Norman Wells
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Solid Waste Disposal Facility, Norman Wells, NT "Interim Closure and Reclamation Plan"

Plan prepared for Sahtu Land and Water Board Review

Prepared by:
Earth Concerns Environmental Contracting Inc.

Revision	Date	Notes
0	22nd July 2021	Prepared and submitted for SLWB review

ACRONYMS

ENR	Department of Environment and Natural Resources
GNWT	Government of Northwest Territories
ICRP	Interim Closure and Reclamation Plan
Licence	SLWB issued Water Licence S186L – 003 (dated November 19,2021)
MACA	Department of Municipal and Community Affairs
MVLWB	Mackenzie Valley Land and Water Board
NT	Northwest Territories
Town	Town of Norman Wells
SLWB	Sahtu Land and Water Board
SNP	Surveillance Network Program
SWDF	Solid Waste Disposal Facility

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1.0 INTRODUCTION

1.0 General

The Town of Norman Wells operates a solid waste disposal facility (SWDF) under a Shatu Land and Water Board licence issued as a renewal in November 2018. Water licence S186L – 003 requires (condition Part 1, item 1) the submission for review and approval every three years an Interim Closure and Reclamation Plan (ICRP). This requirement also applies to the wastewater treatment facility (sewage lagoon). A revised ICRP is also a required supporting document for SLWB application's to expand or develop a new SWDF.

The SWDF at its current location has been in operation since 1997 and is located approximately 6.6 kilometres from the Town centre (Figure 1.)

The capacity of the SWDF for landfilling of waste is expected to reach its limit by the end of 2024 (AECOM 2017). To continue to provide waste management and disposal service to community members an expansion to the existing landfill will be required. With the expansion it is estimated that an additional 14 years (2038) of service life. At that point in time a new SWDF site will be required with the existing and expanded facility subject to final closure and reclamation. There is no need at this time or within the next years ( ) to close and replace the sewage treatment facilities.

1.1 Scope of Work

As described in the Mackenzie Valley Land and Water Board "Operations and Maintenance Plan Templates for Municipal Water Licences: Solid Waste Facility" (June 2017) :

"*When the SWDF reaches capacity or the community decides to stop using the SWDF, it is necessary to complete a closure and post-closure plan for the facility. A closure plan is a detailed document that describes how the facility would be shut down and designed to prevent or minimize impacts to the receiving environment. Typically, a closure plan includes placing final cover over the landfill to prevent water (surface water and precipitation) from infiltrating through the waste, diverting surface water away from the landfill cell, re-vegetating the landfill cover and decommissioning any buildings and facilities. A post-closure plan describes a long-term plan to maintain and monitor the closed site to verify whether the design features are working as designed and protecting the environment. Some aspects of closure and post-closure, such as groundwater and landfill gas monitoring, may be incorporated into the design or operation of a facility.*
Typically, these plans need to be submitted for review by the Land and Water Board a minimum of six months prior to carrying out the work outlined in the plan, but your water licence may specify a different requirement."

The Interim Site Closure and Reclamation Plan (ICRP) has been prepared in conformance with the conditions of the Water Licence and other applicable standards pertaining to the termination of the landfilling operations, post-closure inspection, maintenance, monitoring, reporting and end-use plan for the site. This Interim Plan will be submitted to the SLWB for review and available to members of the Norman Wells community for information and comment.

The ICRP will include the following sections:

• **Introduction and background** —The introduction and background should provide highlights of the site ownership, location, approved area and capacity; design principles of the site, and a brief summary of the facility operation, including the type of waste received and other solid waste management operations carried out at the site, as well as the conceptual plan proposed for use of the site after the site is closed and rehabilitated (if required).

• **Site Closure Works**—This section describes activities to maintain the site in a manner that is aesthetically pleasing and ensures long-term protection of the environment. The site closure activities should include the following:

A.) "Site Grading Plan" showing site appearance after closure, including drainage, control, treatment and monitoring features, landscape, final cover details, etc.;

B.) description of final cover design details, specifications and tendering and construction procedure (if applicable);

C.) description of the control and management of leachate, surface water, groundwater and landfill gas;

D.) descriptions of the procedures for closure of the site, including:

i. advance notification to the public of the land closure.
ii. posting of a sign at the site entrance indicating the landfill is closed and identifying any alternative waste disposal arrangements.
iii. restoration of areas affected by spills or unauthorized discharges.
iv. construction of the final cover, site access roads and landscaping.
v. site security fencing and lockable gates.
vi. removal of unwanted landfill-related structures, buildings and facilities.
vii. final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; and
viii. complaint contact and response procedures.

• **Inspection and Maintenance**—Description of the procedures and schedules for post-closure care of the site, including:

A.) operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas; and

B.) inspection and maintenance programs for the final cover, site security fence and gates, and access roads.

• **Compliance Monitoring Programs**—Description of monitoring programs for groundwater/leachate, surface water and landfill gas to assess compliance

• **Trigger Mechanism and Contingency Plan**—including:

1. description of trigger monitoring programs for groundwater/leachate, surface water and landfill gas, including trigger mechanism and locations to assess the need for implementation of contingency action; and
2. description of contingency plan to be implemented.

• **End-use Plan**—A description and design of the proposed end-use of the site, including design brief and details shown on plans as appropriate.

1.2 Regulations, Standards and Guidelines

There are no design guidelines for landfill closures in the Northwest Territories. For the preparation of the ICRP similar applicable guidelines and standards from other jurisdictions were used for reference. Other SWDF ICRP plans available on the SLWB public registry were reviewed and used as a guide.

The following guidelines and ICRPs were reviewed in the development of Norman Wells ICRP:

- Guidelines for the Planning, Design, Operations, and Maintenance of Modified Solid Waste Sites in the NWT
- Ontario Landfill Standards: A guideline on the regulatory and approval requirements for new or expanding landfill sites
- Closure Requirements for Solid Waste Facilities in Yukon
- ICRP for Solid Waste Facility; Tulita, Northwest Territories (Stantec)

2.0 BACKGROUND

2.0 General

The Town is located in the Mackenzie Valley and is part of the Inuvik Region of the Northwest Territories. Geographic coordinates of the SWDF are 85o17' North Latitude, 126o52' Longitude.
The population of the Town is approximately 750 with an estimated annual waste generation of 2,184 tonnes (AECOM 2017).

2.1 Solid Waste Facility Description

Site History

Based on current knowledge the landfill began operations in 1997 prior to the development of the 2003 GNWT " Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories".

Site and Facility Description

The topography of the landfill area can be described as a hill with elevations that range from 140 to 160 metres above sea level.

The SWDF site is located within the Norman Range low sub-arctic ecoregion of the Taiga Plains ecozone. The description (Ecological Classification Group 2009) of the ecoregion's geology consists of dolomite and limestone bedrock overlain by fine to medium textured tills.
Brunisolic and Luvisolic soils are found in the Norman Wells area. Vegetation found around the site and Town of Norman Wells consists of trembling aspen, paper birch and spruce. Norman Wells is located in a zone of extensive discontinuous permafrost with 50 to 90% ice content
(Natural Resources Canada 1993). The active layer thickness ranges from 0.5 to 2 metres below surface (UMA Engineering Ltd. 2008).

The SWDF has been operated by the Town since 1997 with a conversion to a modified landfill in 2008 and operated using the depression method for landfill waste materials. The conversion was completed to meet GNWT legislation and guidelines (AECOM 2017). The area of the SWDF covers approximately 5.6 hectares and is south sloping (refer to Figure 2). An additional 3 hectares is to be added to the southern portion of the SWDF to allow for an expansion of landfill capacity.

The SWDF is surrounded by a chain link fence with electrical fencing for wildlife deterrence. There are two main entrances on the north side that provide for site access (bring waste in) and for exiting the site.

The SWDF does not have an engineered liner or active leachate collection (AECOM 2017) for the three(3) phases currently in operation. The expansion phases four(4) and five(5) will be constructed with a compacted clay liner (or equivalent liner). A surveillance monitoring program of groundwater wells was established in 2018 . The two existing groundwater wells are sampled on an annual basis to provide detection of any environmental impacts.
As outlined by AECOM (2017) the Town's natural attenuation landfill is acceptable as a modified landfill because of: Town's small population being below 1,000 residents, small projected quantity of waste produced small projected quantity of waste produced (approximately 4,781 cubic metres per year), low annual precipitation (approximately 290 mm per year), and the low mean annual near-surface ground temperature(-5oC). With these environmental and climate conditions the biodegradation of waste is relatively slow.

For reference and viewing of SWDF design plans refer to Appendix A.

A shown in Figure 2 the SWDF site is divided into various areas;

- Active landfill cells (three phases) for disposal of residential, IC&I and collected wastes
- Temporary Hazardous Waste Storage Area
- Transfer Station
- Reuse / Salvage Area
- Appliances / Tires Storage Area
- Scrap Metals (Legacy Wastes) Area
- Proposed landfill expansion areas (Phases 4 and 5)

2.2 Solid Waste Disposal Facility Operations

The SWDF up until 2021 was an open and un-supervised waste disposal site. Residents and businesses from the Town had 24/7 access to the SWDF. The disposal and storage of all types of wastes generated by residents and businesses during this time period occurred. The site has various "legacy" waste materials on site ranging from scrap industrial tanks, equipment and trucks to hazardous wastes such as gas cylinders, waste oils and batteries.

In 2021 the Town undertook a number of initiatives to upgrade and improve the management of waste at the SWDF, including:

- Implementation of a municipal waste by-law
- Staffing the landfill with a Landfill Coordinator and Landfill Operator
- Stopping the acceptance of industrial hazardous and scrap metal wastes
- Established operating hours
- Locked gates during non-operating hours and days
- Community awareness programs

Non-hazardous waste materials and household hazardous waste are accepted at the SWDF for landfilling and temporary storage. Waste received is inspected by SWDF staff and segregated into five main areas for either temporary storage or landfilling: bulky items (appliances), waste tires, household hazardous, scrap vehicles and landfill cells.
Asbestos waste from contractors is permitted but subject to specific handling procedures that include disposal (GNWT regulations) in specific and surveyed locations of the landfill.

Under the Town's waste by-law and SLWB Water Licence conditions the following waste materials are accepted for landfilling or temporary storage:

Non-hazardous waste

- Construction, renovation, and demolition waste
- Bulky items including furniture and appliances (ozone containing include)
- Tires
- Electronic waste
- Recyclables (cans, bottles)
- Reusable and salvageable items
- Animal carcasses
- Residential waste (collected from households)

Household Hazardous Waste (HHW)

HHW received at the SWDF is segregated from waste that is being landfilled. HHW is segregated and stored on a lined area of the SWDF site. Specific HHW materials are stored in appropriate containers to prevent leakage.
The types of HHW received at the SWDF include:

- Batteries
- Waste oil
- Fuel tanks
- Gas cylinders
- Paint
- Glycols
- Waste fuels

The storage of these waste materials is temporary and subject to periodic removal by a licenced contractor hired to transport these materials to an approved hazardous waste treatment or disposal facility.

Scrap Metal
- Cars and SUVs
- Snowmobiles and ATVs
- White goods

The SWDF will manage waste during its operating life in a manner that minimizes the potential environmental impacts that can occur during the post closure period. Operating practices will include:

- Separation of household hazardous waste from regular waste being landfilled
- Removal of fluids and mercury switches from vehicles prior to removal as scrap metals
- Storage of HHW materials in proper containers prior to their removal from the SWDF
- Operation of HHW and asbestos waste in accordance with GNWT regulations and guidelines, specifically:

    - GWNT Guideline for the General Management of Hazardous Waste in NWT
    - Federal Transport of Dangerous goods Regulation
    - GNWT Guideline for the Management of Lead and Lead paints
    - GNWT Guideline for the Management of Waste Batteries
    - GNWT Guideline for the Management of Waste Antifreeze
    - GNWT Guideline to Recycle Mercury – Containing Lamps
    - GNWT Used Oil and Waste Fuel Management Regulation

3.0 SOLID WASTE DISPOSAL FACILITY STATUS

3.1 Solid Waste Disposal Facility Capacity

Based on the determinations completed in Stantec's "SWDF Operations and Maintenance " report of August 22, 2018 the landfill capacity (airspace) remaining in the approved phases I, II, and III will provide for waste filling capacity up to the end of 2024.

A topographic survey completed in the month of June 2021 confirmed that the remaining air space capacity is cubic metres.

3.2 Solid Waste Disposal Facility Expansion

The development of the Town's SWDF was planned for 41 years of capacity in five (V) phases. Phase I, II and II are currently being used to accept and landfill waste. Phase IV and V are planned to be developed starting in 2025 and will provide the Town with landfill disposal for an estimated time period of 14 years (2025 – 2038).

The development of Phase IV and V will require an amendment to the Licence to allow for an expansion of the landfill cells south beyond the existing boundary (current fence line).

3.3 Inspection and Monitoring

Inspections

SWDF staff conduct regular inspections to assess the condition of site facilities and undertake maintenance and repairs as required. The objective is to properly maintain the storage areas to prevent spills or contamination, monitor surface water drainage systems and groundwater wells so that all required systems are in a good state at the time of closure and are operational for the post closure care time period.

Key areas and features inspected include:

<u>Temporary household hazardous waste storage area</u>

- Inspection, repair or replacement of storage containers (prevent leakage)
- Inspection and cleanup of spillage
- Inspection, reporting and repair of liner or berm damage

Berms, Groundwater Wells and Stormwater Controls

The SWDF's design and construction requires the establishment and maintenance of perimeter berms, onsite berms lined temporary hazardous waste storage), groundwater monitoring wells (for sampling) and stormwater ditching (perimeter).

Inspections will be completed on a regular schedule by the Landfill Coordinator to identify any maintenance or re-construction requirements needed to maintain the berm functions.

Groundwater Wells – Inspections by the Landfill Coordinator will be carried out on a regular schedule to identify any damage to the wells. Conditions of the well caps (secure), casings have not settled or fallen over and that access to the well for sampling purposes is still in place.

Stormwater Controls – Inspections will be conducted on a regular schedule by the Landfill Coordinator to identify any signs of sediment buildup, bank collapse or leachate breakout (discolored water coming out of fill slopes).
If inspections find any of concerns repairs or ditching reconstruction works will be undertaken.

Monitoring

Regular groundwater (GW) sampling is included in the Surveillance Network Program (SNP) of the Licence. The expanded SWDF (phase 4 and 5) will require the establishment of a new GW upgradient of the SWDF and the maintenance of the existing two (2) down gradient GWs. The upgradient GW will provide groundwater quality conditions to compare to the quality results of the down gradient GWs to assess if landfilling is impacting groundwater during the operation of the SWDF. During this period if impacts are identified and it is determined that remediation is required than reclamation work will be completed.

4.0 CONCEPTUAL SITE CLOSURE PROGRAM

The final closure and reclamation plan will be completed and submitted to the SLWB for approval six months prior to planned closure which is estimated to be in 2038. The final plan will be based on actual site and environmental conditions experienced during the time period between now and 2038.

The Interim closure and reclamation plan describes the recommended activities and works required to minimize impacts to the environment, human health and wildlife and to restore the SWDF to a state that allows for a beneficial future use of the lands.

4.1 Site Cleanup and Removals

Prior to the closure of the SWDF a number of works will be design and planned prior to being carried out as a closure activity. Works planned will include cleanup work involving litter and debris pickup along access roads, fencing and neighbouring lands. Removal of gate house trailer and reuse shelter.

4.2 Management of Hazardous Waste and Scrap Metals

The Town will inventory, plan and issue tenders the removal of household hazardous waste stored on site and the depollution (fluid removals) of vehicles and scrap equipment prior to shipment to recycling markets.

4.3 Cover Systems

The cover practices at the SWDF include weekly and intermediate cover using locally sourced limestone shale material. Impermeable soil materials such as clay is not available in the area and not viable to be shipped to the site from southern sources (volumes needed, transport costs).
For the preparation of the final closure and reclamation plan consideration will be given to the most viable soil or liner material to use to minimize water infiltration into the waste. An investigation of revegetation options will be completed (i.e. wildlife habitat creation)

4.4 Run-off Drainage Control

The management of surface water involves the grading of ground and waste mound surfaces on site and off-site to minimize the volume of water draining on to the landfill areas. The SWDF has been design to incorporate drainage off finished side and top slopes of the landfill and conveyance of run-off waters into perimeter ditches. Typical sloping conditions allow for 1-2% top slopes and 1:4 side slope profiles.

During the active landfill period (2024 – 2038) SWDF staff will be inspecting the waste mound for evidence of any leachate breakouts (surface water impacts). If a history of leachate breakouts is experienced a qualified engineering consultant will be retained to complete a flow pathway study to identify drainage control measures, remedial works and need for the establishment of surface water sampling program during landfill operations and post closure.

5.0 POST-CLOSURE MONITORING

Following the closure of the SWDF long-term site monitoring will be required to verify that design features in the final closure and reclamation are preventing environmental impacts.

Post closure monitoring will include the following elements:

- Annual groundwater sampling
- Bi-annual inspections of final cover conditions for signs of erosion, settlement and seepage.
- Regular inspection of surface water drainage conditions and evidence of leachate breakout from landfill side slope areas
- Regular inspections for the extent of landfill gas venting (assess risk of fire potential)

It is anticipated at this point in time that the SWDF closure and reclamation process will allow for a passive use of the area. It is too early for the Town to determine the potential of the SWDF site for specific uses or activities recognizing the unknowns of the recreational or infrastructure needs of the Town in the future.

6.0 IMPLEMENTATION SCHEDULE

Based on current waste disposal generation rates, SWDF landfill design and latest surveying information available on air space capacity it is anticipated that the closure and reclamation of the licenced SWDF will occur around the year 2038 (within 17 years). Assuming that this is the time frame for the implementation schedule to complete closure design, planning and construction works the following tasks and timing are being proposed:

Environmental and Engineering Investigations / Closure Design (2036-37)

- Assessment of historical information gained through the SWDF SNP to determine any need for remediation or changes to post-closure SNP
- Development of groundwater quality trigger mechanism to identify if and when remediation maybe required
- Development of contingency plans in the event of adverse environmental impacts
- Design of final cover design and final grading plans
- Identification of SWDF post-closure use and revegetation program
- Development of the final closure and reclamation plan for SLWB submission

Facility and Waste Removal (2037)

- Develop plan for the tendering and removal of gatehouse trailer and reuse shelter
- Tender for the removal of household hazardous waste, scrap vehicles and appliances

Construction Works and Monitoring (2038)

- Grading and contouring of the SWDF site for drainage and erosion controls
- Installation of final cover system and revegetation
- Initiate post-closure SNP

7.0 CLOSURE AND RECLAMATION COSTS AND FINANCING

The closure of the SWDF will entail costs for various activities and construction works. Estimation of these costs items will occur as part of the completion of the final closure and reclamation plan for submission in 2037.
Activities and work items requiring financing include:

- Engineering assessments and cover design works
- Design of SNP and monitoring well upgrade / installations
- Development of tenders for removal contracts
- Waste and scrap metals removal works
- Construction supervision
- Construction and commissioning works
- Post-closure monitoring program

The financing of the closure and reclamation works and long-term monitoring programs will be established through MACA and Town discussions.

FIGURES

Appendices

Appendix A - Solid Waste Disposal Facility Design Plans

APPENDIX A
SOLID WASTE DISPOSAL FACILITY DESIGN PLANS