

Appendix 30

Meadowbank 2021 Landfarm Report



MEADOWBANK COMPLEX

2021 Landfarm Report

In Accordance with NIRB Project Certificates No.004 & No. 008
&
NWB Type A License 2AM-MEA1530 & 2AM-WTP1830

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EXECUTIVE SUMMARY

As per the Meadowbank Landfarm Design and Management Plan (LDMP; March, 2017), this document presents the 2021 landfarm activities indicating the volume of material added to the facility, amount of material removed and disposal or re-use location, all analysis results, volume and type of nutrient addition, visual inspection and volume of contact water pumped.

There was no landfarm at Whale Tail site in 2021. All petroleum-contaminated material was brought to the Meadowbank landfarm. The construction of the landfarm at Whale Tail was approved by the NWB on October 27, 2021. Construction of the landfarm at Whale Tail is schedule for 2022. Once constructed, no more contaminated material should be disposed in the Meadowbank Landfarm. This report discusses only of the activities performed at the Meadowbank Landfarm in 2021.

Meadowbank's first landfarm (Landfarm 1) was constructed in 2012 and located on the north-west side of the South Tailings Cell within the Tailings Storage Facility. Since this area was planned to eventually become flooded with reclaim water, Agnico Eagle constructed a new landfarm (Landfarm 2) in 2016, in order to continue the treatment of contaminated soil. In 2019 the Landfarm 1 area became flooded with reclaim water, and it is thus no longer in operation.

Based on surveys conducted by Meadowbank's Engineering Department the volume of the landfarm 2 in December 2021 was 5,081 m³. It is estimated that between January 2021 and the end of December 2021, 378.5 m³ of soil were added to landfarm 2 from material collected from spill events around the Meadowbank and Whale Tail sites. The remaining capacity of the landfarm 2 is estimated at 6,364 m³.

A landfarm soil sampling event was conducted in 2021. Petroleum hydrocarbons Fraction 3 exceeded the Government of Nunavut Tier 1 soil remediation criteria for industrial land uses. Those results did not allow any material to be removed from the landfarm.

Nutrient additions in the form of sewage sludge occurred in August, as detailed in the LDMP. Total volume of sludge added to the landfarm is 13.6 m³. No aeration of the material by the construction of windrow was performed due to a mechanical failure of the Extec screener. Some material was displaced by an excavator within the landfarm to aerate and reorganize usage of the landfarm.

Surface runoff, due to snow melt and rain, was identified from the landfarm and sampled on July 9th and August 4th, 2021, as per the Water Licence requirements. Water was naturally flowing towards the adjacent Tailing Storage Facilities. No other runoff water outside the landfarm was observed.

Visual inspections (46) indicated that the landfarm berm and pad appear to be structurally intact, and no maintenance was required.

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SECTION 1 • INTRODUCTION

1.1 BACKGROUND

Onsite storage remediation has been established as the preferred method for treatment of petroleum hydrocarbon-contaminated soil that may be generated at Meadowbank Complex. Specifically, remediation through land farming has been identified as the primary treatment option. The Meadowbank Landfarm Design and Management Plan (LDMP, March 2017) describe the operational procedures used onsite in relation to this management strategy.

There was no landfarm at Whale Tail site in 2021. All petroleum-contaminated material was brought to the Meadowbank landfarm. The construction of the landfarm at Whale Tail was approved by the NWB on October 27, 2021. Construction of the landfarm at Whale Tail is scheduled for 2022 and from there, no more contaminated material should be disposed in the Meadowbank Landfarm. This report discusses only of the activities performed at the Meadowbank Landfarm in 2021.

1.2 OBJECTIVES

Per the Meadowbank Landfarm Design and Management Plan the objectives of this report are as follow:

- Provide an overview of contamination soil management;
- Document the volume of material added to the facility;
- Describe the type of nutrient addition and document the volume;
- Document the movement of contaminated soil;
- Conduct annual sampling campaign and analyse result;
- Perform landfarm visual inspection;
- Document the volume of contact water pumped.

SECTION 2 • LANDFARM ACTIVITIES

2.1 MEADOWBANK LANDFARM 1

The original landfarm design was submitted by Agnico to the Nunavut Water Board in October 2012 and was in use until 2016. As presented in Figure 1 below, the original landfarm (Landfarm 1) was located on the north-west side of the South Tailings Cell impoundment (within the Tailing Storage Facility – TSF).

Knowing that this landfarm area would eventually become flooded with reclaim water, Agnico decided to find an alternate location for a new landfarm in 2016 (Landfarm 2, see below).

Contaminated soil was deposited in Landfarm 1 from 2013 – 2016.

In 2017, activities at Landfarm 1 were limited to relocation of contaminated soil (~half the volume) to Landfarm 2.

In 2018, no activities occurred at Landfarm 1.

In 2019, Landfarm 1 was flooded by reclaim water, and is no longer in operation.

2.2 MEADOWBANK LANDFARM 2

The Landfarm 2 facility was constructed in October 2016 in order to provide sufficient area for the ongoing treatment of contaminated soil.

As presented on Figure 1, Landfarm 2 is located on the north east side of the South Tailing Cell, north of the Central Dike. Locating this site within the tailings impoundment provides containment in case of runoff water from the contaminated material.

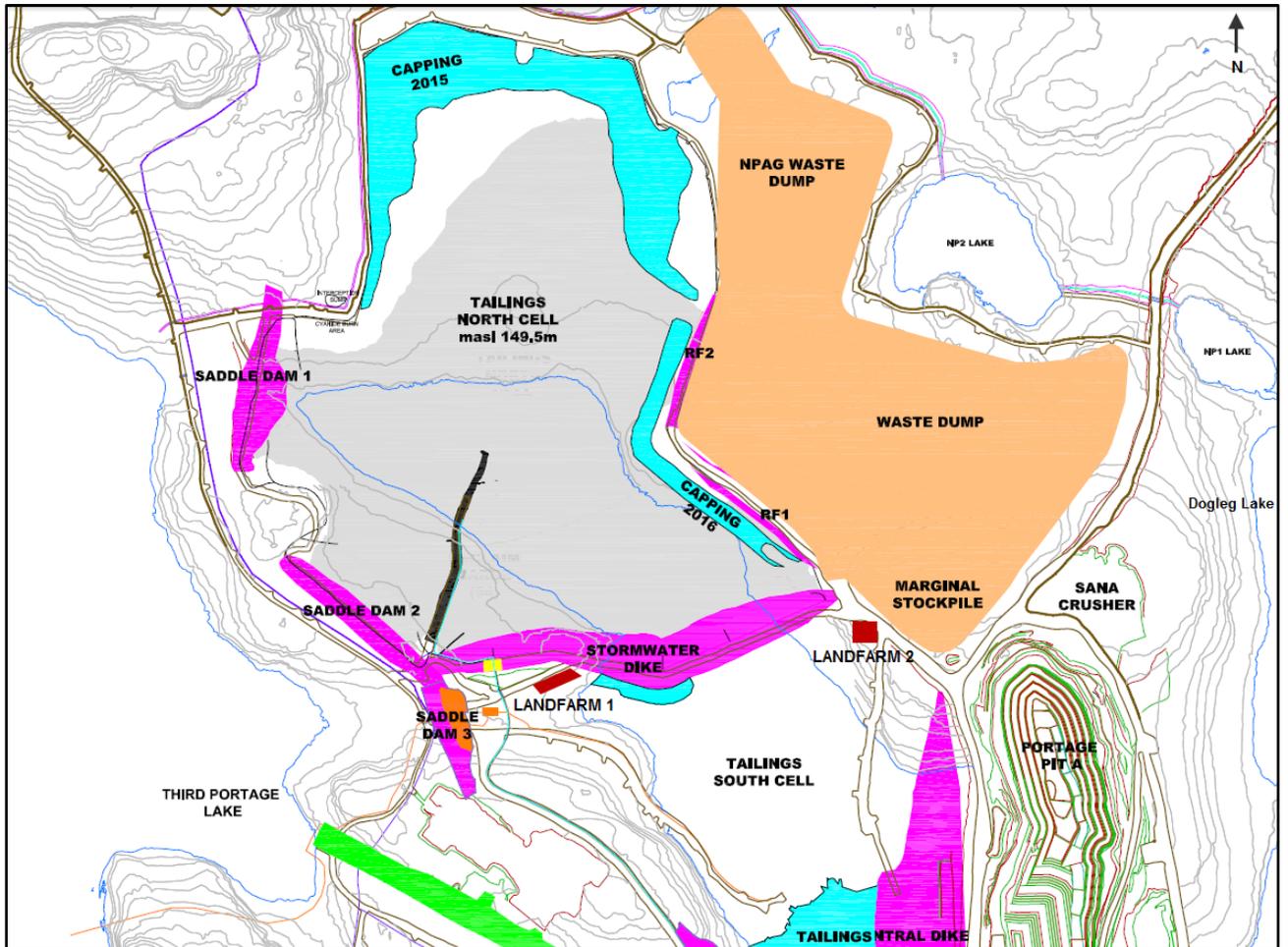
Landfarm 2 is located 900 m west of the nearest water body, Dogleg Lake. Surface drainage in the area of the Landfarm 2 is westerly, towards the South Tailings Cell and away from surface watercourses.

Specifications of the Landfarm 2 design are presented in the LDMP. The facility is designed with one soil remediation/storage cell, which is constructed with a 2.5 m high berm and a 0.5 m thick layer of compacted till base with hydraulic conductivity estimated of 1×10^{-7} m/s. The slope of the base is 3% towards the East side, leading to a slope of 7% towards the South Tailings Cell. The pad underneath the till layer varies between 6 m and 22.5 m thick, based on elevation of the tundra underneath, which ranges from 151 masl to 134 masl. In the Meadowbank area, the shallow groundwater is estimated to be 1.5 m below surface (active layer of permafrost July to September), at the average depth of thaw. Therefore, no impacts to groundwater are anticipated.

From 2017 - 2019, soil was either relocated from Landfarm 1 to Landfarm 2, or deposited in Landfarm 2 from the clean up of spills around the mine site. In 2020 and 2021, all the material was disposed in Landfarm 2, including contaminated material from Whale Tail site. Details of soil additions and removals for Landfarm 1 and 2 are provided in Section 2.3.

As per the Water License 2AM-MEA1530 Part F, Item 19; “*Water accumulating in the landfarm shall be contained within the landfarm and not be discharged to the environment*”. The water will be managed and contained within the landfarm, and discharged to the TSF if required. The monitoring station ST-14B will be sampled as per requirement of the Water License.

Figure 1. Landfarm 1 and Landfarm 2 locations



2.3 SOIL ADDITION AND REMOVAL

Based on engineering surveys, in 2021, 378.5 m³ of soil were added to Landfarm 2 from excavation of PHC spills around the Meadowbank and Whale Tail sites.

A summary of spills occurring in 2021 including those for which excavated material was sent to the landfarm are provided in Section 7 of the 2021 Meadowbank Complex Annual Report.

2.3.1 Very Coarse Material (>1") Screening

As described in the Landfarm Design and Management Plan, the use of an Extec screener to separate coarse and fine material was tested in September, 2013, and use was continued annually through 2017. No screening occurred between 2018 and 2021 and no coarse

material was removed from the landfarm during that period. In 2021, the task was postponed due to a mechanical failure of the Extec Screener which lasted throughout the thawed season.

The landfarm has the capacity to contain contaminated material in 2022.

2.3.2 Remediated Fine Soil Removal

According to the LDMP, for landfarmed soil to be considered remediated and removed for use onsite (e.g. road works), samples must meet GN criteria for agricultural/wildland. Soil meeting industrial criteria may be removed to the waste rock storage facility where it will eventually be capped with up to 2 m of fill, or used as base cover in the TSF where it will eventually be capped with up to 4 m of fill.

In 2021, no soil was removed from the landfarm.

2.3.3 Soil sampling

A summary of historical sample results for years in which sampling was conducted (2014 – 2016) is provided in Table 1. The 2021 results were also added to the Table 1. Since landfarm additions and removals occurred each year, piles were mixed, and sampling locations are not consistent, year-over-year trends were not assessed.

In 2021, soil sampling campaign was performed on September 27th. Exceedances were observed for the Fraction 3. All other parameters were under the remediation criteria.

Table 1. Government of Nunavut soil quality criteria for agricultural/wildlands and industrial areas, and results of landfarm soil analyses.

Year	Sample Name*	Parameter							
		Benzene	Toluene	Ethylbenzene	Xylene	F1	F2	F3	F4
Agricultural/ Wildland (mg/kg)>		0.03	0.37	0.082	11	30	150	300	2800
Industrial (mg/kg) >		0.03	0.37	0.082	11	320	260	1700	3300
2014	CSP-1A	-	-	-	-	<0.06	900	3500	650
	CSP-1B	-	-	-	-	<0.06	380	2200	460
	CSP-STP-2A	-	-	-	-	<0.06	590	2200	6400
	CSP-STP-2B	-	-	-	-	<0.06	450	2300	6600
	CSP-3	-	-	-	-	<0.06	25	110	<50
	CSP-4A	-	-	-	-	<0.06	480	3300	520
	CSP-4B	-	-	-	-	<0.06	51	1100	210
	CSP-5A	-	-	-	-	<0.06	51	2500	550
	CSP-5B	-	-	-	-	<0.06	460	5100	1000

Year	Sample Name*	Parameter							
		Benzene	Toluene	Ethylbenzene	Xylene	F1	F2	F3	F4
	CSP-5C	-	-	-	-	<0.06	130	2100	540
	CSP-5D	-	-	-	-	<0.06	38	1400	360
	CSP-5E	-	-	-	-	<0.06	61	1900	450
	CSP-6	-	-	-	-	0.22	2300	610	57
	Average						455	2178	1483
2015	CSP-1a	<0.03	<0.06	<0.06	<0.06	<0.3	600	3200	490
	CSP-1b	<0.03	<0.06	<0.06	<0.06	<0.3	350	2300	380
	CSP-2a	<0.03	<0.06	<0.06	<0.06	<0.3	810	6200	2400
	CSP-2b	<0.03	<0.06	<0.06	<0.06	<0.3	5600	20000	3100
	CSP-3a	<0.03	<0.06	<0.06	<0.06	<0.3	670	4200	490
	CSP-3b	<0.03	<0.06	<0.06	<0.06	<0.3	920	3500	530
	CSP-4	<0.03	<0.06	<0.06	<0.06	<0.3	840	320	<50
	CSP-5a	<0.03	<0.06	<0.06	<0.06	<0.3	260	5200	720
	CSP-5b	<0.03	<0.06	<0.06	<0.06	<0.3	2000	13000	1600
	CSP-5c	<0.03	<0.06	<0.06	<0.06	<0.3	38	1500	350
	CSP-5d	<0.03	<0.06	<0.06	<0.06	<0.3	640	7300	1600
	CSP-6a	<0.03	<0.06	<0.06	<0.06	<0.3	<10	620	79
	CSP-6b	<0.03	<0.06	<0.06	<0.06	<0.3	200	1200	200
	Average						1052	5496	1057
2016	CSP-1a	<0.03	<0.06	<0.06	<0.06	<0.3	350	3000	530
	CSP-1b	<0.03	<0.06	<0.06	<0.06	<0.3	240	2400	490
	CSP-1c	<0.03	<0.06	<0.06	<0.06	<0.3	840	5400	930
	CSP-2a	<0.03	<0.06	<0.06	<0.06	<0.3	470	3000	560
	CSP-2b	<0.03	<0.06	<0.06	<0.06	<0.3	560	5800	1200
	CSP-2c	<0.03	<0.06	<0.06	<0.06	<0.3	240	2200	400
	Average						450	3633	685
2021	CSP-1a	< 0.0060	< 0.020	< 0.010	< 0.020	< 10	300	1900	290
	CSP-1b	< 0.0060	< 0.020	< 0.010	< 0.020	< 10	480	2300	390
	Average						390	2100	340

*Sample locations do not necessarily correspond year-over-year.
Samples exceeding GN Agricultural/Wildland criteria are shaded grey.

2.4 NUTRIENT ADDITIONS AND SOIL AERATION

As permitted under the LDMP, nutrient additions in the form of sewage sludge occurred on August 31, 2021. Total volume of this addition was 13.6 m³.

No aeration of the material by the construction of windrow was performed due to a mechanical failure of the Extec screener. Some material was displaced by an excavator within the landfarm to aerate and reorganize usage of the landfarm.

2.5 REMAINING LANDFARM CAPACITY

For Landfarm 2, the useful area is 3,815 m². It is considered that contaminated material can be stockpiled up to 4 m high. Accounting for a 25% loss of area due to sloping at that windrow height, the landfarm area will allow for the storage of a maximum of 11,445 m³.

With a current contaminated soil stockpile volume of 5,081m³, and conservatively assuming no soil remediation & removal prior to closure, Landfarm 2 will be able to accommodate an additional 6,364 m³ of soil. The available landfarm volume will not be exceeded within the expected life of mine.

Thus, ample room will be available to accommodate expected future contaminated soil, and to maintain smaller windrow piles to maximize rates of biodegradation and volatilization.

2.6 WATER MANAGEMENT

Following freshet, ponded water was observed within the landfarm area but there was not a sufficient volume to sample. Regular surface runoff, due to snow melt and rain, was identified within the landfarm vicinity. Two (2) sampling campaigns were performed as per the Water Licence. No mitigative measure were required action, as the direction of flow was directly towards the adjacent TSF.

Table 2: Water sampling results (2021)

ST-14b	Sample date	Annual Average	7/9/2021	8/4/2021
Parameter	Unit			
Field Measured				
pH	pH units	7.75	7.69	7.81
Conventional Parameters				
TSS	mg/L	119	98	140
Total Metals				
Arsenic	mg/L	0.03665	0.0355	0.0378

ST-14b	Sample date	Annual Average	7/9/2021	8/4/2021
Parameter	Unit			
Copper	mg/L	0.003195	0.00421	0.00218
Lead	mg/L	0.000405	0.00021	0.0006
Nickel	mg/L	0.0336	0.0242	0.043
Volatile Organics				
Benzene	mg/L	0.0002	< 0.0002	< 0.0002
Ethylbenzene	mg/L	0.0002	< 0.0002	< 0.0002
Toluene	mg/L	0.00021	< 0.00020	0.00022
Xylenes	mg/L	0.00041	0.00042	< 0.00040
F2 (C10-C16)	mg/L	0.1	< 0.1	< 0.1
F3 (C16-C34)	mg/L	0.2	< 0.2	< 0.2
F4 (C34-C50)	mg/L	0.2	< 0.2	< 0.2

2.7 REQUIRED MAINTENANCE

Visual inspections indicated that the landfarm berm and pad appear to be structurally intact, and no maintenance requirements were identified. Inspection sheet can be provided on request.

SECTION 3 • ACTIONS

The following actions are planned for 2022:

- Continue to implement communications plan to ensure records of sewage sludge additions to the landfarm are maintained;
 - Evaluate contaminated material management over the past years and develop an 2022 action plan to assess the state of contaminations and to ameliorate the remediation process. Including the repair of the Extec Screener equipment, Extec Screener training course development and increased workforce during summer period to allocate additional resources to support the landfarm activities;
 - Look at the possibility to hire an external consultant to provide advice on the landfarm and/or assist with the screening and sampling of material in 2022.
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