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Soil Bioengineering for Control of Soil Erosion in a Reconstructed Waterway on an Alberta Oil Sands Dump in Canada

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Background
In 2003 a waterway swale was retrofitted into an Alberta oil sands overburden dump. In spring 2004 Terra Erosion Control Ltd was retained to develop and implement an erosion control prescription using a soil bioengineering approach.

The constructed swale has an average gradient of 7 percent (4 degrees) and is approximately 600 metres long. It is composed of two minor lateral swales connecting onto the main swale. The substrate consists of muskeg placed over clay capping and oil sands tailings.

Objectives
To disperse precipitation water flow and reduce surface erosion that could lead to gully formation. Establishment of vegetation and creation of wildlife habitat.

Soil Bioengineering Prescription and Implementation
The prescription and implementation in 2004 consisted of the following:
• Twenty nine brush sills installed across the swale.
• Smaller diameter cuttings installed in the middle of each sill to improve water dispersion.
• Contour fascines installed across the swale, in two locations above the brush sills, as a trial.
• An upstream wetland was created as a result of seeds germinating from within the seed bank of the applied muskeg; the area was also planted with long live stakes.
• The swale was fertilized and broadcast seeded with a nurse crop of barley.

Monitoring and Survival
The site was monitored in 2004 and survival of brush sill cuttings was estimated at approximately 70 percent, with shoot growth averaging 60 centimetres.

In 2005 survival and growth of the brush sills and fascines was assessed as good. The trial sections of contour fascines, installed above the brush sills, were found to be much better at dispersing water than the brush sill structures alone.

Repair and Maintenance
Measures to address problem areas were implemented in October 2005 / spring 2006:
• Replacement of brush sill sections where mortality occurred.
• Addition of contour fascines above all existing brush sills.
• Live staking in the centre of the swale.
• Installation of muskeg and seed filled burlap sacks to fill in eroded areas.
• Application of additional soil amendments and broadcast seeding with a native grass mix.

Condition of the swale was monitored in 2007, 2009 and 2010 and assessed as good to excellent.

Lessons Learned
The brush sills resulted in channel erosion. When combined with accumulated organic debris this results in falling water (a hydraulic jump) and the creation of splash erosion. The use of contour fascines, without brush sills, appears to be diffusing water instead of creating channels and splash erosion

Based on these findings, trial sites using large diameter contour fascines were established in the spring of 2010 over two newly constructed waterways within the mine dump. Early results will be presented.

Biography
Mr. Pierre Raymond is a senior site rehabilitation specialist. He has worked since 1990 in the natural resources sector in British Columbia and Alberta, Canada. Since 1996, his focus has been on soil bioengineering, biotechnical slope stabilization, erosion control and riparian habitat restoration.

In 2002 he was involved in the monitoring, auditing, training and trial establishment of erosion control measures on a pipeline project in southern Peru. In 2010 he was involved in the assessment and development of soil erosion remedial measures on the access road of the Upper Tamakoshi Hydro Electric Project in Nepal.

Pierre's experience includes biotechnical stabilization prescriptions, implementation, maintenance and monitoring. He has a strong background in post-harvest silviculture treatment, supervision of construction machinery and road deactivation practices. Recent involvement includes the development of streambank restoration guidelines for the City of Calgary, Alberta Canada and implementation of riparian habitat restoration, vegetated log crib walls, storm water outfall protection and mining reclamation.