Remediation of Salt-Impacted Soils Using Automated Conductivity Monitoring, Leachate Collection, Irrigation, and Injection

Ion Ratiu M.Sc. & Dewey Dunnington, B.Sc.
GeoGrid Environmental Inc.
Salt Remediation

- Salt contamination a major issue in western Canada
- Affects soil, vegetation growth, and groundwater quality
- Available remediation options are costly and often have limited success
Options

- Removal and landfill disposal of impacted soil
- In-situ remediation
- Combination of methods
In-Situ Remediation

- Commonly based on soil flushing, sodium displacement and removal

**System Components**

- Salt leaching
- Leachate removal
- Leachate treatment/disposal
Objectives

- Reduce/optimize irrigation water usage
- Maintain control of the hydraulic gradient within the treatment area
- Control the irrigation and leachate disposal through continuous monitoring
- Reduce leachate disposal
The Site

- Remediation of a historic produced water release from ruptured pipeline

Location

- Release occurred on a hillside
- Near operating wellsite

Land Use

- Agricultural land use
Before Remediation
Site Overview

- Spill pathway located on hillside
- The affected area covers 0.6 ha
- Salt impacts extend to approximately 6.0 mbgs
- Approximately 36,000 m$^3$ of salt impacted materials
- Clay till
EM Survey
Master Plan

Take good ideas

- Surface irrigation & subsurface injection
- Drainage tile & wastewater recovery system
- Irrigation water recovery system

Make them better

- Install EC meter to monitor irrigation water quality
- Install flow-computer to automatically route irrigation water
System Model

- EC METER
- IRRIGATION WATER RECOVERY SYSTEM
- DRAINAGE TILE RECOVERY SYSTEM
- FloBoss
- SPRINKLER SYSTEM
- INJECTION SYSTEM
- WASTEWATER STORAGE TANKS
Drainage Tile System
Injection/Sprinkler System
Site Cross-Section

SURFACE IRRIGATION - SPRINKLERS

TO STORAGE TANKS FOR DISPOSAL

TO SURFACE IRRIGATION

TO INJECTION WELLS

INJECTION WELLS

DRAINAGE TILE

FloBoss

EC METER

SUBMERSIBLE PUMPS
Readings
Before remediation
Today
Accomplishments

- Reduced/optimized irrigation water usage
- Maintained control of the hydraulic gradient within the treatment area
- Maintained control of the irrigation water
- Reduced leachate disposal
- Utilized readily available equipment and components
Advantages

- Continuous monitoring of leachate quality & remediation progress
- Automated control of irrigation/injection/disposal
- Reduced disposal costs
- Reduced number of site visits
- System adaptable for diverse implementation
Conclusions

- A variety of in-situ remediation systems are currently operational
- Remote monitoring and flow-computer control technology improves functionality and range of applicability of the remediation system
- Highly adaptable system allows for diverse implementation in the future
Questions