Moving Underground Mountains:

A Winnipeg Landfill and Shooting Range Removal Success Story

SWANA Measuring Success Conference
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Agenda

1. The Site
2. Background
3. Work Stages
4. Waste and Shooting Range Removal
5. Challenges, Opportunities and Applications
1 The Site

49°47’53” N, 97°11’23” W
BRIDGWAY PARK - LANDFILL No. 23
STAGE 1 - REMOVAL AND DISPOSAL

FIGURE 1: LOCATION PLAN
The Site

6.3 ha
Dimensions 300 m x 210 m
7.6 m below grade and 4.6 m above grade
45 m control zone

History
Operated from 1932 - 1965
Collected waste from the RM of Fort Garry
Accepted animal carcasses, domestic and industrial waste and bulk metals
Burned waste in trenches and pits
WPS shooting range developed around time of landfill closure
The Site (Cnt’d)

**Conditions Conducive to Removal**

- **Proximity:** within 4 km of Brady Road Resource Management Facility
- **Age of deposited materials:** non-putrescible wastes that could be used as alternative daily cover
- **Soils:** Located on low permeability, high plastic clay content soils
- **Undeveloped Area:** Located in an area free of neighbouring development
- **Land Value:** Future planned use of the Site and adjacent areas strong economic argument
2 Background
Background

**Client:** Manitoba Housing and Renewal Corporation

**Purpose**
- Allow for:
  - Development of adjacent residences
  - Construction of stormwater retention ponds
  - Dedication of site as recreational parkland

**Objective**
- Remove all on-site wastes until undisturbed soil was encountered
  - Under the direction of a qualified environmental consultant
  - Resident environmental monitor was on-site for the duration of the Project
Regulatory Framework

Remedial Objective

- CCME Canadian Soil Quality Guidelines
  - Protection of Environmental and Human Health
  - Residential/Parkland Land Use Category

Also

- The Contaminated Sites Remediation Act
- CCME Canada-wide Standard for Petroleum Hydrocarbons in Soil
- Manitoba Environment Guideline 96-05: Treatment and Disposal of Petroleum Contaminated Soil
- Waste Disposal Grounds Regulation, M.R. 150/91
- City of Winnipeg Sewer By-Law No. 92/2010
- Manitoba Conservation Leachate Quality Criteria
Timeline

2009
- Removal Plan (MMM Group Ltd.)

2010
- Start of Excavation (January)

2012
- End of Excavation (June)

2013
- Filed Closure Report
- Received Site Closure

2006
- Phase II ESA (ISIS Environmental)
Before + After
Before

Aerial view of the Site, imagery date September 3, 2004.
Source: Google Earth Pro.

WPS Bridgwater Park Shooting Range and landfill, as viewed from Cadboro Road to the South, imagery date July, 2009.
Source: Google Earth Pro Street View.
After

Aerial view of Site imagery date September 4, 2014.
Source: Google Earth Pro.

Lake 4 and playground, as viewed from North Town Road to the North, imagery date June, 2014.
Source: Google Earth Pro Street View.
2  Work Stages + Hours
Work Stages

Stage 1 • January 2010 – March 2010

Stage 2 • June 2010 – August 2010
• January 2011 – April 2011

Stage 3 • Shooting Range Removal
• January 2012 – June 2012
Hours of Operation

• Same as Brady Road Resource Management Facility
• Added a night shift with approval from the CoW
Waste Removal
Non-hazardous domestic waste removed

300,000 m$^3$
Historic Air Photo Review

- Better understand historical deposition pattern and site arrangement
- Deposition around perimeter
- Learned more as excavation progressed
  - Significantly deep pits in NE and SW corners
Removal Oversight

- Full-time Resident Environmental Monitor
- Activities included:
  - Staking the estimated limits of buried waste
  - Monitoring waste removal activities
  - Collecting and submitting samples of laboratory analysis
  - Documenting remedial activities
- Conducted routine site walks to:
  - Monitor progression of waste removal
  - Review the work for signs of impacts
Removal Process

- 20-30 trucks hauling 100-200 loads/day
- Initial cut used to view deposition horizon
- Waste excavated until native clay encountered
  - A 0.2 m to 1.0 m subcut was taken below the encountered waste
• Random test pitting of the excavation floor to identify any additional wastes
• Test pits yielding waste materials were excavated to native soil at all extents
• The working face of the excavation was capped with clay between removal stages
Wastes Encountered

- Rubber tires
- Concrete rubble
- Woody construction waste
- Metal wire
- Animal bones
- Broken glass and glass bottles
- Burned wastes
- Manure
- Newspapers (readable!)
- Tin containers
- Used oil filters
Leachate Management
Low-strength leachate

2,600 m³
Leachate Management

- Stored on-site in containment ponds and “bell holes” in clays
- Tested relative to Sewer By-law
Leachate Management

- Registered as a wastewater generator
- Hauled to North End Pollution Control Centre via vacuum trucks
  - Batch sample delivered with each load
Hydrocarbon impacted soil

400 T

Hydrocarbon impacted soil
Hazardous Waste Management

• Petroleum contaminated soils were encountered during removal activities
• Operators and Environmental Monitor were alert for material character changes during excavation
  • Visual and olfactory vigilance
  • Suspect contaminated soils were bagged and field screened with a gas monitor to evaluate potential contamination.
• Confirmed by laboratory analysis
• Set aside and prepare remedial action plan for approval
• Transported to treatment facilities approved to accept such wastes
Shooting Range Removal
425 T Lead-fragment impacted soil removed
Shooting Range Removal

- North berm: 30 small arms target stations (7mm fragments)
- East berm: shotgun shooting (<2mm fragments)
- Electric service and underground sewage holding tanks
- Buildings
  - Salvaged for re-use
Lead-fragment Soils

- Exceeded the Transportation of Dangerous Goods Act maximum leachable lead concentration (5.0 mg/L)
- Large volume of impacted soils
  - “Dig and dump” approach to treatment cost prohibitive
- Evaluated treatment options:
  - Screening lead-fragments from sand/soil
  - On-site or off-site stabilization
  - Detailed excavation and testing
Detailed Excavation and Testing

- Estimated varying impact level zones based on previous Phase II assessment
  - Position on the berm
  - Penetration depth into the berms
- Peripheral soils were stockpiled separately
- Conducted representative composite sampling based on soil volume to determine leachable lead concentration of stockpiles
- Successful in reducing the number of loads and soil volume requiring treatment at Miller Environmental Corporation
Site Clearance
Site Clearance

- Excavation floor and walls sampled at end of each stage
- Total 79 post-excavation soil samples were collected
- Number of samples required determined based on soil volume of potential additional subcut
- Sample grid established with random sample design
Results
Results

• Remedial objective met, with exception of elevated:
  • Selenium (1.0-1.6x guideline)
  • Barium (1.0 -1.8x guideline)
• Selenium and barium are naturally occurring analytes
• Known to have background concentrations
  • Selenium up to 4.6x guideline
  • Barium up to 8.6x guideline
• Remedial objective was considered to be met
5 Challenges, Opportunities and Applications
Challenges

The Day the Ditch Broke
Leachate Volume Estimate
Challenge: Ditch Break

- Clean site, clean water
  - Clearance sampling was substantially complete
  - Working wall had been capped with clean clay
  - Water was freshwater from spring melt
- Conducted water sampling and analysis
- Met CoW Sewer By-law land drainage discharge criteria
- Discharged to LDS in liaison with CoW
Challenge: Leachate Volume

• Underestimated by Others
  • Estimate: 20 m³
  • Actual: 2,600 m³

• Large volumes entrained in waste
  • particularly wood-based C&D wastes

• Required innovative leachate management
Opportunities

Innovative Leachate Management
Opportunities

Innovative Leachate Management

- Consistent low-strength leachate
- Evaluated irrigating leachate effluent on adjacent agricultural lands
- Received approval to discharge direct to the sewer system
  - Temporary aboveground sewer connection
  - Subject to metering, flow regulation and schedule for discharge
Applications
Applications

• Historic siting of landfills has challenges, such as siting in areas of:
  • Future development opportunity
  • Poor environmental protection
• Landfills constitute an environmental liability
  • Public entities must carry closure costs in accounting
  • May pose a risk to the public or environment
• Removal of poorly sited landfills to larger, more robust facilities:
  • Consolidates liabilities on the landscape
  • Provides enhanced environmental protection
  • Remediates brownfield sites