, but target ecosites are expected to support a range of wildlife species
The Evaluation Matrix

Proven track record. Acknowledge these successes.

Great Potential. May want to target research projects /funding here. May close a knowledge gap.

Limited return on investment. Research topics may not be useful to a wide audience. Not likely to close a knowledge gap.
Evaluation Results

- Pre-workshop survey
- Workshop live voting
- Workshop discussions
- Post-workshop survey
Evaluation Results
Evaluation Results – Greatest potential
### Key Research Focus: Watershed reclamation

#### Gaps to Close

- Watershed scale
- Mechanisms to shed water
- Geomorphic approach
- Water table management and fluctuation
- Climate change effects
- Drawdown effects on natural drainage
- Transport pathways of constituents
- Subsidence of reclaimed surfaces

#### Research Focus

- **Synthesis, knowledge transfer, and implementation**
- Leach characteristics of different materials
- Rates of transport and sink
- Water quality mgt. techniques
- Test landforms that shed water in a predictable way
- Robust soil and vegetation prescriptions
Key Research Focus: Establishment of functional wetlands

Gaps to Close

- Establishment/survival of diverse aquatic and salt tolerant communities
- Loading of wetlands from uplands
- Impact of process components
- Duration of monitoring before target is achieved

Research Focus

- Monitor integrated constructed landforms
- Wetland revegetation
- Water table dynamics
- Cover thickness requirements to maintain pore water quality
- Standard methods for quantifying constituents
- Landform configuration strategies to mitigate migration of salts and naphthenic acids
### Key Research Focus: Soft tailings reclamation

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<thead>
<tr>
<th>Gaps to Close</th>
<th>Research Focus</th>
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<tr>
<td>• Predicting possible water quality issues</td>
<td>• <strong>Implementation at operational scales</strong></td>
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<td>• Water table dynamics</td>
<td>• Validation of conceptual models</td>
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<td>• Subsidence of reclaimed surfaces</td>
<td>• Robust soil and vegetation pres.</td>
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<td>• Geochemical leach characteristics of different materials (salts and metals)</td>
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<td>• Include hydropedology of prescriptions and allocation of water to vegetation, infiltration, runoff, discharge, etc.</td>
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Conclusions

Watershed Reclamation

Functional Wetlands

Soft Tailings
Conclusions – The path forward

Ideal Reclamation

Research
Synthesis
Implementation
Performance monitoring

Path finding

Terrain
Soil
Vegetation
Biodiversity

Water
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