AGNICO EAGLE

MELIADINE GOLD MINE

Landfarm Management Plan

January 2024
VERSION 5_NWB

ᓇᐃᓈᖅᓯᒪᔪᖅ

ᐊᒡᓂᖁ ᐄᒍ ᐅᔭᕋᒃᑕᕆᐊᓕᕆᔾᒃᑯᑦ (ᐊᒡᓂᖁᒃᑯᑦ) ᐱᕙᓪᓕᐊᔪᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒨᓗᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐱᓕᕆᐊᖅ), ᐃᓂᐅᔫᑦᑐᖅ 25 ᑭᓚᒥᑕᓪᓗᐊᓂᒃ ᐅᙵᓯᒃᑎᒋᔪᖅ ᐅᐊᙱᙵᓂᑦ ᑲᖏᖅᖠᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓂᒃ ᐅᙵᓯᒃᑎᒋᑉᓗᓂ ᓂᒋᖅᐸᓯᐊᓂᑦ ᐅᐊᙱᖅᐸᓯᐊᓂᑦ ᐃᒡᓗᓕᓘᕐᔫᑉ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᑦ ᐃᓚᐅᔪᑦ ᐅᒃᑯᐃᖖᔪᑦ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᓕᕆᓂᕐᒧᑦ ᐋᖅᑭᐅᒪᔪᑦ ᐱᕙᓪᓕᐊᓂᖓᓄᑦ ᑎᕆᖓᓂᐊᖅ ᒨᓗᑕᓕᒃ, ᐃᓚᐅᑉᓗᑎᒃ ᒪᕐᑮᒃ ᐅᒃᑯᐃᖖᔪᑦ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ (ᑎᕆᖓᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 1 ᐊᒻᒪᓗ ᑎᕆᖓᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᖅ.

ᑎᑎᖅᑲᖅ ᐱᔾᔪᑎᖃᖅᑐᑦ ᐊᒃᑕᑯᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᐱᓕᕆᐊᕐᒧᑦ ᐊᒻᒪᓗ ᐋᖅᑭᒃᓯᔪᖅ ᐃᓚᒋᔭᐅᔪᖅ ᑎᑎᖅᑲᓄᑦ ᐱᔪᓂᒃ Type A ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᓚᐃᓴᓐᓯᒥᒃ ᑐᒃᓯᕋᐅᑎᒧᑦ. ᐸᕐᓇᐅᑎ ᐅᖃᐅᓯᖃᖅᑐᖅ ᖃᓄᐃᑦᑑᓂᖓᓂᒃ ᐊᒻᒪᓗ ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᐃᓂᒃ ᐊᒃᑕᑯᓄᑦ ᐱᓕᕆᐊᕐᒥᑦ ᑐᖅᑯᖅᓯᓂᐊᕐᓗᓂ ᐊᒻᒪᓗ ᐱᓕᕆᐊᕆᓗᒋᑦ ᐅᖅᓱᐊᓗᙳᒥᑦ ᓴᓗᒪᐃᓕᖅᑐᑦ.

ᐃᓂᐅᔪᒥᑦ ᑐᖅᑯᖅᓯᓯᒪᕙᒃ ᐊᒻᒪᓗ ᐋᖅᑭᒃᓱᐃᓂᕐᒥᒃ ᓴᖅᑭᑦᑎᓚᐅᖅᑐᑦ ᐊᑐᖅᑕᐅᔪᒪᓂᖅᓴᐅᑉᓗᓂ ᐱᓕᕆᐊᕆᓗᒍ ᓄᓇ ᐅᖅᓱᐊᓗᒃᑕᖃᔪᒃᑐᑦ ᑕᐃᒪᓐᓇᐃᓕᑐᐃᓐᓇᕆᐊᓖᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ. ᐊᒃᑕᑯᐃᑦ ᐋᖅᑭᐅᒪᔪᖅ ᓄᓇᒥᒃ ᐱᔪᙵᕐᓂᐊᕐᓗᑎᒃ, ᐅᔭᖅᑲᓂᒃ, ᐊᐳᑎᒥᒃ, ᐊᒻᒪᓗ ᓯᑯᒥᒃ ᐅᖅᓱᓕᙱᓂᑦ. ᐃᓚᐅᓂᐊᖅᑐᑦ ᒥᑭᔪᒥᒃ ᐅᖅᓱᐊᓗᙱᓂᑦ ᐱᔪᑦ ᐊᒻᒪᓗ ᐅᖅᓱᓂᒃ ᐱᓕᕆᐊᖑᔪᑦ ᐅᒃᑖᓯᕙᖏᑦ.

ᐊᕙᑎᓕᕆᔾᒃᑯᑦ ᐅᓂᑉᑳᓕᐅᖃᑦᑕᖅᑐᑦ ᐊᕐᕋᒍᑕᒫᖅ ᐊᒃᑕᑯᓂᑦ ᖃᓄᐃᓕᕐᓂᐅᔪᑦ ᒥᒃᓵᓄᑦ, ᓇᓗᓇᐃᖅᓯᔪᖅ ᖃᓄᑎᒋᐅᓂᖏᑦ ᐃᓕᔭᐅᔪᑦ ᐊᒃᑕᑯᓄᑦ, ᖃᓄᑎᓲᑦ ᐲᖅᑕᐅᔪᑦ, ᐃᒋᑕᐅᔪᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐊᑐᒃᑲᓐᓂᕐᓂᐊᖅᑐᓄᐊᖅᑕᐅᔪᑦ, ᖃᐅᔨᓴᐃᓂᕐᒥᑦ ᖃᓄᐃᙵᓃᑦ, ᖃᓄᑎᒋᐅᓂᖏᑦ ᐊᒻᒪᓗ ᖃᓄᐃᑦᑑᓂᖏᑦ ᐃᓚᓯᕙᐅᓂᖏᑦ, ᑕᐅᑐᒃᓵᒍ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᙵᓂᐅᔪᑦ ᐊᑐᖅᑕᐅᔪᖅ ᐃᒪᖅ ᑯᕙᑎᑕᐅᓂᖓ.

ᓄᓇ ᐅᖅᓱᖃᓕᐊᕐᔪᒃᑐᖅ ᐱᓕᕆᐊᖑᖃᑦᑕᖅᑐᖅ ᒪᓕᒃᓴᒋᑦ ᐊᑐᕆᐊᖃᖅᑐᑦ ᐅᖃᖅᓯᒪᔪᑦ ᓄᓇᕗᒻᒥ ᒐᕙᒪᒃᑯᑦ, ᐊᕙᑎᓕᕆᔾᒃᑯᙲᑦᑕ, ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔪᖅᓴᖏᑦ ᐊᐅᓚᑦᑎᓂᖅ ᐅᖅᓱᒃᑕᓕᙱᓂᑦ. ᐋᖅᑭᒃᑕᐅᔭᕋᙱᑦ, ᓄᓇᐃᑦ ᐲᖅᑕᐅᑉᓗᑎᒃ ᐱᓕᕆᐊᖑᕙᙱᑦ ᐊᒻᒪᓗ ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕈᓐᓇᖅᓱᑎᒃ ᓴᓇᕙᓪᓕᐊᓂᕐᒧᑦ, ᓃᕐᓗ ᖃᓕᖅᑐᐃᓂᕐᒧᑦ ᕿᒪᒃᑎᑦᑐᓄᑦ ᑐᖅᑯᖅᓯᓯᒪᕙᙱᑦ, ᐊᒃᑕᑯᓄᑦ ᐅᕝᕙᓘᓐᓃᑦ ᑲᑎᑕᐅᑉᓗᑎᒃ ᐃᒋᑕᐅᔪᑦ ᐅᔭᖅᑲᓂᒃ ᑐᖅᑯᖅᓯᓯᒪᕙᙳᑦ.

ᐊᒻᒪᓗ ᐊᒡᓂᖁᒃᑯᑦ ᐋᖅᑭᒃᓯᐃᙱᓐᓇᖃᑦᑕᖅᑐᑦ ᐊᒃᑕᑰᓯᕙᑐᖃᕐᒥᑦ ᐱᔾᔪᑎᖃᖅᑐᖅ Type B ᐃᒪᕐᒧᑦ ᓚᐃᓴᓐᓯᒥᑦ - 2BB-MEL1424 ᐊᑐᖅᑕᐅᓚᐅᖅᑐᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᕿᓂᖅᓴᐃᓂᕐᒧᑦ ᓄᓇᓕᐊᓛᙳᓚᐅᖅᑐᒥᑦ.

AGNICO EAGLE

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) operates the Meliadine Gold Mine (Mine), located approximately 25 kilometres (km) north of Rankin Inlet and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut.

This document presents the Landfarm Management Plan for the Mine and forms a component of the documentation series produced for the Type A Water Licence Application. The Plan describes the design features and operational procedures for the landfarm located at the Mine for the storage and treatment of petroleum hydrocarbon-contaminated soils.

On-site storage and remediation have been established as the preferred method for treating light petroleum hydrocarbon-contaminated soil that may be generated on the proposed Mine site. The landfarm is designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons. This will include light hydrocarbons such as diesel and gasoline being treated in the landfarm.

The Environment Department prepares a report of landfarm activities annually, indicating the volume of material added to the facility, amount of material removed, disposal or re-use location, analysis results, volume and type of nutrient addition, visual inspection results, and volume of contact water pumped.

Soils contaminated with light-end petroleum hydrocarbons are remediated following the criteria stated in The Government of Nunavut, Environment Department's *Environmental Guideline for the Management of Contaminated Sites*. When remediated, the soils will be removed from the facility and can be used for construction purposes, such as part of the cover of the Tailings Storage Facility, Landfill or stacked in the Waste Rock Storage Facility.

In addition, Agnico Eagle continues remediation of the historical landfarm associated with the Type B Water License – 2BB-MEL1424 that is used for the former Meliadine Exploration Camp.

TABLE OF CONTENTS

TABLES AND FIGURES

DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	April 2015			First version of the Landfarm Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	February 2018	Figure 2-1	5	- "Main Infrastructure for the Meliadine Project, including the Landfarm" - figure added to figure reference	Meliadine Environment Department
		3.1	9	- Antifreeze removed from list of acceptable contaminates for landfarm disposal	
		2.1	3	-Approximate volume of material adjusted to 700 m^3	
		1.3	2	- Updated Oil Pollution Emergency Plan revision date and version	
		All	All	-General review and revision	
3	February 2019	1.1	1	-Estimated quantity of material in Type A landfarm adjusted to 1500 m^3	Sean Arruda
		2.1	3	-Estimated quantity of material in both landfarms adjusted to 3706 m^3 (1500 m^3 in Type A landfarm, 2206 m^3 in Type B landfarm) -Paragraph containing estimated annual inputs to landfarm has been removed - gasoline and light oil added -microbial activity 'slows' (changed from 'stops')	
		2.2.1	4	-'oil' changed to 'hydrocarbons'	
		Figure 2-1	5	-Site map figure updated.	
		Table 2-2	8	-Sump surface area was a typo (10,040 m^2). Changed to 144 m^2	

Version	Date	Section	Page	Revision	Author
		3.1.1	10	-'Aboriginal Affairs and Northern Development Canada' changed to 'Crown-Indigenous Relations and Northern Affairs' -Sentence added "If there is uncertainty whether or not the material contains additional, unknown contaminants, the material should be placed in totes/drums until lab results confirm that they can be placed in the landfarm."	
		3.3	11	-Contaminated snow is now being sent to the snow cell area	
April 2022	4	All	All	General Update	Agnico Eagle, Environment Department
January 2024	5_NWB	A yellow arrow in the right-hand margin indicates where updates have been made		Submitted to Nunavut Water Board as part of the Meliadine Water Licence Amendment.	Permitting Department

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
BTEX	benzene, toluene, ethylbenzene, and xylene
CIRNAC	Crown-Indigenous and Northern Affairs Canada
CP1	Collection Pond 1
GN	Government of Nunavut
IOL	Inuit Owned Land
KivIA	Kivalliq Inuit Association
Mine	Meliadine Gold Mine
NRC Canada	National Research Council Canada
NWB	Nunavut Water Board
OPEP/OPPP	Oil Pollution Emergency Plan and Oil Pollution Prevention Plan
PHC	Petroleum hydrocarbons
PID	Photoionization Detector
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility

SECTION 1 • INTRODUCTION

1.1 Project History

Agnico Eagle Mines Limited (Agnico Eagle) is operating the Meliadine Gold Mine (Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Mine site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1’23.8’’ N, 92°13’6.42"W), on Inuit Owned Lands. The Mine is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The Mine plan includes open pit and underground mining of the Tiriganiaq gold deposit. The Application to amend the Water Licence is to complete licensing of components approved under Project Certificate No.006, which includes open pit mining at the Pump, F Zone, Wesmeg, and Discovery deposits.

The Landfarm Management Plan focuses on minimizing the waste footprint on-site and maximizing remediation potential through the implementation of bioremediation experience, and research carried out at the Agnico Eagle’s Meadowbank Gold Mine.

When possible, materials contaminated with heavy hydrocarbons (e.g., hydraulic fluid or grease) are to be segregated, packaged, and shipped south for treatment and/or disposal.

1.2 Objectives

On-site storage and remediation have been established as the preferred method for treating light PHC-contaminated soil that may be generated at the Mine. Specifically, remediation through landfarming has been identified as the primary treatment option and, as such, is the focus of this contaminated soil management plan. Alternate contingency options if landfarming is not successful or as efficient as planned are also discussed.

The objectives of this Plan are to:

- provide an overview of contaminated soil management at the Mine;
- describe the physical setting, location, and design criteria of the landfarm;
- define acceptable types of contaminated soils to be placed in the landfarm and conditions for removal of treated soil;
- define operating procedures and monitoring requirements for the landfarm; and
- describe contingency options for alternate treatment/storage of PHC contaminated soil.

1.3 Related Documents

Spill prevention is the first stage in contaminated soil management at the Mine. Documents containing information related to this Plan include:

- Spill Contingency Plan; and
- Risk Management and Emergency Response Plan.

The Landfarm Management Plan is part of the Environmental Management and Protection Plan, which provides overarching environmental direction for the Meliadine Mine.

1.4 Spill Prevention

The plan is to actively minimize spills through suitable work procedures in a manner similar to the waste management philosophy. Plans developed from the environmental impact study address the management of spills on land, ice, water, and the marine environment. When spills occur, the goal is to limit the spill's spread and then manage contaminated material resulting from the spill. The Spill Contingency Plan describes spill prevention measures.

SECTION 2 • LANDFARM DESIGN

2.1 Background

In the event of a spill, on-site storage and remediation is the most practical and efficient method for handling contaminated soil, particularly in an isolated location such as the Mine. Any PHC-contaminated soils generated during the construction, operation and closure phases will be adequately managed. This method involves spreading, mechanical mixing, adding nutrients and water, placing contaminated soil in windrows within a containment area, and creating conditions that facilitate hydrocarbon volatilization and aerobic microbial degradation. When possible, materials contaminated with heavy hydrocarbons (e.g., hydraulic fluid or grease) are to be segregated, packaged, and shipped south for treatment and/or disposal.

Landfarm option analysis prepared for Agnico Eagle by Golder Associates (2007) identified factors relevant to landfarming in the north. A wide range of factors, including environmental conditions and physical properties of the soil, affect microbial growth and rates of biodegradation, including temperature, pH, soil moisture, nutrient content, salinity, and particle size of the soil.

As the Meadowbank landfarm demonstrated, even though biodegradation rates decline with temperature, landfarming is still feasible in Arctic climates. Degradation in the north is typically restricted because microbial activity slows between 0 to -5 degrees Celsius (°C), restricting biodegradation from June to September[1]. Nevertheless, degradation was reported at 90% over two summers on Resolution Island (Paudyn et al., 2008).

It is estimated that soils contaminated with light-end PHCs would require three full summer seasons for complete remediation. Following remediation, the soils will be removed from the facility and can then be used for construction purposes, including as part of the cover for the Tailings Storage Facility (TSF) or stacked in the Waste Rock Storage Facility (WRSF). Based on a remediation period of three seasons, it would be possible to close the landfarm facility three years after the end of the process plant operation.

2.2 Location

The overall site plan showing the primary infrastructure for the Mine, including the landfarm, is shown in Figure 2-1. The central location of the landfarm was chosen to minimize the footprint of the site and the transport distance of contaminated material from potential spill locations. Waste generated at the Mine is managed in the form of dry stack tailings, waste rock, incineration, and landfill waste located very close to the mine's main infrastructure.

[1] Even though bioremediation ceases below -5°C, the PHCs' volatilization continues but at a much slower rate.

2.2.1 Proximity of Surface Water

The landfarm is located adjacent to the infrastructure pad, approximately 200 m from Collection Pond 1 (CP1). Landfarm is situated on a sloped parcel of land sloped towards the southwest corner, which results in any rain or snowmelt draining to temporary water storage having the capacity to store a spring freshet of 1:100 wet years plus 500 m^3 of contaminated snow/ice. Drainage from the landfarm may be used as water to turn the windrows during the remediation process. Excess water is collected within a sump inside the landfarm and will be pumped to an oil pre-treatment plant to remove any hydrocarbons, then discharged into CP1.Discharge from CP1 is controlled by a dike, which stops direct flow to Meliadine Lake[2]. If water is to be discharged from CP1 to Meliadine Lake, it is treated to meet compliance criteria. Except for a brief period during the spring freshet or heavy rains, water ponding will be eliminated from the landfarm by the end of the summer. This will ensure adequate storage capacity for the upcoming spring freshet.

[2] Meliadine Lake is the source of fresh water for the site and is used by the Inuit for traditional pursuits.

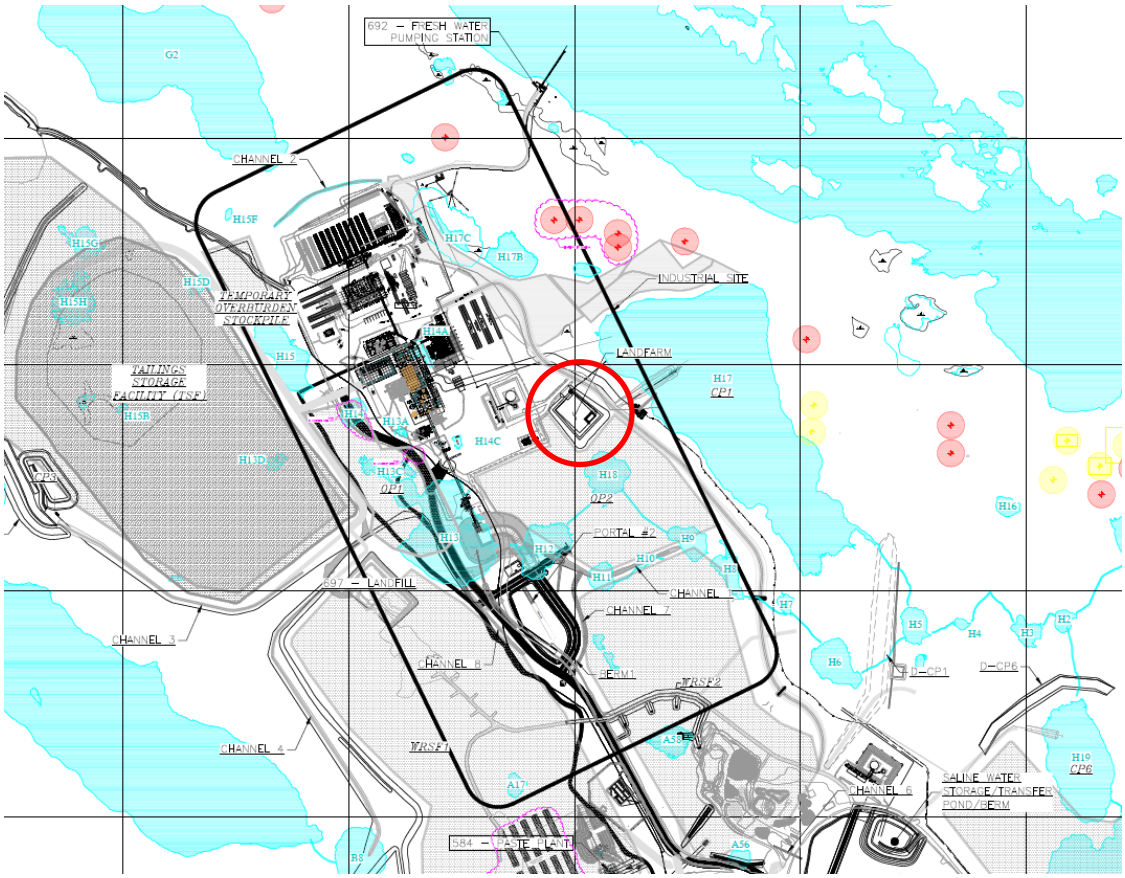

Figure 2-1. *Landfarm Site Location Plan*

2.2.2 Proximity of Groundwater

In the Mine area, the active layer begins to form in July when temperatures largely remain above 0°C and deepens to a maximum in October. The groundwater level in the active layer is estimated to reach 1.5 meters this month. Shallow groundwater flows toward the industrial site in the landfarm area.

To prevent the movement of contaminants from the landfarm facility into groundwater and the surrounding environment, Environment Canada (SAIC, 2006) recommends the implementation of a barrier with 10^{-7} cm/s hydraulic conductivity at a thickness of 0.6 m. The Meliadine landfarm has an impervious liner, and no impacts on shallow groundwater are anticipated.

2.3 Design

The landfarm is designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons. This will include light hydrocarbons such as diesel and gasoline. The design volume of the landfarm is based on allowances for the materials being treated at Meadowbank.

The average floor slope is 3.1% going in the designed direction of northwest to southeast, matching the natural ground slope. This slope is still adequate, allowing leachate/drainage from the PHC soils and internal runoff to seep through the filter berm into the sump area gradually. The water collected in the sump will be pumped to the oil separator for oil removal before being discharged into CP1. The sump area was built as per design capacity.

The geomembrane liner crest elevation was installed at an elevation of 74.80 m. It does allow for 0.45 m of freeboard before reaching the geomembrane liner crest elevation.

2.3.1 Soil Volume Requirements

The landfarm was built with the expectation of effectively treating up to 5,000 m^3 of contaminated soil over the construction, operations, and closure of the Mine, and 500 m^3 of snow and ice annually. Based on Meadowbank's experience, the annual volume of PHC during construction, operation, and closure would be approximately 350 m^3. Table 2-1 outlines the estimated volumes of contaminated soils, rock, snow, and ice expected during each phase of the Mine.

Table 2-1. *Estimated Volume of Petroleum Hydrocarbon Contaminated Soil and Ice/Snow to be Managed.*

Project Phase	Volume of PHC Soil/Rock (m^3)	Annual PHC Snow/Ice (m^3)
Advanced exploration	2,209 (volume in exploration landfarm to date)[(a)]	500 per year
Predevelopment	350 (175 per year)	
Construction	1,050 (350 per year)	
Operations	2,450 (350 per year)	
Closure & Reclamation	700 (350 per year)	

[(a)] The contaminated soil in the advanced exploration landfarm will be transferred to the mine landfarm upon its completion and commissioning.

As described in the Landfarm Design & Management Plan (Agnico Eagle, 2008), it is estimated that soils contaminated with light-end PHCs would require three full summer seasons for complete remediation. When remediated, the soils will be removed from the landfarm and used on-site, placed in a WRSF, or used as cover at the TSF.

2.3.2 Design Specifications

The design criteria for the landfarm are outlined in Table 2-2. Its footprint is approximately 11,000 m^2, with a perimeter berm approximately 2.0 m high above the landfarm surface. The geometry and characteristics of the landfarm are shown in Table 2-2.

Table 2-2. *Geometry and Characteristics of the Landfarm*

Item	Actual
Dimensions of Perimeter Berm Crest Exterior (avg.)	86.8 m x 68.4 m
Dimensions of Perimeter Berm Crest Interior (avg.)	74.4 m x 53.3 m
Side Slopes of Perimeter Berm (avg.)	1V:2.5H (40%)
Perimeter Berm Crest Width (avg.)	3.5 m
Perimeter Berm Height (Min. to Max.)	1.4 m to 5.2 m
Perimeter Berm Crest Elevation (avg.)	75.25 m
Dimensions of Filter Berm Crest Interior (avg.)	19.0 m x 12.0 m
Side Slopes of Filter Berm (avg.)	1V:1.5H (67%)
Filter Berm Crest Width (avg.)	1.0 m
Geomembrane Liner Crest Elevation	74.80 m
Interior Floor Slope (avg.)	-3.1% (NW to SE)
Fill Thickness Above Original Ground for Inside Base/ Sump Area (Min.)	1.52 / 1.48 m
Fill Thickness Above Liner	0.5 m
Inside Base Surface area Including Sump Area	3,794 m^2
Sump Surface Area	144 m^2

Table 2-3 indicates the growth and stabilization of the volume of PHC considering remediation over three years and the maximum volume of contaminated material that is anticipated to be stored over a period of 13 years.

The size of the landfarm is based on the design criteria (Table 2-2), the estimated volume of material (Table 2-3), and the requirement to turn over the surface of the piles during the summer months. The designed footprint of the landfarm is 11,000 m^2 with a functional landfarm surface of 3,650 m^2. Contaminated material is piled 1.5 m so that the material is below the crest height of the perimeter berm. At the maximum estimated capacity of the facility, three windrows, each 890 m^3 of PHC, will cover 1,800 m^2 allowing 1,850 m^2 for turnover and water management.

Table 2-3. *Volume of Petroleum Hydrocarbon Contaminated Material in the Landfarm*

Mine Year	Estimated PHC Produced (m^3)	Accumulated PHC in Landfarm for Remediation (m^3)	Treated PHC Removed from Landfarm (m^3)	Hydrocarbon Contaminated Snow or Ice to Landfarm (m^3)	Maximum Accumulated PHC in Landfarm (m^3)
Before -6	420			0	0
-6 and -5	350			0	0
-4	350			0	0
-3	350	1,470		500	1,970
-2	350	1,820		500	2,320
-1	350	2,170		500	2,670
1	350	1,400	1,120	500	1,900
2	350	1,400	350	500	1,900
3	350	1,400	350	500	1,900
4	350	1,400	350	500	1,900
5	350	1,400	350	500	1,900
6	350	1,400	350	500	1,900
7	350	1,400	350	500	1,900
8	350	1,400	350	500	1,900
9	0	1,050	350	0	1,050
10	0	525	525	0	525
11	0	0	525	0	0

SECTION 3 • LANDFARM OPERATION AND MANAGEMENT

Agnico Eagle is responsible for managing and implementing the landfarm operation plan. It is the responsibility of the Environment General Supervisor, Coordinators or designate to oversee the operation and monitoring of the landfarm, as well as to define training requirements.

3.1 Acceptable Landfarm Material

3.1.1 Contaminants

The landfarm facility will only treat and/or store light PHC-contaminated soils that have been generated through mine-related activities at the Mine and which have been transferred from the Mine's advanced exploration camp landfarm upon closure. Material from the Hamlet of Rankin Inlet or other sites will not be accepted without approval from the Nunavut Water Board (NWB), Crown-Indigenous Relations and Northern Affairs (CIRNAC), Water Resources Inspectors, and the Kivalliq Inuit Association (KivIA).

The following products are acceptable for treatment in the landfarm if generated on-site and spilled on soil:

- diesel fuel;
- gasoline;
- hydraulic oil
- aviation fuel (Jet A); and
- other light oil (e.g., engine oil, lubricating oil).

If the contaminant source is unknown, soil samples will be analyzed for PHCs and possibly additional contaminants before placement in the landfarm. These additional parameters could include total metals, oil and grease, and volatile organic compounds. The Environment Department will determine analysis for additional compounds on a case-by-case basis. Suppose there is uncertainty about whether the material contains additional, unknown contaminants. In that case, the material should be placed in totes/drums until lab results confirm that they can be placed in the landfarm.

Concentrations of contaminants will be compared to the site background values (for metals) and/or criteria in the Government of Nunavut (GN) *Guidelines for Contaminated Site Remediation* (GN, 2009). Suppose this analysis indicates soil contamination above background or GN guidelines for any substance not approved for landfarming (i.e., non-PHC contaminants). In that case, the spilled material will not be placed in the landfarm. Instead, spills of non-PHC material (e.g., solvents) will be placed in drums and stored on-site for shipment to approved facilities during the shipping season. This ensures that PHC-contaminated soils are not contaminated with other products.

3.1.2 Grain Size

Bioremediation of very coarse-grained, large soil material is inhibited as it does not readily retain moisture. However, volatilization will occur more rapidly (SAIC, 2006). It has been noted that this material likely contains lower concentrations of contaminants due to a lower volume-to-surface area ratio and can typically be screened out prior to landfarming (SAIC, 2006). As a result, soils, and rock material with grain size less than 2.5 cm will be separated from larger-grained material, where possible. This will occur at the spill location or in the landfarm using a screen sieve, should it prove necessary. The two soil fractions will be treated separately in the landfarm.

3.2 Contaminated Soil Additions

3.2.1 Spill Excavation

Soil contaminated with the above-described PHC materials will be excavated and transported to the landfarm facility in dump trucks or other approved methods. As a precaution, care will be taken to ensure that the entire spill is excavated (verified by olfactory and visual assessment or through sampling, if necessary) and that no contaminated material is lost during transportation.

3.2.2 Placement in the Landfarm

As described above, larger coarse material (rocks) will be separated from the finer material (sand and gravel) in the landfarm and assessed visually for PHC staining and product. If the material is saturated, it will be spread to allow volatilization in the designated area of the landfarm.

Materials identified as acceptable in the landfarm will be placed in windrows with dimensions about 18 m wide at base x 1.5 m high x 34 m long. Windrows may be piled wider, higher, or longer as space permits. There will be a record kept by the on-site Environmental Coordinator or designate as to the amount and location of each load of contaminated soil placed in the landfarm.

3.2.3 Decontamination of Soil Movement Equipment

The decontamination of soil movement equipment is outlined in the Landfarm Soil Movement Procedure, included as the Appendix A to this Management Plan.

3.3 Contaminated Snow

PHC-contaminated snow and ice will be placed in a designated snow-cell area and treated as contact water after snowmelt. Upon snowmelt, the contaminated water will be pumped through the site's oil-water separator to remove PHC residue. The treated water will be discharged to the CP1.

In particular, snow accumulation in the landfarm will be allowed to melt and accumulate in the Landfarm sump, where it will be treated through the oil-water separator as needed upon melt or used in the bioremediation process for the contaminated soil. Any excess snow accumulation in the Landfarm will be moved to the snowcell.

3.4 Remediation

Remediation of fine-grained PHC-contaminated soil in the landfarms occurs naturally through volatilization and aerobic microbial degradation. Remediation rates can be enhanced by soil aeration, nutrient amendment, and water addition. Agnico Eagle commissioned the National Research Council (NRC) Canada to undertake the bioremediation research study to optimize biodegradation. Agnico Eagle will look at increasing biodegradation rates through potential opportunities such as nutrient amendment.

3.4.1 Absorbent Materials

Coarse-grained soils are not readily bio-remediated, but concentrations of PHC contaminants may still be reduced through volatilization. Oil absorbent pads will be used to help remove the visible product from coarse-grained material.

3.4.2 Aeration

To promote aerobic conditions throughout the windrows, the soil will be mixed mechanically with earth-moving equipment. This turnover of soil piles will occur approximately two to four times per year during the summer months.

3.4.3 Soil Moisture

Prior to turning, site personnel will ensure that the soil is not so dry as to generate significant dust or overly saturated. If the soil is too dry, non-contaminated water from within the landfarm containment area will be used as a moisture source and sprayed on the piles. If no accumulated water is available, water from CP1 or freshwater will be used. If the windrows are saturated, aeration will be delayed until the moisture content is reduced.

3.4.4 Nutrient Amendment

The use of sewage sludge as a nutrient amendment has precedent in the north. Sewage sludge as a nutrient source has also been proposed for the Mine Inlet Mary River Project (EBA, 2010). This material not only provides the benefit of nutrients but also adds organic matter to help retain moisture and microorganisms. Furthermore, the use of sewage sludge produced on-site helps to reduce the waste footprint of the mine by re-directing this material from disposal facilities and avoids needing to import a chemical fertilizer. The use of sewage sludge or another recommended nutrient amendment will be considered for the optimization of biodegradation.

3.5 Removal of Soil From the Landfarm

3.5.1 Government of Nunavut Remediation Guidelines

The following parameters will be measured and compared with the GN industrial remediation criteria to determine whether PHC-contaminated soil has been adequately remediated:

- benzene, toluene, ethylbenzene and xylene (BTEX); and
- petroleum hydrocarbon fractions 1 - 4.

The GN remediation criteria are characterized for agricultural/wildlife, residential/parkland, commercial, and industrial land use. At the Mine, remediation to agricultural/wildlife criteria is targeted; however, if these criteria cannot be met, industrial criteria will be followed.

The GN remediation criteria for coarse-grained soils will be applied. Table 3-1 presents the applicable Tier 1 criteria for coarse-grained soil, assuming agricultural/wildlife or industrial land uses.

Table 3-1. *Summary of Relevant GN Tier 1 Soil Remediation Criteria for Surface Soil (mg/kg)*

	Land Use Criteria (mg/kg)	
	Agricultural/Wildlife	**Industrial**
Benzene	0.03	0.03
Toluene	0.37	0.37
Ethylbenzene	0.082	0.082
Xylene	11	11
PHC Fraction 1	30	320
PHC Fraction 2	150	260
PHC Fraction 3	300	1,700
PHC Fraction 4	2,800	3,300

3.5.2 Sampling and Analysis

Landfarm windrows will be sampled annually at the end of the summer season to determine if remediation objectives have been met. Representative composite samples will be taken of each windrow to estimate the remaining PHC concentrations. For each 10 m of windrow length, one composite sample will be collected, each consisting of three surface sub-samples and three sub-samples at 1 m depth. Sub-samples will be taken approximately 3.3 m apart and will be taken from both sides of the windrow. Sampling QA/QC measures will include a collection of 1 duplicate per 10 samples.

After two seasons of treatment in the landfarm, degradation rates will be assessed to estimate the total remediation time required for PHC-contaminated soil under these conditions. If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments as described above. However, if degradation rates are

not sufficient through this method, alternate options will be further investigated, as described in Section 4.2.

3.5.3 Soil Removal

Toward the end of the summer season, Environment Department technicians will assess coarse-grained soils for the presence of PHC products and odors. Based on the experience learned at Meadowbank, Agnico Eagle is confident that confirmatory sampling and laboratory analysis are not required prior to removing coarse-grained soil from the Landfarm. Observations show that volatilization of PHCs from coarse-grained soil occurs more rapidly than biodegradation. It has been noted that this material likely contains lower concentrations of contaminations due to a lower volume-to-surface area ratio and can typically be screened out prior to landfarming. Thus, the use of a photoionization detector (PID) is sufficient to confirm the material is in a suitable state to be removed from the landfarm. When PHC odours are no longer detected, the material will be removed to the WRSF or at the TSF to be used as cover material.

At the end of a season, when samples of fine-grained material show concentrations of contaminants below GN guidelines, soil piles or appropriate sections of soil piles are considered acceptable for removal from the facility. Interim monitoring may be conducted through measurements of headspace with a portable instrument (e.g., flame ionization detector), but samples will be confirmed by an accredited laboratory prior to soil removal.

When remediated, the soils will be removed from the facility and can be used for construction purposes such as normal overburden (i.e., part of the cover of the TSF) or stacked in the WRSF. Based on a remediation period of three seasons, it would be possible to close the landfarm facility three years after the end of the process plant operation.

3.6 Water Management

Since the landfarm facility is uncovered to facilitate natural weathering, water accumulating inside the bermed area may come into contact with contaminated material.

Although the landfarm has an impermeable liner, visual inspections will be conducted by the Environment Department to determine whether contact water is seeping through the perimeter berm or accumulating within the containment berm. This will be conducted on a weekly basis, starting after freshet, and continuing until October, when water is likely to be present. If water accumulates or seepage occurs, ponded water will be pumped through the site's oil-water separator to remove PHC residue and analyzed for BTEX, lead, oil, and grease before discharge to CP1 or used to increase the moisture content of the windrows as necessary. Water accumulating in the landfarm will not be discharged directly to the receiving environment.

3.7 Winter Landfarm Management

Uncontaminated snow will be removed as much as possible during winter to minimize the quantity of spring melt water inside the berm. To prevent contamination of snow or soil, a base layer of snow of no less than 10 cm will be left in place. Following snowmelt, any contaminated product left from winter spill clean-up operations will be padded up. The base soil in these areas will be excavated and added to existing remediation windrows as soon as possible after snowmelt to minimize migration into the facility substrate.

3.8 Landfarm Closure and Reclamation

After removal of all remediated soil and prior to closure and reclamation of the landfarm, the berm and base will be sampled on a 10 m grid to determine if these soils are free from PHC contamination. The results of this analysis will be compared to the GN criteria set out in Table 3-1. No excavation will be necessary if agricultural/wildlife criteria are met. If industrial criteria are used, the landfarm will be covered with 2 m of waste rock or other material used for reclamation. The surrounding berm will be breached to avoid water accumulation on the landfarm.

3.9 Summary of Activities

A summary of landfarm activities, including monitoring of the physical condition and potential environmental impacts of the landfarm, is provided in Table 3-2. An annual report will be prepared to indicate the volume of material added to the facility, amount of material removed, disposal or reuse location, all analysis results, volume and type of nutrient addition, visual inspection results, and volume of contact water pumped. This information will be appended to Agnico Eagle's Annual Report.

Table 3-2. *Summary of Landfarm Activities, Analyses, and Records*

Activity	Analysis	Frequency of Analysis	Record
Excavation of spill and transport of contaminated material to landfarm.	If unsure of full excavation - F1-F4, BTEX If contaminant source unknown, F1-F4, BTEX, metals, oil and grease, VOCs	As needed	Date, time and location of spill and excavation; estimated volume of spill; estimated quantity of excavated soil; storage/disposal location of excavated soil, if applicable. Any evidence of remaining product
Soil aeration	NA	Two to four times over the summer	Date and time of the aeration; location; soil condition (moisture, odour, granulometrie, etc.)
Soil treatment with sewage sludge as nutrient supplement.	Visual inspection to ensure proper incorporation	At least once during summer on selected windrows	Date and time; type of treatment (aeration or nutrient amendment); location in landfarm; any odour noticed during aeration
Sampling for progress of remediation	Hydrocarbon vapour in headspace (by PID); F1-F4, BTEX (laboratory)	Vapour – as needed; Laboratory - annually	Date and time; location; odour; laboratory report
Soil removal from landfarm	Removal subject to meeting GN criteria	Once GN criteria are met	Date and time; location; quantity of soil removed; final location
Ponded contact water	BTEX, oil and grease, lead – as specified in Water Licence	Prior to any dewatering; if re-used in landfarm, no sampling necessary	Date and time, location, laboratory report, in Annual Report
Seepage	Visual inspection; BTEX, oil and grease, lead – as specified in Water License	Weekly during summer	Location, extent, approximate depth, evidence of sheen
Identification of maintenance requirements	Visual inspection of landfarm	Twice over the summer	Inspected areas; condition of berm and base; previously unidentified safety concerns

SECTION 4 • CONTINGENCY OPTIONS

This section describes the contaminated soil management plan, should a large spill event occur, and if landfarm treatment prove not successful.

4.1 Large Spill Event

A significant spill event producing a quantity of soil that cannot be contained in the landfarm is unlikely because the landfarm is designed to hold nearly two times as much contaminated soil as is expected to be produced. Nevertheless, soils will be placed in a temporary storage area in this event. A temporary stockpile area would be set up on an emergency basis, such as in the WRSF or the TSF. As space becomes available, the soil would be added to the landfarm. Through spill prevention measures discussed earlier in this Plan, Agnico Eagle minimizes the probability of this scenario occurring.

4.2 Alternate Treatment Options

Should landfarm treatment not perform as anticipated and it is evident that rates of degradation are not sufficient to meet GN Tier 1 criteria within the life-of-mine and the anticipated closure, the following alternative treatment options will be considered. Implementation will be after development of a more detailed protocol and approval of a revised plan by the NWB.

4.2.1 Soil Amendment

Since pH, salinity, moisture content, and microbial population density all affect rates of biodegradation by microbes, these factors may be monitored and adjusted through soil amendments if they are not found to be optimal (SAIC, 2006). In addition, the height of soil windrows could be reduced to maximize air exposure if space in the landfarm allows.

4.2.2 Tier 2 – Modified-Criteria Approach

According to the GN *Environmental Guideline for Contaminated Site Remediation* (GN, 2009), in cases where site conditions, land uses, receptors, or exposure pathways differ from those assumed in the development of the Tier 1 criteria, modified criteria may be permitted. This process requires collecting of site-specific information on exposure and risk estimates and is subject to GN approval. For this Mine, landfarmed soils are to be encapsulated in a WRSF rather than used in surface applications, as assumed in Tier 1, reducing the likelihood of exposure to any remaining contamination. Therefore, the Tier 2 approach could be warranted if Tier 1 criteria cannot be met. Any consideration for this approach would be based on soil sampling results and science-based information.

4.2.3 Direct Placement in Waste Rock Storage Facility or on Tailings Storage Facility

Another option for managing contaminated soil if bioremediation proves ineffective would be the direct placement of this material in a WRSF or on the TSF. Although using PHC-contaminated soils in these storage areas are not optimal, the quantity generated on-site is small compared to the quantity

of waste rock and cover on the TSF. While this method would not result in the soil treatment, it is a viable contingency option as it would allow for the safe disposal of the contaminated material. Encapsulation and freeze-back would occur, eliminating any movement of contaminants. Over time, this material would undergo natural degradation. Consideration of this option would also include a suitable monitoring program for PHCs, which would be incorporated into the Closure and Reclamation Plan.

SECTION 5 • ASSESSMENT AND REPORTING

5.1 Feasibility

After two seasons of treatment in the landfarm, degradation rates of PHC contaminants are assessed to estimate the total remediation time required under these conditions. If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments described above. If degradation rates are insufficient through this method, alternate options will be further investigated (Section 4).

5.2 Reporting

Agnico Eagle reports landfarm activities annually through the NWB Annual Report, which includes information on the volume of materials added to the facility, removal and disposal of materials, disposal or re-use location, and confirmatory analyses performed.

5.3 Plan Review and Continual Improvement

The Landfarm Management Plan is reviewed annually by the Meliadine Environmental Department, and, if necessary, updated at least every two years of operation.

REFERENCES

Agnico Eagle Mines Limited. 2008. Landfarm Design and Management Plan In Accordance with Water License 2AM-MEA0815, Meadowbank Gold Project, 20 p. + Figures and Appendix. October 2008.

Agnico Eagle Mines Limited . 2017. Version 1.1, Supporting Document 8-2 Oil Pollution Emergency Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut. Submitted to the Nunavut Impact Review Board. September 2017.

EBA. 2010. Hydrocarbon Impacted Soils Storage and Landfarm Facility Operations, Maintenance and Monitoring Plan, Milne Inlet, Mary River Project, Nunavut. Prepared for: Baffinland Iron Mines Corporation. Issued for Review. December 2010.

Golder Associates Ltd (Golder). 2007. Technical Memorandum: Landfarm Option Analysis, Meadowbank Gold Project, Nunavut. Prepared for: Agnico-Eagle Mines Ltd. August 23, 2007.

Government of Nunavut, March 2009. Environmental Guideline for Contaminated Site Remediation http://env.gov.nu.ca/sites/default/files/Guideline%20Contaminated%20Site%20Remediation.pdf

Paudyn, K. et al, 2008. Remediation of hydrocarbon contaminated soils in the Canadian Arctic by landfarming. Cold Regions Science and Technology, v53, p 102-114, n 1 June 2008

Science Applications International Corporation (SAIC), 2006. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. Final report presented to: Contaminated Sites Division and Emergencies Engineering Technologies Office (EETO), Environmental Technology Centre, Environment Canada. SAIC Canada Project #: 11953.B.S08. CM #: 001659. March 31, 2006.

TetraTech EBA. 2014. Tailings, Waste And Water Management For Feasibility Level Study Meliadine Project, Nunavut, FILE: E14103188-01, AEM Report Number: 6509-REP-05, 145 p. + Appendix.

APPENDIX A

AGNICO EAGLE
NUNAVUT

DOCUMENT ID: NU-E&I-PRO – Land farm soil movement	
People concerned: Site services HEO, environmental department	**Effective Date: 2018-03-13**
This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.	

Rev #	Date	Description	Initiator
0	2018-03-13	Draft	Guillaume Gemme

Objective:

- Safe operation of equipment during land farm soil movement

Definitions (If applicable):
This procedure is in place to ensure proper usage of heavy equipment on the land farm during the soil movement process.

Page 1 of 4

2019-02-17 *This document is void 24 hours after printing*

AGNICO EAGLE NUNAVUT

Tool/Equipment Required	PPE Required
• Heavy equipment (Backhoe/excavator/ Dozer/ Etc.) equipped with flat lip bucket to avoid membrane damage • Measuring device (Ex: Measuring tape) • Shovel and broom	• Standard PPE

Specific Training Requirements
• Appropriate Heavy equipment operator training. (Class 2 Operator or equivalent)

1. Access to the Land farm a. Before entering the land farm, the operator need to have the approval of the Site Services field Supervisor and be accompanied by an environmental representative. 2. Soil movement a. Following the environmental department direction, proceed with the requested soil movement work. (Drawing of the work to be done including exact location, dimension of the area and maximum deepness to reach need to be done by Environment department before proceeding with the work) b. Sampling will be completed by environment department following procedure : MEL-ENV-Permanent Land farm & Soil Sampling

AGNICO EAGLE
NUNAVUT

3. Equipment decontamination
   a. Before exiting the area, make sure to remove all contaminated soil from the heavy equipment.
   b. Using a hand shovel remove all contaminated soil on the equipment. If required use a broom to reach all potential contaminated parts of equipment
   c. Call the field supervisor to assess the equipment cleanness before exiting the land farm.

Related Documentation (If applicable):
• N/A

References (If applicable):
• Meliadine Water license type A (Land farm Management plan)

Appendix (If applicable):
• Pictures • Plans