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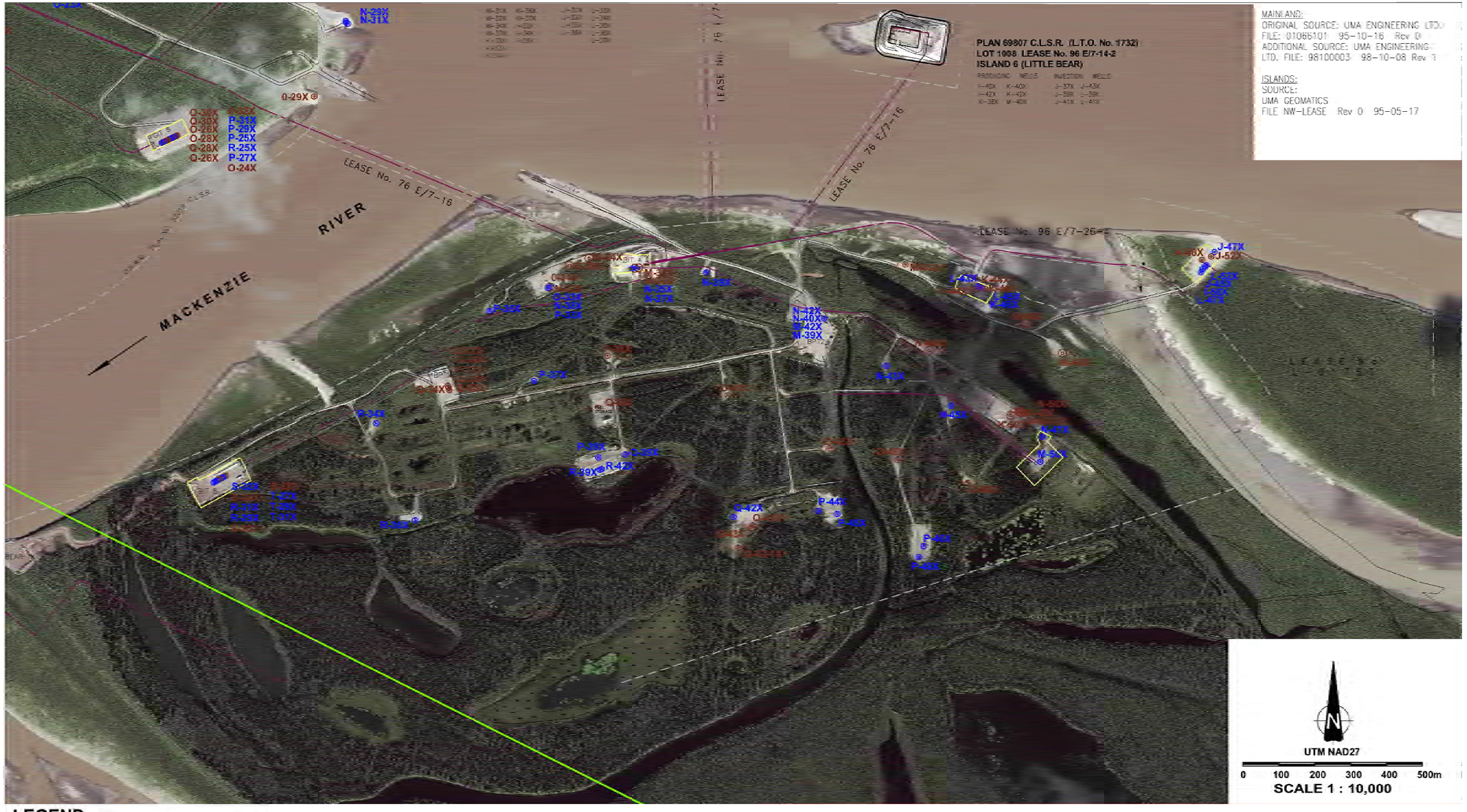


LEGEND

- INJECTION WELL LOCATION
- PRODUCTION WELL LOCATION
- ESSO LEASE BOUNDARY
- PROVEN AREA

amec foster wheeler

CLIENT: IMPERIAL OIL LIMITED

PROJECT NAME: NORMAN WELLS

PROJECT NUMBER: CC4058

SHEET TITLE: CLOSURE AND RECLAMATION PLAN
BEAR & FRENCHY'S ISLAND
GENERAL ARRANGEMENT

FIGURE NUMBER: 5-29

ISSUE/REVISION: A

File Name: P:\CC4058\1 Deliverables\2 Figures\CC4058_FIG 5-29_E1013.dwg Saved By: Layte, Christopher Plot Date: 15/09/04 3:04 PM

ANSI B 432mm x 279mm

MAINLAND:
ORIGINAL SOURCE: UMA ENGINEERINC LTD.
FILE: 01066101 95-10-16 Rev 0
ADDITIONAL SOURCE: UMA ENGINEERING LTD. FILE: 98100003 98-10-08 Rev 1

ISLANDS:
SOURCE:
UMA GEOMATICS
FILE NW-IFASF Rev 0 95-05-17

LEASE No. 96 E/7-29

LEASE No. 76 E/7-16

LEASE No. L-2825T
LOT 8 REMAINDER GROUP 1458
PLAN 52019 C.L.S.R.

O.H.W.M. PLAN NO. 52019 C.L.S.R.

MACKENZIE

UTM NAD27
0 100 200 300 400 500m
SCALE 1 : 10,000

LEGEND

- INJECTION WELL LOCATION
- PRODUCTION WELL LOCATION
- ESSO LEASE BOUNDARY
- PROVEN AREA

amec foster wheeler

CLIENT: IMPERIAL OIL LIMITED

PROJECT NAME: NORMAN WELLS
PROJECT NUMBER: CC4058
SHEET TITLE: CLOSURE AND RECLAMATION PLAN GOOSE ISLAND GENERAL ARRANGEMENT
FIGURE NUMBER: 5-30
ISSUE/REVISION: A

File Name: P:\CC4058\1 Deliverables\2 Figures\CC4058_FIG 5-30_E-1014.dwg Saved By: Layte , Christopher Plot Date: 150904 2:58 PM

Table 5-12: Well Site Equipment Summary

Property	Well Site Equipment	
	Bunkered	**Pumpjack**
Mainland	8	19
Bear and Frenchy's Islands	13	25
Artificial Islands	0	15
Goose Island	74	106
Total	**95**	**165**

A pumpjack is an aboveground drive for a reciprocating piston pump in an oil well. Each pumpjack and wellhead at Norman Wells contains approximately 30 tonnes of steel. Many of the wells are bunkered to protect the wellhead from winter ice. On average, each bunker contains approximately 8 tonnes of steel.

.2 Dangerous and/or Hazardous Materials

Facilities of the nature, scale and age of the Operations typically generate or use a range of potentially dangerous or hazardous materials. The ongoing identification and disposition of these materials during facility operations has been guided by Waste Management Plans that are routinely updated (Imperial 2015). Some of these dangerous or hazardous materials will remain following shut-down and will, therefore, influence subsequent dismantling and demolition (D&D) activities for buildings and equipment. Materials like asbestos, lead paints and poly chlorinated biphenyls (PCBs) can be associated with decommissioned structures and equipment, and require special materials handling and disposition protocols that must be reflected in detailed D&D plans. While a detailed inventory of all potential hazardous material sources and locations is not available for the Operations, from what is known of the facility's operational history, and from various issue or location specific hazardous materials management efforts over the years, it is not anticipated that these materials will be present at frequencies or in quantities that are likely to require atypical and/or unusually elaborate D&D specifications and protocols.

A sense of the potential scale of hazardous materials management requirements post closure can be derived from a review of typical waste generation rates during operations. Table 5-13 summarizes typical waste stream volumes described in the Operations' 2015 Waste Management Plan (Imperial 2015). The material volumes described here are small fractions of those that will be associated with remediation of the contaminated soil inventory on the Proven Area.

Table 5-13: Typical Waste Volumes

Waste Stream	Source	2012	2013	2014	Estimated Volumes (Annually)*
Impacted Soil	Releases or leaks	1,176 T	351 T	117 T	548 T
Closure and Reclamation (C&R) Activities	Material resulting from reclamation and restoration projects	12 T	0 T	790 T	No estimated volumes - variable depending on yearly work activity
Sludge	Well servicing mud/sludge, other liquids (i.e., Well Servicing Tank, Grizzly Tank)	242 m^3	387 m^3	127 m^3	252 m^3
Oily Rags	Maintenance and clean-up activities	13 T	15 T	13 T	14 T
Waste Lube Oil	Lubrication of machinery, engines, compressors and vehicles	5 T	3 T	0 T	3 T
Empty Containers (barrels, pails)	Packaging from supplies	2	8	5	5
Waste Glycol	Heat trace, waste heat recovery unit	1 T	1 T	2 T	2 T
Batteries	Vehicles, equipment	1 T	5 T	7 T	4 T

* Estimated volumes are based on a three year average.

5.5.5.2 Component Specific Objectives

The closure objectives and criteria that apply specifically to the Buildings and Equipment Component are outlined in Table 5-14. The basis and derivation of these objectives and criteria were described in the general planning discussion included in Section 5.2.

5.5.5.3 Proposed C&R Scope and Activity

Broadly speaking, the scope of C&R activity for the buildings and equipment component consists of decommissioning, dismantling and/or demolition of facilities following shut-down, and the management and disposition of all materials and/or wastes generated during the activity.

.1 Decommissioning

Decommissioning refers to taking processes and their associated equipment permanently out of service at closure and includes the activity required to remove or purge process chemicals and/or residuals from them. These equipment shut-downs are typically required from time to time during operations, and the operational protocols for these shut-downs in place at the time of closure will be applied. The chemicals, residuals and/or wastes generated during these activities will be managed in accordance with the facility waste management plan in place at the time (i.e., the version of Imperial (2015) that is operative at the time of closure).

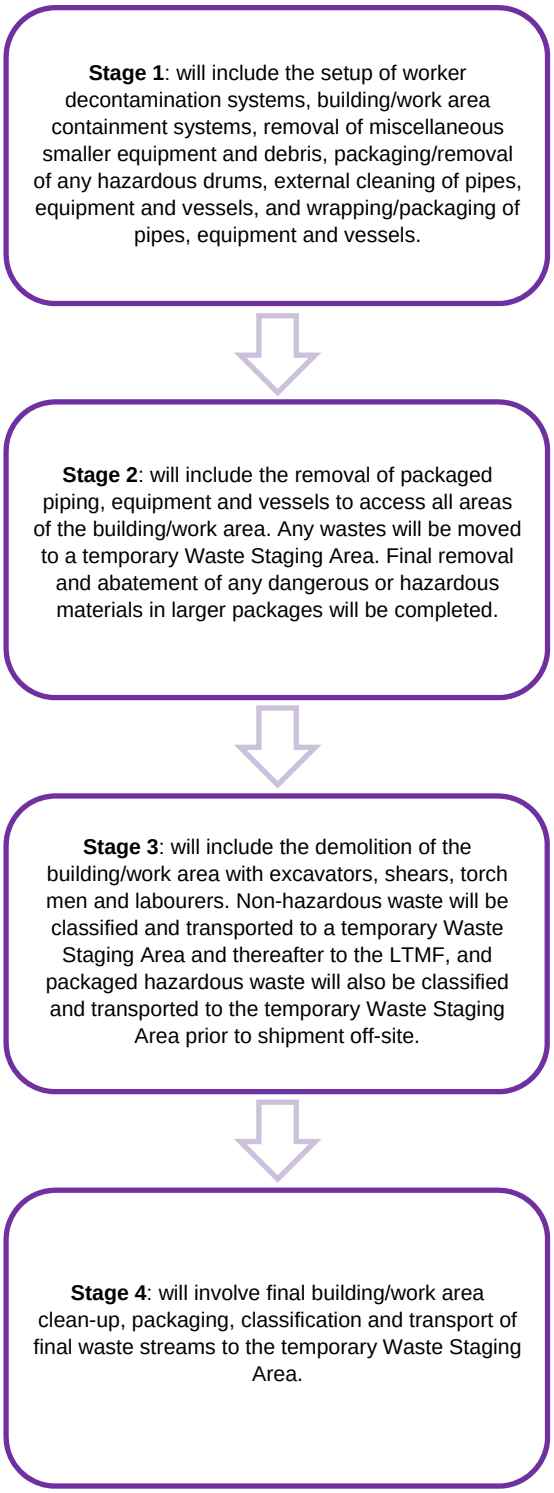
.2 Dismantling and Demolition (D&D)

Above Grade Structures and Equipment

The deconstruction of above grade structures and equipment will be executed according to sequencing and protocols defined by detailed plans developed at the time of closure. Individual plans will be structure or area specific, but will likely incorporate a series of general stages similar to the following:

Table 5-14: Objectives and Criteria for the Surface Buildings, Infrastructure and Equipment Component

Component	Media	Objective	Criteria	Actions-Measurements
Surface Buildings, Infrastructure and Equipment	Land	Above-ground facilities, infrastructure and debris are removed*	Facilities, infrastructure and debris are removed at surface	Post-dismantling visual surface inspections and documentation by qualified professionals
	Materials Management	Reutilization of materials and equipment that retain economic value	Value of materials and equipment (as benefits to the community) demonstrated to be net positive	Monitoring of materials disposal process by qualified professionals


Stage 1: will include the setup of worker decontamination systems, building/work area containment systems, removal of miscellaneous smaller equipment and debris, packaging/removal of any hazardous drums, external cleaning of pipes, equipment and vessels, and wrapping/packaging of pipes, equipment and vessels.
Stage 2: will include the removal of packaged piping, equipment and vessels to access all areas of the building/work area. Any wastes will be moved to a temporary Waste Staging Area. Final removal and abatement of any dangerous or hazardous materials in larger packages will be completed.
Stage 3: will include the demolition of the building/work area with excavators, shears, torch men and labourers. Non-hazardous waste will be classified and transported to a temporary Waste Staging Area and thereafter to the LTMF, and packaged hazardous waste will also be classified and transported to the temporary Waste Staging Area prior to shipment off-site.
Stage 4: will involve final building/work area clean-up, packaging, classification and transport of final waste streams to the temporary Waste Staging Area.

Detailed plans for the removal or recovery of marketable equipment and materials will also be facility specific and will be integrated appropriately within the general D&D execution framework outlined above.

Foundations

Uncontaminated foundation elements (generally concrete slabs, pedestals, grade beams and/or footings, and steel pipe piles) will be cut and removed to depths ranging between 1.5 and 2.0 m below final reclaimed surfaces. Specific depths will be established on an area specific basis in the detailed execution plans developed at closure.

Foundation elements with surfaces known to exhibit contaminants (e.g., oiled concrete slabs), or that cannot be confirmed to be uncontaminated, will be excavated and removed entirely, and managed thereafter as contaminated rubble (i.e., directed to the LTMF).

Material Quantities

Table 5-11 provides the estimated tonnage associated with the buildings and equipment inventory at the Operations. At this preliminary level of C&R planning, it was conservatively assumed that this entire inventory would require management and disposition as waste. In fact, a proportion will likely have a net market value and will be recovered for reuse or recycling. However, it was assumed that the proportion would not have a material influence on the total quantity requiring management and disposition as waste.

Material Disposition

It is anticipated that D&D activities for buildings and equipment at the Operations will generate the following general material categories:

- Salvageable Materials: materials that have a net positive market value and will, therefore, be directed to reuse or recycling. Market values, and hence the proportion of materials involved, will be a function of market conditions at closure.
- Hazardous Materials: materials that are categorized as hazardous by the regulatory definitions applicable at closure will be directed to appropriate third party commercial waste management facilities in southern Canada, or to a dedicated portion of the LTMF equipped with appropriate containment upgrades (if compatible with regulatory requirements and stakeholder expectations at the time of closure).
- Non-hazardous D&D Waste and Debris: the bulk of the D&D waste stream is anticipated to be non-hazardous waste and rubble that can be directed to the LTMF and placed with the contaminated soil inventory. For the current C&R planning purposes, the waste inventory has been conservatively converted to an LTMF air space requirement using factors interpreted from Franklin Associates (1998), Calhoun (2012) and FEMA (2010). In practice, air space requirements could likely be reduced if the waste/rubble is processed via various available processes (e.g., cutting, shredding, compaction). A decision on the appropriate degree of waste/rubble processing will be made on the basis of a detailed processing/ LTMF air space economic trade-off study conducted at closure.

5.5.5.4 Consideration of Options

There are a variety of equipment and procedural alternatives that could be applied to the deconstruction of buildings and equipment. These alternatives will be considered during detailed closure design, or by contractors during tendering of D&D activity. The specific deconstruction methods selected are not anticipated to have a material impact on the general nature of the proposed C&R Plan for the buildings and equipment component.

The one significant alternative considered for this plan was the option of directing D&D waste and rubble to third party commercial waste management facilities outside the community (most likely in northern BC or Alberta). This approach was discounted on the basis of considerations relating to the following execution criteria (see Section 5.4.3 for a more complete description of these criteria):

- Consumption of Resources: transporting the volumes of D&D waste and rubble generated by the deconstruction of Operations' buildings and equipment over the distances required to reach existing commercially available disposition sites would involve large consumptions of energy (at least relative to the on-site disposition option) with an associated generation of greenhouse gas emissions. This consumption of resources would not deliver any commensurate benefits in terms of incremental mitigation of post closure environmental impacts or risks, or reduction of end use restrictions.
- Performance Uncertainties/Risks: there are few uncertainties associated with the use of an on-site LTMF for disposition of D&D waste/rubble and, therefore, few incremental performance uncertainty or risk mitigation benefits offered by off-site disposition.
- H&S Risks: apart from the resource consumption drawbacks, off-site waste/rubble disposition also generates risks to wildlife and the public associated with the large scale transport of materials over long distances.

5.5.5.5 Engineering Required

The following planning and engineering activities are anticipated for the Buildings and Equipment component:

- Hazmat Survey: detailed surveys of the nature and locations of hazardous or potentially hazardous materials contained on or in Proven Area structures.
- Market Assessment: identification of materials and/or equipment for which reuse or recycling is economically viable at closure.
- Waste Processing Assessment: a technical and cost benefit evaluation of alternative methods for reducing the volume of D&D wastes destined for the LTMF. The intent would be to determine if waste processing is more or less cost effective than providing more LTMF air space to accommodate relatively bulky D&D wastes.
- D&D Plan: detailed plans for dismantling and/or demolition of Proven Area structures and equipment that describe the required sequences, methods, equipment, processing, handling, and material disposition.

The first two of the above studies would be completed shortly before closure and would constitute key inputs to the D&D Plan. The last two studies might also be completed just prior to closure, or this detailed planning activity may be undertaken by potential contractors during procurement (i.e., detailed engineering of D&D activities is often included in tendered work scopes because much of the specialist expertise required resides in the contracting community).

5.5.5.6 Final Site Conditions

Site conditions following removal of buildings and equipment are represented by the illustrations of the property following reclamation that have been described for other components, specifically Figures 5-14 and 5-18 through 5-26. Note that these figures assume that the entire Mainland tank farm is removed following closure. In practice, there may be some tanks retained to support community requirements after facility shutdown.

5.5.5.7 Residual Effects

Dismantling and demolition activities will generate waste requiring disposition to the LTMF and, therefore, a modest, but nonetheless real, increase in the LTMF's capacity and size. The residual impacts of LTMF development described previously for the Mainland component (Section 5.5.1) are consequently influenced by the proposed C&R activity for the Buildings and Equipment component.

The only other residual effect of significance for this component would be the presence of foundation elements left in place below the root zone following closure. These may be encountered occasionally during future site redevelopment activities, but are not anticipated to place significant limitations on those redevelopment efforts, or the future use of the lands in general.

5.5.5.8 Uncertainties

There are relatively few uncertainties associated with the Buildings and Equipment component. The outcomes of the planning and engineering activities outlined in Section 5.5.1.5 will be influenced by circumstances at closure, and some conditions (e.g., a poor market for reuse or recycling of D&D materials) could increase volumes directed to the LTMF. However, these variations are unlikely to have material impacts on the general nature and scope of the proposed C&R activity.

5.5.6 Wellbores

The Wellbores component includes C&R activity related to the downhole abandonment of production and injection wells on the Operations, and the reclamation of local excavations or disturbances required to complete abandonment activity.

5.5.6.1 Existing Conditions

A summary of the distribution of wells across the Proven Area by type and location is provided on Table 5-15. The general geographic distribution of these wells across the Proven Area is illustrated on Figure 5-31.

Table 5-15: Operations Well Status Summary

Property	Well Status					Total
	Abandoned	Injector	Producer	Observation	Suspended	
Mainland	16	32	36	1	1	**86**
Bear and Frenchy's Islands	4	39	39	0	0	**82**
River	6	0	0	0	0	**6**
Artificial Islands	0	45	54	0	0	**99**
Goose Island	7	52	50	0	4	**113**
Total	**33**	**168**	**179**	**1**	**5**	**386**

This summary reflects the Imperial well inventory that is provided in Appendix M (Imperial 2013). The majority of the operating wells are completed at a depth of less than 1,000 m. Two of the operating wells have measured depths between 1,000 m and 2,000 m.

5.5.6.2 Component Specific Objectives

The closure objectives and criteria that apply specifically to the Wellbores Component are outlined in Table 5-16. The basis and derivation of these objectives and criteria were described in the general planning discussion included in Section 5.2.

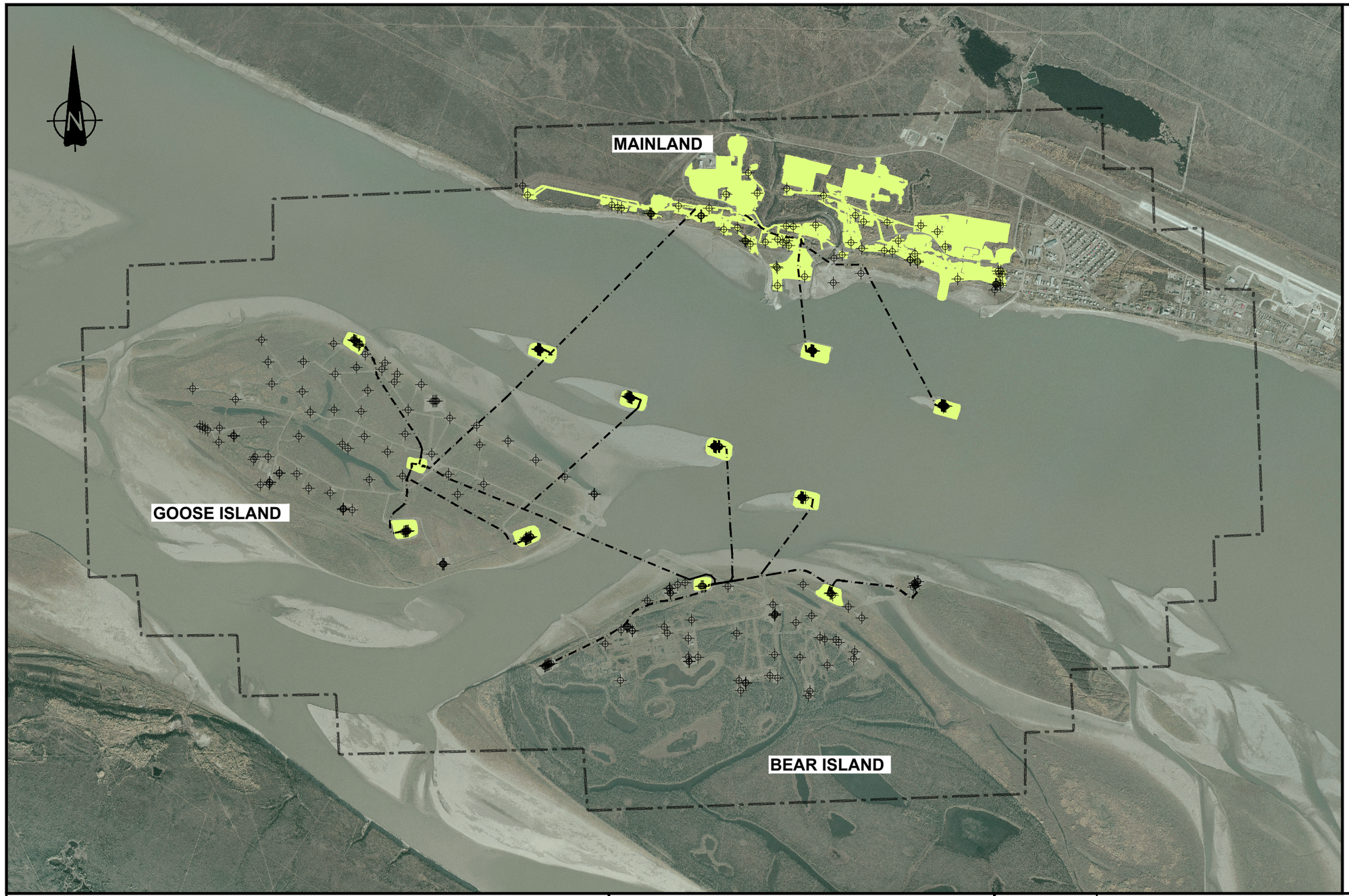
5.5.6.3 Proposed C&R Scope and Activity

There are three C&R activities that will be associated with the Wellbores component, specifically:

- Downhole Abandonments: the protocols and methods applied to permanently isolate the stratigraphy intercepted by the wellbores from the reclaimed ground's surface.
- Cutting and Capping: the process of removing all hardware above a defined depth and placing a physical cap on the wellbores at that elevation.
- Backfilling and Reclamation: the process of reclaiming the land's surface in the immediate vicinity of the former wellbore.

C&R activities addressing these elements of the Wellbore Component will be largely defined, or at least influenced, by specifications and/or procedures that Imperial has, or will define during the Operations' operational phase. Relevant specifications and/or procedures are as follows:

- Wellbore Abandonment: Imperial's processes for downhole abandonment are guided by well-defined operating procedures that are routinely updated on the basis of both facility specific and corporate experience.



LEGEND

- Proven Area Boundary
- Cut and Capped Underground Flowlines
- Abandoned Wellbores
- Dismantled Surface Infrastructure

0m 300 600 900 1200

1 : 30000

CLIENT: IMPERIAL OIL LIMITED

amec foster wheeler

DWN BY:	MDDS
CHK'D BY:	BG
DATUM:	-
PROJECTION:	-
SCALE:	AS SHOWN

PROJECT: NORMAN WELLS INTERIM CLOSURE AND RECLAMATION PLAN

TITLE: WELL BORES AND PA INFRASTRUCTURE

DATE:	OCT. 2015
PROJECT No.:	CC4058.300
REV. No.:	A
FIGURE No.:	FIGURE 5-31

Table 5-16: Objectives and Criteria for the Wellbores Component

Component	Media	Objective	Criteria	Actions-Measurements
Wellbores	Land	Wellbores are abandoned as appropriate for safe utilization of the defined future land use	Compliance with applicable oil & gas production regulations and other appropriate regulatory guidance for the abandonment of below-ground oil and gas infrastructure	Monitoring and documentation of facility demolition for adherence to materials management plans and environmental and OHS standards

- Cutting and Capping: similarly, standard Imperial procedures for cutting and capping wells would be applied to the Operations' C&R program. The definition of cutting and capping depths would be defined on the basis of the requirements of the final C&R Plan and would be consistent with the removal depths specified for subsurface infrastructures (i.e., 1.5 to 2.0 m in most areas). For those locations (e.g., the Artificial Islands) subject to fluvial erosional processes, cut and cap depths would be established on the basis of area specific studies.

The backfilling and reclamation activity required for the Wellbore Component is anticipated to be relatively straightforward because of the limited earth movements that are expected to be associated with it. Relatively shallow Mainland cut and caps will involve minor excavations of materials that will subsequently be replaced (unless they are contaminated, in which case they will form part of the inventory directed to the LTMF) following capping activity. In most cases, any material deficits will be mitigated by local site grading. Backfilled excavations will be revegetated using the prescribed area seed mix or left to revegetate naturally. Deeper cut and cap requirements (i.e., on the Artificial Islands) are expected to be executed using drilling technologies and processes that will not require large scale material movements. Again, the comparatively modest surface disturbances post capping will generally be addressed via local grading and contouring followed by revegetating (naturally or by seeding/fertilizing).

5.5.6.4 Consideration of Options

There are detailed procedural options that are routinely considered as well abandonment, cutting and/or capping procedures and are reviewed and updated (e.g., NEB guidelines relating specifically to wellbore abandonment and cutting and capping procedures). However, there are no general C&R planning alternatives that apply to the wellbore component. Wellbores must be safely and permanently abandoned in place with any hardware in potentially erodible lands or within the root zone removed.

5.5.6.5 Engineering Required

The planning and engineering required for the Wellbore component will largely involve applying the abandonment, cutting and capping specifications/procedures operative at closure to the large scope associated with a program involving all of the Operations' wells. A detailed execution plan providing the required sequences and schedules and their integration with the broader C&R execution schedule will be prepared prior to closure.

5.5.6.6 Final Site Conditions

The surface reclamation of ground disturbances associated with the Wellbores component would be integrated with the general Proven Area reclamation activities that are illustrated on Figures 5-14 and 5-18 through 5-26, and described in the related commentary provided in Sections 5.5.1.3.4 and 5.5.2.3.2.

5.5.6.7 Residual Effects

The primary post closure residual effect associated with the Wellbores component will be the remaining presence of the subsurface completions themselves. These retained completions are an inherent feature of any oil and gas development and their potential impacts on future land uses are partially mitigated by the removal of equipment and hardware above the root zone and within any lands subject to significant erosion and/or displacement.

5.5.6.8 Uncertainties

There are few uncertainties related to the Wellbore Component that will impact the general nature of the C&R activities proposed. The effectiveness of some of the specific abandonment methods applied may require validation and adjustment through performance monitoring and testing. However, in any and all cases, Imperial would retain a commitment to apply final processes and procedures that provide the required safety, integrity and predictability in abandoned well characteristics.

5.5.7 Subsurface Infrastructure

This component addresses below grade infrastructure other than wellbores and foundations for structures and equipment. These latter subsurface scope elements are addressed in Sections 5.5.6 and 5.5.5, respectively.

5.5.7.1 Existing Conditions

Subsurface infrastructure on the Operations' Proven Area is comprised of flowlines, both overland and under the Mackenzie River, and various utilities (i.e., utilidors, electrical lines, communications lines and potable water and septic service).

.1 Flowlines

The network of flowlines that service the Operations' facilities constitute the most significant element of the subsurface component. These flowlines are used to connect the Field Operations with the CPF. Flowlines between the Field and CPF are used for:

- production (oil, produced water and gas) from the producing wells in the Field to the CPF;
- injection (fresh water, produced water and propane) from the CPF to injection wells in the field; and
- natural gas (fuel gas, artificial lift) from the CPF to gas lift wells and field facilities.

Twenty-seven flowlines (oil, water and gas) run under the Mackenzie River. A summary of these is provided on Table 5-17 (Imperial 2013).

Table 5-17: Summary of Flowline Corridors Crossing the Mackenzie River

Flowline Corridor	Description of the Right-of-Way (ROW)	No. of Flowlines	Flowline Diameter and Use
1	Goose Island - Island 3 - Mainland	5	14” Produced Gas 10” Oil Emulsion 8” Produced Water 6” Freshwater 6” Gas Lift Supply
2	Goose Island - Island 4	3	8” Oil Emulsion 3” Produced Water 3” Gas Lift Supply
3	Goose Island - Bear Island	4	10” Oil Emulsion 6” Oil Emulsion 6” Freshwater 4” Gas Lift Supply
4	Bear Island - Island 5	3	6” Oil Emulsion 3” Freshwater 3” Gas Lift Supply
5	Mainland - Island 1	3	6” Oil Emulsion 3” Produced Water 3” Gas Lift Supply
6	Bear Island - Island 6	3	6” Oil Emulsion 3” Freshwater 3” Gas Lift Supply
7	Mainland - Island 2	3	8” Oil Emulsion 4” Produced Water 4” Gas Lift Supply
8	Bear Island - Frenchy’s Island	4	2” Gas Lift 2” Gas Lift 4” Oil Emulsion 4” Freshwater

Note: Electrical lines are not identified in the table above; however, are present in the flowline corridors.

The following sections describe the operational characteristics of these flowlines (Imperial 2014b).

Production Flowlines

Oil Emulsion

Oil emulsion flowlines consist of flowlines that travel from the wellhead to the gathering system group flowline. Oil emulsion group flowlines carry the accumulated production from the various areas of the Norman Wells field to central terminals and the CPF.

Produced Gas Gathering System

The produced gas gathering system consists of a 3.2 km long (2.5 km under river) 14 inch cross river flowline that runs from GIT #4 to the CPF (Line 71/82). Production gas enters the 14” flowline at GIT #4 downstream of the group separator and is water wet with the potential of condensation. Gas from a separator on Island 3 also ties into the main 14 inch flowline via a 6 inch line (Line 88). Production gas at Island 3 enters into the 6” flowline downstream of the Island 3 group separator which then ties into the cross river 14” flowline.

Injection Flowlines

Produced Water System

The produced water system consists of water injection lines carrying produced water from the treater and free water extracted at the CPF to injection wells located throughout the field. This includes cross river flowlines and the flowlines to all of the produced water injection wells. The majority of the produced water flowlines are internally coated or lined with an HDPE liner.

Fresh Water System

Fresh water flowlines transfer fresh water from the Mackenzie River to the CPF and field for use in:

- cooling for crude oil processing within the CPF; and
- injection to maintain reservoir pressure and increase oil recovery.

Natural Gas Flowlines

Gas Lift and Fuel Gas Systems

The gas lift system consists of all lines from the CPF to gas lift wells located throughout Norman Wells. The gas lift system is used to assist in lifting fluids from producing wells. The fuel gas system flowlines supply gas for heating, instrumentation and controls throughout the field. Once the production gas reaches the CPF, it is dehydrated and distributed to one of two systems: the gas lift or the fuel gas system.

Propane Injection

Propane injection flowlines transfer propane from the CPF to the field for use in injection to maintain reservoir pressure and increase oil recovery.

Corrosion Mitigation Features and Processes

Internal Coatings and Liners

Internal coatings and liners are utilized to protect flowlines from internal corrosion by providing a protective layer between the pipe internal surface and the corrosion products. Some produced water and fresh water injection flowlines utilize internal coatings and liners to prevent internal corrosion.

External Coatings

All buried flowlines are heat traced, insulated and covered with a protective external coating. The purpose of the coating is to prevent damage to the pipe during burial and prevent water ingress to the external surface of the pipe.

Chemical Programs

A chemical program refers to the injection or addition of chemical into a flowline. The addition of the chemical can be batch as required or continuous and assists or helps to form a protective film in the flowline. This results in the potential inhibition or prevention of corrosion that is

caused by naturally occurring bacteria and production fluids. Operations utilize chemical inhibition to mitigate internal corrosion on most internally bare carbon steel systems that are subject to corrosive fluids, specifically oil effluent flowlines, three phase group lines and wet gas streams. In addition, biocide is injected into the injection flowline system to kill planktonic bacteria and, in conjunction with pigging, inhibit Microbial Induced Corrosion (MIC).

.2 Utilities

In addition to the flowlines, there are a variety of subsurface utilities that service the Operations on both the Mainland and the Islands. This includes the inventory of electrical lines, communications infrastructure and potable water and septic service that would typically be associated with an industrial facility of the nature and scale of the Operations.

5.5.7.2 Component Specific Objectives

The closure objectives and criteria that apply specifically to the Subsurface Infrastructure Component are outlined in Table 5-18. The basis and derivation of these objectives and criteria were described in the general planning discussion included in Section 5.2.

5.5.7.3 Proposed C&R Scope and Activity

This section outlines the proposed C&R approaches for the flowlines and utilities that make up the subsurface infrastructure component of the Operations.

.1 Flowlines

The portion of any flowline above the root zone, or in areas subject to long term erosion or displacement, will be removed. The remaining portions of the flowlines will be abandoned in place according to protocols appropriate for the specific locations involved (e.g., the matrix on Table 5-19). All flowlines will be cleaned prior to removal or abandonment. Scrap pipe generated during C&R activity will be directed to the LTMF unless it has a net positive market value as scrap metal at closure.

Cleaning Protocols

At closure, Imperial's operational flowline cleaning procedures (i.e., the version of Imperial (2014) operative just prior to closure) will be supplemented by additional cleaning procedures defined on a line specific basis as a function of line characteristics and conditions.

Imperial's operational cleaning procedures apply gas purging and pigging technologies to remove wax deposits in flowlines. Pigging involves inserting a full line-size ball or scraper into the flowline at the wellhead or facility. As the pig obstructs flow in the line, backpressure behind the pig increases, and the pigging device is pushed down the flowline. The tight tolerance between the outside diameter of the pig and the inside diameter of the pipe provides the means for which debris is removed from the pipe wall. A larger pig must be inserted at each location where the line size increases in diameter. The pigs are launched into the line by pig senders and retrieved by pig receivers.

Table 5-18: Objectives and Criteria for the Subsurface Infrastructure Component

Component	Media	Objective	Criteria	Actions-Measurements
Subsurface Infrastructure	Land	Subsurface infrastructure (e.g., flowlines, utilities) is abandoned or removed as appropriate for safe utilization of the defined future land use	Compliance with Canadian Oil and Gas Drilling and Production Regulations and other appropriate regulatory standards and practices for the abandonment of below-ground oil and gas infrastructure	Monitoring and documentation of facility demolition for adherence to materials management plans and environmental and OHS standards

Table 5-19: Pipeline Abandonment Matrix (from CEPA 2007)

Land Use		Pipe Diameter		
		60.3 to 323.9 mm (2" to 12")	355.6 to 610 mm (14" to 24")	> 660 mm (> 26")
Agricultural	**Cultivated**	A	A	A
	Cultivated with special features (depth of cover considerations)	R	R	R
	Non Cultivated (Native Prairie, Rangeland, Pasture)	A	A	A
Non-Agricultural	**Existing Developed Lands** (Commercial, Industrial, Residential)	A	A	A
	Prospective future development (Commercial, Industrial, Residential)	R	R	R
	No future development anticipated (e.g., Forest Areas)	A	A	A
Other Areas	**Environmentally Sensitive Areas** (including Wetlands)	A	A	A
	Roads and Railways	A+	A+	A+
	Water Crossings	A	A	A
	Other Crossings (Utilities)	A	A+	A+

Legend

Abandonment Option	Description
A	Pipeline is abandoned in place
A+	Pipeline is abandoned in place with special treatment to prevent potential ground subsidence (e.g., fill pipe with concrete)
R	Pipeline is removed

For some flowlines, these standard procedures will likely be supplemented with additional protocols to reduce residual contaminant accumulations. Specific procedures will be defined on a line specific basis considering conditions at closure, but would typically involve passing a slug of liquid hydrocarbons having solvent properties (usually condensate or diesel fuel) through the pipeline between two stiff rubber scraper pigs at a constant speed using an inert gas (e.g., nitrogen). Other additives or treatment chemicals may be added if needed. Solvent volumes are calculated to maintain a minimum pipe wall contact time ranging from five to ten minutes depending on the effectiveness of the initial operational cleaning process (CEPA 2007).

All wastes generated during cleaning processes will be managed in accordance with the flowline integrity and facility waste management plans in place at the time of closure (e.g., Imperial (2014)) (typically this would involve directing them to on-site treatment capabilities or appropriate third party disposition facilities outside the community).

Abandonment Protocols

The ends of flowlines will be removed to elevations below the root zone (typically 1.5 to 20 m; depths will be established on a line specific basis in detailed C&R Plans) and the residual portion capped. In addition, line portions in lands subject to post closure erosion or displacement will be removed and capped at the point of removal. This will apply in particular to

lines servicing the Artificial Islands. Current assessments of fluvial processes indicate that lines will need to be removed to depths ranging between 6 m and 14 m below existing features to reach stable elevations (WorleyParsons 2014c). Final cut elevations will be established on a line specific basis and considering updates to fluvial process assessments completed at the time of closure and any relevant NEB protocols applicable at closure.

Cleaned and capped flowlines will be left, unfilled in place unless they traverse significant transportation alignments. These sections will be filled with structurally competent material (e.g., sand, grout). Long term ground subsidence related to the degradation of pipe in other areas is not anticipated to be significant or incompatible with future land uses (CEPA 2007).

The portions of flowlines left under the Mackenzie River will be left in conditions that will mitigate the risks of displacements via buoyant effects. This will be done by breaking the lines (i.e., allowing them to fill with water), or filling them with grout at closure.

.2 Utilities

Utilities within the root zone (typically within 1.5 m to 2.0 m) of the reclaimed surface will be removed and directed to the LTMF. Removal schedules will be established on an area and utility specific basis in the detailed execution plans developed at closure.

Utilities known to contain or exhibit residual contamination, or that cannot be confirmed to be uncontaminated, will be excavated and removed entirely, and managed thereafter as contaminated rubble (i.e., directed to the LTMF).

5.5.7.4 Consideration of Options

C&R activity for subsurface infrastructure is influenced most directly by a decision for or against leaving infrastructure in the ground. The C&R proposal for the Operations calls for infrastructure to be left in place if and where it will not compromise the quality of local environmental media or the specified future utility of the lands. This decision was taken because it is consistent with approaches to infrastructure decommissioning applied at facilities of a similar nature and scale, and because it avoids the ground disturbance, execution risk and cost that would be associated with a large scale excavation and removal effort.

In the particular case of flowlines, in place abandonment is also consistent with industry guidelines for the decommissioning of pipelines. The matrix (Table 5-19) from CEPA (2007) supports the conclusion that abandoning of Operations' flowlines below root zones and erodible/ unstable surfaces would be appropriate considering the Proven Area's status as an existing industrial development, that will continue to be used for industrial purposes (in the case of the Mainland) or as Parkland (elsewhere in the Proven Area).

5.5.7.5 Engineering Required

The following planning and engineering activities are anticipated for the subsurface infrastructure component:

- Detailed Inventory: compilation of a detailed inventory of the nature and location of subsurface infrastructure and its status as contaminated, uncontaminated or indeterminate (i.e., materials/structures that cannot be confirmed uncontaminated).
- Cleaning Plan: detailed procedures and protocols for removing contaminants from infrastructure that will be abandoned in place (flowline cleaning protocols will be a particular focus of this plan).
- Materials Disposition Plan: identification of disposition options for all wastes and scrap generated by the Subsurface Component, based on market conditions at closure. This plan will be developed in concert with the Market and Waste Processing Assessments completed for the Buildings and Equipment component.
- Execution Plan: detailed schedules, sequences and methods for cleaning, removal and capping activities for all Proven Area assets included in the Subsurface Infrastructure component.

5.5.7.6 Final Site Conditions

Site conditions following removal of subsurface infrastructure are represented by the illustrations of the property following reclamation that have been described for other components, specifically Figures 5.14 and 5-18 through 5-26.

5.5.7.7 Residual Effects

C&R activities for subsurface infrastructure will generate waste requiring disposition to the LTMF and, therefore, a modest, but nonetheless real, increase in the LTMF's capacity and size. The residual impacts of LTMF development described previously for the Mainland component (Section 5.5.1.7) are consequently influenced by the proposed C&R activity for the Subsurface Infrastructure component.

The only other residual effect of significance for this component would be the presence of uncontaminated flowlines and other infrastructure elements left in place below the root zone following closure. These may be encountered occasionally during future site redevelopment activities, but are not anticipated to place significant limitations on those redevelopment efforts, or the future use of the lands in general.

5.5.7.8 Uncertainties

There are relatively few uncertainties associated with the Subsurface Infrastructure component. The outcomes of the planning and engineering activities outlined in Section 5.5.7.5 will be influenced by circumstances at closure, and some conditions (e.g., a poor market for reuse or recycling of scrap materials) could increase volumes directed to the LTMF. However, these variations are unlikely to have material impacts on the general nature and scope of the proposed C&R activity.

5.6 Materials Management Plan

5.6.1 Scope and Purpose

The Norman Wells C&R Plan is based on a central LTMF that will rely on the large scale relocation of soils and shales from across the Proven Area. The methods, sequences and schedules developed for these relocations will, therefore, have major influences on C&R Plan content, conduct and cost. The purpose of this Materials Management Plan is to provide a definition of the materials relocation effort required for the LTMF. This plan is intended to:

- validate that the requisite materials relocations are technically and economically feasible;
- identify how relocation methods and costs could influence other elements of the C&R; and Base Case (e.g., LTMF siting and design, default reclamation concepts); and
- provide inputs to the broader, integrated schedule of activities for the C&R Plan (i.e., Section 8.0).

Note that the Materials Management Plan described in this section does not quantitatively reflect any proportion of the soil inventory that is ultimately judged to be treatable (see discussion in Section 6.3). It is not anticipated that redirecting a portion of the soil inventory to treatment on the Mainland instead of the Mainlined Sumps LTMF will have a material impact on the general nature and scale of the materials management scope. However, this will be assessed in updates to this interim C&R Plan and any appropriate adjustments made to reflect the outcomes of progressive reclamation assessments in the lead up to facility closure.

5.6.2 Materials Management Workbook

The workbook in Appendix O was used to describe the management of impacted source area soil volumes and to identify where backfill (either shale or clean overburden) for each of the excavations will be sourced. The material volumes described in this workbook support the LTMF assessment and costing workbooks described previously in Section 5.5.1.4 and provided in Appendix K. The Materials Management Workbook in Appendix O incorporates the individual worksheets described below.

- Dashboard: allows the user to select an LTMF siting and land use (i.e., cleanup criteria) option and to navigate amongst the other worksheets in the file.
- Relocation Scheme: provides a schematic of the concept for managing clean overburden fills and shales in the backfilling of impacted soil excavation areas.
- LTMF Capacity: describes the total impacted soil inventory for each of the siting and capacity options, and the proportions of those totals that are included within the LTMF perimeter for each siting option.
- Backfill Management: describes all backfill sources and the inter-area transfers within the Proven Area that will be required to fill impacted source area excavations.
- Materials Balance: describes impacted soil dispositions for each siting and criteria option, and the specific sources and volumes for backfilling completed excavations.

- Fill Volumes: these worksheets calculate the available shale and overburden volumes by major source area.
- Island Relocations: this worksheet determines the equipment workforce capacity needed to relocate the natural islands (i.e., Bear and Goose) impacted soil inventory to the Mainland over one winter season. This was required to support the evaluations of the potential sequencing and scheduling of major material relocations (see Section 5.3.2).
- Reclamation Requirements: summarizes the movements of clean overburden and shale required to support the surface reclamation scope.
- Shale Surfaces: provides the detailed shale volume calculations that support the Reclamation Requirements summary worksheet.

5.6.3 Materials Management Methods

5.6.3.1 Excavation and Transport

Amec Foster Wheeler has not encountered anything in the characterizations of contaminated source materials and/or the site stratigraphy that would suggest that specialized excavation and transport equipment would be needed to support the materials relocation scope. More detailed phases of project development might identify localized situations requiring adjustments or supplements in methods and equipment (e.g., unstable cut slopes, wet sloughing sands at depth), but it seems reasonable to assume that these modifications would not have a material impact on general C&R planning. Amec Foster Wheeler has assumed that “conventional equipment” refers to heavy civil earthmoving equipment commonly used on northern mining projects (e.g., CAT 336 excavators, CAT 770 Wiggle Wagons), and likely to be owned by, or accessible to, potential contractors.

Transfers to and from the natural and artificial islands would be undertaken during the winter via an ice road similar to those constructed and maintained by Imperial as a part of current facility operations. Imperial has advised that these ice roads typically have the following specifications, capabilities and/or limitations (Layton 2015):

- average number of annual useable days between 2005 and 2014 has been 54;
- maximum capacity of 48,000 kg with an ice thickness of 1.2 m; and
- road width of 37 m.

5.6.3.2 Sequencing

The sequencing of material relocations will be defined by the seasonal constraints associated with transfers to and from the islands, the likely capacity limitations of potential contractors and Imperial/stakeholder objectives for major project completion milestones. A preliminary outline of the possible relocation sequence is included in the integrated schedule of activities that is provided and detailed in Section 8.0. The following paragraphs highlight two of the materials management issues that have particular influences on schedules presented in Section 8.0:

The Materials Management Plan assumes that the relatively small volume of Goose Island soil will be staged via ice road to Bear Island and that the Bear and Goose Island inventories will also be transferred to the Mainland via an ice road. Winter source excavations on the islands would be managed to maximize the maintenance of an unfrozen cut face that could then be removed, transported and placed directly into the LTMF before freezing. The first frozen cut on the islands and any other frozen proportions of the inventory (e.g., after shutdowns) would be directed to an interim Mainland stockpile for thawing and placement during the following summer season.

One of the key assumptions in the sequencing reflected in the Section 8.0 schedules is that materials from the natural islands (i.e., Bear and Goose) can be relocated to the Mainland over one winter. To test this assumption, Amec Foster Wheeler prepared the “Island Relocation” worksheet in the Materials Management Plan workbook (Appendix O) to determine the approximate equipment workforce capacity needed to move the natural islands soil inventory within the available operating window for an ice road. Information provided by Imperial relating to typical (ice road capabilities and operating windows (Layton 2015)), indicates that equipment weights of about 48,000 kg can be accommodated over a 54 day period and that greater weights could be accommodated over a more restricted operating window. For the analysis in Appendix O, Amec Foster Wheeler assumed that weights up to 78,000 kg (the loaded weight of a CAT 770 haul vehicle) could be accommodated over a 30 day window. Amec Foster Wheeler then estimated that a workforce comprised of five CAT 336 EL excavators and seven CAT 770 haul trucks could move the islands inventory within this 30 day window. It was concluded that mobilizing this scale of earthmoving capacity should be well within the practical capabilities of the regionally available contracting and transportation infrastructure.

5.7 Post Closure Monitoring, Maintenance and Reporting

This section provides an integrated description of the monitoring, maintenance and reporting activities proposed for the Proven Area as a whole following execution of the component specific C&R activities described in previous sections. Note that the monitoring requirements during execution of the C&R Plan will be addressed in the detailed planning and engineering documents that will be developed by component at closure (i.e., within the scope of the “Engineering Required” descriptions by component in Section 5.5).

5.7.1 Monitoring Requirements

Post closure monitoring will be required for both the environmental media potentially influenced by C&R activity and the facilities and equipment that will remain following closure as part of the proposed C&R Plan. More specifically, monitoring will be required for the LTMF, the LTMAs as well as groundwater, surface water, vegetation, and wildlife.

5.7.1.1 LTMF Monitoring

Monitoring requirements focused specifically on the LTMF will address the following elements:

- groundwater;
- surface water;

- leachate; and
- cover integrity.

Protocols and procedures will, of course, vary by element, but programs will be similar in that each will:

- provide specific qualitative definitions of what constitutes background or baseline conditions;
- define specific recognized monitoring protocols and standards that will be used to assess conditions;
- specify what constitutes a changed condition requiring a response of some sort; and
- outline how responses to changed conditions will be defined and applied.

Detailed monitoring protocols will be developed on the basis of final LTMF designs and site conditions as closure approaches. However, these protocols will be guided by requirements that have been established for similar structures (e.g., those outlined in Alberta Environment (2010)). The following sections outline the likely scope and content of an LTMF monitoring program.

.1 Groundwater Program

Developing a groundwater monitoring program for the LTMF will involve completing the following tasks:

- Designing Well Networks: this task will involve establishing a network of monitoring wells at locations and in numbers appropriate for evaluating groundwater quality at a specified compliance boundary (this would be defined in consultation with regulatory authorities, but would typically be in the range of 10 to 60 m from the perimeter of the waste footprint). Similarly, the number of monitoring locations would be established during detailed design and in consultation with regulatory authorities, but would typically involve well spacings of about 200 m along the compliance boundary (this would equate to something in the order of 10 wells for the LTMF footprint shown on Figure 5-8; at least some of which would likely involve completions in more than one interval (i.e., shallow groundwater and bedrock aquifers)).
- Defining Background Quality: each monitoring location would require a working definition of background groundwater quality for the parameters of concern. This background definition could be established on the basis of LTMF specific well installations or, more likely, from a review of the groundwater quality database compiled during Operations.
- Defining Parameters and Control Limits: this task would involve defining the specific analytical parameters that will be monitored to assess trends in groundwater quality and establish the control limits for each. Monitoring parameters would likely be those considered during the operational phase (i.e., the LTMF will be storing the same materials that were of interest during operations); specifically, chloride and volatile organic hydrocarbons (i.e., benzene, toluene, ethylbenzene and xylene)

(Imperial 2014a). Control limits would be established for each parameter considering background data and the proposed water quality criteria for the Mainland component (i.e., CCME Freshwater Aquatic Guidelines.

- Defining Methods: this task would define the specific sampling and analytical methods that would apply to the program. These methods would likely be derived from those applied to operational monitoring efforts adjusted as may be appropriate to address specifications typically applied to the monitoring of structures like the LTMF.
- Defining Frequencies: the frequency of LTMF groundwater monitoring would likely be guided by typical specifications for landfill monitoring programs (e.g., Alberta Environment (2010)). These usually specify monitoring frequencies in the range of twice annually for facilities of the nature and scale of the proposed LTMF.
- Establishing Performance Standards and Contingency Plans: monitoring performance standards for facilities like the proposed LTMF typically require that:
  - groundwater quality for any parameter does not exhibit an increasing trend;
  - none of the parameters monitored exceed the corresponding groundwater quality limit; and
  - there are no parameters that are not naturally present in groundwater detected in three consecutive sampling events (unless these parameters have been identified as associated with the Mainland groundwater quality prior to LTMF construction).

The groundwater contingency plan would outline those actions to be taken should the monitored groundwater fail to satisfy these performance standards. The outlines of this plan would likely follow that in Imperial's current groundwater response plan which includes the following action hierarchy (Imperial 2014a):

- Verification: confirming that the performance excursion is true and accurate;
- Risk Review: assessing the potential risks and associated consequences of the excursion;
- Delineation: quantifying the geographic and temporal scopes of the excursion;
- Evaluation: identifying and quantifying the source of the excursion and its likely impact on groundwater quality vectors; and
- Remediation: defining and executing those actions required to mitigate the groundwater quality impacts defined during application of the response hierarchy.

.2 Surface Water Program

Following construction, up gradient surface waters will be directed around the LTMF and runoff contacting the cover will be directed to the local watershed without impoundment. There will be no direct contact between precipitation and the stored materials provided that the cover system is functioning as designed. The surface water component of the LTMF monitoring program will, therefore, be comprised primarily of physical inspection of the LTMF drainage structures and

sampling and testing of any unanticipated water accumulations. These monitoring activities would be integrated with the other monitoring activities for the LTMF (i.e., groundwater, leachate and cover monitoring). Any surface water quality excursions above CCME Freshwater Aquatic Guidelines identified during these monitoring efforts would be addressed using the same response hierarchy proposed above for groundwater.

.3 LTMF Cover

The physical integrity and performance of the LTMF cover will be regularly and systematically assessed at frequencies defined in the detailed post closure monitoring plan (these frequencies will, to some degree, be a function of final cap details, but are likely to involve annual inspections). The cover assessments would involve physical inspections undertaken to identify:

- any evidence of unanticipated differential settlements that have, or have the potential to, compromise cover integrity;
- any evidence of deep seated soil movements impacting cover integrity;
- the vigour and percent cover of any vegetation that is part of the final cover design;
- any evidence of shallow soil movements or displacements above cover barrier and drainage systems;
- any evidence of near surface soil erosion or displacement generated by precipitation running off the cover; and
- the condition of any fencing around the cover, or any vents or surface infrastructure associated with the cover.

.4 Leachate

Again, detailed monitoring protocols for LTMF leachate systems need to be developed on the basis of final facility designs and in consultation with regulatory stakeholders considering any NWT regulations that will be operative at closure. However, the outlines of leachate monitoring requirements can be anticipated from a review of existing regulatory guidance (e.g., Alberta Environment (2010)). Leachate monitoring and management requirements are likely to include:

- a program to regularly measure the depth of leachate head;
- definition of a maximum allowable liner head depth and development of protocols for reducing any heads above this maximum; and
- retrieval of representative leachate samples at regular frequencies followed by analytical testing for a specified schedule of parameters selected to align with the LTMF and property wide groundwater monitoring programs.

The frequencies associated with these leachate monitoring and management activities would likely be similar to those described in Table 5-20 below.

Table 5-20: Leachate Sampling and Analysis

	Monitoring		
Monitoring Activity	**Minimum Frequency**	**Method**	**Sampling Location**
Leachate level monitoring in cells	April to October - weekly	Measurement	At each leachate manhole and sump
	November to March - monthly		
Volume of leachate removed from cells	As removed	Measurement	At each leachate manhole and sump
Leachate parameters			
pH, Total Dissolved Solids, Total Suspended Solids	Annually	(a) grab sample (b) representative grab	(a) at each leachate manhole and sump; and (b) at the leachate pond (if applicable)
Chloride, Sodium, Sulphate			
Metals			
BTEX			

5.7.1.2 LTMA Monitoring

The LTMAs described in Section 5.5.1.3 (i.e., the Refinery Bank and Battery 3 areas) incorporate control and/or monitoring systems as part of Imperial's operational management efforts on the Operations. These activities will be regularly reviewed and the associated protocols updated through the balance of the operational phase. Prior to closure, assessments of any adjustments to control and/or monitoring requirements will be defined on the basis of LTMA conditions at the time. While details will vary, it is known the ongoing post closure control and/or monitoring of environmental media (groundwater in particular) will be an inherent and integral element of detailed post closure LTMA management plans.

5.7.1.3 Groundwater Monitoring

The proposed C&R Plan will relocate and consolidate the large majority of anthropogenically derived contamination to the LTMF. The only contamination remaining outside the LTMF will be that controlled and/or monitored in LTMAs. There should therefore, be no need for groundwater monitoring beyond that associated with the LTMF or LTMAs, and none is proposed in the C&R Plan.

The version of the Operations' Groundwater Management Plan operative prior to closure (i.e., the operative version of Imperial (2014a)) will be applied until C&R activities have been completed and accepted by the project stakeholders. The specific timing for this transition will be defined during detailed C&R planning at, or just prior to, closure.

5.7.1.4 Surface Water Monitoring

Post closure surface water monitoring requirements will be influenced by the general nature of the C&R Plan in much the same way as groundwater monitoring. Because the plan relocates all contaminant sources to the LTMF, surface water quality monitoring requirements beyond those specified for the LTMF facility itself (see Section 5.7.1.1) will be limited to ensuring that ditches, drainageways and/or other hydrologic features incorporated into surface reclamation designs

function as intended. This will involve inspections of drainage features and performance for a period following C&R execution for signs of unanticipated erosion, soil displacement and/or revegetation gaps that have the potential to generate unacceptable sediment loads in surface runoff. Specific monitoring protocols and durations will be defined in detailed C&R Plans based on final surface reclamation plans and will include a general response hierarchy for addressing any post closure deficiencies that may be encountered.

5.7.1.5 Vegetation Monitoring

The proposed reclamation component of the C&R Plan relies on re-establishing grass cover over remediated and/or disturbed lands, and to a lesser extent, planting tree species at the interface between reclaimed areas and existing woodlands. Post closure vegetation monitoring will, therefore, be comprised of:

- herbaceous vegetation establishment;
- forest establishment; and
- forest performance.

The primary purpose of herbaceous vegetation monitoring on areas reclaimed to grass (or left to revegetate naturally) will be to verify that vegetation cover is developing at a rate sufficient to control erosion and to provide an acceptable aesthetic on reclaimed lands. Vegetation cover (by species) will be recorded along permanent transects established at spacings defined in detailed monitoring plans prepared at closure (likely in the range of 50 to 100 m), in representative reclamation areas. Field assessment and sampling will typically be conducted in late July or August when the vegetation is at full maturity. Again, assessment/sampling frequencies will be defined in detailed monitoring plans at closure, but will likely be annually for the early post closure period, changing to more extended intervals as vegetation becomes established.

To ensure that areas planted to trees are establishing successfully, a tree establishment survey will be carried out within a few years of planting. The survey method will be based on the Establishment Survey Standard described in the Reforestation Standard of Alberta (ESRD 2013). The main objective of this survey will be to determine sufficient density of planted trees following an initial period of establishment (nominally four to eight years after planting). The survey consists of sampling plots placed in a grid fashion over the planted area and determining the proportion of plots containing an acceptable tree. If the proportion is lower than desirable, then infill planting will be undertaken.

5.7.1.6 Wildlife Monitoring

The degree to which animals use reclaimed areas is the most effective measure of the success of reclamation for wildlife. The detailed monitoring program prepared at closure will include ungulate browse and pellet group surveys, plant litter measurements to assess suitability for small mammals, spring songbird point counts, and amphibian call surveys. Winter tracking surveys will be proposed to collect data on ungulate movements and the use of habitat by furbearers. Tracking data allows a more complete understanding of wildlife habitat use and changes that occur over time.

Monitoring of reclaimed habitats would likely be undertaken at five year intervals. Initial monitoring would collect data for the following:

- ungulate browse;
- faecal pellet groups; and
- plant litter measurements.

Sample locations will be selected within reclamation areas and sampling undertaken in the summer. Within each location, a defined number of plots will be randomly chosen at least 150 m apart. A plot will be about 5 m in diameter (80 m^2). These plots will remain permanently established for subsequent monitoring purposes. Sites will be chosen so that they will vary in the degree of access and, by implication, human disturbance. Plots will be sampled according to the protocols outlined below.

For browse data collection, a simple scoring system of the proportion of twigs browsed will provide information on habitat use. The proportion of browse on shrubs and grazing on grasses and forbs will be determined qualitatively by a browse score of 0 to 4:

- 0 = 0 percent browse;
- 1 = less than 10 percent browse;
- 2 = 10 to 25 percent browse;
- 3 = 25 to 50 percent browse; and
- 4 = more than 50 percent browse.

Faecal pellet group surveys will provide information primarily on moose and hare. In each plot, pellet groups will be identified and counted for each species encountered.

Plant litter measurements will provide information on habitat quality for small mammals, the predominant prey base of fisher, but also of owls and hawks. Litter depth will be measured to the nearest centimetre in representative locations within the plot.

Data will be statistically analyzed to address differences between sites and between years. The analysis of sites will provide information on how various factors, such as degree of disturbance, size and surrounding habitats, affect reclamation. Future data from these same sites will provide information on how the reclamation success changes over time. The analysis of habitats will provide information on how reclamation relates to the overall wildlife community in the region.

5.7.2 Maintenance Requirements

The proposed C&R Plan calls for the development of facilities or the application of concepts that will require operational and/or maintenance activity post closure. These requirements are associated with the LTMF, the LTMA in the Refinery Bank area and reclamation areas. Some of these operation and maintenance obligations will diminish or cease over time, while others will extend indefinitely post closure.

5.7.2.1 The LTMF

Operation and/or maintenance for the LTMF will be needed for the facility cover and the leachate management and treatment systems. The general nature and scope of these requirements will be influenced by the findings of the monitoring program described in Section 5.7.1.1, and are outlined in summary form below.

.1 LTMF Cover Maintenance

- Restoration of any gaps in the cover vegetation.
- Removal of any invasive, deep rooting trees or shrubs that could damage the cover.
- Repair of any erosional rills or other soil displacements above the cover geosynthetics.
- Repair of any damage to geosynthetic layers caused by unanticipated soil displacements.

.2 Leachate Management and Treatment Systems Operations and Maintenance

- Maintenance of the piping and pumping systems needed to transfer leachate from collections sumps to the treatment plant, and from the plant to watershed discharge points.
- Supply of the reagents, equipment and labour required to sustain leachate treatment plant operations.
- Disposition of the solid residuals generated by the treatment process, either via third party facilities off-site or using a dedicated, and comparatively small, adjunct to the LTMF.

5.7.2.2 LTMAs

The LTMA that has been identified in the Refinery Bank area will generate ongoing operations and maintenance requirements. Again, the detailed scope of these will be influenced by monitoring outcomes both before and after closure, but the outlines are provided below (addressing at least some elements of these requirements would likely be integrated with the O&M capability developed to support the leachate treatment plant):

- supply of the equipment and labour requirement to sustain product and groundwater recovery/containment systems;
- disposition of any hydrocarbon product recovered by the systems (likely off-site via third party disposition contractors); and
- maintenance of the piping and pumping systems needed to support system operations.

5.7.2.3 Reclamation Areas

Maintenance in reclamation areas differs from that described above for the LTMF and LTMA in that it can be anticipated that these requirements will diminish over time, and eventually cease, as vegetation is re-established post closure and area specific erosion problems addressed. The maintenance requirements for reclamation areas in the near to intermediate term following closure will include:

- restoration of any poor or degraded vegetation catches (either in grassed areas or areas planted with tree seedlings); and
- repair of any erosional degradation, or larger scale soil displacements, in ditches, drainageways or other hydrotechnical elements of the C&R Plan.

5.7.3 Reporting

The detailed content, format and frequency of reporting for post closure monitoring and maintenance activity will be established in consultation with regulatory stakeholders. However, it can be anticipated that these reporting requirements will be similar to those applied during facility operations, rescaled as will be appropriate for the more modest post closure monitoring and maintenance scopes. Monitoring reports will present data, interpretations thereof and describe how outcomes will influence the scope and conduct of both maintenance requirements and subsequent monitoring efforts.

Maintenance reports will fully describe the conduct of LTMF and LTMA operations, present performance outcomes relative to specifications, document any facility modification and outline any changes in facility capabilities and/or operating configuration indicated by performance and/or monitoring outcomes. The reclamation component of the maintenance report will document any revegetation efforts and/or hydrotechnical facility restoration conducted during the reporting period.

5.7.4 Contingencies/Adaptive Management

For the purposes of the C&R Plan, the contingencies required to address uncertainties in anticipated C&R execution or performance outcomes, will be addressed by Adaptive Management Plans. As noted in the discussion of general planning principles outlined in Section 5.2.1, Adaptive Management refers to the application of mitigation strategies in response to the observed performance outcomes provided by a remediation plan and/or management system. It is particularly relevant in the context of complex remediation plans/systems for which reliable predictions of long term performance are difficult, unreliable or inconclusive. Rather than relying entirely on prediction, the proponent commits to adjusting the elements of a remedial system on the basis of the performance actually delivered.

Broadly speaking, the Adaptive Management requirements anticipated are comparatively modest for a facility of the scope and scale of the Operations, largely because the central elements of the proposed C&R Plan involve proven technologies whose application to the Operations' Proven Area can be anticipated and understood with a comparatively high degree of certainty. More specifically, the use of an LTMF to manage contaminated materials over

extended timelines has many precedents in the oil and gas sector and the performance of LTMF design applications and components in this setting can be reliably predicted. Excavating contaminated soils requires managing the uncertainties that are inherent to activities involving subsurface conditions and stratigraphy. However, from what has been reliably established about subsurface conditions at Norman Wells, it is unlikely that unexpected ground conditions encountered during excavation will have a material impact on the general nature and scope of the C&R Plan.

Those components of the proposed C&R Plan for which uncertainties are most likely to influence actions post closure are as follows:

- Leachate Treatment Plant Operations: operational experience and the outcomes of performance monitoring could drive changes to the treatment regime and/or the management of treatment residuals (e.g., operational experience might indicate that storage and batch plant operation might be more efficient than continuous treatment of a small leachate flow).
- LTMA Operations: again, operational experience and performance monitoring will likely result in refinements, or possibly more substantial changes, to recovery/containment systems and/or operational protocols.
- Reclamation: monitoring revegetation success may result in adjustments to seed mixes, application procedures and/or the proportions of disturbed areas that are planted to grass vs. trees.

Adaptive Management Plans that address these contingent actions will be developed in concert with the detailed C&R component plans at closure. These detailed plans will also address any specific Adaptive Management responses that are appropriate for addressing the component specific descriptions of uncertainties that were outlined previously in Section 5.5.

5.7.4.1 Air Monitoring

There are no significant post closure air quality impacts anticipated for the proposed C&R Plan and, therefore, no monitoring required for the air component.

6.0 PROGRESSIVE RECLAMATION

6.1 Definition of Progressive Reclamation

Imperial has adopted the following definition of Progressive Reclamation offered in MVLWB (2013):

"Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve a purpose. These activities can be completed during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure and enhance environmental protection. Progressive reclamation may shorten the time for achieving closure objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure."

6.2 Progressive Reclamation to Date

6.2.1 Scope of the Progressive Reclamation Program

Imperial has undertaken a variety of C&R initiatives and activities over the years and will continue to do so in the lead up to facility closure. These activities are regularly described and reported in annual progress reports submitted to the SLWB (Schedule 7 of SLWB (2015)), the most recent of which was provided by Imperial (2015). The C&R activities described in this report are included in the summary table provided in Appendix P. Broadly speaking, these C&R initiatives and activities have been comprised of:

- completion of downhole abandonment activities for decommissioned production, groundwater characterization, and/or monitoring wells;
- the site characterization activities required to identify and delineate contaminant source areas and the relevant characteristics of the subsurface environment;
- monitoring activities and requirements that have been identified as a consequence of site characterization programs;
- soil remediation, via excavation and treatment on-site, the application of in-situ extraction techniques, or interim in-situ containment via capping;
- groundwater remediation via combinations of containment, product recovery and treatment; and
- surface restoration and revegetation in select areas.

The Imperial Progressive Reclamation Annual Report also summarizes activities which were anticipated for 2015, and the schedule (following) provides a representative description of the nature and scale of Imperial's ongoing C&R efforts.

- The groundwater monitoring program conducted in 2014 was further optimized and executed in 2015.

- The groundwater pumping, Multi-Phase Extraction (MPE) and Dual Phase Extraction (DPE) systems at the refinery and B-38X sites, respectively, continued operations in 2015 and are continuously optimized as needed to improve performance.
- Operation of the two soil treatment cells continued until treated soil met applicable CCME Industrial land use standards. Treated soils were reused on the site in industrially zoned areas. As space became available in the cells, hydrocarbon impacted soils were imported from various locations within the Norman Wells lease, and prioritized appropriately to mitigate environmental risk.
- Hydrocarbon impacted soil excavation and on-site treatment continued in the areas south of the current biocells.
- Hydrocarbon impacted soil excavation and on-site treatment continued at the site of the former Terminal 1 on Bear Island.
- Vegetation cover and physical stability monitoring continued at the well services and Mainland sumps areas, the reduced crude flare pit, the Tank 401 and Tank 53 areas, the Cemetery sump area, and the east bank of Bosworth Creek.
- Wellhead cut and cap activities were conducted at abandoned wells deemed by Imperial to be no longer required for site operations.
- Phase II investigations were conducted at any wellsites selected by Imperial for abandonment, locations of reported spills from operational facilities, and at historic areas of impact where data gaps have been identified.
- Key applied technology and guideline development (vegetation and invertebrate eco-toxicity) continued.
- Shallow permafrost conditions were monitored through a network of thermistors installed in key areas in 2013. The thermistors assist in determining the potential for lateral groundwater migration above permafrost on a year-round basis in the vicinity of key areas of concern.

Imperial anticipates that this general approach to the progressive management of environmental liabilities at the Operations will continue prior to facility closure. The specifics of the program will be routinely reviewed and refined on the basis of operational requirements, detailed closure schedules and the general progressive reclamation principles outlined in Section 6.3. Imperial also expects that the use of LTMF containment will feature in future progressive reclamation efforts. The intent will be to expand the range of available material disposition options prior to closure by developing an initial phase of the full scale LTMF that forms a central component of the broader C&R Plan (see Section 5.4.2.2).

6.2.2 Current Treatment Facilities for Progressive Reclamation

Imperial maintains, or is in the process of developing, the following treatment facilities that are used to manage impacted soils generated by progressive reclamation efforts:

- a biological treatment facility (biocells) located in the Mainland area north of the former Battery 3 site; and

- a soil washing facility that is currently being constructed in the area south of the biocells, immediately northeast of the former Battery 3.

The biocells are focused on the treatment of hydrocarbons in soil and the washing facility on the removal of chlorides.

6.2.2.1 Biocells

Imperial operates two biocells that are located as shown on Figure 6-1. These cells address the treatable hydrocarbon fraction of contaminated soils. The design and operating concepts for the second of these biocells are illustrated on Figure 6-2 (note: this figure is a design concept; the as-built facility varies slightly in detail from that shown). The combined physical capacity of the two biocells provides for 10,000 m3 of contaminated soil.

Soils are directed to the biocells from various locations across the Proven Area, after they have been characterized and deemed suitable for bioremediation based on evaluations of soil chemistry. Supplemental nutrient requirements are monitored through regular analysis and amendments incorporated as required to the soil windrows placed in the facility using a twister bucket. Soils are treated to comply with CCME Industrial criteria and then removed and stockpiled for subsequent use on the Mainland as a general fill source (Imperial 2015).

6.2.2.2 Soil Washing Facility

The general location and configuration of the soil washing facility that Imperial is currently constructing for the Operations is shown on Figure 6-3. This facility is designed to treat salt impacted soils generated by progressive reclamation efforts on the Operations. The facility is comprised of a treatment pad, a process water holding pond, a freshwater storage tank, and freshwater supply infrastructure. The treatment facility removes salt by irrigating the subject soils with a freshwater leachate solution. The treated material is directed to the Mainland fill stockpile if compliant with CCME Industrial criteria (or directly to source excavations for use as backfill), or to the biocells if supplemental reduction of hydrocarbon contents is required. Salt rich irrigation process water is directed to the F-31X treatment and injection facility via truck (Imperial 2015b).

6.3 Progressive Reclamation Scope

6.3.1 Planning and Operational Principles

Imperial anticipates that the following principles will define the general nature, scope and timing of C&R initiatives and/or activities prior to facility closure.

1. Material Volumes: impacted materials will be addressed prior to closure if:
    - their removal is required to support ongoing facility operations;
    - they create unacceptable risks or have the potential for significant migration;
    - removing some materials prior to closure better supports or facilitates the development of a workable and timely post closure C&R execution schedule; or

ANSI B 432mm x 279mm

BIOCELL #1

BIOCELL #2

MAINLAND SUMPS

MAINLAND DRILLING SUMP

WELL SERVICES SUMP

CENTRAL PROCESSING FACILITY

BOSWORTH CREEK/BATTERY #3

MAINLAND TANKFARM

REFINERY BANK

FORMER REFINERY BANK

IMPERIAL OIL LEASE BOUNDARY

BYPASS ROAD

LEGEND

- INJECTION WELL LOCATION
- PRODUCTION WELL LOCATION
- ESSO LEASE BOUNDARY
- REGISTERED PLAN BOUNDARY
- UTILIDOR LOCATION

SOURCES:

1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).

amec foster wheeler

CLIENT: IMPERIAL OIL LIMITED

PROJECT NAME: NORMAN WELLS OPERATIONS

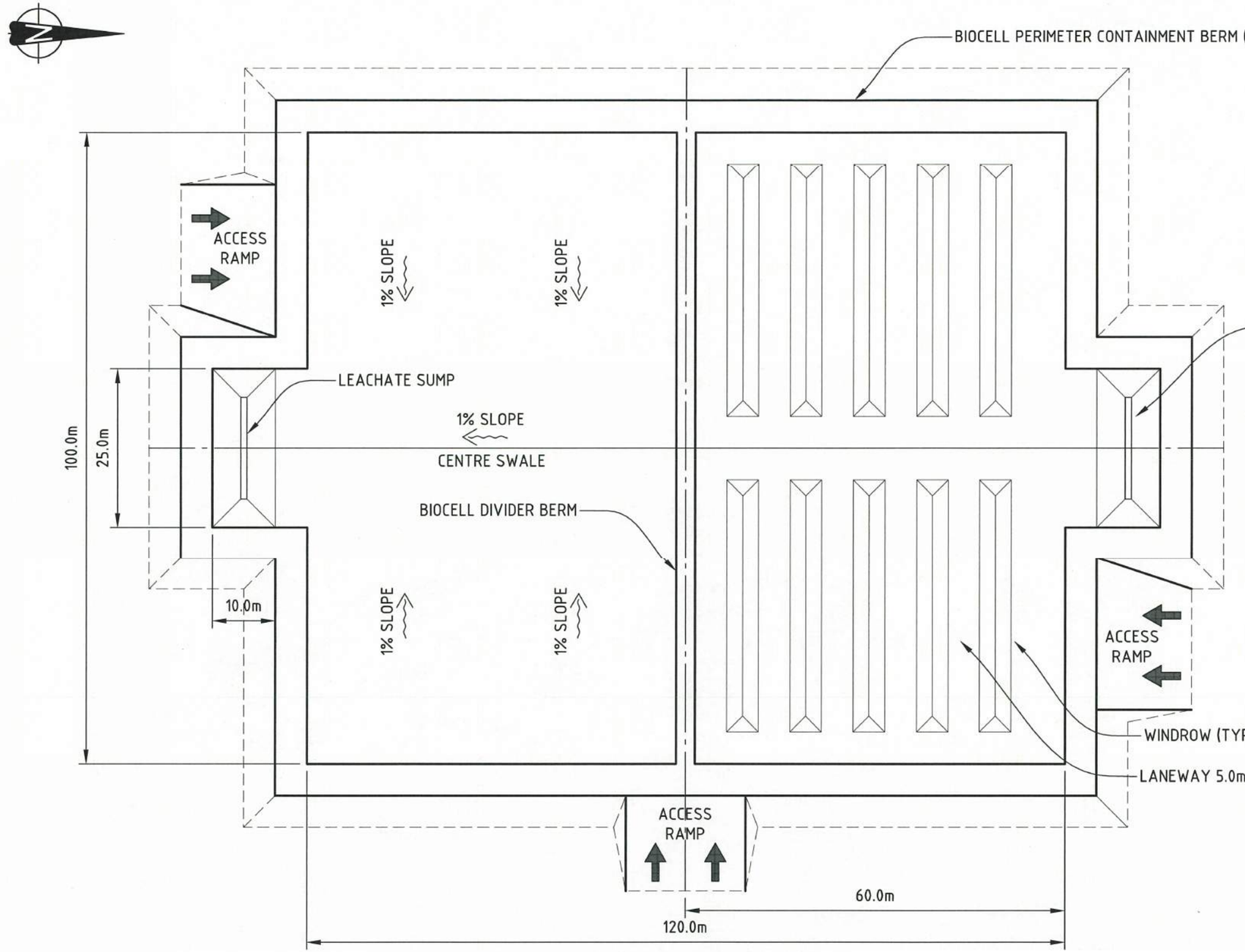
PROJECT NUMBER: CC4058

SHEET TITLE: CLOSURE AND RECLAMATION PLAN BIOCELL LOCATION MAP

FIGURE NUMBER: 6-1

ISSUE/REVISION: A

File Name: P:\CC4058\1 Deliverable\2 Figures\CC4058_FIG 6-1_E-1016.dwg Saved By: Layle, Christopher Plot Date: 15\1023 2:27 PM



PLAN - CONCEPTUAL BIOCELL

1:750

BIOCELL STORAGE CAPACITY

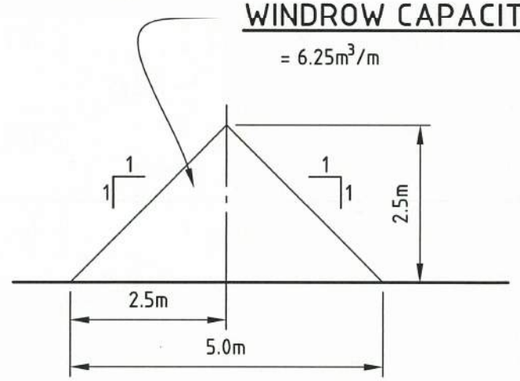
EACH WINDROW
40m L X 6.25m^3/m = 250m^3
EACH CELL
10 WINDROWS X 250m^3 = 2500m^3
TOTAL BIOCELL FACILITY
2 CELLS X 2500m^3 = 5,000m^3

LEACHATE SUMP CAPACITY

POND @ FSL = 79m^3
POND INCL. F_B = 179m^3

WINDROW CAPACITY

= 6.25m^3/m



TYPICAL WINDROW

1:100

NOTE:

1. EACH CELL IS A MIRROR IMAGE OF THE ADJACENT CELL.
2. THE BIOCELL FACILITY SHALL BE SECURED WITH A CONTINUOUS 1.8m HIGH CHAINLINK FENCE.

amec foster wheeler	PROJECT NAME: NORMAN WELLS OPERATIONS	PROJECT NUMBER: CC4058
CLIENT: IMPERIAL OIL LIMITED	SHEET TITLE: CLOSURE AND RECLAMATION PLAN BIOCELL #2 DESIGN & OPERATING CONCEPT	FIGURE NUMBER: 6-2
		ISSUE/REVISION: A

TREATMENT PAD
30 m x 100 m

EQUIPMENT CONTAINER

PROCESS WATER POND
15 m x 50 m

FRESHWATER
STORAGE TANK

POWER

PIPE

TO WATER SOURCE
(SEE INSET MAP)

Bosworth Creek

LEGEND

- Flare Pit Assessment Area
- Battery #3 Area Extents
- POWER — Powerline
- PIPE — Pipeline
- E — Power Pole
- Access Road Extents
- X — Location of Former Fence

0 5m 10m 15m 20m 25m

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CLIENT
IMPERIAL OIL LIMITED

PROJECT NAME
NORMAN WELLS OPERATIONS

PROJECT NUMBER
CC4058

SHEET TITLE
CLOSURE AND RECLAMATION PLAN
SOIL WASHING
FACILITY GA

FIGURE NUMBER
6-3

ISSUE/REVISION
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- o portions of the Operations are shut down prior to general facility closure and removing local soils in these areas will advance Progressive Reclamation efforts.

2. Material Disposition: treatable volumes remediated prior to closure will be directed to treatment systems currently on, or approved for, the Operations (i.e., the biocells or salt washing facility). These treatment systems will produce CCME Industrial compliant materials that can be used to support C&R activities in the Mainland area (e.g., backfilling source excavations and/or in surface reclamation activities). If and when any LTMF capacity is available, material volumes generated pursuant to Planning Principle 1 above will be addressed via the most cost and schedule effective combination of treatment and/or LTMF disposition determined by Imperial to be suitable for the materials in question.
3. LTMF Capacity: any pre-closure LTMF capacity will be developed in areas, configurations and with containment specifications compatible with full scale LTMF development post closure. Pre-closure LTMF capacities will be physically integrated with full scale LTMF developments at closure.
4. Surface Reclamation: surface restoration for source areas resulting from the application of planning principle 1 will be backfilled and reclaimed at surface by applying the general approaches to restoration outlined in Section 5.4.2.3. Areas restored prior to closure will be used to assess the efficacy and cost of the specific reclamation techniques proposed, and to evaluate how these outcomes may vary from area to area across the Proven Area.

6.3.2 Definition of Treatable Soil Fractions

The treatment facilities described in Section 6.2.2 will be used to better define the proportion of the total impacted soil inventory that can be treated post closure. Treatable soils would be those that can be processed to meet the applicable CCME criteria and used thereafter on the Mainland for backfill and/or surface reclamation. For the purposes of the Operations C&R Plan, treatable soils would be those hydrocarbon and/or salt impacted soils that can be processed:

- with technology that is proven, available and economically feasible, and that can be practically be scaled up to accommodate the volumes anticipated at the Operations; and
- to deliver soils meeting applicable CCME criteria over timelines compatible with general C&R execution schedule objectives and constraints.

These criteria for defining the treatable fraction are consistent with the general C&R planning principles relating to soil treatment and C&R technology as outlined in Section 5.2.1. Defining more specifically how these criteria will apply to the current soil inventory will be assessed by operating the existing soil treatment facilities to continue the evaluation of:

- the characteristics and parameter concentrations that are compatible with treatment;
- the parameters and throughputs associated with those soil characteristics;
- the design and performance factors appropriate for scaling facility throughputs as necessary;

- the likely timelines associated with treatment for each soil category; and
- the anticipated capacities and operating costs for each soil category.

6.4 LTMF Development

Pursuant to the general planning principles described above, Imperial anticipates that LTMF capacity will be required to support remediation and reclamation activities prior to closure.

6.4.1 First Development Stage

The LTMF capacity required as part of the general Progressive Reclamation plan will be developed as the initial stage of the permanent LTMF described in Section 5.5.1. The specific attributes and configuration of this facility will be influenced by detailed planning activities prior to closure, but it is anticipated that the first stage will be sized, at a minimum, to accommodate all of the impacted soils in the Mainland sumps area (estimated in Table 5-2 to amount to some 30,000 m^3). This entire sump inventory will be addressed during the initial stage of LTMF development to:

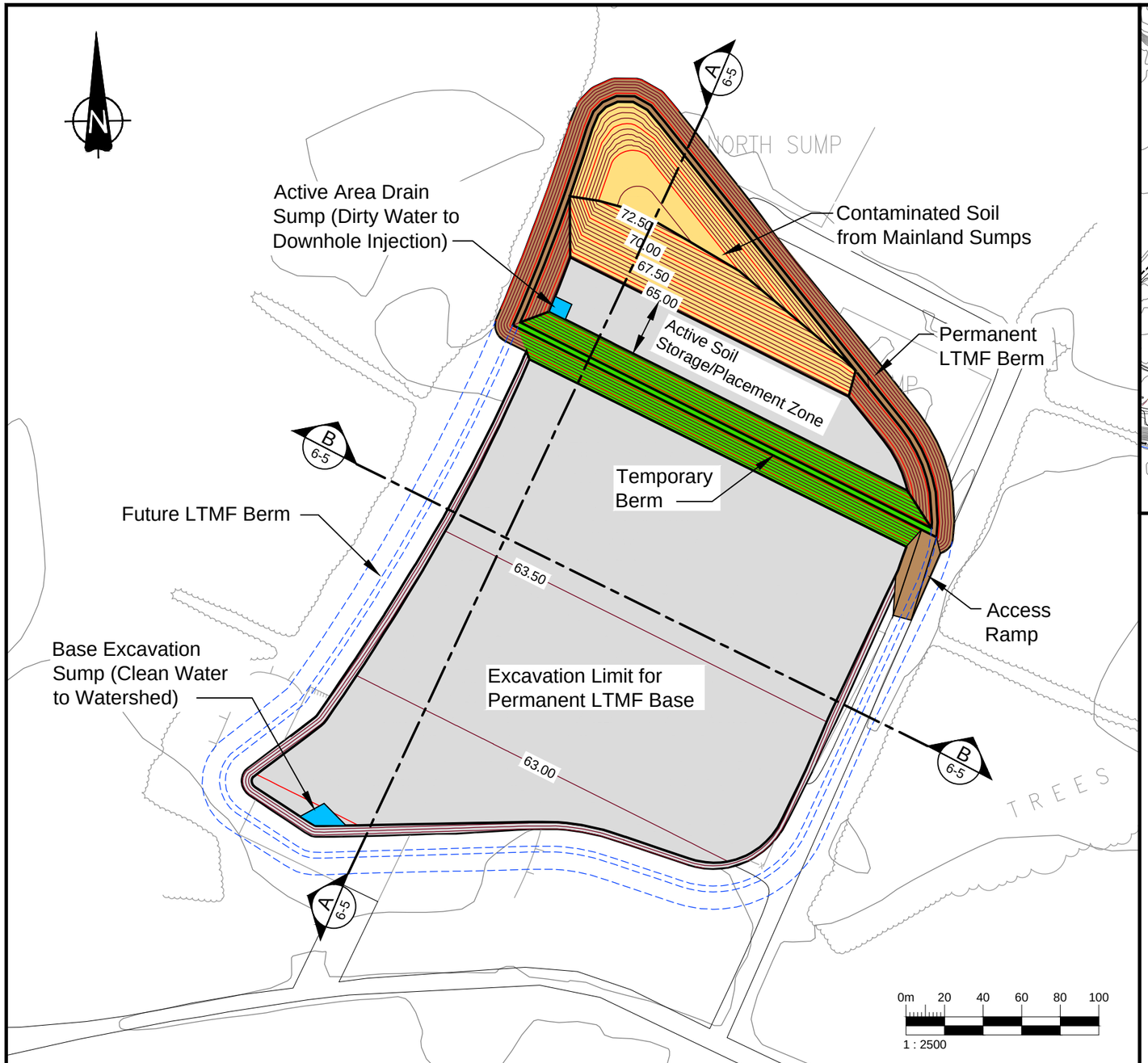
- minimize the potential for recontaminating the LTMF subgrade and/or surrounding lands via the movement of sump materials;
- capture the materials management and contacting efficiencies available from a significant execution scope; and
- limit volumes to those needed only to support the initial stage of LTMF development (while still sufficient to provide execution efficiencies).

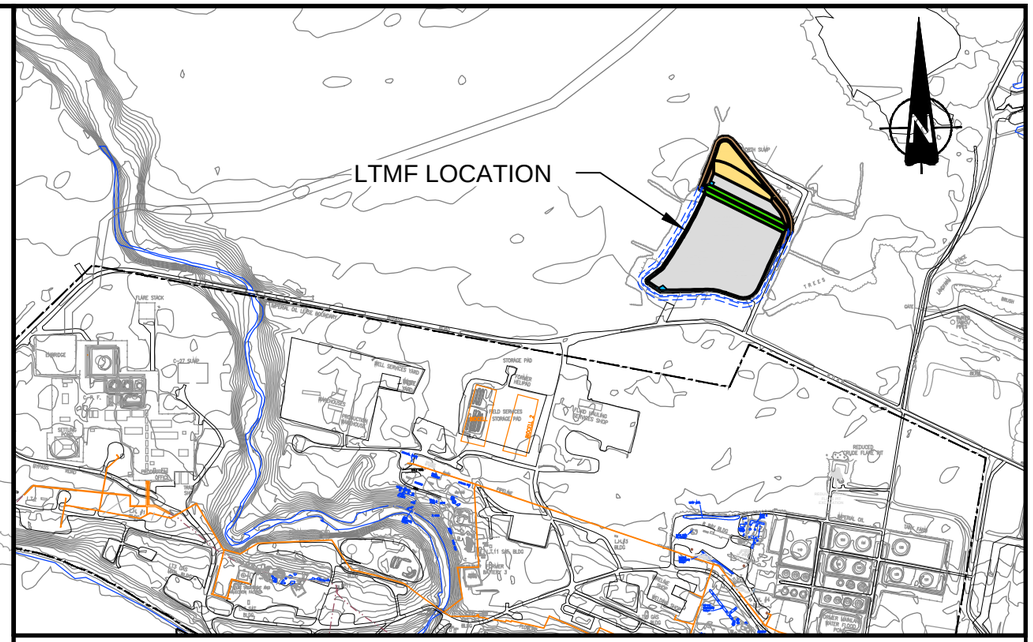
6.4.2 Pre-Closure LTMF Configuration

The pre-closure LTMF will be developed within the horizontal and vertical footprints of the permanent LTMF that has been proposed for the Mainland sumps area. Beyond providing capacity for the impacted materials inventory in the sumps area, the pre-closure LTMF will be developed to expand within the permanent LTMF footprint as needed to accommodate impacted material volumes generated prior to Operations closure.

The physical portion of the permanent LTMF that will be most suited to pre-closure facility development will be influenced by the outcomes of the planning studies and site investigations needed to support design, and by Imperial's operational requirements and constraints prior to closure. However, a representation of a potential pre-closure LTMF configuration has been developed to better illustrate the concept, and is provided in Figures 6-4 and 6-5. Descriptions of the facility characteristics shown on these figures is provided below:

- Generally, the pre-closure facility will start with a modest portion of the full LTMF base footprint and extend vertically to the full permanent design height before expanding that base footprint. This will minimize the operative LTMF base area at any given time, and thereby limit its associated water management liability.





LOCATION PLAN

0m 100 200 300 400 500 600

1 : 15000

LEGEND

- Future LTMF Berm
- Proposed Contours
- LTMF Permanent Excavation
- LTMF Permanent Berm
- Temporary Berm
- Contaminated Soil from Mainland Sumps

CLIENT: IMPERIAL OIL LIMITED

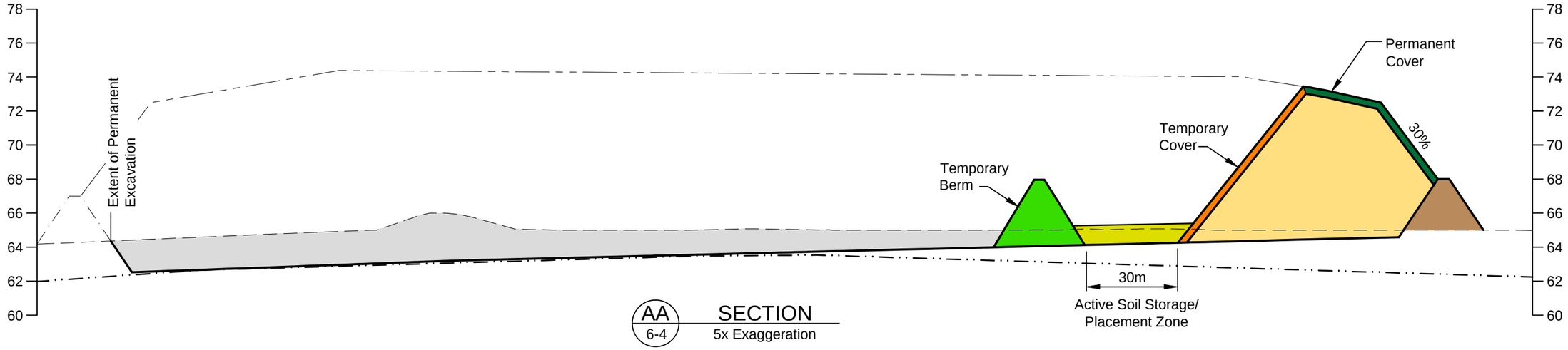
amec foster wheeler

DWN BY:	MDDS
CHK'D BY:	BG
DATUM:	-
PROJECTION:	-
SCALE:	AS SHOWN

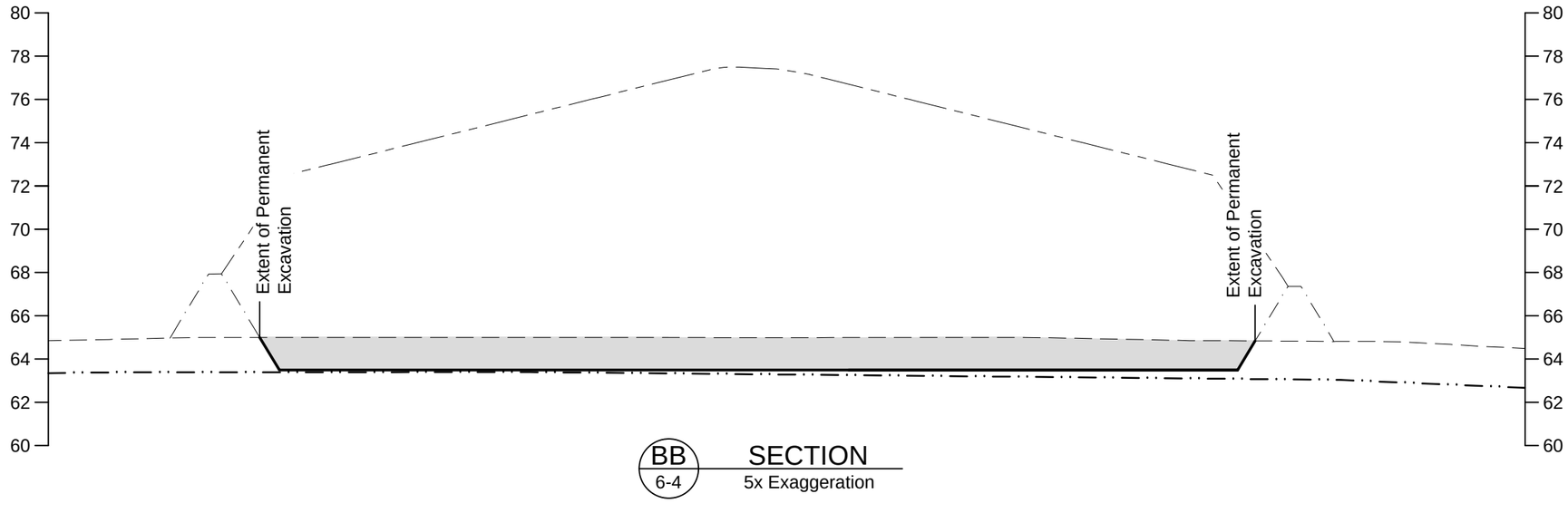
PROJECT: NORMAN WELLS INTERIM CLOSURE AND RECLAMATION PLAN

TITLE: MAINLAND PRE-CLOSURE LTMF GENERAL ARRANGEMENT

DATE:	OCT. 2015
PROJECT No.:	CC4058.300
REV. No.:	A
FIGURE No.:	FIGURE 6-4



AA 6-4 SECTION
5x Exaggeration



BB 6-4 SECTION
5x Exaggeration

LEGEND

- Existing Ground
- Bedrock
- Interim Design Base
- Future LTMF Berm
- Future LTMF Cap
- LTMF Permanent Excavation
- LTMF Permanent Berm
- Temporary Berm
- Contaminated Soil from Mainland Sumps
- Permanent Cover
- Temporary Cover
- Active Soil Storage/Permanent Zone

0m 10 20 30 40 50
1 : 1250

0m 2 4 6 8 10
1 : 250

CLIENT: IMPERIAL OIL LIMITED

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DWN BY:	MDDS
CHK'D BY:	BG
DATUM:	-
PROJECTION:	-
SCALE:	AS SHOWN

PROJECT: NORMAN WELLS INTERIM CLOSURE AND RECLAMATION PLAN

TITLE: MAINLAND PRE-CLOSURE LTMF SECTIONS AA AND BB

DATE:	OCT. 2015
PROJECT No.:	CC4058.300
REV. No.:	A
FIGURE No.:	FIGURE 6-5

- Removing all of the existing sump materials as part of the first stage of LTMF development will create a depression between the pre-closure LTMF footprint and the southern edge of the permanent LTMF. This area will capture clean precipitation (drainage from active areas of the pre-closure LTMF will be contained and kept out of this depression) that will be drained via passive, gravity structures discharging to the south into Bosworth Creek and/or the Mackenzie River.
- The cover over the pre-closure LTMF will apply a comparatively simple specification comprised of a geomembrane covered with a geonet and approximately 50 cm of clean overburden or imported clay (the geonet will improve the cover stability by reducing pore pressures in the cover soils). These cover soils will be used subsequently for berm construction in the permanent LTMF following replacement of the interim cover with the permanent structure. The use of this comparatively straightforward interim cover will simplify the regular reconfiguration of the cover that will be required as materials are added to the facility prior to Operations closure.
- Depending on the pre-closure volumes ultimately directed to the pre-closure LTMF, it may make sense to cover any portions developed to the final design height with the permanent cover. The viability of this approach will depend on the cover areas involved. Permanent cover construction will benefit from economies of scale, meaning that it will not be efficient to mount a permanent cover construction effort below a certain area threshold. The feasibility of staged permanent cover construction will be reviewed and assessed regularly as the pre-closure LTMF is developed.
- The controlled perimeter of the pre-closure LTMF (i.e., that area requiring active containment, collection and disposition of water) will incorporate a staging area where volumes directed to the LTMF can be stored until sufficient to justify consolidating and covering within the facility.
- Water volumes from the controlled perimeter will be directed to existing wastewater management infrastructure that Imperial will be maintaining as part of regular operations prior to closure.
- Developing the pre-closure LTMF will require bringing forward some of the design activities anticipated for the permanent LTMF to ensure that the specific location and attributes of the interim facility are compatible with the permanent one. In particular, the geometric studies, the geotechnical and hydrogeological evaluations, and the civil designs and stability assessments detailed in Section 5.5.1.5 will likely be required, at the least in preliminary form, to support pre-closure LTMF development.

7.0 TEMPORARY CLOSURE

The Mackenzie Valley Land and Water Board's "Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories" (MVLWB 2013) defines temporary closure as occurring when an operation closes with the intent of resuming activities in the near future. The guidelines require that proponents outline their plans for preparing and managing facilities during this period. For the Norman Wells operation, there is no expectation that the facility will be restarted after the shut down date, and there is, therefore, no requirement for the development of management plans for a temporary period of closure.

8.0 INTEGRATED SCHEDULE OF ACTIVITIES

Preliminary schedules for the C&R activities proposed in this interim plan are provided on Figures 8-1 through 8-8 as follows:

- Figure 8-1 is a high level summary of all proposed C&R activities (i.e., both Progressive Reclamation and C&R Plan Execution);
- Figure 8-2 focuses on those activities planned over the near term to initiate and undertake Progressive Reclamation activities; and
- Figures 8-3 through 8-8 describe the 13 year interval spanning the Operations' shut down date (the three years prior and 10 after) that will be required for the detailed planning and engineering of C&R work packages, the execution of these work packages and the initiation of post closure monitoring and maintenance programs.

These schedule figures incorporate the following common editorial or formatting features:

- durations in years are used in place of specific calendar years;
- Year 1 refers to the year in which this Interim C&R Plan is approved and put in place; and
- the black vertical line in Figures 8-2 through 8-8 indicate the assumed facility shut-down year.

It should be noted that all of these schedules are technical documents that do not include the various points of community engagement that will be associated with the activities described, particularly during planning and development. Community interactions and inputs will be described and scheduled in separate planning documents initiated and maintained by Imperial and/or the project team.

General comments on the nature and content of the schedules in Figures 8-1 through 8-8.

- The schedules are based on a Work Breakdown Structure (WBS) outline that includes the key C&R planning and execution activities for each of the project components described in Section 5.0, and for the major Progressive Reclamation activities that will occur prior to closure.
- The specific activities and tasks included in the schedules are based on the C&R plans and engineering studies detailed in Section 5.0 for each component.
- The schedules assume that over the near term, a pre-closure LTMF will be planned, constructed and begin operations as outlined in Section 6.0 to support Progressive Reclamation efforts that will be ongoing over the period leading up to facility closure.
- The schedules extend to as late as the end of Year 20 for those post closure monitoring, maintenance and/or management activities that have been identified. This cut-off date functions as an editorial placeholder for the Section 8.0 schedules. Year 20 does not have any particular significance; the intent is to show that these activities will extend indefinitely post closure.

- The timing and sequencing of the material relocations that are a central feature of the C&R program are based on the Materials Management Plan outlined in Section 5.6.
- Wellbore abandonment is the critical path activity for the C&R execution schedules on Figures 8-3 through 8-8. The schedules assume that the abandonment capacity that could practically be mobilized to support closure would be in the range of 30-40 wells per year. This figure is based on preliminary discussions with Imperial. The more detailed examinations of technical and procurement options for providing abandonment capacity that will be undertaken as the C&R Plan evolves could identify practical approaches for expanding capacity and reducing the overall C&R execution schedule.
- Well abandonment timelines were based on the following distribution of the total operating well count:
    - Mainland - 70;
    - Bear/Frenchy's Islands - 78;
    - Goose Island - 106; and
    - Artificial islands - 99.
- The schedules assume that all wells will continue to produce until the assumed facility shutdown date (i.e., that there will be no progressive shutdown and abandonment of wells prior to general facility shutdown). Again, this assumption is based on inputs from Imperial. In fact, there will likely be some reductions in the producing well inventory as closure approaches. However, the nature of the reservoir is such that most wells will continue operations until shutdown.
- The schedules also assume that impacted soil excavation follows well abandonment activities in any particular area. This follows from the assumption that soil excavation operations will be more efficient and effective if not constrained physically by the presence of wells and their associated infrastructure.
- For the Artificial Islands, the Figure 8-5 schedule assumes that rock armouring removed from the islands will be returned to the Norman Wells Quarry (its original source), and that impacted soil volumes will be low enough that summer transport to the LTMF via barge is feasible.
- The schedule does not incorporate any of the Adaptive Management activities that might be considered or undertaken as described in Section 5.7.4. These activities would most likely be initiated and scheduled in the post closure period following execution of the basic C&R Plan, as part of the broader, ongoing facility maintenance and monitoring program.

At this preliminary stage of C&R planning, the basic durations reflected in the schedules (i.e., three years planning and construction of an interim LTMF; 10 years at closure for execution of the final C&R Plan) should be viewed as general representations of likely planning and execution timelines and sequences. Detailed execution schedules based on the more defined plans that will be available at closure will vary from Figures 8-1 through 8-8, and will also be influenced by the schedule objectives and imperatives operative at closure (e.g., if circumstances emerge requiring reductions or expansions of general execution timelines).

ID	Task Name
1	**Progressive Reclamation**
2	**Interim LTMF Development**
3	**Preliminary Engineering Studies**
7	Regulatory Permitting & Approvals
8	**Construction**
12	**Interim LTMF Operation**
15	Biotreatment Facility Operations
16	Soil Washing Facility Operations
17	**Source Area Remediation & Reclamation**
20	
21	**Mainland**
22	**Permanent LTMF Development**
23	**Final Engineering Studies**
28	**Facility Construction**
35	**LTMA Development**
36	**Final Engineering Studies**
40	**Facility Construction**
43	**Post Closure Operations**
46	**Source Area Remediation**
47	**Engineering Studies**
51	**Contaminated Soil Excavations**
55	**Source Area Reclamation**
56	**Engineering Studies**
60	**Construction**
64	
65	**Natural islands**
66	**Source Area Remediation**
67	**Engineering Studies**
71	**Contaminated Soil Excavations**
79	**Source Area Reclamation**
80	**Engineering Studies**
84	**Construction**
89	
90	**Artificial Islands**
91	**Engineering Studies**
94	**Construction**
97	**Source Area Remediation**
98	**Engineering Studies**
102	**Contaminated Soil Excavations**
105	**Source Area Reclamation**
106	**Engineering Studies**
109	**Construction**
111	
112	**Buildings & Equipment**
113	**Above Grade Structures**
114	**Engineering Studies**
119	**Execution - Mainland**
125	**Execution - Natural Islands**
130	**Execution - Artificial Island**
135	**Foudations**
136	**Execution - Mainland**
138	**Execution - Natural Islands**
140	**Execution - Artificial Island**
142	
143	**Wellbores**
144	**All Areas**
145	**Engineering Studies**
147	**Execution - Mainland**
152	**Execution - Goose Island**
157	**Execution - Bear/Frenchy's Islands**
162	**Execution - Artificial Islands**
167	
168	**Subsurface Infrastructure**
169	**All Areas**
170	**Engineering Studies**
175	**Execution**

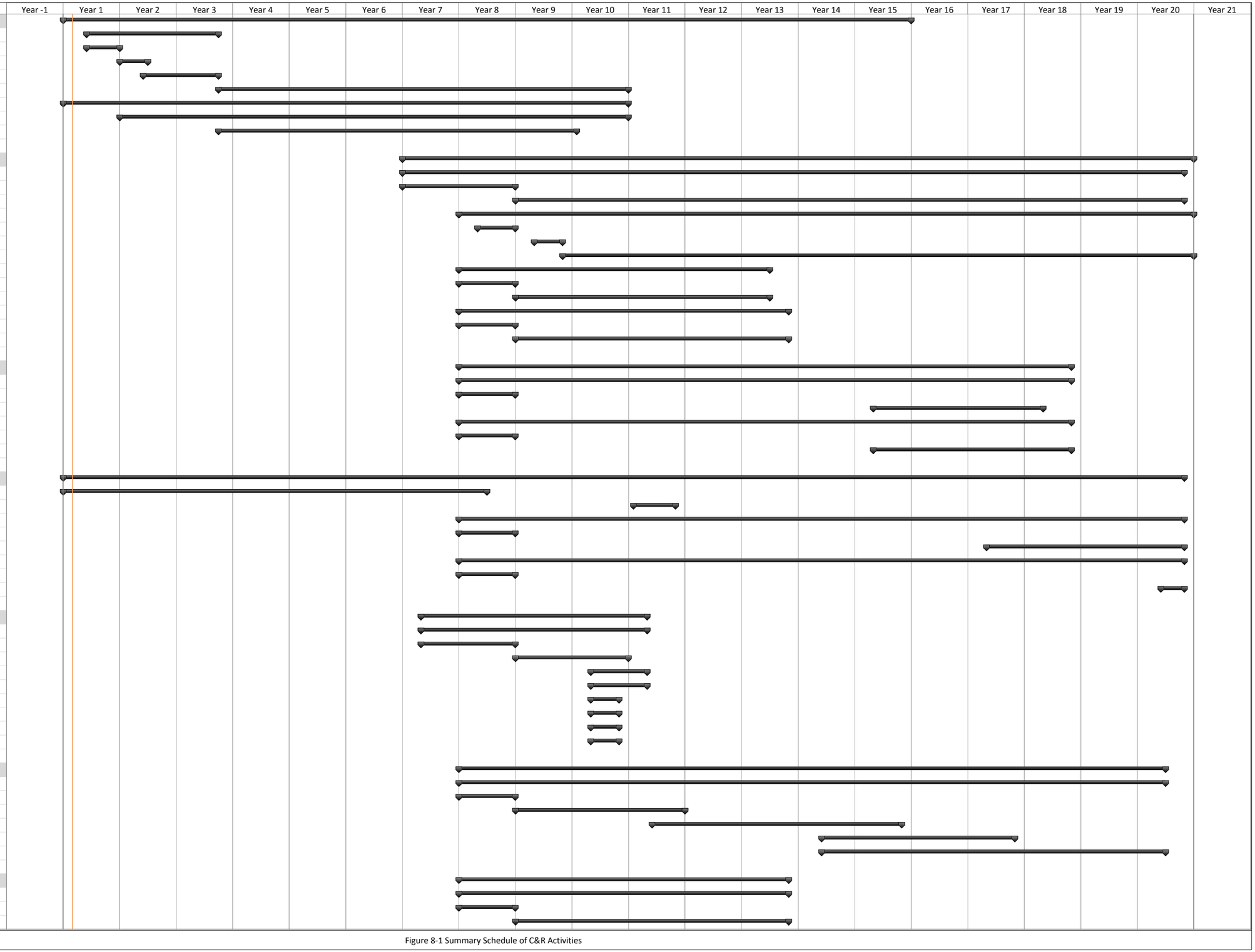


Figure 8-1 Summary Schedule of C&R Activities

ID	Task Name
1	**Progressive Reclamation**
2	**Interim LTMF Development**
3	**Preliminary Engineering Studies**
4	Geometric Studies
5	Geotechnical and Hydrogeological Evaluations
6	Civil Designs and Stability Assessments
7	**Regulatory Permitting & Approvals**
8	**Construction**
9	Site Preparation
10	Base Excavation
11	Mainland Sumps Material Removal and Re-consolidation
12	**Interim LTMF Operation**
13	Waste Storage & Placement
14	Temporary Cover Construction
15	Biotreatment Facility Operations
16	Soil Washing Facility Operations
17	**Source Area Remediation & Reclamation**
18	Contaminated Soil Excavations
19	Source Area Backfilling & Surface Restoration
20	
21	
22	
23	

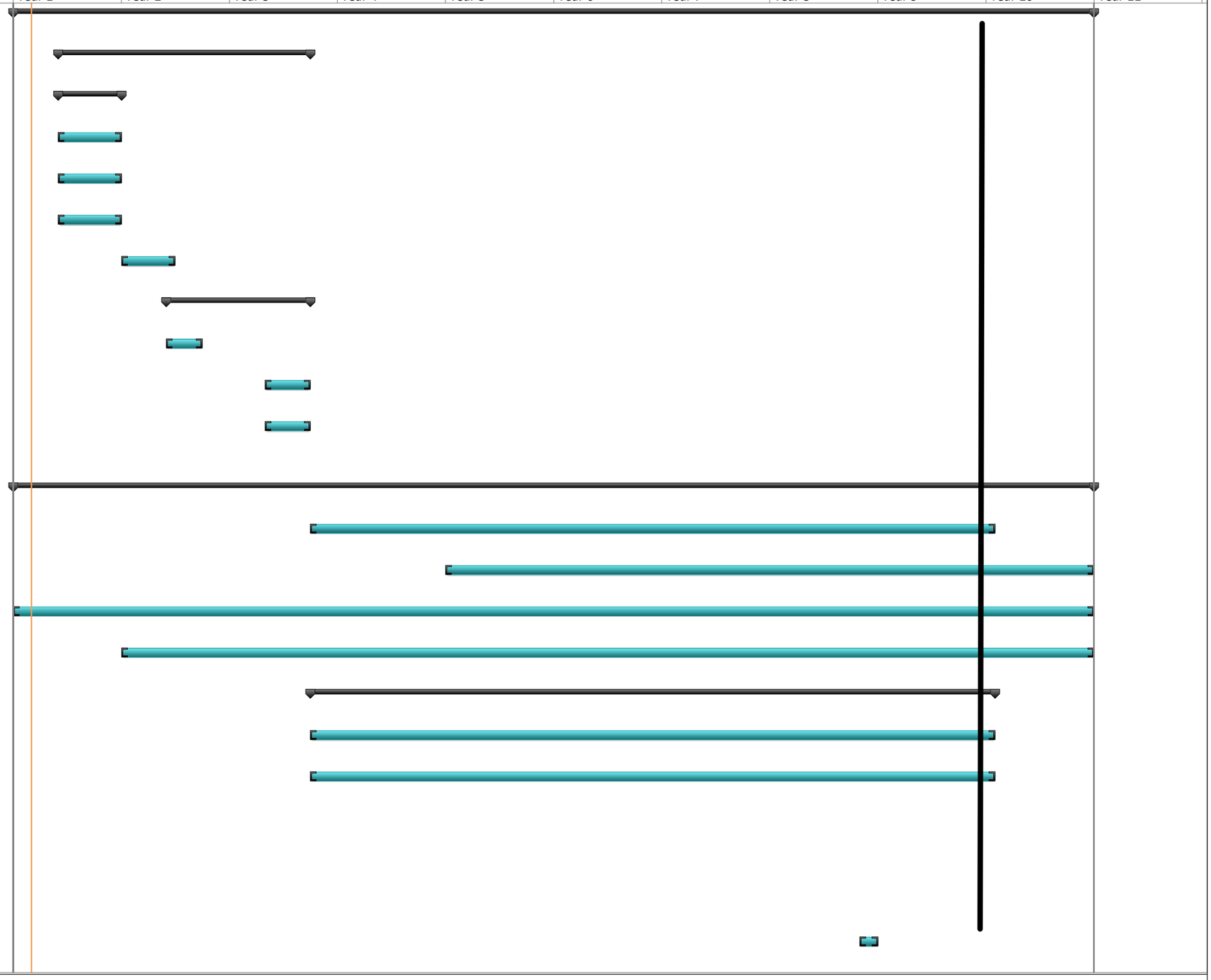


Figure 8-2 Schedule of Activities for Progressive Reclamation

ID	Task Name
1	**Mainland**
2	**Permanent LTMF Development**
3	**Final Engineering Studies**
4	Geometric Studies
5	Geotechnical and Hydrogeological Evaluations
6	Civil Designs and Stability Assessments
7	Leachate Treatment Assessments
8	**Facility Construction**
9	Tendering/Procurement
10	Site Preparation & Development
11	Water Treatment Plant Construction
12	Liner Construction
13	Contaminated Material Placement
14	Cover Construction
15	**LTMA Development**
16	**Final Engineering Studies**
17	Containment and Recovery System Design
18	Product Disposition System Design
19	Battery 3 Management
20	**Facility Construction**
21	Containment and Recovery System Installation
22	Product Disposition System Installation
23	**Post Closure Operations**
24	Containment
25	Management of Water & Product
26	**Source Area Remediation**
27	**Engineering Studies**
28	Excavation Plan
29	Remediation Materials Management Plan
30	Verification Plan
31	**Contaminated Soil Excavations**
32	Tendering/Procurement
33	Soil Excavation
34	Transport & Placement
35	**Source Area Reclamation**
36	**Engineering Studies**
37	Reclamation Materials Management Plan
38	Regrading Plan
39	Revegetation Plan
40	**Construction**
41	Tendering/Procurement
42	Source Area Backfilling & Contouring
43	Revegetation

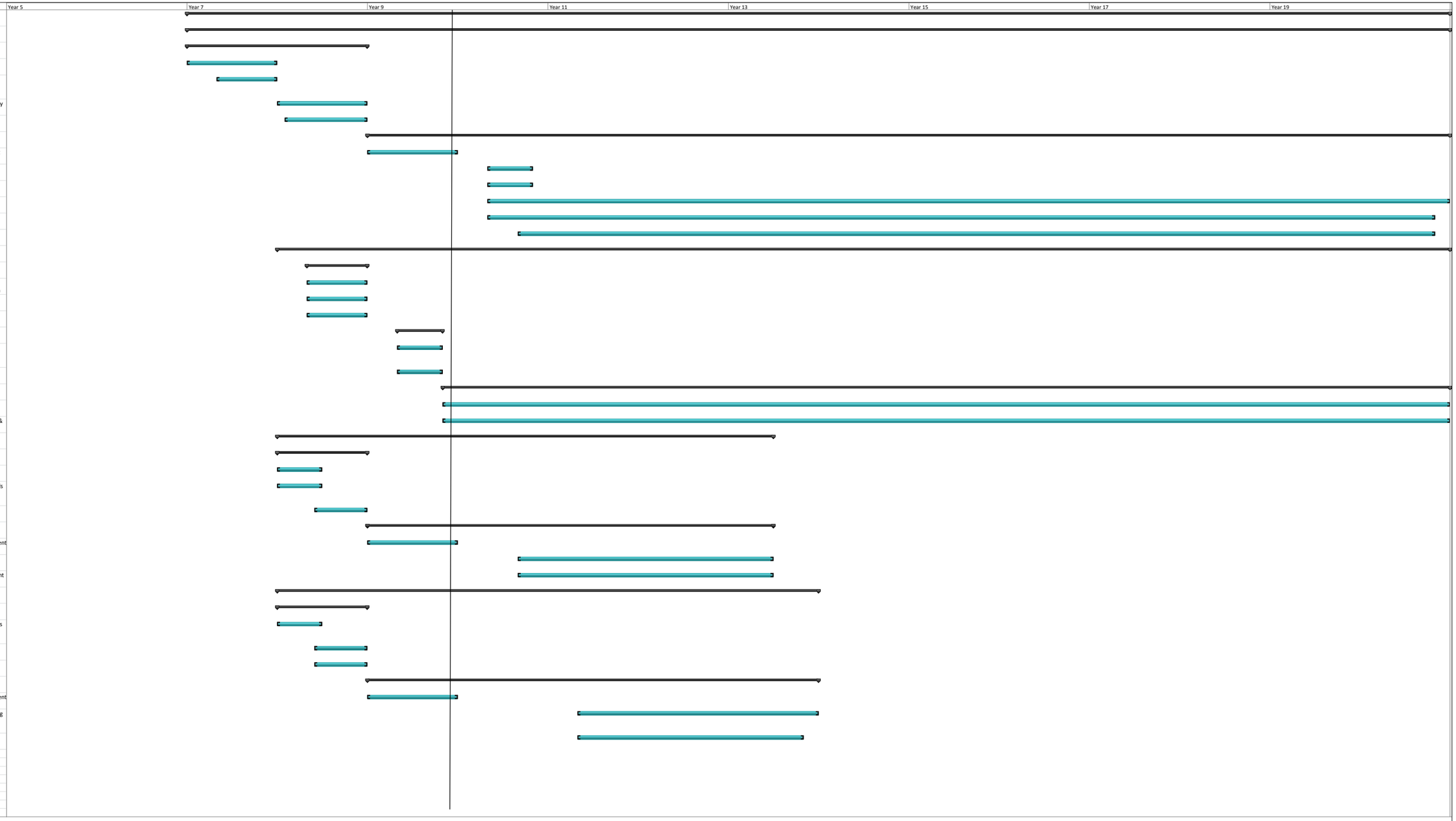


Figure 8-3 Schedule of Activities for the Mainland Component

ID	Task Name
1	**Natural islands**
2	**Source Area Remediation**
3	**Engineering Studies**
4	Excavation Plan
5	Remediation Materials Management Plan
6	Verification Plan
7	**Contaminated Soil Excavations**
8	Goose Island
9	Ice Road Construction - Goose to Bear
10	Goose Inventory Staged to Bear
11	Bear Island Sump Dewatering
12	Bear/Frenchy's Islands
13	Ice Road Construction - Bear to Mainland
14	Island Inventories to Mainland & Placed to LTMF
15	**Source Area Reclamation**
16	**Engineering Studies**
17	Reclamation Materials Management Plan
18	Regrading Plan
19	Revegetation Plan
20	**Construction**
21	Source Area Backfilling & Contouring - Goose Island
22	Source Area Backfilling & Contouring - Bear/Frenchy's Islands
23	Revegetation - Goose Island
24	Revegetation - Bear/Frenchy's Islands

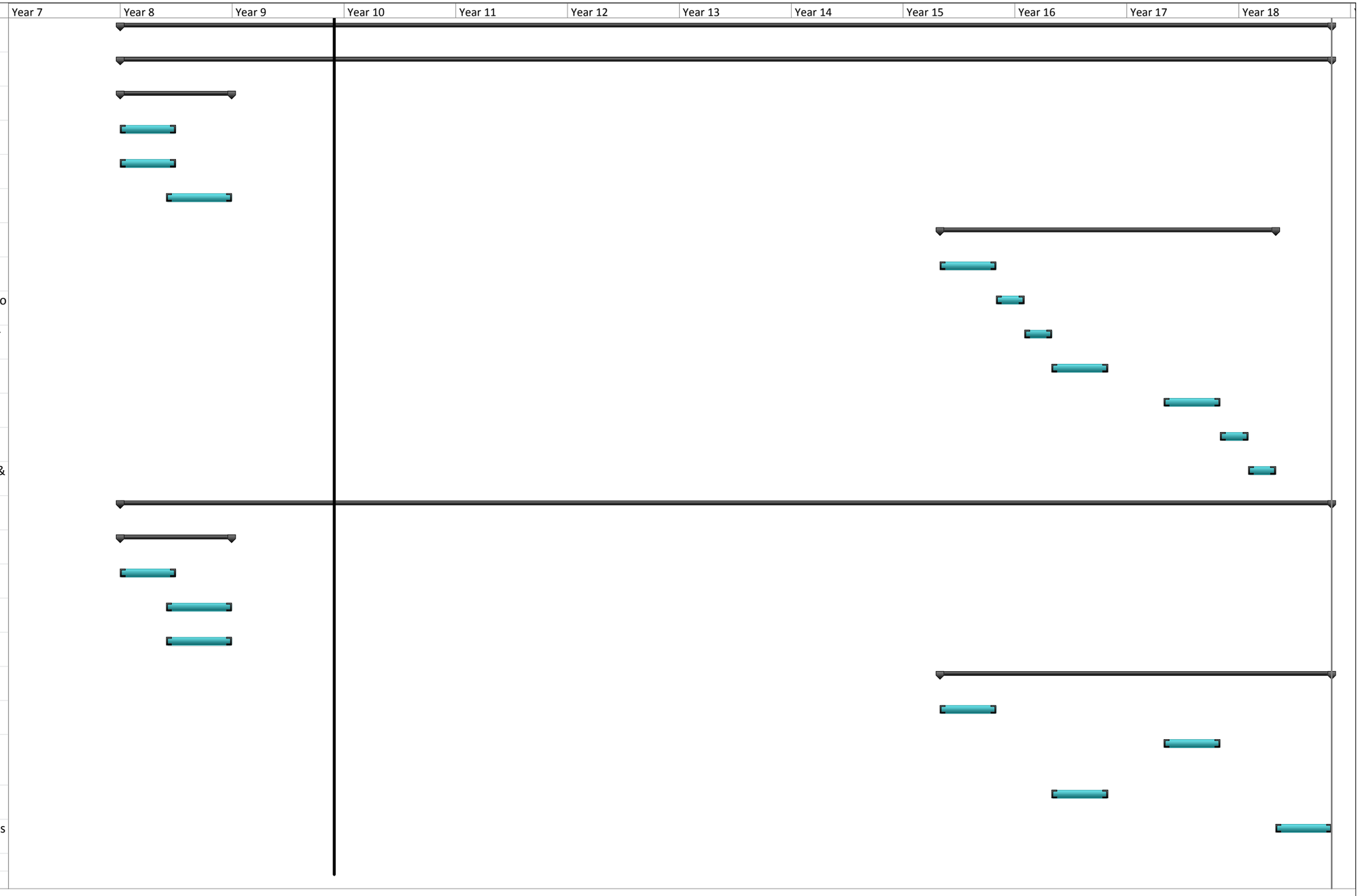


Figure 8-4 Schedule of Activities for the Natural Islands Component

ID	Task Name
1	**Artificial Islands**
2	**Engineering Studies**
3	River Dynamics Study
4	Armour Removal & Relocation Plan
5	**Construction**
6	Armour Removal
7	Armour Transport and Final Placement @ NW Quarry
8	**Source Area Remediation**
9	**Engineering Studies**
10	Excavation Plan
11	Remediation Materials Management Plan
12	Verification Plan
13	**Contaminated Soil Excavations**
14	Soil Excavation
15	Transport & Placement
16	**Source Area Reclamation**
17	**Engineering Studies**
18	Reclamation Materials Management Plan
19	Regrading Plan
20	**Construction**
21	Source Area Backfilling & Contouring

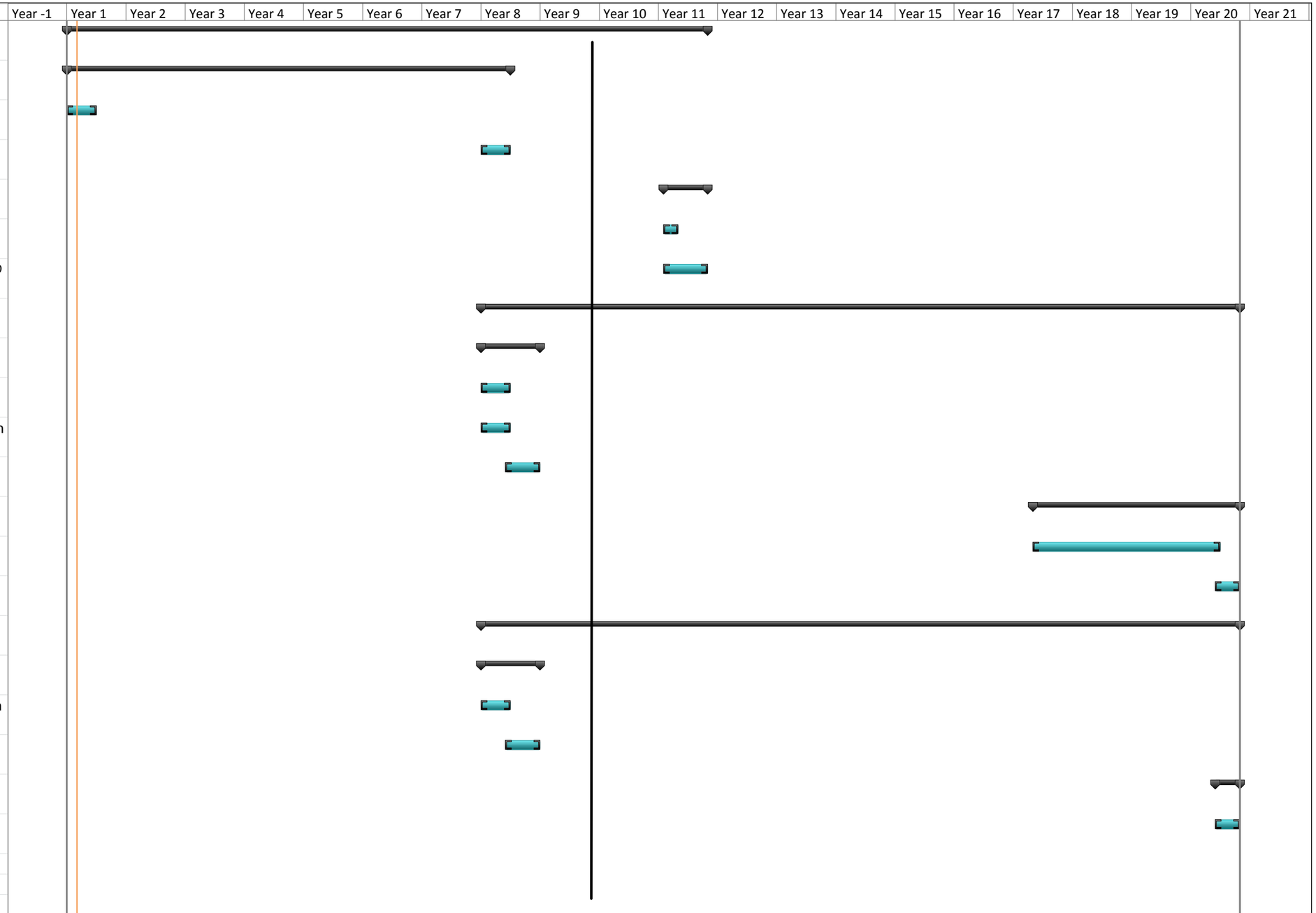


Figure 8-5 Schedule of Activities for the Artificial Islands Component

ID	Task Name
1	**Buildings & Equipment**
2	**Above Grade Structures**
3	**Engineering Studies**
4	Hazmat Survey
5	Market Assessment
6	Waste Processing Assessment
7	D&D Execution Plan
8	**Execution - Mainland**
9	Tendering/Procurement
10	Stage 1: Decommissioning & Decontamination
11	Stage 2: Packaging & Disposition of Marketable Equipment
12	Stage 3: Dismantling & Demolition
13	Stage 4: Waste Handling & Disposition
14	**Execution - Natural Islands**
15	Stage 1: Decommissioning & Decontamination
16	Stage 2: Packaging & Disposition of Marketable Equipment
17	Stage 3: Dismantling & Demolition
18	Stage 4: Waste Handling & Disposition
19	**Execution - Artificial Island**
20	Stage 1: Decommissioning & Decontamination
21	Stage 2: Packaging & Disposition of Marketable Equipment
22	Stage 3: Dismantling & Demolition
23	Stage 4: Waste Handling & Disposition
24	**Foudations**
25	**Execution - Mainland**
26	Removal & Disposition
27	**Execution - Natural Islands**
28	Removal & Disposition
29	**Execution - Artificial Island**
30	Removal & Disposition

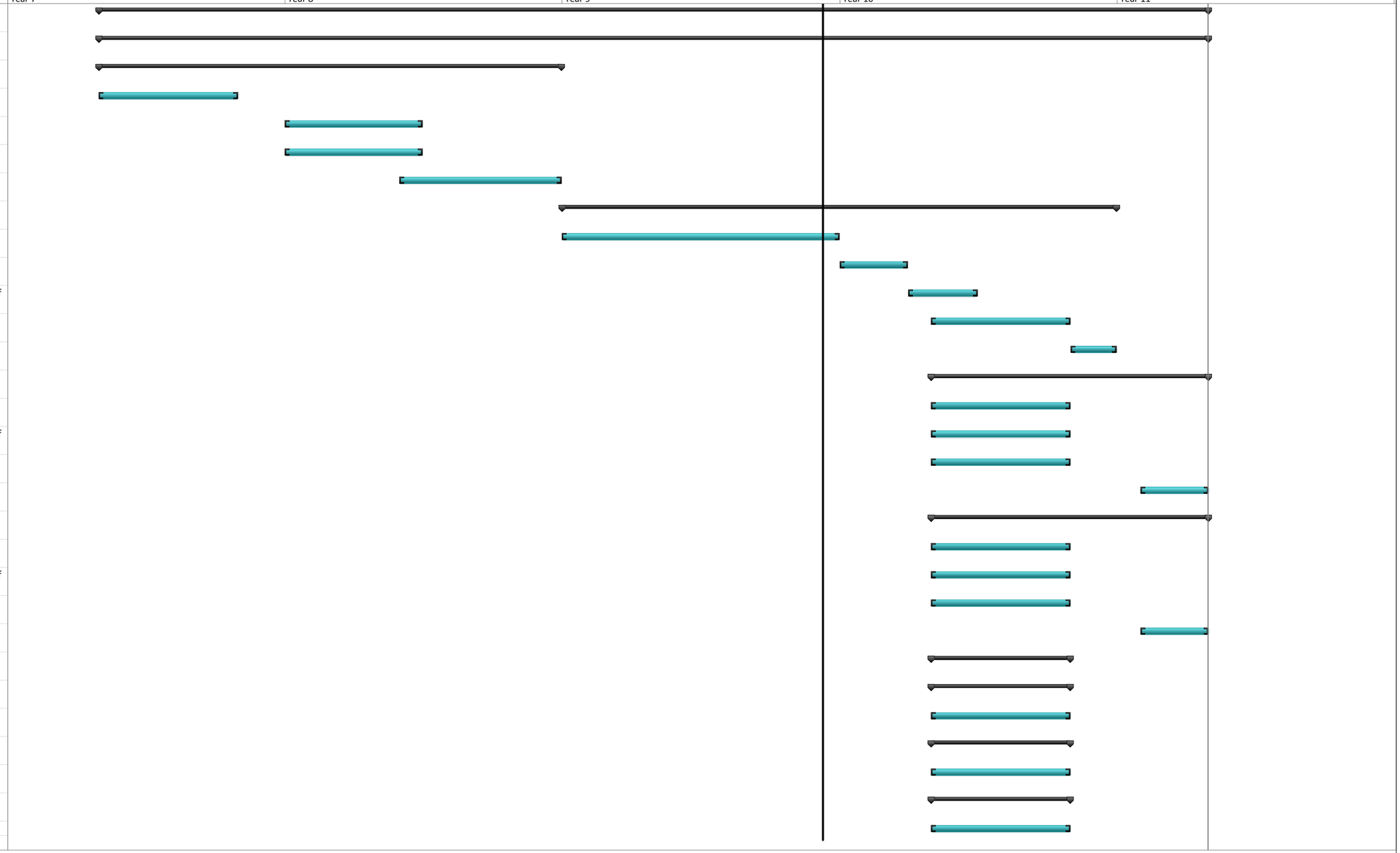


Figure 8-6 Schedule of Activities for the Buildings & Equipment Component

ID	Task Name
1	**Wellbores**
2	**All Areas**
3	**Engineering Studies**
4	Detailed Abandonment Schedule & Execution Plan
5	**Execution - Mainland**
6	Tendering/Procurement
7	Downhole Abandonments
8	Cutting and Capping
9	Backfilling and Reclamation
10	**Execution - Goose Island**
11	Tendering/Procurement
12	Downhole Abandonments
13	Cutting and Capping
14	Backfilling and Reclamation
15	**Execution - Bear/Frenchy's Islands**
16	Tendering/Procurement
17	Downhole Abandonments
18	Cutting and Capping
19	Backfilling and Reclamation
20	**Execution - Artificial Islands**
21	Tendering/Procurement
22	Downhole Abandonments
23	Cutting and Capping
24	Backfilling and Reclamation

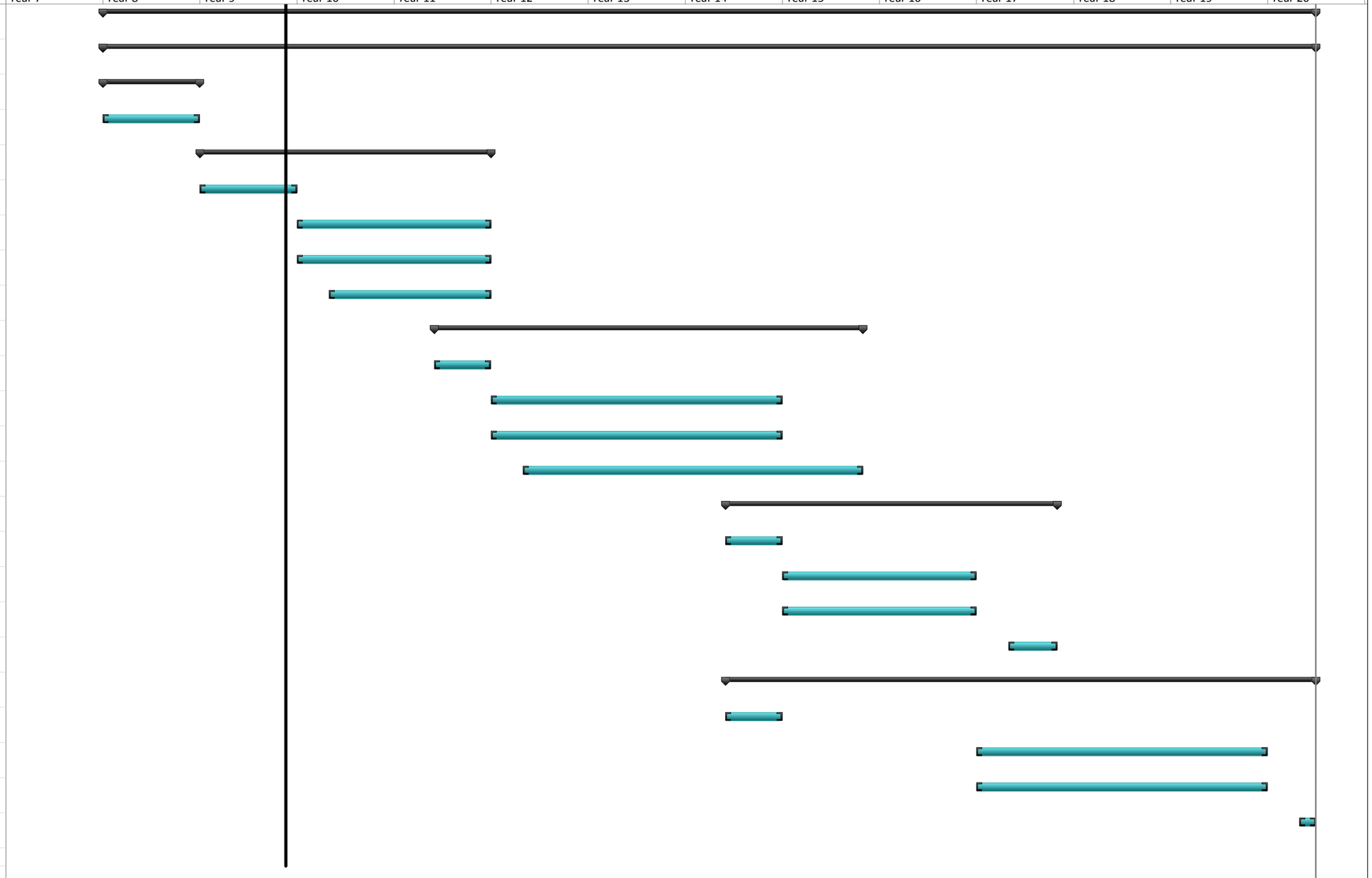


Figure 8-7 Schedule of Activities for the Wellbores Component

ID		Task Name
1		**Subsurface Infrastructure**
2		**All Areas**
3		**Engineering Studies**
4		Detailed Inventory
5		Cleaning Plan
6		Materials Disposition Plan
7		Detailed Execution Plan
8		**Execution**
9		Tendering/Procurement
10		Flowline Cleaning
11		Flowline Removal/Capping
12		Utilities Removal

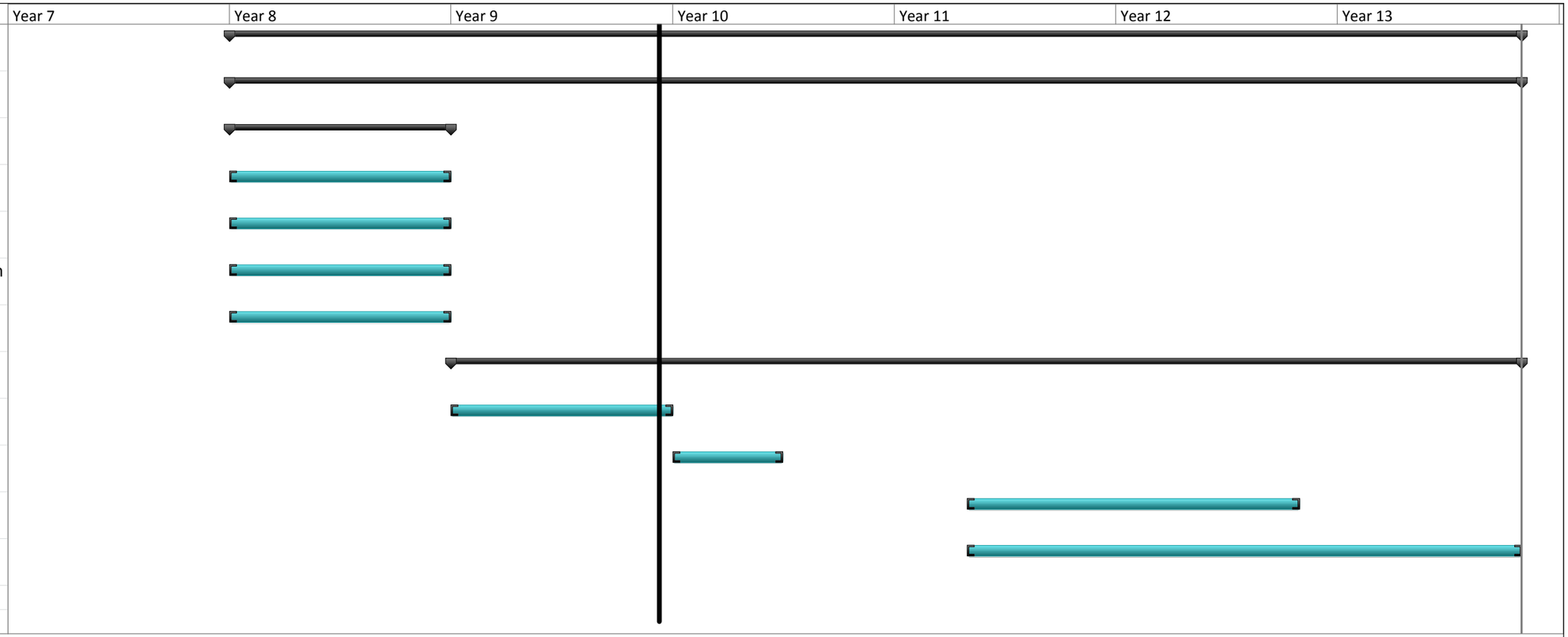


Figure 8-8 Schedule of Activities for the Subsurface Infrastructure Component

9.0 POST CLOSURE SITE ASSESSMENT

There will be a variety of initiatives and activities undertaken before, during and after execution of a final C&R Plan that will be focused on confirming that the objectives set for the Plan have been met. Table 9-1 repeats the objectives initially presented in Section 5.2 and identifies the specific programs that will be used to determine if these objectives have been satisfied. The table refers to the following distinct assessment initiatives or programs:

- Pre-execution Review of Final C&R Plan: interim C&R Plans (of which this document is the first) will be regularly reviewed and updated in the operational period prior to closure. This review refers to the technical and stakeholder reviews of the final C&R Plan applicable at the time of facility closure and immediately prior to C&R Plan execution.
- Testing and Monitoring During C&R Plan Execution: various testing and monitoring activities will be undertaken during C&R Plan execution to evaluate those criteria compliance issues which are related to the scope, duration and scale of C&R activities (e.g., confirmatory sampling in impacted soil excavations).
- Ongoing Post Closure Monitoring: these are the testing and monitoring activities described in Section 5.7 that will continue, at least in some form, following completion of the C&R Plan.
- One Time Post Closure Assessment: this program will be a dedicated, point in time assessment undertaken at the conclusion of C&R Plan execution to evaluate static issues and conditions relating to the remediated and reclaimed landscape that are not subject to change or variation post closure.

Most of the objectives included in Table 9-1 will be evaluated under just one of the above programs. However, some (i.e., those with multiple checkmarks in the table) will be most effectively evaluated at more than one juncture over the general C&R planning and execution timeline.

Imperial Norman Wells Operations - Interim Closure and Reclamation Plan

Table 9-1: Assessment Programs for Monitoring the Status of C&R Planning Objectives

Component	Media	Objective	Criteria	Actions-Measurements	Program(s) Used to Assess Objective Status			
					Pre-Execution C&R Plan Review	Testing or Monitoring During C&R Plan Execution	Ongoing Post Closure Monitoring Program (Section 5.7)	One Time Post Closure Site Assessment
All Components	*Overarching Values*	Landscape closed and reclaimed in a manner that reflects consultation with community members and associated traditional knowledge and use	Traditional knowledge and use information consistently updated through consultation with community members and incorporated in project schedule, and footprint	Documentation of how traditional knowledge and use has been considered in project planning and scheduling	✓			
		Removal or mitigation of physical and chemical hazards	Inspection by a qualified professional to ensure no unmitigated risks on reclaimed land	Documentation and sign-off by qualified professional(s)				✓
		Incremental disturbance of land required to support closure and reclamation activity is minimized	Closed and reclaimed footprint contained to existing Proven Area, unless otherwise approved	Post-closure assessment by qualified professionals	✓			
		Compliance with legal, regulatory and corporate obligations pertaining to post-closure and reclamation conditions	Adhere to post-closure and reclamation assessment and monitoring plans	Post-closure and reclamation reporting and documented regulatory reviews	✓			
		Closed and reclaimed sites that are compatible with requirements for safe navigation of the Mackenzie River	Compliance with applicable Transport Canada regulations and other appropriate regulatory standards and guidelines for safe navigability	Inspection and documentation by qualified professional(s) of final artificial island status for adherence to applicable Transport Canada and other appropriate regulatory standards and guidelines	✓			✓
		Archaeological and historically significant sites identified by entities such as the Prince of Wales Northern Heritage Centre, Norman Wells Historical Society, regional Land Corporations and Secretariat are protected and preserved	No significant impact on archaeological or historical resources	Inspection of archaeological and historically significant sites by qualified professionals, with input from community members as appropriate, to verify and document avoidance and/or protection		✓		
Mainland	*Air*	Dust levels at the closed and reclaimed site safe for people, vegetation, wildlife, and aquatic life	Dust/total suspended particulate levels that meet appropriate *NWT ENR Guideline for Ambient Air Quality Standards in the Northwest Territories*	Monitoring of dust levels by qualified professionals				✓
	Land	Soil that is safe for people and the environment and compatible with the defined future land use	Remediated soils that meet: 1. CCME criteria suitable for Industrial Land Use, or site-specific risk based criteria (as appropriate for future land and water use and protection of site-specific human and ecological receptors); or 2. If greater, background conditions	Confirmatory sampling by qualified professionals		✓		
		Landscape that is physically stable, safe and generally compatible with the surrounding natural area	Satisfactory final inspection by qualified professional engineers	Post-closure assessment and documentation by qualified professionals	✓			✓
	Water	Water quality that is safe for humans, wildlife and aquatic life	Surface water and groundwater quality (at the final receptor or point of use) that meets: 1. CCME guidelines, or site-specific risk based criteria (as appropriate for future water use and protection of site-specific human and ecological receptors); or 2. If greater, background water quality	Surface water and groundwater quality monitoring, at final receptor and/or point of use locations, by qualified professionals			✓	
		Hydrology and drainage of the reclaimed land surface consistent with the character of the local watershed and appropriate to the defined land use	Surface contours that promote drainage consistent with natural drainage patterns	Post-reclamation monitoring of surface water drainage by qualified professionals	✓			✓
	Wildlife	Terrain restoration to allow safe utilization and passage by terrestrial wildlife	Safe use of formally disturbed areas by wildlife within the defined future land use	Wildlife monitoring by qualified individuals			✓	
Natural Islands	*Air*	Dust levels at the closed and reclaimed site safe for people, vegetation, wildlife, and aquatic life	Dust/total suspended particulate levels that meet appropriate *NWT ENR Guideline for Ambient Air Quality Standards in the Northwest Territories*	Monitoring of dust levels by qualified professionals				✓
	Land	Soil that is safe for people and the environment and compatible with the defined future land use	Remediated soils that meet: 1. CCME criteria suitable for Parkland Land Use, or site-specific risk based criteria (as appropriate for future land and water use and protection of site-specific human and ecological receptors); or 2. If greater, background conditions	Confirmatory sampling by qualified professionals		✓		
		Closed and reclaimed landscape that is physically stable, safe and generally compatible with the surrounding natural area	Satisfactory final inspection by qualified professional engineers	Post-closure assessment and documentation by qualified professionals	✓			✓
	Water	Water quality that is safe for humans, wildlife and aquatic life	Surface water and groundwater quality (at the final receptor or point of use) that meets: 1. CCME guidelines, or site-specific risk based criteria (as appropriate for future water use and protection of site-specific human and ecological receptors); or 2. If greater, background water quality	Surface water and groundwater quality monitoring, at final receptor and/or point of use locations, by qualified professionals			✓	
		Hydrology and drainage of the reclaimed land surface consistent with the character of the local watershed and appropriate to the defined land use	Surface contours and substrate types that promote drainage generally consistent with pre-development drainage patterns	Post-reclamation monitoring of surface water drainage by qualified professionals	✓			✓
	Wildlife	Terrain restoration to allow safe utilization and passage by terrestrial wildlife	Safe use of formally disturbed areas by wildlife within the defined future land use	Wildlife monitoring by qualified individuals			✓	

Imperial Norman Wells Operations - Interim Closure and Reclamation Plan

Table 9-1: Assessment Programs for Monitoring the Status of C&R Planning Objectives

Component	Media	Objective	Criteria	Actions-Measurements	Program(s) Used to Assess Objective Status			
					Pre-Execution C&R Plan Review	Testing or Monitoring During C&R Plan Execution	Ongoing Post Closure Monitoring Program (Section 5.7)	One Time Post Closure Site Assessment
Artificial Islands	*Air*	Dust levels at the closed and reclaimed site safe for people, vegetation, wildlife, and aquatic life	Dust/total suspended particulate levels that meet appropriate *NWT ENR Guideline for Ambient Air Quality Standards in the Northwest Territories*	Monitoring of dust levels by qualified professionals				✓
	Land	Soil that is safe for people and the environment and compatible with the defined future land use	Remediated soils that meet: 1. CCME criteria suitable for Parkland Land Use, or site-specific risk based criteria (as appropriate for future land and water use and protection of site-specific human and ecological receptors); or 2. If greater, background conditions	Confirmatory sampling by qualified professionals		✓		
		Closed and reclaimed landscape that is physically stable, safe and generally compatible with the surrounding natural area	Satisfactory final inspection by qualified professional engineers	Post-closure assessment and documentation by qualified professionals	✓			✓
	Water	Closed and reclaimed artificial islands that do not cause an adverse effect to Mackenzie River water quality	Surface water and groundwater quality (at representative downstream locations) that meets: 1. CCME guidelines, or site-specific risk based criteria (as appropriate for future water use and protection of site-specific human and ecological receptors); or 2. If greater, background water quality	Surface water quality monitoring, at representative downstream locations, by qualified professionals				✓
Natural Watercourses	*Land*	River and creek banks that are stable and compatible with surrounding lands	Satisfactory final inspection by qualified professional engineers and representative project stakeholders	Post-closure assessment and documentation by qualified professionals	✓			✓
	Sediment	River sediment quality that is safe for humans, aquatic life, and fish habitat	Sediment quality downstream of the closed and reclaimed site that meets: 1. CCME criteria , or site-specific risk based criteria (as appropriate for future land and water use and protection of site-specific human and ecological receptors); or 2. If greater, background conditions	Removal of source area contaminants to levels that address criteria for both the source areas and downstream watercourses.			✓	
	Water	Water quality that is safe for humans, wildlife, aquatic life, and fish habitat	Surface water quality (at the final receptor or point of use) that meets: 1. CCME guidelines, or site-specific risk based criteria (as appropriate for future water use and protection of site-specific human and ecological receptors); or 2. If greater, background water quality	Surface water and groundwater quality monitoring, at final receptor and/or point of use locations, by qualified professionals			✓	
Surface Buildings, Infrastructure and Equipment	*Land*	Above-ground facilities, infrastructure and debris are removed	Facilities, infrastructure and debris are removed at surface	Post-dismantling visual surface inspections and documentation by qualified professionals				✓
	Materials Management	Re-utilization of materials and equipment that retain economic value	Value of materials and equipment (as benefits to the community) demonstrated to be net positive	Monitoring of materials disposal process by qualified professionals	✓			✓
Subsurface Infrastructure	*Land*	Subsurface infrastructure (e.g. flowlines, utilities) is abandoned or removed as appropriate for safe utilization of the defined future land use	Compliance with Canadian Oil and Gas Drilling and Production Regulations and other appropriate regulatory standards and practices for the abandonment of below-ground oil and gas infrastructure	Monitoring and documentation of facility demolition for adherence to materials management plans and environmental and OHS standards	✓			✓
Wellbores	*Land*	Wellbores are abandoned as appropriate for safe utilization of the defined future land use	Compliance with applicable oil & gas production regulations and other appropriate regulatory guidance for the abandonment of below-ground oil and gas infrastructure	Monitoring and documentation of facility demolition for adherence to materials management plans and environmental and OHS standards	✓			✓

10.0 FINANCIAL SECURITY

The Financial Security section of the MVLWB guidelines (MVLWB 2013) acknowledge that any financial security obligations associated with an operation should be based on the approved C&R Plan. Imperial has developed liability estimates for the operation to address various requirements that pre-date this interim C&R Plan and expects to update these estimates following the review and acceptance of this interim plan by the SLWB.

11.0 CLOSURE

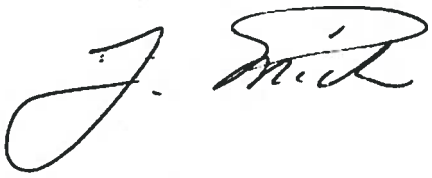
The work described in this report was conducted in accordance with the Contract for Environmental Consulting Services between Imperial Oil Limited and Amec Foster Wheeler Environment & Infrastructure, and generally accepted engineering and assessment practices.

Yours truly,

Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited

Reviewed by:

R. Brian Geddes, P.Eng.
Principal Engineer



John Mick, M.E.Des., P.Ag.
Principal Environmental Scientist

E. Christopher Wenzel, P.L. (Eng.)
Senior Associate

Carl Warner, M.Sc., P.Biol.
Principal Biologist
Reclamation Component

Rachael Powell, M.E.Des., EP
Associate Project Manager

RBG/JM/ECW/CW/RP/jm

Permit to Practice No. P-4546

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Appendix A

Glossary of Terms and Definitions

The following terminology is utilized in this document following the definitions provided in MVLWB (2013), SLWB (2015), Imperial liability estimates (AMEC 2014) and other NWT C&R Plans (specifically Diavik 2011).

Term	Definition
Abandonment	The dismantlement of a facility so it is permanently incapable of its intended use. This includes the removal of associated equipment and structures.
Abiotic	Non-living factors that influence an ecosystem, such as climate, geology and soil characteristics.
Acid Rock Drainage	The production of acidic leachate, seepage or drainage from underground workings, pits, ore piles, rock waste, tailings, and overburden that could lead to the release of metals to groundwater and surface water during the life of the mine and after closure
Active Layer	The layer of ground above the permafrost which thaws and freezes annually.
Acute Lethality	An effluent which is deemed acutely lethal if the undiluted (100%) effluent kills 50% or more of the fish or daphnia in the test. (Biological test method. Acute Lethality Test Using Rainbow Trout Report EPS 1/RM/9 July 1990), and (Biological test method: Acute Lethality of Effluents to Daphnia magna EPS 1/RM/14 Second Edition December 2000), as may be amended from time to time.
Adaptive Management	The application of mitigation strategies in response to the observed performance outcomes provided by a remediation plan and/or management system.
Adsorption	The adhesion of atoms, ions, or molecules from a gas, liquid or dissolved solid to a surface. The process creates a film of the adsorbate on the surface of the adsorbent.
Alkalinity	A measure of the buffering capacity of water, or the capacity of bases to neutralize acids.
Ambient	The conditions surrounding an organism or area.
Ambient Air	The air in the surrounding atmosphere.
Anthropogenic	Caused by human activity.
Aquatic Effects Monitoring Program	A monitoring program designed to determine the short and long term effects in the receiving environment resulting from Project activities and to evaluate if the receiving environment is being adequately protected or waters used are being adequately managed or additional mitigation measures are necessary.
Aquitard	A material of low permeability between aquifers.
Artificial Islands	The physical structure of the constructed islands including the sand core, slope and scour protection, drilling equipment and supplies, storage facilities, wellhead equipment, and temporary or permanent buildings.

Term	Definition
Backfill	Material excavated from a site and reused for filling the surface or underground void created by mining.
Background	An area near the site under evaluation not influenced by chemicals released from the site, or other impacts created by on-site activity.
Baseline	A surveyed condition and reference used for future surveys.
Bathymetric	Measurement of the depth of an ocean or large waterbody.
Bedrock	The body of rock that underlies gravel, soil or other subregion material.
Benthic Invertebrate	Invertebrate, organisms living at, in or in association with the bottom (benthic) substrate of lakes, ponds and streams. Examples of benthic invertebrates include some aquatic insect species (such as caddisfly larvae) that spend at least part of their lifestages dwelling on bottom sediments in the waterbody. These organisms play several important roles in the aquatic community. They are involved in the mineralization and recycling of organic matter produced in the water above, or brought in from external sources, and they are important second and third links in the trophic sequence of aquatic communities. Many benthic invertebrates are major food sources for fish.
Berm	A mound of rock or soil used to retain substances or to prevent substances from entering an area.
Biocell	The area or engineered cell designed for the treatment of contaminated soil through biological processes by degradation of contaminants. The bioremediation process may involve the addition of water and nutrients, as well as aeration through mechanical processing.
Biodiversity	The variety of plants and animals that live in a specific area.
Biotic	The living organisms in an ecosystem.
Board	The Mackenzie Valley Land and Water Board established under Part 4, Section 57.1 of the *Mackenzie Valley Resource Management Act*.
Boards	Land and Water Boards of the Mackenzie Valley, as mandated by the *Mackenzie Valley Resource Management Act.*
Boreal Forest	The northern hemisphere, circumpolar, tundra forest type consisting primarily of black spruce and white spruce with balsam fir, birch and aspen.
Central Processing Facility	The plant where oil, gas and Produced Water are collected from the oilfield and separated, with plant cooling being accomplished using Mackenzie River water.
Closure	Is the process of returning the Norman Wells Operations site and affected areas to conditions that prevent or minimize any adverse effects on the environment or threats to human health and safety.

Term	Definition
Closure Criteria	Standards that measure the success of selected closure activities in meeting closure objectives. Closure criteria can be site-specific or adopted from territorial/federal or other standards and can be narrative statements or numerical values.
Closure Goal	The guiding statement that provides the vision and purpose of reclamation. Attainment of the closure goal happens when the proponent has satisfied all closure objectives. By its nature, the closure goal is a broad, high-level statement and not directly measurable.
Closure Objectives	Statements that describe what the selected closure activities are aiming to achieve; they are guided by the closure principles. Closure objectives are typically specific to project components, are measurable and achievable, and allow for the development of closure criteria.
Closure Options	A set of proposed alternatives for closing and reclaiming each mine component. The closure options are evaluated to determine the selected closure activity, which must be approved by the Board.
Closure Principles	The four core closure principles are 1) physical stability, 2) chemical stability, 3) no long-term active care requirements, and 4) future use (including aesthetics and values). The principles guide the selection of closure objectives.
Conductivity	A measure of the ability of water to pass an electrical current, which is affected by the presence of inorganic dissolved solids and organic compounds.
Contamination	See “Impact”.
Contouring	The process of shaping the land surface to fit the form of the surrounding land.
Corrosion Coupon	A corrosion coupon is a weighed sample (coupon) of the metal or alloy under consideration introduced into the process, and later removed after a reasonable time interval. The coupon is then cleaned of all corrosion product and is reweighed. The weight loss is converted to a corrosion rate or metal loss.
Criteria	Detail to set precise measures of when an objective has been satisfied.
CRP	Closure and Reclamation Plan.
Decommissioning	Taking out of service/closure and preliminary cleanup of a facility or a portion thereof, such as a pit or pond, during or following operations, taking into account long-term protection of human health and the environment, with no intent to obtain a release from the surface lease agreement. Decommissioning includes activities such as purging flowlines and disconnecting electrical supplies.

Term	Definition
Dewatering	The removal or drawdown of water from any waterbody or from the groundwater table by pumping or draining.
Dike	Temporary water-retaining structure designed for water control to enable safe open pit and underground mining.
Discharge	The direct or indirect release of any waters or waste to the receiving environment.
Dismantling	Downhole and surface abandonment of a well or dismantling of a facility in a manner that meets or exceeds regulatory requirements.
Disposal	The placement, containment, treatment or processing of unwanted materials. This may involve the removal of contaminants or their conversion to less harmful forms.
Drainage	Excess surface or groundwater runoff from land.
Drainage Basin	A region of land that eventually contributes water to a river or lake.
Dredging	Excavating and moving lake-bottom sediments and glacial till below the high watermark and from the bottom of Lac de Gras in the area of the footprints of the dikes.
Ecodistrict	A subdivision of an ecoregion which is characterized by distinctive regional ecological factors, including physiography, climate, soil, vegetation, water and wildlife.
Ecoregion	A subdivision of an ecozone which is characterized by distinctive regional ecological factors, including physiography, climate, soil, vegetation, water, and wildlife.
Ecosystem	An ecological unit consisting of both biotic (living) and abiotic (non-living) environment that interacts within a defined physical location.
Ecozone	An area at the earth's surface representative of large and very generalized ecological units characterized by various abiotic (non-living) and biotic (living) factors.
Effluent	Treated or untreated liquid waste material that is discharged into the environment from a treatment plant.
Electrical Conductivity	The capability of a solution to transmit an electrical current. A capability closely related to the concentration of salts in soils.
End Land Use	The allowable use of disturbed land following reclamation. Municipal zoning and/or approval may be required for specific land uses.
Engagement	The communication and outreach activities a proponent is required, by the Boards, to undertake with affected communities and Aboriginal organizations/governments prior to and during the operation of a project, including closure and reclamation phases.
Engineered Structures	Any constructed facility which was designed and approved by a Professional Engineer registered with the Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories.

Term	Definition
Environment	The components of the earth and includes land, water and air, including all layers of the atmosphere, all organic and inorganic matter and living organisms, and the interacting natural systems that include the aforementioned components.
Environmental Assessment (EA)	An assessment of the environmental effects of a project that is conducted in accordance with the *Canadian Environmental Assessment Act* and its regulations.
Erosion	The wearing away of rock, soil or other surface material by water, rain, waves, wind or ice.
Esker	Glaciofluvial landform that occurs when meltwater deposits are left behind after glacier melts, resulting in long winding ridges of sediment.
Evaporation	The process by which water is changed from a liquid to a vapour.
Fish	Fish as defined in the *Fisheries Act* includes parts of fish, shellfish, crustaceans, marine animals, and any parts of shellfish, crustaceans or marine animals and the eggs, sperm, spawn, larvae, spat, and juvenile stages of fish, shellfish, crustaceans, and marine animals.
Fish Habitat	Areas used by fish for spawning, nursery, rearing, foraging, and overwintering.
Flowline	A line that is used to transport fluids from a well to a production facility or vice versa, and includes intrafield export and all gathering lines.
Footprint	The proposed development area that directly affects the soil and vegetation components of the landscape.
Freeboard	The vertical distance between the water line and the effective water containment crest on a dam's or dike's upstream slope.
Freshet	An increase in surface water flow during the late winter or spring as the result of rainfall, and snow and ice melt.
Geotechnical Engineer	A professional engineer registered with the Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories and whose principal field of specialization is the design and construction of earthworks in a permafrost environment.
Glacial Till	Unsorted and unlayered rock debris deposited by a glacier.
Glaciofluvial Deposits	Material moved by glaciers and subsequently sorted and deposited by flowing glacial meltwater. Consists primarily of course to medium grained sands, gravels, cobbles, and boulders.
Glaciolacustrine Deposits	Material moved by glaciers and deposited in glacial lakes. Consists primarily of fine sands, silts and clay.
Groundwater	All waters below the ground surface.
Groundwater Recharge	Water that enters the saturated zone by a downward movement through soil and contributes to the overall volume of groundwater.

Term	Definition
Groundwater Treatment Facilities	System designed to collect and treat contaminated groundwater.
Habitat	The place where an animal or plant naturally lives and grows.
Habitat Unit	Generally used in Habitat Suitability Index models. A habitat is ranked in regards to its suitability for a particular wildlife species. This ranking is then multiplied by the area (hectares) of the particular habitat type to give the number of habitat units (HU) available to the wildlife species in question.
Home Range	The area within which an animal normally lives and traverses as part of its annual travel patterns.
Hummock	A bulging mound of soil having a silty clay core that often develops in wet and/or permafrost conditions and shows evidence of movement due to regular frost action.
Hydrogeology	The study of the factors that deal with subsurface water (groundwater) and the related geologic aspects of surface water. Groundwater, as used here, includes all water in the zone of saturation beneath the earth's surface, except water chemically combined in minerals.
Hydrology	The science that deals with water, its properties, distribution and circulation over the earth's surface.
Impact	Any chemical concentration (in soil or water) which exceeds applicable cleanup criteria. The term "impact" as used is not intended to suggest resultant adverse effects, which are to be determined by formal risk assessment.
Hydraulic Conductivity	Measure of the capacity of an aquifer to transmit water.
In Situ Treatment	A method of managing, treating or disposing of material "in place" in a manner that does not require the material to be physically removed or excavated from where it is located.
Inspector	An Inspector designated by the Minister under Section 35(1) of the Northwest Territories *Water Act*.
Landowner	Has the administration and control or ownership of land where an advanced mineral exploration or mine project will occur. AANDC (on behalf of Her Majesty the Queen) administers and manages Crown land, while the Commissioner of the Northwest Territories administers and manages Commissioner's land. Designated Land Claim Organizations received ownership of lands pursuant to their respective Land Claims in the Northwest Territories.
Land Use Permit	A land use permit required for an activity set out in Sections 4 and 5 of the Mackenzie Valley Land Use Regulations, for an activity set out in the Territorial Land Use Regulations, or for a land use permit (Type C) required by Tlicho law for use in Tlicho lands for which a Type A or Type B land use permit is not required.

Term	Definition
Landfill	An engineered waste management facility at which waste is disposed of by placing it on or in land in a manner that minimizes adverse human health and environmental effects.
Leachate	Water or other liquid that has washed (leached) from a solid material, such as a layer of soil or water; leachate may contain contaminants.
Leaching	The removal, by water, of soluble matter from any solid material lying on top of bedrock (e.g., soil, alluvium or bedrock).
Lithology	The systematic description of sediment and rocks in terms of composition and texture.
Littoral Zone	The zone in a lake that is closest to the shore. It includes the part of the lake bottom, and its overlying water, between the highest water level and the depth where there is enough light (about 1% of the surface light) for rooted aquatic plants and algae to colonize the bottom sediments.
Local Study Area	Defines the spatial extent directly or indirectly affected by the project.
Long Term Active Care	A post closure mine site is in long term active care when sustained monitoring and maintenance of active facilities is required.
Migration	The movement of chemicals, bacteria, and gases in flowing water or vapour.
Mitigation	The process of rectifying an impact by repairing, rehabilitating or restoring the affected environment, or the process of compensating for the impact by replacing or providing substitute resources or environments.
Monitoring	Observing the change in geophysical, hydrogeological or geochemical measurements over time.
Natural Islands	Bear, Goose and Frenchy's Islands including drilling equipment and supplies, waste and storage facilities, wellhead equipment, and temporary or permanent buildings.
No Net Loss	A term found in Canada's *Fisheries Act*. It is based on the fundamental principle of balancing unavoidable losses of fish habitat with habitat replacement on a project by project basis in order to prevent depletion of Canadian's fisheries resources.
Norman Wells Proven Area	The proven area identified in the Proven Area Agreement between Canada and Imperial Oil Limited dated 21 July 1944, as amended.
Nutrient Regime	The relative supply of nutrients available for plant growth at a given site.
Objectives	Objectives describe what select activities are aiming to achieve.
Outliers	A data point that falls outside of the statistical distribution defined by the mean and standard deviation.

Term	Definition
Parent Material	Material (generally bedrock) from which soils typically obtain structure and minerals. Consolidated (rock) or unconsolidated (e.g., river deposits) material that has undergone some degree of physical or chemical weathering.
Particulate Matter	A mixture of small particles and liquid droplets, often including a number of chemicals, dust and soil particles.
Passive Long Term Care	Occasional monitoring, coupled with infrequent maintenance or repairs that take place following reclamation in the post closure phase of the mine site. Many mine sites require ongoing passive care, which can be an acceptable practice.
Passive Treatment	Treatment technologies that can function with little or no maintenance over long periods of time (e.g., use of wetlands).
Permafrost	Ground that remains at or below zero degrees Celsius for a minimum of two consecutive years.
Permafrost Aggradation	A naturally or artificially caused increase in the thickness and/or area extent of permafrost.
Permeability	The ease with which gases or liquids penetrate or pass through a soil or cover layer.
pH	A measure of the alkalinity or acidity of a solution, related to hydrogen ion concentration, a pH of 7.0 being neutral.
Piezometer	An instrument used to monitor pore water pressure.
Pore Water	The groundwater present within the spaces between sediment particles.
Pore Water Pressure	The pressure of groundwater held within the spaces between sediment particles.
Post Closure	The period of time after closure of the mine.
Produced Water	Waters naturally present in the reservoir or injected into the reservoir to enhance production and produced as a co-product when gas or oil is produced.
Progressive Reclamation	Selected closure activities that can be taken at advanced mineral exploration and mine sites before permanent closure. Progressive reclamation takes advantage of cost and operating efficiencies by using the resources available from operations to reduce the overall reclamation costs incurred. It enhances environmental protection and shortens the timeframe for achieving the closure objectives.
Project	Imperial's Norman Wells Operations conducted within the Proven Area.
Project Infrastructure Development	Project infrastructure required to execute A&R work that is not related specifically to any one A&R activity.
Proponent	Applicant for, or a holder of, a water licence and/or land use permit.

Term	Definition
Proven Area	An area of 7,939 acres incorporating Imperial's Norman Wells Operations that was formed through an agreement between Imperial and the federal government.
Rare Plants	A native plant species found in restricted areas at the edge of its range or in low numbers within a province, state, territory or country.
Receiving Environment	The natural environment that receives any deposit or discharge of waste, including runoff, from the Project.
Reclamation	Activities which facilitate the return areas affected by the Project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment, human activities, and the surrounding environment.
Reclamation Research	Literature reviews, laboratory or pilot-scale tests, engineering studies, and other methods of resolving uncertainties. Proponents conduct reclamation research to answer questions pertaining to environmental risks; the design of reclamation research plans aims to provide data and information which will reduce uncertainties for closure options, selected closure activities, and/or closure criteria.
Regional Study Area	Defines the spatial extent related to the cumulative effects resulting from the project and other regional developments.
Relative Humidity	The ratio of the amount of water vapour in the atmosphere to the amount necessary for saturation at the same temperature. Relative humidity is expressed in terms of percent and measures the percentage of saturation.
Remediation	Treating or removing soil or groundwater affected by potential contaminants of concern that result from former oil and gas operations and exceed regulatory criteria.
Restoration	The renewing, repairing, cleaning up, remediation or other management of environmental media so that functions and qualities are comparable to those of its original unaltered state.
Revegetation	Replacing original ground cover following a disturbance to the land.
Riparian	Refers to streams, channels, banks and the habitats associated with them.
Risk Assessment	Analysis of potential threats and options for mitigation for a given site, component, or condition. Risk assessments consider factors such as risk acceptability, public perception of risk, socio-economic impacts, benefits, and technical feasibility. It forms the basis for risk management.
River Ice Breakup	The period from the time the ice first starts to move in the Mackenzie River at Norman Wells in the spring, to the time when the river is free of pack ice at Norman Wells.

Term	Definition
Runoff	Water that is not absorbed by soil and drains off the land into bodies of water.
Scarification	Preparation of a site to make it more amenable to plant growth.
Security Deposit	Funds held by the Crown (Aboriginal Affairs and Northern Development Canada) or landowner that can be used in the case of abandonment of an undertaking to reclaim the site or carry out any ongoing measures that may remain to be taken after the abandonment of the undertaking.
Sedge	Any plant of the genus *Carex*, perennial herbs, often growing in dense tufts in marshy places. They have triangular jointless stems, a spiked inflorescence and long grass-like leaves which are usually rough on the margins and midrib. There are several hundred species.
Sediment	Solid material, both mineral and organic, that has been moved by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.
Seepage	Slow water movement in subsurface. Flow of water from constructed retaining structures. A spot or zone, where water oozes from the ground, often forming the source of a small spring.
Selected Closure Activity	The closure and reclamation activity chosen from the closure options for each project component.
Sewage	All toilet wastes and grey water.
Sewage Treatment Plants	Comprises the engineered structures that are designed to contain and treat sewage.
Shoals	A shallow but submerged area isolated from the shorelines of a body of water.
Shoreline Habitat	Area extending from the high water mark to the low water mark of a given waterbody.
Slurry	A mixture of fine rock and water that can be pumped.
Soil	The naturally occurring, unconsolidated mineral or organic material at least 10 cm thick that occurs at the earth's surface and is capable of supporting plant growth.
Soil Horizon	A layer of mineral or organic soil material approximately parallel to the land surface that has characteristics altered by processes of soil formation.
Spawning Habitat	A particular type of area where a fish species chooses to produce and deposit its eggs.
Spillway	An engineered structure to facilitate the release of water from a water retention facility, often in an emergency. The spillway elevation is the elevation at which water begins to flow through the spillway structure.

Term	Definition
Stakeholders	Industry, federal agencies, the territorial government, Aboriginal organizations/governments, landowners, affected communities, and other parties with an interest in a project.
Substrate	The material that comprises the bottom of a water body.
Sump	A catch basin where water accumulates before being pumped elsewhere for storage, treatment or release.
Surface Waters	Natural waterbodies such as rivers, streams, brooks, ponds and lakes, as well as artificial watercourses, such as drainage ditches and collection ponds.
Surficial Material	Deposits on/at the earth's surface.
Sustainable Development	The design, development, operation and closure of all mining activities so as to ensure the optimization of post closure outcomes in terms of social, environmental and economic development needs and expectations.
Tailings	Material rejected from a mill after the recoverable valuable minerals have been extracted.
Taliks	Unfrozen zones that can exist within, below or above permafrost layers. They are usually located below deep waterbodies.
Temporary Shutdown	The cessation of mining and diamond recovery for a finite period due to economic or other operational reasons, with the intent to resume operations under more favourable conditions.
Thermistor	An instrument used to monitor temperature change.
Thermokarst	A landscape characterized by shallow pits and depressions caused by selective thawing of ground ice, or permafrost.
Till	Sediments laid down by glacial ice.
Total Dissolved Solids (TDS)	A measure of the amount of dissolved substances in a waterbody.
Total Organic Carbon	Total organic carbon is composed of both dissolved and particulate forms. Total organic carbon is often calculated as the difference between Total Carbon (TC) and Total Inorganic Carbon (TIC). Total organic carbon has a direct relationship with both biochemical and chemical oxygen demands, and varies with the composition of organic matter present in the water. Organic matter in soils, aquatic vegetation and aquatic organisms are major sources of organic carbon.
Total Suspended Particulate	A measure of the total particulate matter suspended in the air. This represents all airborne particles with a mean diameter less than 30 µm (microns) in diameter.
Total Suspended Solids (TSS)	A measure of the particular matter suspended in the water column.

Term	Definition
Traditional Knowledge	A cumulative, collective body of knowledge, experience, and values built up by a group of people through generations of living in close contact with nature. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual, and political change.
Trophic	Pertaining to part of a food chain, for example, the primary producers are a trophic level just as tertiary consumers are another trophic level.
Turbidity	A measure of the degree to which the transparency of water declines due to the presence of suspended particulates.
Type A Water Licence	A water licence required as per Column IV of Schedules IV to VIII of the Northwest Territories Waters Regulations SOR/92/203.
Type B Water Licence	A water licence required as per Column III of Schedules IV to VIII of the Northwest Territories Waters Regulations SOR/92/203.
Unauthorized Discharge	A discharge of any waters or waste not authorized under this Licence or legislation.
Understorey	Trees or other vegetation in a forest that exist below the main canopy level.
Waste Rock	All unprocessed rock materials that a mining operation produces.
Water Intake	The wetwell pump and associated facilities installed in the Mackenzie River and the water line to the Central Processing Facility.
Watercourse	A natural body of flowing or standing water or an area occupied by water during part of the year, and includes stream, springs, swamps and gulches but does not include groundwater.
Waterflood	The injections of waters into the Norman Wells oilfield reservoir for pressure maintenance and enhanced oil production.
Waterfowl Staging Area	Waterbodies used by waterfowl to gather, nest and feed before or during migration.
Watershed	A region or area bordered by ridges of higher ground that drains into a particular watercourse or body of water.
Wetland	A swamp. Marsh, bog, fen or other land that is covered by water during at least three consecutive months of the year.
Wildlife	Under the *Species at Risk Act*, wildlife is defined as a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus that is wild by nature and is native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.

Appendix B

List of Acronyms, Units and Symbols

Acronyms

Acronym	Description
A&R	Abandonment and Reclamation
AACE	Association for Advancement of Cost Engineering
AANDC	Aboriginal Affairs and Northern Development Canada
AEMP	Aquatic Effects Monitoring Program
API	American Petroleum Institute
ARD	Acid Rock Drainage
BCE	Base Case Estimate
CCME	Canadian Council of Ministers of the Environment
CPF	Central Processing Facility
COGOA	*Canada Oil and Gas Operations Act*
DFO	Department of Fisheries and Oceans
DLC	Déline Land Corporation
DRRC	Déline Renewable Resources Council
EA	Environmental Assessment
EER	Environmental Effects Report
EMPR	Department of Energy Mines and Petroleum Resources
ENR	Department of Environment and Natural Resources
EPP	Environmental Protection Plan
GAC	Granular Activated Carbon
GNWT	Government of Northwest Territories
HADD	Harmful alteration, disruption or destruction (of fish habitat)
HELP	Hydraulic Evaluation of Landfill Performance
Imperial	Imperial Oil Limited
ISR	Inuvialuit Settlement Region
LTMAs	Long Term Management Areas
LTMF	Long Term Management Facility
MACA	Municipal and Community Affairs
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLUR	Mackenzie Valley Land Use Regulations
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	*Mackenzie Valley Resource Management Act*
NEB	National Energy Board
NTPC	Northwest Territories Power Corporation
NWRRC	Norman Wells Renewable Resource Commission
NWT	Northwest Territories
Operations	Norman Wells Operations
RAP	Remedial Action Plan
RRC	Fort Good Hope Renewable Resources Council

Acronym	Description
RSA	Regional Study Area
SARA	*Species at Risk Act*
SLWB	Sahtu Land and Water Board
SRRB	Sahtu Renewable Resource Board
SSA	Sahtu Settlement Area
WLWB	Wek'éezhii Land and Water Board

Units and Symbols

Unit	Description
%	Percent
‘	Minutes
“	Inches
<	Less than
>	Greater than
°	Degrees
° ’	Degrees, minutes
°C	Degrees Celsius
BTU	British Thermal Units
cm	Centimetre
dS/m	deci Siemens per metre
FeSi	Ferro-silicon
ha	Hectare
kg $CaCO_3$/tonne	Kilograms calcium carbonate per tonne
km	Kilometres
km/hr	Kilometres per hour
km^2	Square kilometres
kV	Kilovolts
m	Metre
m/s	Metres per second
m^3	Cubic metres
m^3/day	Cubic metres per day
m^3/s	Cubic metres per second
masl	Metres above sea level
mbgs	Metres below ground surface
mg/dm^2/yr	Milligrams per square decimetre per year
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
ML	Million litres
mm	Millimetre
Mm^3	Million cubic metres
Mt	Million tonnes (1 tonne = 1,000 kilograms)
MW	Megawatts
ng/L	Nanograms per litre
NTU	Nephelometric Turbidity Units
ppb_v	Parts per billion by volume
ppm	Parts per million
t	Tonnes
µg/m^3	Microgram per cubic metre
µS/cm	Micro Siemens per centimetre
wt%	Percent by weight

Appendix C

Record of Engagement

Imperial Norman Wells Operations - Closure and Reclamation Plan
ENGAGEMENT LOG

ROE#	Date	Affected Party/Attendees	Engagement Activity Type	Reason(s) for Engagement	Issue(s) Summary (Issue(s) raised by Affected Party, recommendations from Affected Party)	Proponent Response (Was issue resolved/unresolved?)	Reference	Info materials provided to AP? Y/N	Written corr., meeting notes/mins? Y/N	Comments	Log Issue ID
1	November 6, 2014	Imperial, SLWB, C&R Working Group	Letter (with attachments for Working Group)	Circulate materials for C&R Working Group Meeting #1	See "Comments" column.	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	Requested by SLWB to be submitted two weeks prior to Working Group Session #1. SLWB did not circulate to the Working Group in advance of the Session.	
2	November 18, 2014	Imperial, SLWB, C&R Working Group	Meeting	Regulatory Requirement for C&R Plan	See "Comments" column.	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	Successful, and well attended Working Group session.	
3	November 27, 2014	Imperial, SLWB, C&R Working Group	Letter (with attachments for Working Group)	Minutes from Working Group Meeting #1	See "Comments" column.	Y	Minutes from Working Group Session #1	Y	Y	Accepted by the Working Group on January 15, 2015.	
4	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*The overall closure objectives above are really an expansion of closure goals and not really closure objectives as intended by the Closure and Reclamation Guidelines.*	
5	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*Closure Objectives should be narrative statements established to protect and maintain the physical, chemical and biological integrity of the land and water after operations have ceased and the site has been reclaimed.*	
6	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*What operational components of IORL does the goal apply to? eg. Site Wide, Artificial Islands, Natural Islands, Mainland, CPF, Biocell, etc... (these should be major sites or infrastructure groups which have similar physical and/or chemical structures, and are similarly related in reclamation planning and application of closure objectives and criteria.*	
7	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*Site specific closure objectives for each of the operational components could be developed under the categories of Air, Land, Water, Wildlife, Community, Health and Safety, Operations. Air, Land Water, Wildlife, Community represent Valued Ecosystem Components which attribute to having scientific, social, cultural, economic or aesthetic value. Health and Safety category takes into account IORL's policy for health and safety and to ensure the land and water are safe for people to use after the operation is closed. The Operations category ensures that reclamation objectives related to administrative and compliance requirements are met.*	
8	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*Component Specific Objectives – What level of reclamation is being required for each of these components and how is it going to be measured?*	
9	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*The following are examples of Closure Objectives adapted from Ekati Diamond Mine and Diavik Diamond Mine ICRPs. (provided in letter)*	
10	January 16, 2015	SLWB	Letter	Comments on IORL Closure and Reclamation Plan	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*In summary, the SLWB recommends that the proposed seven overall closure objectives be restated as closure goals. These seven goals are specific enough to develop closure objectives for site components which must be measurable and allow development of closure criteria. More detailed closure objectives should be developed and circulated for review and comment in advance of the next Working Group meeting.*	
11	February 24, 2015	Imperial (Hynes, Scott); SLWB (Dixon, Bergsma)	Teleconference	Imperial initiated: discussion with SLWB on expectations/ obligations for the C&R Plan Working Group process	Environmental Services C&R Team to work with Operations and Imperial's SocioEc team to input in the 10-Year Community Engagement Plan, including participating in the Neighbour Week visits to the 5 communities.	Y	2015 Norman Wells SocioEconomic Plan (***internal Imperial document***)	N	N	1) Imperial's progress on C&R Plan Objectives; 2) SLWB thoughts around community engagement; roles of the Working Group members; 3) Timing for the next Working Group session, and what – if any – community interfacing needs to happen; 4) Next steps around the Mackenzie Valley Land & Water Board; what that may mean to the process, who will be the key contacts, any guidance for Imperial.	
12	March 7, 2015	Imperial, SLWB, C&R Working Group	Letter (with attachments for Working Group)	Progress Report to C&R Working Group	See "Comments" column.	Y	Update #1: RE: Draft Closure and Reclamation Plan, Norman Wells Operations	Y	Y	1) Cover letter with detail on Attachments; 2) Draft C&R Plan Outline/Table of Contents; 3) Draft Supplemental Objectives, as requested by the Sahtu Land & Water Board.	
13	April 15, 2015	GNWT ENR (P. Clancy)	Letter (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*ENR recommends that any closure objective for surface and groundwater be specified. Note, it may be possible to relate safety of people and the environment to both surface water and groundwater criteria.*	
14	April 15, 2015	GNWT ENR (P. Clancy)	Letter (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*ENR recommends that IORL review their closure objectives to ensure they are consistent in scale. An assessment of overlap or redundancies should occur.*	

Imperial Norman Wells Operations - Closure and Reclamation Plan
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15	April 15, 2015	GNWT ENR (P. Clancy)	Letter (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*ENR recommends that IORL review closure objectives related to water and determine which are appropriate. Rationale should be provided to the Board regarding final selections (e.g. CCME, natural background, other jurisdictional guidelines, etc.).*	
16	April 15, 2015	GNWT ENR (P. Clancy)	Letter (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*ENR recommends that closure criteria for surface water drainage include factors in addition to flow such as velocities, slope and substrate types to reduce erosion potential and promote the re-establishment of aquatic species*	
17	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Management of fugitive dust levels" – as written, this is more of an action than objective to be achieved…*	
18	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Manage emissions" – again, as written, this is more of an action than objective to be achieved. … if the intent is to ensure that vapours released from soil and groundwater at the closed and reclaimed site do not pose a hazard to the environment or to the health and safety of future users of the site (outdoor or inside future buildings). If soil and groundwater meet appropriate generic remediation criteria, this objective may be redundant.*	
19	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Remove above-ground facilities, infrastructure and debris." Consider rephrasing as an objective (eg: "Above-ground facilities, infrastructure and debris are removed"). Associated "closure criteria" are appropriate elements of potential closure activities, but do not meet the definition of "closure criteria". Consider specifying a depth to which all near-surface infrastructure (eg: underground utilities, piles, etc) is also removed to ensure safe and unimpeded future use (may vary depending on end-use of different areas)… Criteria may simply be that everything at surface and to a certain depth is removed.*	
20	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Abandon or remove below ground facilities or infrastructure." Consider rephrasing as an objective… Criteria look appropriate for oil and gas facilities…and should be phrased "Comply with Canadian Oil and Gas Drilling and Production Regulations and other appropriate regulatory standards and practices…". Is the intent to remove underground pipe (flow-lines, etc) or abandon it in-situ? Are non-oil-and-gas-specific below-grade structures such as foundations, piles and utilities best included under this objective or (3) above; will they be removed or abandoned in situ, and do criteria for (3) or (4) apply? How will buried debris (in any dump sites) be addressed? Risk from future river scour and other natural processes should also be considered in development of objective and criteria.*	
21	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Land which is safe for people and the environment." Consider rephrasing "Soil is safe for people and the environment" …Criteria is appropriate as far as it goes, but need more clarity around end-use and more specific commitments regarding criteria to be met.. Pending greater certainty with respect to future land use, consider criteria to the effect of "Soils meet CCME generic or risk-based site-specific standards appropriate for future land and water use and protection of human health and ecological receptors." How does drilling waste sump management fit into closure objectives and criteria? Strategy with respect to background hydrocarbon concentrations / natural hydrocarbon seeps should also be considered in development of objective and criteria.*	
22	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*Consider adding objectives/criteria specifically addressing final landscape (including surficial materials, vegetation and topography, except as pertains to drainage per (9) below). Desired end-use or uses need to be considered to develop meaningful objectives and criteria. Depending on the end-use of various areas, considerations would include: current community needs, traditional use, traditional knowledge (crossover with Community objectives), pre-development conditions, soil stability/erosion prevention/drainage (crossover with Water objectives), safe passage for humans and wildlife, and wildlife habitat (crossover with Wildlife objectives).*	

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ENGAGEMENT LOG

ROE#	Date	Affected Party/Attendees	Engagement Activity Type	Reason(s) for Engagement	Issue(s) Summary (Issue(s) raised by Affected Party, recommendations from Affected Party)	Proponent Response (Was issue resolved/unresolved?)	Reference	Info materials provided to AP? Y/N	Written corr., meeting notes/mins? Y/N	Comments	Log Issue ID
23	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*Consider adding objectives pertaining to river-bank and creek-bank stability and the fate of the artificial islands.*	
24	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Water that is safe for people and the environment." Objective good. As for (5) above, consider more specific commitments regarding closure criteria to be met. In addition to ecological receptors, what are current or potential future uses of groundwater or surface water in the vicinity? Cited closure criteria includes "Remediate or manage surface water and groundwater …" What type of "management" is being considered, and can this be achieved in keeping with the closure principle of "no long-term active care"?*	
25	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Surface water drainage designed to allow natural flow." "Surface water runoff or seepage water that does not cause an adverse effect on the Mackenzie River or Bosworth Creek." These expanded objectives appear appropriate. Ensure prevention of erosion and sediment transport is considered in drainage design and surface water quality criteria.*	
26	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*There are no objectives pertaining to sediment quality in the creek or river. Have sediments been sampled and is contamination of sediments considered an issue at the site?*	
27	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*Consider adding an objective pertaining to safe navigation of the Mackenzie River (could fit under Water or Community objectives).*	
28	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Minimize disruption to birds and wildlife" and associated details under "closure criteria." As written, these are environmental protection/mitigation measures to be incorporated into plans for closure and reclamation activities but are not closure objective / criteria.*	
29	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Surface restoration to allow safe use and travel within formerly disturbed areas." Note overlap with (13) and potential Land objectives (6). Is the intent to restore wildlife habitat similar to surrounding environment or to simply permit wildlife to safely move through the area (recognizing that this may vary in different parts of the site depending on different potential end uses)? Is it desirable to be neutral to wildlife relative to pre-development conditions as cited in the Diavik example (ie: not attract or deter wildlife)?*	
30	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Protect and preserve archeological and historically significant sites." Consider rephrasing as a result to be achieved as opposed to an action (i.e. "Archeological and historically significant sites are protected and preserved.")*	
31	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Minimize the use of undisturbed areas." As written, is a measure to be integrated into selection and planning of closure and reclamation options and activities but not an objective. If desired as a specific objective, consider rephrasing similar to Diavik example (i.e. "SW7. Areas in and around the site that are undisturbed during operation of the mine should remain undisturbed during and after closure.")*	1
32	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Incorporation of traditional knowledge (TK) into plan development." As written, this is more of a guiding principle than a closure objective. A potential objective might address a restored landscape compatible with traditional use (crossover with Land objectives).*	
33	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Maintain a safe work environment" and associated details under "closure criteria." As written, these are safety measures to be incorporated into plans for closure and reclamation activities but are not closure objective / criteria.*	
34	April 17, 2015	NEB (K. Roblin)	Email (provided via SLWB)	Comments on Draft Site-Wide Closure Objectives and Criteria	See "Comments" column (issue(s) summarized in italics).	Y	Working Group Session #1 (Nov. 19, 2014) Presentations by Imperial and AMEC	Y	Y	*"Removal or management of physical and chemical hazards." Somewhat overlapping/redundant to a number of the stated or suggested objectives above, but a good high-level or overarching objective. "Management" element need to be in keeping with the closure principle of "no long-term active care"?*	

Imperial Norman Wells Operations - Closure and Reclamation Plan
ENGAGEMENT LOG

ROE#	Date	Affected Party/Attendees	Engagement Activity Type	Reason(s) for Engagement	Issue(s) Summary (Issue(s) raised by Affected Party, recommendations from Affected Party)	Proponent Response (Was issue resolved/unresolved?)	Reference	Info materials provided to AP? Y/N	Written corr., meeting notes/mins? Y/N	Comments	Log Issue ID
35	June 25, 2015	Imperial, SSI, AANDC, NEB, Land Corps, NWRRC, several Sahtu Beneficiaries	Meeting	Chapter 9 Meeting	See "Comments" column.	Y	Chapter 9 Meeting	Y	N	Environmental Services' presentation on Progressive Reclamation, and Q&A's on C&R Plan and process. Meeting was recorded, and possibly minutes are available from AANDC (who hosted the Chapter 9 meeting).	
36	June 26, 2015	Imperial (Hynes, Scott); NWLC (Hodgson); NWRRC (MacDonald)	Meeting	Discuss C&R Plan progress to date, including opportunities associated with LTMF	See "Comments" column.	Y	-	N	N	Informal coffee meeting; discussed progress on C&R Plan, upcoming dates to plan for, and key points for the next Working Group session. Also discussed Imperial's need for a local long-term waste management area, including the challenges with long-haul trucking out of the NWT. In particular, the Land Corp recognized the need in the Territories, and expressed interest in the potential business opportunity.	
37	June 30, 2015	Imperial, SLWB, C&R Working Group	Letter (with attachments for Working Group)	Progress Report to C&R Working Group	Need to circulate Component-Specific Closure Objectives (Component Objectives) to the Working Group in advance of September 2015 meeting.	Y	Update #2 RE: Draft Closure and Reclamation Plan, Norman Wells Operations	Y	Y	1) Cover letter with update to the C&R Working Group, including Action Items from Working Group Session #1; 2) Updated Draft Site-wide Closure Objectives and Criteria; 3) Responses to comments received on C&R Objectives (log).	
38	July 27, 2015	Imperial (Hynes); NWLC (Hodgson)	Teleconference	Discuss LTMF economic opportunities for Sahtu businesses	Imperial to add structure to the potential business model for further discussion with NWLC. NWLC to consider appropriate parties to consult with, in order to ensure information is made available and shared appropriately with all stakeholders.	Y	-	N	N	Follow-up to meeting in Norman Wellson June 26. Brainstormed on ideas and possible solutions and next steps.	
39	September 9, 2015	Imperial, SLWB, C&R Working Group	Letter (with attachments for Working Group)	Circulate materials for C&R Working Group Meeting #2	See "Comments" column.	Y	Working Group Session #2 (Sept. 23-24, 2015) material: 1) Meeting Agenda 2) Component Objectives 3) Updated Table of Contents 4) Cover letter	Y	Y	Not specifically requested this time by SLWB, however Imperial submitted two weeks prior to Working Group Session #2. SLWB circulated the week prior to the Working Group meeting.	
40	September 22, 2015	Imperial (Hynes); NWLC (Hodgson)	Meeting	Discuss LTMF economic opportunities for Sahtu businesses	See "Comments" column.	Y	-	N	N	Informal coffee meeting at NWLC office; discussed progress on C&R Plan, including Imperial's continued plan for a local long-term waste management area. The Land Corp continues to be interested in the potential business opportunity.	
41	September 22, 2015	Imperial (Hynes); NWRRC (Macdonald)	Meeting	Discuss C&R Plan Objectives and progress to date	See "Comments" column.	Y	-	N	N	Informal and impromptu meeting at NWRRC office; discussed progress on C&R Plan, including the next two days' Working Group topics.	
42	September 22, 2015	Imperial, SLWB, C&R Working Group	Site Tour of NWO	Regulatory Requirement for C&R Plan	See "Comments" column.	Y	-	N	N	Bus tour of the Norman Wells operations and facilities on the mainland. Good dialogue among the whole team, and good leadership/presentation by our tour guide, R. Powder.	
43	Sept 23-24, 2015	Imperial, SLWB, C&R Working Group	Meeting	Regulatory Requirement for C&R Plan	See "Comments" column.	Y	Working Group Session #2 (Sept. 22-23, 2015) Presentation by Imperial and AMEC	Y	Y	Successful, and well attended Working Group session - more participation than WG#1, and better feedback from the group.	

Appendix D

Lessons Learned from Other Projects

Table D-1 summarizes some key learnings that can be derived from remediation and closure activities undertaken, or planned, in Canada's north. These high level messages will be supplemented with additional learnings in updates to this C&R Plan as more detailed planning and engineering studies described in this document are executed in the lead-up to facility closure.

Table D-1: C&R Lessons Learned Summary

Development	Activity Which Leads to Lesson	Lesson Learned	Management Result
The Distant Early Warning (DEW) Line Remediation Project	During the Cold War, North America relied on radar networks to provide an early warning of airborne attacks inbound over the North Pole. From the early 1950s, a series of isolated radar stations were constructed in Alaska, Canada and Greenland to identify unfriendly aircraft and direct fighter planes to intercept them. In 1989, Canada's Department of National Defense (DND) started investigating the environmental conditions of the DEW Line sites and commenced work at two sites in 1996. Remediation work at each site typically consisted of the demolition of surplus infrastructure, the remediation of chemically contaminated soils, the stabilization of existing landfill sites, the construction of new, engineered landfills, and the shipment of certain contaminated soil and debris to southern disposal facilities. The remediation was designed to prevent chemical contamination from the DEW Line sites from entering the Arctic food chain, and to return the sites to an environmental safe condition (GOC 2015) It is useful to note that Imperial has successfully developed LTMFs per RAPs developed using DEW Line criteria in the Inuvialuit Settlement Region (ISR).	Engineered landfills or LTMFs can be designed and constructed at or near source sites to safely contain materials of concern over indefinite timelines in ways that are compatible with community objectives for future use of the lands.	An LTMF has been proposed as a key element of the Operations' C&R Plan.

Development	Activity Which Leads to Lesson	Lesson Learned	Management Result
The Faro Mine Remediation Project	The Faro Mine is located in the south-central Yukon close to the Town of Faro and was an open pit lead-zinc mine from 1969 until it went into interim receivership in 1998. The site covers approximately 2,500 hectares and includes 70 million tonnes of tailings and 320 million tonnes of waste rock. Both the tailings and waste rock contain high levels of heavy metals that could leach into the environment in the absence of remediation. The closure plan for Faro emphasizes stabilizing contaminants, rather than removing them from the site. Key features include upgrading dams to ensure tailings stay in place, re-sloping waste rock, installing engineered soil covers over approximately 320 million tonnes of tailings and waste rock, upgrading stream diversions, and installing state-of-the-art water collection and treatment systems. Implementation of the plan will reduce the total liability associated with the site. However, the site will require ongoing monitoring and, as such, the federal government will retain some residual financial responsibility for the site in perpetuity (IANAC 2015).	Remediation and closure plans for large and complex resource sector developments typically incorporate concepts that provide for the long term containment and management of large volume contaminated soil and rock inventories. Large scale relocation of these materials is usually determined to be impractical technically and economically, and often times counterproductive environmentally.	The Operations' C&R Plan includes elements that will require ongoing post closure monitoring, maintenance and management.
The Giant Mine Remediation Project	The Giant Mine Remediation Project in Yellowknife, NWT, addresses the long term containment and management of the arsenic trioxide waste, the demolition and removal of all buildings on the surface, and the remediation of all surface areas including the tailings ponds. It also includes water management and treatment options. The Remediation Plan for the Giant Mine site can be broken down into five distinct but interconnected components:	The lesson taken here is similar to that described above for the Faro project, which is that large closure plans for difficult sites can be developed in ways that avoid large scale material relocations while meeting community objectives for post closure land use and local economic development.	Opportunities for local community participation in post closure facility monitoring, maintenance and/or management will be explored with stakeholders as the interim Operations' C&R Plan is reviewed and updated.

Development	Activity Which Leads to Lesson	Lesson Learned	Management Result
	1. The arsenic trioxide waste stored in sealed chambers and vaults will be contained in frozen blocks. 2. The surface remediation includes taking down close to 100 buildings, covering four tailings ponds, fencing off eight open pits and cleaning up the contaminated soil. 3. Water entering the underground tunnels and coming into contact with contaminated material used to backfill mined out areas during the mine's operation will continue to be treated. 4. Baker Creek, which runs through the mine site, will require some remediation to help restore it to a condition that is as ecologically sound as possible. This Remediation Plan was developed after years of site investigations, research and extensive consultation with the public and with the Independent Peer Review Panel (IANAC 2015a).		
The Mount Nansen Remediation Project	In 2012, the Little Salmon/Carmacks First Nation, Government of Yukon, and Government of Canada agreed on a preferred remediation option for the former Mount Nansen mine site near Carmacks, YT. The chosen remediation option is to backfill the pit, install a dry cover on the tailings, remove the dam and restore the valley. This plan is intended to (GY 2015): ► protect human health and safety; ► protect and restore the environment including land, air, water, as well as fish and wildlife and their habitats; ► return the site to an acceptable state that reflects original, traditional and pre-mining land use; ► maximize local and Yukon and First Nation benefits; and ► manage risk in a cost effective manner.	The Mount Nansen materials inventory includes large volumes of non-acid generating (NAG) waste rock that contains some parameters that are marginally elevated above background levels in local overburden soils. The plan recognizes that it will not be necessary to execute large scale relocations and/or engineered containment of these materials to meet the project objectives and provide adequate long term protection for local surface and groundwaters.	The shale materials that have been distributed across much of the Operations' Proven Area are viewed as uncontaminated material inventories that do not require containment or management (beyond that required for surface reclamation) as part of the C&R Plan.

Development	Activity Which Leads to Lesson	Lesson Learned	Management Result
Port Radium Mine Site Remediation Project	The Port Radium Site is the original source of radium in pitch blend in Canada. It is also a former uranium and silver mine located on a peninsula along the eastern short of Great Bear Lake in the Northwest Territories, 450 km north of Yellowknife and 265 km east of Déline, within the Sahtu Dene and Métis traditional lands. The site was decommissioned in 1982 to the standards of the day. Due to more than 40 years of mining, silver, copper and uranium were present in soils and surface water at the immediate site. The site also had waste rock and tailings containing radionuclides. Small amounts of hydrocarbons and asbestos residue were also present at the site. Physical hazards, such as mine openings, were the most immediate safety issues on the property. Remediation work was completed at the site in 2007/08 and included: ► improving drainage to reduce leaching of silver, copper and uranium into soils and surface water around the immediate site; ► reducing gamma radiation levels by covering waste rock and tailings; ► removing small amounts of hydrocarbons and asbestos residue; ► covering exposed waste materials or moving them to a landfill on-site; and ► closing mine openings. Long term monitoring is an important element of the Port Radium Remediation Plan (Geddes et al. 2011).	The lesson taken here is similar to that described above for the Faro project, which is that large closure plans for difficult sites can be developed in ways that avoid large scale material relocations while meeting community objectives for post closure land use and local economic development.	Opportunities for local community participation in post closure facility monitoring, maintenance and/or management will be explored with stakeholders as the interim Operations' C&R Plan is reviewed and updated.

Development	Activity Which Leads to Lesson	Lesson Learned	Management Result
The Diavik Diamond Mine	The Diavik Diamond Mine (DDM) is located on East Island, a 17 square kilometre (km^2) island in Lac de Gras, NWT, approximately 300 kilometres (km) northeast of Yellowknife. The area is remote, and major freight must be trucked over a seasonal winter road from Yellowknife. Worker access is by aircraft to the Mine's private airstrip. The Diavik Diamond Mine involves mining of four diamond-bearing kimberlite pipes. The DDM has a mineral claim to an area that includes portions of Lac de Gras, the East and West Islands, and portions of the mainland to the southeast and northwest. Lac de Gras is about 100 km north of the treeline in the central barren ground tundra of the NWT, at the headwaters of the Coppermine River. As part of its Water Licence obligations, the Diavik Diamond Mine submitted an Interim Closure and Reclamation Plan (ICRP) to the Wek'éezhii Land and Water Board using the guidance and formats specified in MVLWB (2013) (Diavik 2011). Among other things, this ICRP calls for the development of on-site, engineered landfills for the long term management of impacted materials and/or materials with no resale/reuse/recycle value.	On-site containment structures have been successfully incorporated into ICRPs prepared pursuant to MVLWB guidelines, and these ICRPs have attracted the necessary stakeholder support.	An on-site containment structure is an important element of the NWO Interim Closure and Reclamation Plan, and that plan has been developed using MVLWB Guidelines.

Appendix E

Reclamation Research

E.1 RECLAMATION RESEARCH

Imperial has undertaken various research activities over the years that have focused on issues relevant to Progressive Reclamation efforts, and potentially to the development of more detailed C&R activity plans in the lead-up to facility closure. The specific objectives, conduct and findings of that research has been presented, and will continue to be described, in the annual closure and reclamation progress reports that Imperial submits to the SLWB pursuant to requirements of the Water License. The following discussions of current research initiatives have been reproduced from the latest C&R Progress Report (Imperial 2015). In addition to these ongoing research activities, Imperial anticipates that some of the detailed planning and engineering activities outlined in Section 5.0 will drive the need for focused, issue specific research that will be defined and executed as facility closure approaches.

E.2 APPLIED TECHNOLOGY AND GUIDELINE DEVELOPMENT

Several applied technology and guideline development based initiatives were undertaken in 2013 and ongoing work was planned for 2014. One area focused on understanding plant and invertebrate eco-toxicity in relation to specific petroleum hydrocarbon sub-fractions in soil. There is currently no guidance published in the Northwest Territories for risk-based development and application of eco-contact guidelines for use in establishing remediation objectives and/or to meet site closure requirements. The approach to derivation of site-specific eco-contact guidelines for PHC F3 for the Norman Wells field has thus been based on the “weight of evidence” approach outlined by CCME. The guidelines being developed are to be protective of plants and invertebrates native to the area and reflective of the typically aged and/or weathered nature of hydrocarbons in bio-remediated soils at Norman Wells.

Progress to date for both plant and invertebrate programs is summarized below and planned work is briefly described.

E.2-1 Plant Eco-Toxicity Testing

Beginning in 2009, research has been carried out to develop toxicity testing for plant species that are native to the Norman Wells region.

Critical milestones met from 2009-2014 are summarized below:

- a short list of 39 plant species found in the Norman Wells region was generated through review of published and Imperial consultant vegetation surveys;
- ten of the 39 short-listed species were identified as potential test species based on strong germination and growth testing;
- two sets of growth conditions were established for the project. The first is the standard Environment Canada (EC) test climate. The second was developed from climate data for Norman Wells to reflect summer conditions and has longer daylight hours and cooler temperatures relative to the EC test climate;
- preliminary growth trials were conducted to assess growth and appropriate test duration in artificial soils under the two climate regimes;

- preliminary screening tests were conducted using four plant species;
- additional growth tests were conducted using the 10 potential test species to establish growth test durations and confirm the effects of fertilizer, climate conditions and background soils for all candidate plant species; and
- a number of candidate soils were collected from Norman Wells to be used for method development and toxicity testing.

Plans for 2015 include range finding tests for the assessment of hydrocarbon sensitivity of select plants. Following the range finding tests, a more detailed definitive sensitivity testing will be used to contribute to the development of a PHC F3 site-specific guideline.

Note that the specific elements and details of the plant invertebrate and eco-toxicity testing are routinely reviewed and changes are regularly made to the nature and scope of the research on the basis of these reviews.

E.2-2 Invertebrate Eco-Toxicity Testing

Invertebrate toxicity testing provides site-specific, quantitative invertebrate toxicity data by evaluating organism survival and/or reproduction upon chronic exposure to contaminated soils. A revision of the Environment Canada methodology is required for Norman Wells to account for the different species, soils and climate. The invertebrate toxicity data will be used, in conjunction with plant toxicity data, to derive site-specific remediation objectives for PHC F3 for the eco-contact pathway.

Critical project milestones met from 2011-2014 are summarized below:

- collection of soils cores from six locations in the Norman Wells field from which soil invertebrates were extracted and preserved;
- inventory of invertebrates present and their distributions through the soil profiles was conducted;
- a total of 8,483 specimens were extracted from 116 samples collected from the six sampling locations. Preliminary (coarse-level) sorting of the specimens extracted was carried out in the following manner:
    - Acari were placed into suborders (*Astigmata, Mesostigmata, Prostigmata* or *Oribatida*);
    - Collembola were identified to the family level (*Entomobryidae, Isotomidae, Hypogastruridae, Neelidae, Onychiuridae*, and *Sminthuridae*); and
    - remaining invertebrates were identified at the class, order or family level, if present.
- species level identification focused on Acari and Collembola specimens in a subset of the total samples collected (83 of 116 samples). A total of 4,441 specimens were classified. Eleven species were identified, and a further 28 types of invertebrates were classified to genus level;

- species abundance and diversity was assessed in relation to sampling depth which indicated that the large majority of organisms were found in the upper 0.2 m of the soil profile;
- four species obtained from Norman Wells soils were selected for ongoing culturing (*Tulbergia pacifica*, *Folsomia bisetosa, Onychiurus flavencens* and *Opiella nova*);
- development of test methods and toxicity testing for the invertebrate project was to move forward in 2014-2015 using the springtail (*Folsomia bisetosa*) extracted from the Norman Wells soils as well as three additional established invertebrate test species: *Folsomia candida, Oppia nitens,* and *Proisotoma minuta.* Included in the 2014-2015 work plan are the following elements;
  - maintenance and routine backup of cultures for the four invertebrate candidate test species;
  - culture acclimation to Norman Wells climate conditions;
  - test method development and refinement, to reach survival of all four species in a minimum number of tests in both artificial and Norman Wells soils;
  - quality assurance of test methods using boric acid;
  - range-finding tests in one soil to evaluate the sensitivity of all four candidate test species, if possible, to PHC F3 in Norman Wells remediated soils;
  - definitive dilution testing of reproduction for two invertebrate species, shortlisted based on sensitivity from the range-finding tests, in two Norman Wells soils; and
  - reporting and derivation of site-specific remediation objectives for PHC F3 in Norman Wells soils.

E.3 THERMISTOR INSTALLATIONS

Thermistor installations were completed in 2013 in the vicinity of the Mainland Sumps, the Mainland Tank Farm and the Cemetery Sump. Baseline ground temperature data were downloaded from continuous data loggers at each location in 2014 and will continue to be collected to provide year-round soil temperature information from surface to 5 m depth to improve understanding of the presence, nature, vertical distribution and seasonal variability of permafrost in key C&R investigation areas. This information will influence the detailed planning and engineering activities for LTMF development and excavation and materials management plans for contaminated source areas.

Appendix F

Imperial Community Engagement Plan for the Sahtu Settlement Area Communities

Community Engagement Plan for Sahtu Settlement Area Communities

April 1, 2012 – February 28, 2025

Norman Wells Operations, Water Licence S13L1-007

Rev	Date	Reasons for Revision	Developer	Owner	Endorser
0	September 2013	Original Submission	P&GA	Sandy Whiteman	Jennifer Watson
1	April 1, 2015	Update as per licence req.	Susan Scott	Sandy Whiteman	Jennifer Watson
2	June 15, 2015	Update as per license req.	Susan Scott	Sandy Whiteman	Jennifer Watson

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1.1 Background

The Mackenzie Valley Land and Water Board (MVLWB) *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits* (engagement guidelines), adopted by the Sahtu Land and Water Board (SLWB), requires that the proponent conduct community engagement over the life of a project to ensure that governments and Aboriginal organizations are able to:

- develop an understanding of a proposed project
- provide feedback during the engagement process on issues of concern with respect to the project
- work towards building relationships with proponents that are operating within their traditional territory

Imperial Oil Resources N.W.T. Limited (Imperial) will meet the board's engagement guidelines by developing and submitting:

- a record of engagement as per Appendix E – *Pre-Submission Engagement Record (Summary and Log) Template* from the MVLWB engagement guidelines
- an engagement plan adapted from Appendix F – *Engagement Plan Template* from the MVLWB engagement guidelines (this document)

Imperial is committed to ongoing interaction with internal and external audiences to manage issues relating to its business in the Sahtu Settlement Area (SSA). Imperial will conduct its activities while adhering to its Operations Integrity Management System standards and Aboriginal Relations Guiding Principles and Guidelines (Appendix A).

1.2 Engagement Objectives

Engagement objectives for the renewal and maintenance of the water licence are to:

- gather concerns, insights and ideas from the members of the Sahtu Settlement Area (SSA) that can be used to improve project designs and operational plans by providing:
    - timely information on project activities and longer term operations
    - a meaningful and timely process for providing input on project descriptions and resolving issues
- be respectful, attentive and responsive to the concerns of affected parties
- actively engage affected communities, research organizations and northern businesses to understand their environmental concerns and explain potential development benefits
- maintain high safety, business and ethical standards
- respect northern culture

Figure 1-1 shows a step-by-step guide to meeting the SLWB's engagement guidelines.

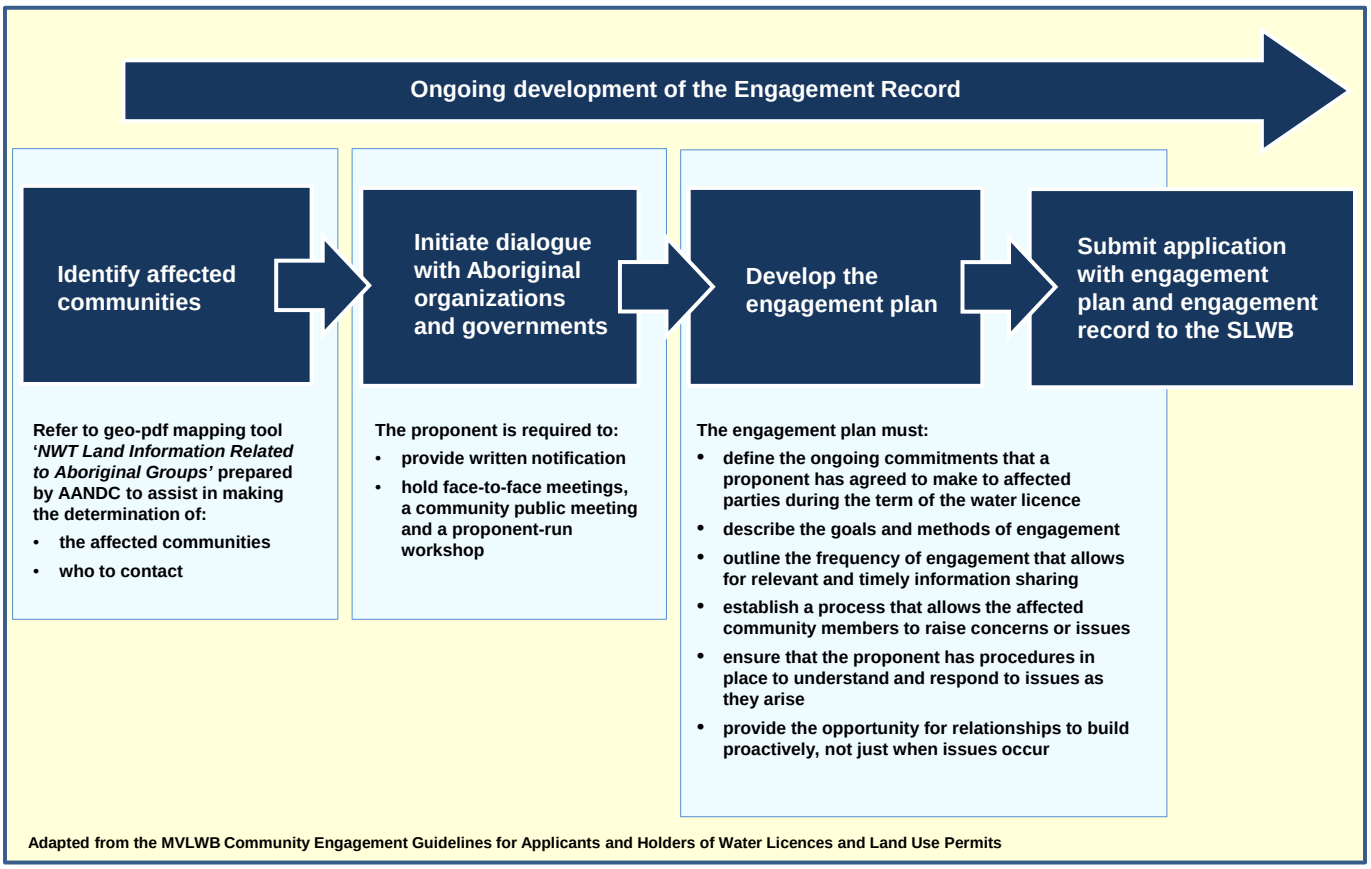

Figure 1-1: Step-By-Step Guide to Meeting the SLWB's Engagement Guidelines

1.3 Stakeholders in the Sahtu Settlement Area

Imperial will continue to consult with the Sahtu (i.e. the Aboriginal people of the SSA), local community members and regulators on items that might have an impact in their jurisdiction. Consultation and engagement will be conducted in the SSA communities shown in Figure 1-2 and listed in Table 1-1.

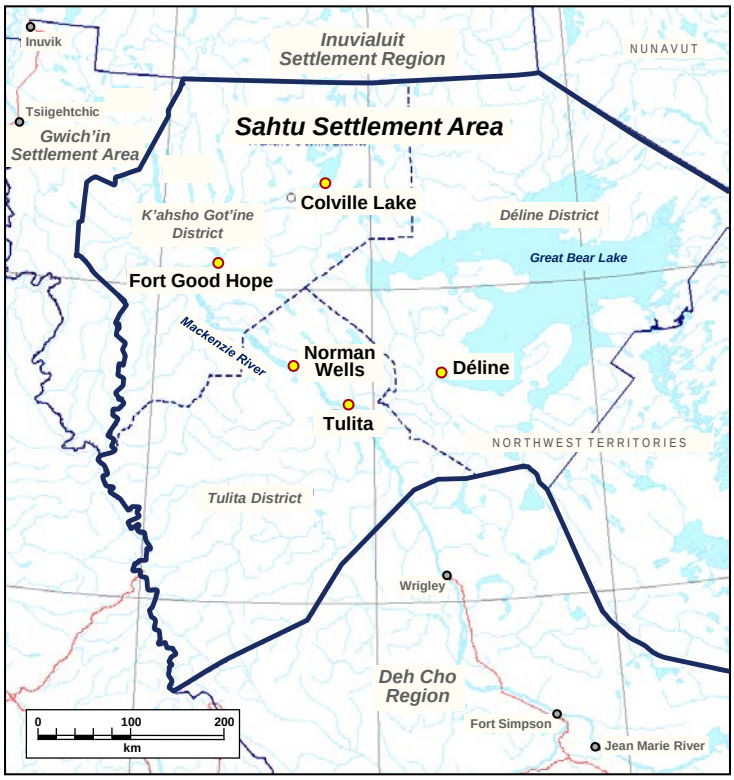

Figure 1-2: Map of Sahtu Settlement Area Communities

Table 1-1: Sahtu Settlement Area Communities

Community	Translation (community name)	Government Type	Population *
Colville Lake	*K'áhbamñtúé; ptarmigan net place*	Settlement corporation (Behdzi Ahda First Nation)	149
Déline	*where the waters flow*	Charter community	472
Fort Good Hope	*Rádeyîlîkóé; where the rapids are*	Charter community	515
Norman Wells	*Tåegõhtî; where there is oil*	Town	727
Tulita	*where the two rivers meet*	Hamlet	478
Note *: NWT Bureau of Statistics, Population Newstats (Feb 2012), 2011 census data. Website accessed April 10, 2013.			

In addition to engagement and consultation with members of the Sahtu communities, Imperial engages with local agencies. The agencies are responsible for various mandates throughout the SSA and includes, for example:

- Sahtu Secretariat Incorporated (SSI)
  - *K'ahsho Got'ine District Land Corporation, which includes the:*
    - Yamoga Land Corporation (FGH – Dene)
    - Ayoni Keh Land Corporation (Colville Lake – Dene)
    - Fort Good Hope Metis Land Corporation
  - *Tulita District Land Corporation*
    - Tulita Land Corporation (Tulita– Dene)
    - Norman Wells Land Corporation (Norman Wells Metis)
    - Fort Norman Metis Land Corporation
  - *Deline Land Corporation*
- Regulatory and Land Management Agencies
  - *Sahtu Land and Water Board*
  - *Sahtu Land Use Planning Board*
  - *Sahtu Renewable Resources Board*
  - *Deline Renewable Resources Council*
  - *Behdzi Ahda Renewable Resources Council*
  - *Norman Wells Renewable Resources Council*
  - *Fort Good Hope Renewable Resources Council*
  - *Tulita Renewable Resources Council*
- Band Councils
  - *K'ahsho Got'ine Community Council (Fort Good Hope)*
  - *Deline First Nations Band Council*
  - *Tulita Band Council*
  - *Behzi Ahda First Nations Band Council (Colville Lake)*
- Town of Norman Wells
- Incorporated Hamlet of Tulita
- Charter Community Council of Deline
- Elected Officials
- Various additional regulatory agencies representing the Sahtu region, Territorial and Federal Governments

Imperial will continue to consult with stakeholders in Sahtu communities to incorporate their traditional knowledge and feedback into project design, and limit the impact of project or operations activity on traditional lifestyle. Imperial incorporated community feedback and traditional knowledge into the project description before filing the water licence renewal application with the SLWB.

Table 1-2: Contact Information for Sahtu Agencies

Agency	Contact Information
Sahtu Secretariat Incorporated (SSI)	
Sahtu Secretariat Incorporated	P.O. Box 155 Déline, NT X0E 0G0 Ph: (867) 589-4719 Fax: (867) 589-4908 Website: www.sahtu.ca
Déline Land/Financial Corporation	P.O. Box 156 Déline, NT X0E 0G0 Ph: (867) 589-8100 Fax: (867) 589-8101
K'ahsho Got'ine District Land Corporation	P.O. Box 18 Fort Good Hope, NT X0E 0H0 Ph: (867) 598~2519 Fax: (867) 598~2437
Tulita Land Corporation	P.O. Box 63 Tulita, NT X0E 0K0 Ph: (867) 588-3734 Fax: (867) 588-4025 Email: assistant@tulitalandcorp.ca Website: www.tulitalandcorp.ca
Norman Wells Land Corporation	P.O. Box 69 Norman Wells, NT X0E 0V0 Ph: (867) 587-2455 Fax: (867) 587-2545 Email: admin@nwlc.ca Website: www.nwlc.ca
Regulatory & Land Management Agencies	
Sahtu Land & Water Board	P.O. Box 1 Fort Good Hope, NT X0E 0H0 Ph : (867) 598-2413 Fax : (867) 598-2325 www.slwb.com
Sahtu Land Use Planning Board	P.O. Box 235 Fort Good Hope, NT X0E 0H0 Ph: (867) 598-2055 Fax: (867) 598-2545 Website: www.sahtulanduseplan.org
Sahtu Renewable Resources Board	P.O. Box 134 Tulita, NT X0E 0K0 Ph: (867) 588-4040 Fax: (867) 588-3324 Website: www.srrb.nt.ca
Déline Renewable Resource Council	P.O. Box 163 Déline, NT X0E 0G0 Ph: (867) 589-8100 Fax: (867) 589-8101

Behdzi Ahda First Nation Renewable Resource Council	Colville Lake, NT X0E 1L0 P.O. Box 53 Ph: (867) 709-2200 Fax: (867) 709-2202
Norman Wells Renewable Resources Council	P.O. Box 69 Norman Wells, NT X0E 0V0 Ph: (867) 587-2455 Fax: (867) 587-2545 Email: nwrrc@nwlc.ca Website: www.nwlc.ca
Fort Good Hope Renewable Resources Council	P.O. Box 19 Fort Good Hope, NT X0E 0H0 Ph: (867) 598~2193 Fax: (867) 598~2437
Tulita Renewable Resources Council	P.O. Box 27 Tulita, NT X0E 0K0 Ph: (867) 588~4724 Fax: (867) 588~3726
Band Councils	
K'ahsho Got'ine Community Council (Fort Good Hope)	P.O. Box 80 Fort Good Hope, NT X0E 0H0 Ph: (867) 598-2231/2232/2233 Fax: (867) 598-2024
Déline First Nation Council	P.O. Box 180 Déline, NT X0E 0G0 Ph: (867) 589-3151 Fax: (867) 589-4208 Website: www.delinefirstnation.com
Tulita Dene Band Council	P.O. Box 118 Tulita, NT X0E 0K0 Ph: (867) 588~3341 Fax: (867) 588~3613
Behdzi Ahda First Nation Band Council	P.O. Box 53 Colville Lake, NT X0E 1L0 Ph: (867) 709-2200 Fax: (867) 709-2202
Other	
Town of Norman Wells	P.O. Box 5 Norman Wells, NT X0E 0V0 Ph: (867) 587-3700 Fax: (867) 587-3701 Email: info@normanwells.com Website: www.normanwells.com
Incorporated Hamlet of Tulita	P.O. Box 91 Tulita, NT X0E 0K0 Ph: (867) 588~4471/ 4351 Fax: (867) 588~4908
Charter Community Council of Deline	P.O. Box 180 Deline, NT X0E 0G0 Ph: (867) 589-4800 Fax: (867) 589-4106

1.4 Sahtu Dene and Métis Rights

Broadly speaking, traditional cultures have been formed and recognized as a result of the distinctive and ancestral lifestyle and practices of Aboriginal people. Traditional cultures relate to the historic and current use of ancestral lands for fishing, hunting, trapping and harvesting (adapted from the *Constitution Act, 1982*, Section 35).

As Aboriginal people of Canada, the Sahtu Dene and the Métis hold the right to consultation by the Crown on any potential impacts from development that might occur in their jurisdiction.

The Crown is responsible for consulting with Aboriginal people on the potential effect of development on Aboriginal ancestral lands, but many procedural aspects of consultation are delegated to project proponents by the Crown.

2.1 Scope

The community engagement strategy encompasses all public engagement with Aboriginal and other northern stakeholders residing in the Sahtu Settlement Area (SSA). The strategy reflects Imperial's commitment to offer interested parties the opportunity to provide feedback and to influence program planning. Local stakeholders are encouraged to provide feedback on program design, environmental and socioeconomic issues, land access and traditional knowledge studies.

2.2 Strategy

Imperial's strategy is to:

- actively engage interested community members and solicit feedback on water use for Norman Wells operations
- consult with Sahtu community members and agencies and meet regulatory guidelines related to public engagement and involvement as prescribed in the *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits* (the new guidelines)

2.3 Engagement Activities

Imperial has been engaging communities in the SSA for more than 70 years to learn about traditional lifestyles and incorporate this knowledge into project improvements. Imperial regularly provides information on Norman Wells' operation activities and updates to stakeholders through community engagements. Imperial actively works to identify opportunities for socioeconomic benefits such as business, training and employment for Sahtu beneficiaries. An example showing engagement activities for the water license renewal and 2009 – 2012 is included in Appendix B of this document.

To implement the 10 Year Community Engagement Plan, Imperial will, for example:

- maintain regular ongoing contact with the communities through Imperial's office to promptly address any questions and concerns from local stakeholders
- notify and communicate regularly with communities on processes and timelines to apply for training programs, community funding and other Imperial initiatives
- hold meetings in Sahtu communities to update community members on past operations activity and engage on upcoming activity associated with Norman Wells operations
- maintain logs on all discussions and meetings with Sahtu stakeholders to compile an engagement report for regulatory filing
- ensure that all commitments made to the Sahtu have been followed up on (i.e., reports are sent to communities)
- collect data from community members to understand the traditional knowledge of the area
- host a community visit every two years, if the community desires

- use a variety of engagement and communication methods, if requested, such as:
    - issue-specific workshops
    - meetings with Sahtu communities
    - career fairs and classroom visits to engage youth
    - tours of the Norman Wells facility
- annual updates to Sahtu communities
- provide translators at public meetings

2.4 Long Term Ongoing Engagement

Imperial will continue to engage with Sahtu communities to ensure that community stakeholders are informed and have the opportunity to provide feedback. Community engagement will continue for the life of the water license and the Norman Wells operation to ensure that community concerns are recognized and, if practicable, addressed.

Table 2-1 Summary of Engagement Triggers and Methods

Summary of Engagement Triggers and Methods	Primary Purpose of Engagement	Primary Method of Engagement	Participants
Engagement – On-going			
Host a community visit every two years, if desired by the community (5 Sahtu Communities)	Ongoing communication and sharing of information on Norman Wells Operations with community members and opportunity for Imperial to capture and discuss issues raised by community members	Community Meetings – minimum every 2 years	Imperial staff Community Members Community Leaders
Maintain regular ongoing contact with the communities through Imperial's office to promptly address any questions and concerns from local stakeholders	Promptly address any questions and concerns from local stakeholders	Ad hoc meetings as requested Chapter 9 annually with Government Canada, Sahtu Secretariat Incorporated and Sahtu beneficiaries Community visits every 2 years minimum, if the community desires Imperial site visits (ad hoc)	Community Leadership Community Members Imperial Staff and Leadership
Seek opportunities to actively engage youth	Provide information on employment, education and training, and Norman Wells Operations	Career Fairs Site tours Classroom Visits Community events	Community Youth Imperial Staff

Actively engage communities to facilitate participation in Imperial training, employment and community investment programs and other initiatives	Provide information on processes, timelines and requirements for training programs, employment and community investment funding	Community Events Notifications to align with application deadlines Community visits	Imperial Staff Community Members
Work with community members to collect information and understand the traditional knowledge of the area for new developments, projects or activities	Work with stakeholders in Sahtu communities to incorporate their traditional knowledge and feedback as applicable	Imperial site visits (as appropriate) Workshops (as appropriate)	Imperial Staff Community elders Community youth
Engagement Primarily Related to Water Board Processes, Licences or Permits			
Application for Renewal of Water Licence	-Pre-application engagement -Water Board review process to gain community input	Pre-application engagement may include: -Meetings with community leadership -Community meetings -Workshops -Technical Meetings -Written comments/responses -Imperial Site Visit Water Board Review Process, including: -Technical Meetings -Written comments/responses -Public Hearing	Community members Community technical staff Community leadership

Amendment to Plans and Programs (as required) • Aquatic Effects Monitoring Plan* • Closure & Reclamation Plan* *Submission required 1 year after Water License renewal	Community input into proposed changes to established Plans and Programs or into new Plans	Water Board review process, including: -Technical meetings -Written comments/responses -Workshops / Working Group	Imperial staff Regulator & Government Community Technical staff Community members
Engagement Primarily Related to Agreements			
Agreement between the Government of Canada and the Sahtu: *Sahtu Dene Metis Land Claim Agreement* - Chapter 9 Norman Wells Proven Area Annual Chapter 9 Meeting	Fulfill requirements of Chapter 9 of the Agreement between the Sahtu and Government of Canada including providing annual update to community Ensure all commitments made to the Sahtu are followed up	Community Meeting	Government of Canada Imperial Staff & Leadership Community members Community Leadership
Engagement Primarily Related to Specific Requests or Needs			
Community requests for engagement	Respond to community requests for engagement	As appropriate to request	As appropriate to request
Imperial specific needs for engagement	Obtain community input	As appropriate to topic at hand	As appropriate to topic at hand

2.6 Addressing Community Concerns

Imperial's Operating Integrity Management System (OIMS) Section 10.1 (Community Awareness) is an internal process designed to collect and manage community concerns relating to Imperial's business.

During the term of the water licence, an Imperial community relations advisor will be responsible to collect and ensure concerns raised by members of the community are addressed. As part of the OIMS process, the community relations advisor is expected to steward all concerns to closure and report results annually to the area manager.

Imperial will ensure the community relations advisor contact information is available to the community and that this information is updated as applicable.

Appendix A – Imperial Aboriginal Relations Guiding Principles and Guidelines

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Aboriginal Relations

Guiding Principles and Guidelines

Many of Imperial's operations and development opportunities are located within Aboriginal communities or on their traditional lands. Imperial supports communities in areas where it explores, develops and operates, and strives to establish lasting relationships built on mutual trust and respect.

Principles

Imperial conducts its business in a manner that respects the land, environment, rights and cultures of Aboriginal communities, in accordance with the laws of Canada and corporate policies and guidelines that underlie the company's commitment to ethics, equity, environment and safety.

Imperial engages Aboriginal communities and their representatives in open and forthright consultation. We seek to understand Aboriginal perspectives on issues of mutual interest and to deal constructively with differing views.

Imperial supports recruitment and development programs that enable Aboriginal people to meet the company's employment requirements and business needs.

Imperial fosters the development of Aboriginal businesses in ways that provide benefits to the company and to Aboriginal communities.

Imperial creates lasting relationships with Aboriginal communities by supporting initiatives that address community needs and are consistent with the Imperial Oil Foundation's philanthropic objectives.

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ExxonMobil Imperial

Aboriginal Relations Guidelines

Consultation

Imperial maintains an ongoing dialogue with elected Aboriginal leaders and their designated representatives by:

- Respecting the legal rights of Aboriginal people and adhering to government requirements.
- Ensuring timely discussions when activities have the potential to impact the community.
- Supporting the identification of specific infringements on traditional uses and rights in order to mitigate impacts.
- Treating all parties fairly.
- Respecting traditional practices, decision-making processes, cultural activities and language.
- Coordinating with Crown consultation.

Workforce Development

In accordance with Imperial's equal employment opportunity policy, the company's goal is to achieve a workforce that is representative of the available qualified Aboriginal peoples in the labour market. To this end, Imperial:

- Develops and supports educational programs and recruiting practices that facilitate employment of qualified Aboriginal people.
- Establishes internal training and development programs that enhance retention of Aboriginal employees throughout the company.
- Addresses workplace barriers that may exist and that hinder Aboriginal employees from doing their jobs effectively.

Business Development

Imperial recognizes that Aboriginal communities may be interested in maximizing the economic benefits of development on their lands. The company fosters the development of Aboriginal businesses in ways that benefit the company and the community by:

- Using Aboriginal suppliers of goods and services that are competitive and meet Imperial's safety, technical and quality standards and timing needs.
- Providing information and training on Imperial's procurement processes, safety standards and expectations of business conduct.
- Developing local Aboriginal content plans, which address employment of Aboriginal people and the amount of work subcontracted to Aboriginal businesses, as a factor in evaluating and awarding contracts.

Community Relations

Imperial builds lasting relationships with Aboriginal communities in areas where it explores, develops and operates by:

- Working collaboratively in the design and implementation of community relations programs.
- Supporting projects that meet community needs and are consistent with the Imperial Oil Foundation's objectives in the areas of education, the environment, civic and community initiatives.

Appendix B – Engagement Activities 2009 – 2014

This section is intended to provide examples of previous engagement activities by Imperial Norman Wells Operations illustrating the ongoing relationship between the operation and the Sahtu communities.

Included are examples of engagement activities from 2009-2012 as part of the ongoing operation and an overview of 2012-2014 engagement for the water license renewal.

Engagement activities for 2009-2012 do not represent formal consultation items and a detailed record with information such as names of representatives of affected parties, overview of issues identified (resolved or unresolved) is not available and therefore not included.

A detailed record of the water license renewal activities, including formal consultation information is included in *S13L1-007 Section 10 – Engagement Record and Engagement Plan.*

2012-2014 Water License Renewal Engagement Activities (Actuals)

Activity	Date
Initiate Communications re: Water License Renewal Engagement	Nov 2012
Mackenzie River Traditional Knowledge and Use workshop	April 24-26, 2013
Conduct face-to-face community meetings	May 6-10, 2013 Norman Wells May 6 Fort Good Hope May 7 Tulita May 8 Colville Lake May 9 Deline May 10
Send consultation records back to communities Actively solicit community input on Engagement Plan	July- August, 2013
Mackenzie River Workshop	July 17 and 18, 2013
Emergency response workshop (Norman Wells)	August 26-27, 2013
Submit Water License Application – including Engagement Record & Engagement Plan - to the SLWB	August 27, 2013
Public Hearings Water License Renewal	June 12 & 13 2014
Closure & Reclamation Plan Working Group Meeting	November 19, 2014
Aquatic Effects Monitoring Program (AEMP) Working Group Meeting	November 20, 2014

Norman Wells 2012 Engagement Activities

Date	IOR Attendees	Activity
February 21	N. Andres	SLWB's public training session on land and water licences
	M. Trefy	
	L. Trefry	
	K. Giesbrecht	
February 23	J. Lepine	Junior Achievement Program at Mackenzie Mountain School
	H. Pierrot	
	L. Duncan	
	N. Andres	
February 27 to March 2	J. Brown	NEB Inspection-John Korec and Don Logan
	R. Powder	
	N. Ochsner	
	R. Beck	
	N. Andres	
April 4	N. Andres	Meeting in Fort Good Hope with the SLWB to discuss upcoming water licence renewal
	C. Sykes	
	N. Ochsner	
	A. Campbell	
	S. Whiteman	
	D. Ford	
April 4	C. Sykes	Annual community visit into Fort Good Hope
	S. Whiteman	
	N. Andres	
	N. Ochsner	
	A. Campbell	
	D. Ford	
April 4	J. Lepine	Junior Achievement Program at Fort Good Hope School
	H. Pierrot	
	L. Duncan	
April 25		Skills development workshop-Norman Wells, IOR Leadership Team, NWAC members, contractors, government agencies
June 8	C. Sykes	Tours and presentations of IOR's Norman Wells facilities
June 13	C. Sykes	Chapter 9 meeting in Norman Wells
	S. Whiteman	
	N. Andres	
	N. Ochsner	
	L. Duncan	
June 21		Aboriginal Day activities attended by JIC delegation/management/employees, contractors, subcontractors
July 24	C. Sykes	Fort Good Hope community delegation tours of IOR's Norman Wells facilities
September 25 and 26	S. Whiteman	Exploration Readiness Conference-Norman Wells
September 25	I. Newton	Tulita career fair
	D. Manual	
	S. Whiteman	
	L. Kozma	

Norman Wells 2012 Engagement Activities (cont'd)

Date	IOR Attendees	Activity
September 26	J. Lepine	Norman Wells career fair
	L. Duncan	
	R. Beck	
December 12	C. Sykes	Norman Wells town meeting
	S. Whiteman	
	N. Ochsner	

Norman Wells 2011 Engagement Activities

Date	IOR Attendees	Activity
January 14	C. Sykes	Meeting with Norman Wells town manager regarding natural gas conversion
January 20	C. Sykes	Norman Wells public meeting, update on the natural gas situation and advisement on replacement of natural gas stoves to electric stoves
	N. Ochsner	
	A. Campbell	
January 25	N. Ochsner	Norman Wells town meeting, discuss stove replacement
February 1	C. Sykes	Meeting with town council
February 24	N. Andres	Indian and Northern Affairs environmental inspection (T. Bradbury)
February 28	N. Andres	Public engagement session on pipeline maintenance
	C. Sykes	
	J. Brown	
	S. Whiteman	
February	N. Andres	Mackenzie Mountain School science fair judging
March 3	N. Andres	Meeting with Transport Canada (TC) on Norman Wells review and TC regulations
	C. Sykes	
	N. Drummond	
	D. Ford	
March 10	S. Whiteman	Attended ARN Network meeting
March 18 to 20		Hosted the 12th Annual Sahtu Regional Minor Hockey Tournament in Norman Wells
March 22	C. Sykes	Norman Wells town meeting on gas stove replacement
	N. Ochsner	
March 25	S. Whiteman	Attended Spring Fling events
March	J. Maaten	Oil spill workshop
April 6	J. Maaten	Attended Native Network meeting
April 7	C. Sykes	Blondin and Yakeleya family 1920's issues & concerns, met with Norman & Gordon Yakeleya, Ethel Blondin-Andrew
	J. Maaten	
	S. Whiteman	
April 8	C. Sykes	Meeting with Norman Wells Mayor Dudley Johnson and Sandy Lee (Conservative party candidate) regarding town gas situation
	N. Ochsner	
May 10	C. Sykes	Discussion with Norman Wells representatives on alternative energy source for the town
	N. Ochsner	
June 1	D. Willis	IOR town hall meetings, road show
June 6	C. Sykes	Meeting with Bob McLeod, Minister, GNWT Michael McLeod, Minister, GNWT

Norman Wells 2011 Engagement Activities (cont'd)

Date	IOR Attendees	Activity
June 14	J. Brown	Discussion with Norman Wells representatives on the quarry contract
June 21		Co-hosted the National Aboriginal Day event with the Norman Wells Historical Society
July 5	C. Sykes	Meeting with Norman Wells Council on cost sharing of electric stoves
	N. Ochsner	
July 6	C. Sykes	Chapter 9 meeting in Tulita
	S. Whiteman	
	T. Yachimec	
	A. Yakeleya-Fournel	
	D. Bailes	
	N. Ochsner	
July 6	M. Trefry	Meeting with SLWB in Fort Good Hope to discuss 2011 A&R Plan
	SPM Group-Heather Hynes	
July 7	C. Sykes	Inspection by NEB
August 23	C. Sykes	Meeting with NWCC Board on pioneer family discussions
	S. Whiteman	
	L. Duncan	
September 7	N. Andres	Inspection by INAC (T. Bradbury)
September 30	C. Sykes	Meeting with representatives of Norman Wells and NWCC concerning the graveyard
October 4	S. Whiteman	National Addiction Awareness Week planning meeting
November 7	25 Regional participants	Hosted the Indigenous Women In Leadership venue
	N. Ochsner	
November 9	N. Andres	Pipeline public engagement session
	J. Brown	
November 13	J. Brown	National Addictions Awareness Week Opening
November	S. Whiteman	National Addictions Awareness Week Committee meetings
December 1	J. Brown	Ice road usage in the Sahtu
December 13	N. Ochsner	Presentation to Norman Wells Alternate Energy Committee
December 15	S. Whiteman	Presentation to the NWT Disability Council
Monthly	C. Sykes	EMO meetings with the Town of Norman Wells Town
	T. Yachemic	

Norman Wells 2010 Engagement Activities

Date	IOR Attendees	Activity
January 28	T. Babiuk	Tours and presentations of IOR's Norman Wells facilities by the SLWB (G. Govier and A. Love)
February 1	J. Murray	Norman Wells town hall meeting on natural gas situation
February 4	S. Whiteman D. Manuel B. Compton	Apprenticeship luncheon, E.C.E., Government of the Northwest Territories (GNWT)
February 5	J. Murray	Norman Wells town hall meeting on natural gas situation
February	D. Nichols	Meeting with town Fire Chief
February	D. Nichols	Meeting with the RCMP
Q1	T. Babiuk	Tours and presentations of IOR's Norman Wells facilities, environmental monitoring class
Q1	R. Powder	Tours and presentations of IOR's Norman Wells facilities for the Mackenzie Mountain School students
April 6	N. Oschner	Sahtu MLA and ministers meeting
May 5	J. Murray P. Sokol	IOR town hall meeting, safety stand down
May 31	J. Murray	Chamber of Commerce open house with First Air
June 1	J. Murray	Chapter 9 Meeting at the Royal Canadian Legion with SSI and Department of Indian Affairs and Northern Development
	T. Babiuk	
	S. Whiteman	
	G. Lammi	
June	J. Brown	EMO Meeting
	D. Nichols	
	T. Babiuk	
July 13	S. Whiteman	Meeting with GNWT on potential funding request from Sahtu
November 9	J. Murray	Norman Wells town hall meeting on natural gas supply
November 23	N. Oschner J. Murray	Report to Norman Wells Town Council
December 14	N. Oschner	Norman Wells town meeting on firearms bylaw and the gas stove survey

Norman Wells 2009 Engagement Activities

Date	IOR Attendees	Activity
January 25	J. Murray	IOR town hall meeting
January 30	I. Newton S. Kimler S. Whiteman	Open house for new establishment (The Red Door)
February 23	J. Murray S. Whiteman	Norman Wells town hall meeting to discuss the 2009 drilling work program
February 25	J. Murray S. Whiteman B. Misener	Northwest Community College (NWCC) meeting on the 2009 drilling work program
February 28	C. Frankemolle	Chamber of Commerce meeting
March 10 and 11		Cultural awareness workshop

Norman Wells 2009 Engagement Activities (cont'd)

March 19	T. Babiuk	EMO meeting
April 1	N. Ochsner	Review of NWT electricity regulations and rates
April 8	J. Murray	NWCC review firearms bylaw and review of IOR's lease area
	S. Whiteman	
	J. Brown	
April 28	J. Murray	Sahtu Secretariat Inc. (SSI) annual Chapter 9 meeting at Norman Wells Legion Hall
	S. Whiteman	
	T. Babiuk	
	N. Ochsner	
	C. Frankemolle	
May 4	J. Murray	Town Meeting on recreation complex
May 5	J. Murray	IOR town hall meeting
	D. Willis	
May 8	D. Nichols	Community consultation group meeting with RCMP
June 19	J. Murray	Tours and presentations of IOR's Norman Wells facilities for diplomats
June 30	J. Murray	Tours and presentations of IOR's Norman Wells facilities for the Fort Good Hope Band Council
August 12	S. Whiteman	Sahtu Regional Leadership meeting on Mackenzie Valley Highway
September 24	S. Whiteman	Attended Sahtu Regional Training Committee meeting
October 14 and 15	S. Whiteman	Attended Sahtu ARDA meeting
November 26	S. Whiteman	Attended Sahtu Regional Training Committee meeting

Appendix G

- **Working Group Minutes and Action Items; 19 November 2014 and 22-24 September 2015**
- **Update Correspondences; March 2015, June 2015 and 8 December 2015**

1. INTRODUCTION

The Closure and Reclamation Plan for Imperial Oil's Norman Wells Operations[1] will be the first for oil and gas projects in the NWT and could serve as a template for other oil and gas companies. Imperial Oil Limited (IOL) is expected to submit its proposed Closure and Reclamation Plan to the Sahtu Land and Water Board (SLWB) by March 2016 as required under Water Licence S13L1-007.

The goals outlined by the Sahtu Land and Water Board for the working group include the following:

- To confirm closure criteria (e.g. CCME, site specific);
- To confirm that Imperial Oil's Closure and Reclamation Plan is scientifically rigorous;
- To incorporate traditional knowledge;
- To ensure that communities understand and support the planned end land use; and
- To assist IOL in the preparation of its closure and reclamation plan.

Collectively, the working group is to provide IOL with suggestions and advice on what is to be included in its Closure and Reclamation Plan (Plan) for the Norman Wells Operations. The working group represents a chance to address concerns held by regulators, communities, land claim organizations, and individuals. The intent is for IOL to participate in the working group to obtain guidance and feedback, and to resolve issues before the review of the Plan for approval by the Sahtu Land and Water Board.

The Closure and Reclamation Plan will outline the physical closure and removal of the Norman Wells Operations, including those on the natural and artificial islands.

2. CLOSURE AND RECLAMATION GUIDELINES

The Land and Water Boards of the Mackenzie Valley developed Closure and Reclamation Guidelines[2] in 2013 for mining. These serve as a template and resource in the development of Imperial Oil's C&R Plan, wherever possible. While the guidelines are specific to mining, they can be adapted to reflect closure and reclamation of the Norman Wells Operations. As an example of the difference between mining and oil and gas, the Diavik Mine impacted 1,400 hectares while the Norman Wells Operations impacted only 140 hectares. The area to be reclaimed by IOL is much less than the average diamond mine.

Imperial Oil Limited (IOL) accepted for its purposes the closure and reclamation goal for advanced exploration and mine sites in the NWT found in the guidelines. This goal was adapted as follows:

> *The closure goal for the Norman Wells Operations is to return the site and affected areas to viable and, wherever practicable, self- sustaining ecosystems that are compatible with a healthy environment and with human activities.*

[1] The Norman Wells Operations consist of a well field, gathering system, central processing facility, and related process and ancillary infrastructure. The well field and gathering system are located on the mainland, natural islands (Bear, Frenchy's and Goose Islands) and six artificial islands in the Mackenzie River.
[2] http://mvlwb.com/sites/default/files/documents/wg/WLWB_5363_Guidelines_Closure_Reclamation_WR.pdf

Further, the four core closure principles from the guidelines are applicable to the Norman Wells Operations and were adopted by IOL; these relate to:

- *Physical stability;*
- *Chemical stability;*
- *No long term active care; and*
- *Future use.*

The members of the working group supported the closure goal and the four principles found in the Guidelines. These are being adopted by IOL for use in its Plan.

ACTION ITEM #1: *IOL will follow an objectives-based approach in developing its Reclamation and Closure Plan for its Norman Well Operations that reflect the closure goal and four principles agreed to by the working group.*

Additionally, seven overall closure and reclamation objectives were presented by IOL to the Working Group, these are:

- Promotion of solutions which benefit the community;
- Protection of worker and public health and safety;
- Promotion of solutions that are economically viable;
- Minimize the use of undisturbed areas (reduce footprint);
- Removal of facilities and infrastructure;
- Attain regulatory compliance; and
- Land and water that is safe for people and the environment.

There was not unanimous support for the seven objectives; some members of the working group felt they are not necessary, as the closure and reclamation goal in the guidelines should suffice. However, it was agreed that the objectives need wide distribution and are to be discussed within the Sahtu communities and with the elders. All need to be "comfortable" with the objectives.

ACTION ITEM #2: *IOL will distribute the overall objectives to the SLWB and also directly to the working group members this one time. The SLWB will post these on its registry and send an email to the working group members confirming their posting. Working Group members are to review the overall objectives with the organizations they represent with comments sent to the SLWB on or before January 15th, 2015. If comments are not heard from any working group member by January 15th, it will be assumed that they are in agreement with the overall objectives.*

Should the overall objectives be agreed to by January 15th, IOL would then proceed to create objectives for each project component.

Working group members were uncertain what some terms being used in the meeting meant. To address this, definitions for commonly used terms will be included in the Plan, (e.g. environment, wildlife, wildlife habitat, etc.)

3. HISTORICAL CLOSURE AND RECLAMATION

Presently, IOL is using an approved Abandonment and Reclamation Plan for its present progressive reclamation at the site.

Past closure and reclamation activities were of interest to the working group. It was noted that previously reclaimed sites may not meet present closure criteria. This led to a request that past closure activities and the closure criteria used at the time be included in the Plan.

Mention was also made of 1975 leases surrendered by IOL. These are thought to be associated with the Canol Project, not with the Norman Wells Operations. A 1944 agreement was also mentioned. IOL believes this is the Proven Area Agreement dated July 21, 1944 between IOL and the Government of Canada but will confirm this at the next meeting.

Action Item #3: *IOL is to report to the working group on any IOL leases surrendered in the mid 1970s and any 1944 agreement.*

The issue of cabins destroyed near Bosworth Creek some time ago was raised. The SLWB pointed out this issue is not within the scope of the SLWB and the working group does not have a goal to get into legal or land tenure issues. The working group does have to consider cultural integrity, which includes historical land use. A definition of "cultural integrity" was not provided.

The eventual fate of the artificial islands was raised. It is thought that they are included in the Sahtu Dene and Metis Comprehensive Land Claim. IOL reviewed the Land Claim and found no mention of the artificial islands.

Bosworth Creek was previously called Oil Creek but its Dene name is not known. Walter Bezha of the Deline Land Corporation asked that the Dene name be sought. Various reports on the early discovery and its development were reviewed but no mention was found of the creek's Dene name. However, the following reference to the initial oil discovery was found:

> *The discovery of the seepages was made in 1911 through J. K. Cornwall of the Northern Trading Company, who sent an Indian named Karkesee to search for them because of his knowledge that float containing oil had been found along the river banks in the area below Fort Norman. From observations that had been made, the general area where the oil-stained rocks originated was suspected. The Indian found small pools of oil in the gravel and later guided Mr. Cornwall to the location*[3]*.*

[3] Hume, G.S. 1954. Geological Survey of Canada Memoir 273. The Lower Mackenzie River Area, Northwest Territories and Yukon.

4. PROGRESSIVE RECLAMATION

Progressive reclamation is an ongoing activity at the Norman Wells operations. The success of bioremediation in treating up to 10,000 cubic metres each year was described. The steps taken include obtaining drill cores and sampling groundwater if present. Analytical results of the soil and groundwater are used to determine if the ground is clean or needs to be remediated. IOL follows guidelines developed by Canadian Council of Ministers of the Environment for petroleum hydrocarbons in soil in deciding which soils require remediation.

No archaeological sites have been discovered to date. If such a site were found, IOL stated that work would stop in that area. An archaeologist would be called in to identify the site, take steps to protect it and, if protection is not possible, undertake its mitigation.

A suggestion was made by a working group member that a representative of a local organization observe and possibly participate in the sampling of soil and groundwater samples. IOL stated it is beneficial to have local participation in reclamation activities.

Pilings cut off at or below ground level continue to rise above the surface over time necessitating they be cut off once more. A working group member wanted a more permanent solution for pilings. It was asked at what depth wells will be cut off on the artificial islands. IOL will follow National Energy Board regulations where the wells are to be cut off below the anticipated scour depth of the river.

Action Item #4: *In its Plan, IOL is to discuss historical closure and reclamation activities such as the decommissioning of the refinery and other infrastructure, and the closure criteria used at the time. The success of progressive reclamation is to be included in the Plan, as is the ongoing assessment of areas scheduled for progressive reclamation. A forecast of progressive reclamation in upcoming years is to be included in the Plan.*

5. CLOSURE CRITERIA

Although the Norman Wells operations date back 100 years, the original state of the land before development will be described in the Plan if possible. Some working group members questioned if the land will be returned to its original state where it would be good for hunting. IOL indicated that assurances cannot be given that the land will be returned to same state as it was 100 years ago. However, IOL does see returning reclaimed land to a use similar to surrounding land.

Closure criteria were briefly discussed at the meeting. IOL mentioned Canadian Council of Ministers of the Environment guidelines for petroleum hydrocarbons in soil and how some areas are to be reclaimed to residential/parkland criteria while other areas to industrial criteria. Closure objectives are expected to be different for various areas of the site; it depends on the end use of the land.

One goal set by the SLWB for the working group is “confirming closure criteria”. This goal remains outstanding for resolution at future meetings of the working group.

6. CLASS 2 LANDFILL

A definition of classes of landfills was provided by AMEC, consultants to IOL. The use of a class 2 landfill was envisaged in calculating the security for the Norman Wells Operations using the RECLAIM model.

There are no class 2 landfills in the NWT at this time. A description of safeguards built into a class 2 landfill were briefly described, with emphasis on controlling leachate, groundwater monitoring, and how water would be kept from entering the landfill. This would isolate the contents of the landfill from the surrounding environment. The potential use of a landfill by IOL in its closure and reclamation plan remains to be discussed in more detail by the working group.

7. COMMUNITY CONSULTATION AND TRADITIONAL KNOWLEDGE

Community consultation and communication of information on the Plan is important. It allows first-hand knowledge to be shared with the communities on what IOL is presently doing and plans to do in closing and reclaiming the site. A working group member stated that more community involvement will lead to better community acceptance of the Plan. It builds trust with the communities and the Dene people.

IOL stated that it supports community involvement. The SLWB requested that IOL undertake community consultation on the Plan. In particular, community consultation will focus on overall and project component objectives, and closure criteria (level of standards) proposed for reclamation. These must be presented and explained in non-technical terms.

While IOL will lead consultations, working group members share in this responsibility in presenting the outcomes of working group meetings and the Plan as it evolves to their organizations and communities.

The inclusion of Traditional Knowledge in the Plan will be respectful, mindful, and with the approval of the local people. Its use will be acknowledged in the Plan. Traditional Knowledge is to be incorporated in the Plan through consideration of the future traditional use of the land following closure. This will ensure that the combination of science and traditional knowledge leads to a Plan that meets the expectations of government, communities and Dene organizations.

8. CLOSURE OPTIONS

Optimal solutions are desired in closing and reclaiming all components of the Norman Wells Operations. The various component closure objectives will support the overall objectives outlined in section 1 of this report.

A high level of detail is needed in closing many site components and each will have its own objectives. Decisions in closing and reclaiming some components may prove to be relatively easy while others that have a high level of complexity will make decisions more difficult. IOL foresees component objectives being weighed by the each working group member in order to reach a decision. This approach will allow an equitable means of reaching a decision even when the opinions of working group members are different. Further details on closure options are expected to form the larger part of the discussions at working group meeting #2.

NWT – ENR supported a logical analysis of the options considered. The working group needs to look at options for all project components and provide feedback to IOL, as well as work together to complete the decision analysis matrices. This evaluation may prove challenging to do as a group.

IOL was asked to include a proposed general closure sequence and how long each will take in the Plan, however, the closure sequence and timing is subject to change. IOL will attempt to provide a sequence of events in the Plan.

Action Item #5: *IOL will identify closure options for components that form part of its Norman Wells Operations at Working Group meeting #2. Reasons for their selection will be substantiated.*

9. Post-Closure Monitoring Programs

Although it is early in the process, IOL listed some proposed post-closure monitoring programs in measuring performance of closure and reclamation activities; these include:

- Surveillance Network Program (SNP) specific to the Closure and Reclamation Plan;
- Groundwater Monitoring Program;
- Geotechnical Inspections; and
- Vegetation Monitoring Program.

10. Next Steps

Before the next meeting of the working group, IOL will use the overall objectives to prepare component objectives for closure options.

IOL recognises that consultation is a required element in preparing its Closure and Reclamation Plan. IOL will conduct consultation with communities and interested organizations as appropriate. Consultations will center on the overall and component objectives.

The date for the next meeting will set by the SLWB in consultation with the working group members. The Plan will have a significant bearing on the town of Norman Wells and they will be encouraged to attend.

S13L1-007 Imperial Oil
Closure and Reclamation Working Group
Attendees Working Group Session #1

Organization	Name	E-Mail
Facilitator	John Witteman	johnwitteman@shaw.ca
GNWT - ENR	Nathan Richea	nathen_richea@gov.nt.ca
GNWT - ENR	Rick Walbourne	rick_walbourne@gov.nt.ca
GNWT - ENR	Laurel McDonald	laurel_mcdonald@gov.nt.ca
GNWT - ENR	Gila Somers (by phone)	gila_somers@gov.nt.ca
AANDC	Michael Roesch	michael.roesch@aandc-aadnc.gc.ca
NEB	Katherine Roblin (by phone)	katherine.roblin@neb-one.gc.ca
FGHRRC	Rodger Boniface	bonifacerodger@hotmail.com
DLRC	Russell Kenny	not given
DRRC	Mitchell Naedzo	mnaedzo28@gmail.com
DLC	Walter Bezha	dlc_lands@gov.deline.ca
DLC	Anthony Neylle	anthony_neylle@gmail.com
NWRRC	Ruby McDonald	nwrrc@nwlc.ca
SRRB	Catarina Owen	eas@srrb.nt.ca
SLWB	Sabrina Sturman	sabrina.sturman@slwb.com
SLWB	Bakutiyor Mukhammabiev	b.mukhammabiev@slwb.com
SLWB	Paul Dixon	paul.dixon@slwb.com
IOL	Heather Hynes	m.heather.hynes@esso.ca
IOL	Ramy Rahbani	Ramy.rahbani@esso.ca
IOL	Ayan Chakraborty	ayan.chakraborty@esso.ca
AMEC	John Mick	john.mick@amec.com
AMEC	Chris Wenzel	chris.wenzel@amec.com
AMEC	Bruce Vincent	bruce.vincent@amec.com

NORMAN WELLS CLOSURE AND RECLAMATION WORKING GROUP MEETING #2 - MINUTES AND ACTION ITEMS

1. INTRODUCTION

The Closure and Reclamation Plan (C&R Plan) for Imperial Oil's Norman Wells Operations[1] will be the first for an oil and gas project in the NWT. Imperial Oil's C&R Plan will outline the physical closure and removal of the Norman Wells Operations, including those on the natural and artificial islands. The C&R Plan is due to the Sahtu Land and Water Board by March 5, 2016 as required under Water Licence S13L1-007.

In 2014 the Sahtu Land and Water Board requested establishment of a Working Group to provide a formal mechanism for meeting with stakeholders interested in development of Imperial Oil's C&R Plan for the Norman Wells Operations. The goals outlined for the Working Group by the Sahtu Land and Water Board include the following:

- To confirm closure criteria (e.g. CCME, site specific);
- To confirm that Imperial Oil's Closure and Reclamation Plan is scientifically rigorous;
- To incorporate traditional knowledge;
- To ensure that communities understand and support the planned end land use; and
- To assist Imperial in the preparation of its closure and reclamation plan.

Collectively, the Working Group is to provide Imperial with suggestions and advice on the contents of its C&R Plan for the Norman Wells Operations. The Working Group represents a chance to address concerns held by regulators, communities, Land Claim organizations, and individuals. The intent is for Imperial to participate in the Working Group to obtain guidance and feedback, and to resolve issues before the review of the Plan for approval by the Sahtu Land and Water Board.

Working Group Meeting #2

The second Working Group Meeting was held September 22-24, 2015 in Norman Wells. The specific purposes of Working Group Meeting #2 were:

- To review the progress made since Working Group Meeting #1 on November 19, 2014
- To provide a forum for an open dialogue among all stakeholders; and
- To acquire feedback and guidance on the next steps of the draft C&R Plan – in light of the March 5, 2016 deadline.

Primary outcomes/products expected for Working Group Meeting #2 were:

1. Agreement and alignment on Objectives and Criteria
2. An understanding of the points that require further refinement and discussion, if there are any

2. CLOSURE AND RECLAMATION GUIDELINES

The Land and Water Boards of the Mackenzie Valley have developed Closure and Reclamation Guidelines[2] in 2013 for mining. The Guidelines serve as a template and resource in the development of

[1] The Norman Wells Operations consist of a well field, gathering system, central processing facility, and related process and ancillary infrastructure. The well field and gathering system are located on the mainland, natural islands (Bear, Frenchy's and Goose Islands) and six artificial islands in the Mackenzie River.
[2] http://mvlwb.com/sites/default/files/documents/wg/WLWB_5363_Guidelines_Closure_Reclamation_WR.pdf

Imperial's C&R Plan, wherever possible. While the guidelines are specific to mining, they can be adapted to reflect closure and reclamation of the Norman Wells Operations.

Imperial accepted for its purposes the closure and reclamation goal for advanced exploration and mine sites in the NWT found in the Guidelines. This goal was adapted as follows in Working Group Meeting #1:

> *The closure goal for the Norman Wells Operations is to return the site and affected areas to viable and, wherever practicable, self- sustaining ecosystems that are compatible with a healthy environment and with human activities.*

Further, Imperial has committed to following an *Objectives-Based Approach* in developing its Closure & Reclamation Plan for its Norman Wells Operation. This commitment addresses Action #1 from Working Group Meeting #1. The *Objectives-Based Approach* includes the establishment of higher level Site-Wide Closure Objectives, with subsequent development of Component-Specific Closure Objectives which further drill down from the Site-Wide Objectives.

Closure Objectives

At Working Group Meeting #2, the Site-Wide Objectives were presented in detail to demonstrate alignment with iterations and provision of feedback facilitated through the Sahtu Land and Water Board in the interim months between Working Group Meetings #1 and #2. Refer to the Presentation deck used at Working Group Meeting #2 for details on this discussion.[3]

The members of the Working Group provided additional feedback and comments on the Site-Wide Objectives, which have been implemented. Imperial will proceed on the basis that the Site-Wide Objectives are acceptable to the Working Group, and that all are in agreement. Refer to the Site-Wide Objectives final version.[4]

After the Working Group reviewed and agreed on the Site-Wide Objectives, several hours were spent on presenting and discussing the Component-Specific Objectives. These are Closure Objectives developed at the level of Closure Component. Components established for the Norman Wells Operations represent Geographic Areas and Infrastructure/Equipment and include: the Mainland, the Natural Islands, the Artificial Islands, Natural Watercourses, Surface Buildings, Infrastructure and Equipment, Subsurface Infrastructure, and Wellbores.

There was good discussion and feedback from the Working Group on the Component-Specific Objectives, with Imperial taking away several follow-ups designed to improve the Component-Specific Objectives document, making it even more robust and specific. Refer to the Component-Specific Objectives draft version.[5]

During the discussion Sahtu Land and Water Board requested that definitions for the commonly-used terms be included in the Objectives, and C&R Plan overall, (e.g. environment, wildlife use, wildlife habitat, etc.) Imperial has agreed to this.

[3] Norman Wells C&R WG #2 – Presentation – 2015.09.23-24 (slides 17-20)
[4] Norman Wells C&R Plan – Site-Wide Objectives – Final
[5] Norman Wells C&R Plan – Component-Specific Objectives - Draft

Action Item #1: *The Sahtu Land and Water Board will post the Component-Wide Closure Objectives on its registry and will send an email to the Working Group members confirming their posting. Working Group members are to review the Component-Wide Objectives, which align with the Site-Wide Objectives previously agreed upon, with the organizations they represent. Comments further to those received at the Working Group session are to be sent to the Sahtu Land and Water Board on or before* ***October 20th, 2015****. If comments are not received from the working group members by this date, then it will be assumed that the Objectives are complete and agreeable, and can be considered Final.*

3. Progressive Reclamation

The Norman Wells Background and Field History was reviewed for the new participants of the Working Group, and as a recap for existing Working Group Members. Then some time was spent discussing Imperial's Progressive Reclamation program. Imperial continues to follow the approved Abandonment and Reclamation Plan for its ongoing Progressive Reclamation program at the Norman Wells Operation. This includes short-term and long-term remediation projects, ongoing remediation systems, biotreating wherever possible, exploring new technologies and their applicability in the Sahtu Region, and returning the land to useful purpose.

4. Artificial Islands

The artificial islands are a matter requiring further discussion from the Closure and Reclamation Working Group. At this time, Imperial is gathering information on the dynamics of the Mackenzie River in order to present data to stakeholders, which will allow an informed decision to be made. The Plan will include the removal of the facilities on the islands, as well as any remediation work that may be required. The reclamation of the islands has yet to be determined before the data can be studied; however the artificial islands are included in the Component-Specific Objectives. It was asked at Working Group Meeting #1 at what depth wells will be cut off on the artificial islands. Imperial will follow National Energy Board regulations, and the wells will to be cut off below the anticipated scour depth of the river.

5. Closure Criteria and End-Land-Use

Imperial is currently remediating and reclaiming the no-longer-operational areas of the land in accordance with the existing Land Use Plan for Norman Wells.[6] The reclaimed land will be consistent with the surrounding land. The following is the proposed Closure Criteria[7], which was discussed at Working Group Meeting #2:

- CCME[8] Parkland/Residential Criteria everywhere, except for mainland lease area
- CCME Industrial Criteria on mainland lease area, as it is currently zoned
- In some cases, site-specific (surrounding) criteria is most appropriate
- Some long-term management areas on Mainland: proposed Long Term Management Facility (LTMF) for impacted soil; remediation systems
- Land to be re-contoured and/or reclaimed as appropriate

[6] http://www.normanwells.com/sites/default/files/community_plan_by-law_13-01.pdf
www.normanwells.com/sites/default/files/04-19_zoning_by-law.doc
[7] Criteria = "Standards that measure the success of selected closure activities in meeting closure objectives" (MVLWB Guidelines)
[8] CCME = Canadian Council of Ministers of the Environment

It was asked that Imperial provide information on CCME criteria in plain language at Working Group Meeting #3, which Imperial has agreed to do.

6. LONG-TERM MANAGEMENT FACILITY (LTMF)

During the Norman Wells Operations site tour, and later review of Imperial's Progressive Reclamation program during the Working Group meeting, it was discussed that there are soils at the Norman Wells Operations unsuitable for the types of treatment currently applied as part of progressive reclamation. Imperial communicated that the C&R Plan for the Norman Wells Operations includes consolidating impacted soils throughout the Proven Area into a single Long Term Management Facility (LTMF) - an engineered landfill for soils.

Working Group discussion on the LTMF included associated opportunities for local and regional businesses. Imperial confirmed that ongoing communications regarding these opportunities have been initiated with the Norman Wells Land Corporation, Norman Wells Renewal Resources Corporation and other stakeholders. These ongoing communications are a key priority for Imperial moving forward.

In response to a question regarding a timeline for the LTMF, Imperial communicated that staged development could begin as early as 2017/2018. The LTMF will be located within the Proven Area, at a site which will be determined in consideration of input from Working Group members.

7. COMMUNITY ENGAGEMENT AND TRADITIONAL KNOWLEDGE

Imperial again presented on its progress talking with community members on the land and learning about their Traditional Knowledge when it is shared. At Working Group Meeting #1, a Working Group member stated that more community involvement will lead to better community acceptance of the C&R Plan. Engagement builds trust with the communities and the Dene people. In the interim months, Imperial has met informally with several members of the communities, discussing ideas and thoughts. These engagement activates have been logged for reference, and will be referenced in the C&R Plan.

In September 2015, the Closure and Reclamation team from Imperial travelled with the Norman Wells Operations team to each of the five Sahtu communities for a series of *Neighbour Night* meetings. The objective was to talk about the Plan with the interested community members, focussing on the project objectives, closure criteria, and reclamation. These meetings were face-to-face in an open forum, and were informal, and non-technical. Several thoughts and ideas were shared, and these have also been logged for C&R Plan purposes.

While the Imperial team will lead community engagement, the Working Group members share in this responsibility in presenting the outcomes of meetings and the Plan as it evolves to their organizations and communities.

The inclusion of Traditional Knowledge in the C&R Plan will be respectful, mindful, and with the approval of the local people. Its use will be acknowledged in the Plan. Traditional Knowledge is to be incorporated in the Plan through consideration of the future traditional use of the land following closure. This will ensure that the combination of science and Traditional Knowledge leads to a Plan that meets the expectations of government, communities and Dene organizations.

8. Closure Mechanism

There was a discussion around the mechanism for Closure in the Northwest Territories. Specifically, given the number of stakeholders and regulatory bodies, as well as the lack of existing precedent, Imperial is seeking information and guidance at this matter. Ultimately, this will enable Imperial to plan its Progressive Reclamation appropriately, with the end goal of conveying completed areas.

> **Action Item #2:** *The regulatory bodies participating in the Working Group have agreed to progress the mechanism for Closure in the Northwest Territories. As the Imperial operations at Norman Wells are the only one of its type, no current formal Closure mechanism exists, and it will be important to formalize this as Imperial approaches its operations' end-of-life in Norman Wells.*

9. Post-Closure Monitoring and Management Programs

Although it is early in the process, there are several proposed post-closure monitoring programs that must be considered in the proposed C&R Plan for measuring performance of closure and reclamation activities. These will also necessarily involve the local people and businesses, including:

- Surveillance Network Program (SNP) specific to the Closure and Reclamation Plan;
- Groundwater Monitoring Program;
- Geotechnical Inspections;
- Management, Operation, and Maintenance of the Long-term Soil Management Facility (LTMF);
- Management, Operation, and Maintenance of the Long-term Remediation Systems;
- Vegetation Monitoring Program.

10. Next Steps

The date for the next meeting was agreed among the Working Group for the week of January 25-29, 2016 – again aligned with the AEMP Working Group. A detailed Agenda for Working Group #3 will be circulated in advance. As discussed during Working Group Meetings #1 and #2, the C&R Plan will have a significant bearing on the town of Norman Wells and all Working Group members will again be encouraged to attend.

Imperial is committed to regular and timely communication, and understands the importance of open dialogue. Interim ideas and feedback are welcome from the Working Group.

Before Working Group Meeting #3, Imperial will forward the draft sections of the C&R Plan that will require review and feedback by the Working Group, in order to meet the deadline for submission of March 5, 2016.

S13L1-007 Imperial Oil
Closure and Reclamation Working Group
Attendees Working Group Session #2

Invited Participants:

- Heather Hynes - Imperial Oil
- Ramy Rahbani - Imperial Oil
- Ayan Chakraborty - Imperial Oil
- Susan Scott - Imperial Oil
- Chris Wenzel – Amec Foster Wheeler
- Rachel Morris– Amec Foster Wheeler
- Paul Dixon - Sahtu Land and Water Board (SLWB)
- Bonnie Bergsma - SLWB
- Laurel McDonald ENR – GNWT
- Rick Walbourne ENR – GNWT
- Stephanie Hughes ENR – GNWT
- Kelly Fischer ENR – GNWT
- Kate Hillman-Barnes - AANDC
- Christopher Aguirre - Transport Canada
- Mark D'Aguiar - DFO
- Katherine Roblin - NEB
- Alec Simpson (or alternate) - Town of Norman Wells
- Sidney Tutcho - Deline RRC
- Ruby McDonald - Norman Wells RRC
- Orlena Modeste - SSI
- Clarence Campbell - Tulita Land Corp
- Walter Bezha - Deline Land Corp
- Isidore Manuel - Yamoga Land Corp
- Sean Rorison - Norman Wells Land Corp
- Kirk Dolphus - Charter Community of Deline
- Robert Kelly - Yamoga Land Corp

Attendees (per sign-in sheet):

- Heather Hynes - Imperial Oil
- Ramy Rahbani - Imperial Oil
- Ayan Chakraborty - Imperial Oil
- Susan Scott - Imperial Oil
- Chris Wenzel – Amec Foster Wheeler
- Rachel Morris– Amec Foster Wheeler
- Paul Dixon - Sahtu Land and Water Board (SLWB)
- Bonnie Bergsma - SLWB
- Laurel McDonald ENR – GNWT
- Rick Walbourne ENR – GNWT
- Stephanie Hughes ENR – GNWT
- Kelly Fischer ENR – GNWT

- Kate Hillman-Barnes - AANDC
- Katherine Roblin - NEB
- Ruby McDonald - Norman Wells RRC
- Orlena Modeste - SSI
- Walter Bezha - Deline Land Corp
- Isidore Manuel - Yamoga Land Corp
- Sean Rorison - Norman Wells Land Corp
- Kirk Dolphus - Charter Community of Deline
- Robert Kelly - Yamoga Land Corp

Not in Attendance:

- Christopher Aguirre - Transport Canada
- Mark D'Aguiar – DFO
- Alec Simpson (or alternate) - Town of Norman Wells
- Sidney Tutcho - Deline RRC
- Clarence Campbell - Tulita Land Corp

M. Heather Hynes, P.Eng.,
Upstream Project Developer
Environmental Services - Imperial
237 Fourth Avenue S.W.
P.O. Box 2480, Station 'M'
Calgary, Alberta, T2P 3M9
m.heather.hynes@esso.ca

March 13, 2015

Bonnie Bergsma, Regulatory Specialist
Sahtu Land and Water Board
P.O Box 1
Fort Good Hope, NT
X0E 0H0

RE: Draft Closure and Reclamation Plan, Norman Wells Operations

Dear Bonnie:

Further to our teleconference on February 24, and the comments that the Sahtu Land and Water Board (SLWB) sent to Imperial on the Closure and Reclamation (C&R) Plan Objectives on January 16, this is a brief update to the Working Group, and it accompanies Imperial's supplementary detail to the Objectives and a draft Table of Contents for the C&R Plan.

The SLWB has suggested that the Objectives that were reached collaboratively at the Working Group session on November 19 are really an expansion of Closure Goals and not really Closure Objectives, as intended by the Closure and Reclamation Guidelines. In an effort to address this, Imperial has prepared the attached supplemental list to the Objectives that the Working Group agreed upon. We have made an effort to follow the examples of Closure Objectives adapted from the Ekati Diamond Mine and Diavik Diamond Mine ICRPs, as recommended by the SLWB.

The team is presently working on a further level of detail, which will be derived from the Component Objectives forthcoming in future weeks. We would like to circulate these to the Working Group in advance of the next meeting so that the members can review and prepare appropriately – and also to feel comfortable discussing the various options and opportunities the next time that we meet as a group.

Imperial is also submitting a proposed Outline of the draft C&R Plan, and requests that this document is made available to the Working Group so the members can become familiar with the structure of what the final document will ultimately look like. It is based on the Table of Contents from the MVLWB/AANDC Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories, November 2013, as required – however we have removed the sections that pertain to mine sites explicitly, and have added sections specific to the Norman Wells operation. We trust that this will be a helpful starting point to the Working Group.

Thank you. We look forward to our next working session.

Regards,

Heather Hynes

M. Heather Hynes, P.Eng.,
Upstream Project Developer
Environmental Services - Imperial
237 Fourth Avenue S.W.
P.O. Box 2480, Station 'M'
Calgary, Alberta, T2P 3M9
m.heather.hynes@esso.ca

December 18, 2015

Bonnie Bergsma, Regulatory Specialist
Sahtu Land and Water Board
P.O Box 1
Fort Good Hope, NT
X0E 0H0

Update #3 RE: Interim Closure and Reclamation Plan, Norman Wells Operations

Dear Bonnie:

In keeping with Imperial's commitment to Working Group participation, we would like to take this opportunity to provide an update on the Norman Wells Operations Interim Closure and Reclamation Plan (Interim C&R Plan) as year-end 2015 approaches.

Imperial has progressed the Interim C&R Plan since Working Group session #2, held in Norman Wells on September 22-24, 2015. The plan is now complete in draft form and will be reviewed and refined over the coming weeks. We are on schedule to submit the Interim C&R Plan to the Sahtu Land and Water Board for approval per the recently clarified March 5, 2016 deadline.

Consistent with Working Group consensus at the wrap-up of the September session, meeting #3 is planned for January 2016. This session is expected to focus on key features of the Interim C&R Plan; however review of the full plan is not a pre-requisite for participation in the meeting. As such, we have attached a Plain Language Summary of the Interim C&R Plan to this letter for review and consideration of Working Group participants prior to the session. This summary constitutes Section 1 of the Interim C&R Plan. It refers to specific sections of the full plan, copies of which will be available for reference during the Working Group session.

Imperial would also like to confirm the timing for Working Group session #3; which is scheduled during the week of January 25, 2016. We request that members of the Working Group advise, by January 8, 2016, of any conflicts that may have arisen since our last meeting. If no feedback is received by this date, travel and booking arrangements will be made for the week of January 25, 2016 as planned.

Imperial's Closure and Reclamation team would like to thank the Working Group members for your work and participation to date and wish you a safe and happy holiday season.

Regards,

Heather Hynes

NORMAN WELLS CLOSURE AND RECLAMATION PLAN WORKING GROUP MEETING #3:

MINUTES AND ACTION ITEMS

INTRODUCTION

Imperial's Interim Closure and Reclamation (C&R) Plan outlines the overall objectives-based planning approach and the physical closure and removal of the Norman Wells Operations, including those on the Natural and Artificial Islands. The C&R Plan is due to the Sahtu Land and Water Board (SLWB) by March 5, 2016 as required under Water Licence S13L1-007, and it will be submitted on schedule.

The Working Group was established in 2014, at the request of the SLWB, to provide a formal mechanism for meeting with stakeholders interested in the development of Imperial's C&R Plan for the Norman Wells Operations. It has been generally agreed that the goals as established by the Working Group at Meeting #1, and used as the foundation for Meeting #2, have been met – or at a minimum, are underway, and will continue to progress as appropriate in the years leading up to shutdown of the Operations:

- ✓ To confirm closure criteria;
- ✓ To confirm that Imperial's Closure and Reclamation Plan is scientifically rigorous;
- ✓ To incorporate Traditional Knowledge;
- ✓ To ensure that communities understand and support the planned end land use; and
- ✓ To assist Imperial in the preparation of its Closure and Reclamation Plan.

Collectively, the Working Group has provided Imperial with suggestions and advice on the contents of its C&R Plan for the Norman Wells Operations. The Working Group has consisted of regulators, communities, Land Claim organizations, and individuals, and the intent was for Imperial to participate in the Working Group to obtain guidance and feedback, and to resolve issues before the review of the Plan for approval by the SLWB.

WORKING GROUP MEETING #3

The third Working Group Meeting was held January 26-27, 2016 in Norman Wells. The specific purposes of Working Group Meeting #3 were:

- To review the Plain Language Summary for the Plan, which was provided in draft form to the Working Group in December, 2015. At Working Meeting #2 in September, 2015, the Working Group members had requested conceptual drawings, diagrams, and photographs to help them to understand and visualize the proposed details of the Plan.
- To provide a forum for an open dialogue among all stakeholders; and
- To acquire feedback and guidance on the draft C&R Plan – in preparation for the final submission on March 5, 2016.

The primary goal of this final Working Group Meeting was to obtain general alignment and support from the Working Group members, including an understanding that this is an interim Plan for a still-operating field, and that there are inevitably areas that require further refinement, stakeholder engagement, and approval over the coming years.

FEEDBACK, GUIDANCE, AND FOLLOW-UPS

GNWT

- Request to make specific note in the Plan that water bodies on the Natural Islands are captured within that closure component (i.e.: to demonstrate they have not been overlooked).

NEB/SLWB

- Request to ensure that the wording for the management of soil treatment (e.g.: biotreatment facility versus Long-Term Management Facility 'LTMF') is clear in the Plan and in the Plain Language Summary.

NEB

- Request for assurance of continuous improvement process, in some form, specifically around the remediation systems, and areas of long-term management.
- Request to determine what – if any – navigational management will be required if the islands are allowed to naturally erode after they are taken out of operation.
- Request to confirm that CCME-Parkland is the appropriate criteria for the artificial islands.

SLWB

- Request for refinement of Closure Options to be noted as iterative in nature, so that opportunities can be reviewed and presented through the process between submission of the interim plan and the final plan.

DFO

- Request to determine whether there is fish habitat around/behind the artificial islands, as well as assess potential downstream fish habitat, to determine what impact there may be if the islands are allowed to naturally erode after they are taken out of operation.

Deline Land Corp

- Request for history to be clearly communicated, particularly as the operation nears its 100-year anniversary. How can we commemorate and thank Mother Earth for 100 years of operation?

Yamoga Land Corp

- Expressed concern for individuals who work at the Operation as the site approaches closure.
- Request for business and work opportunities associated with the remediation and reclamation activities, including training for local people.

The Meeting Minutes from **Working Group #2 on September 22-24, 2015**[1]contain detailed sections on the following:

- Progressive Reclamation
- Artificial Islands
- Closure Criteria
- Proposed Long-term Management Facility (LTMF)
- Community Engagement and Traditional Knowledge
- Closure Mechanism
- Post-Closure Monitoring and Management Programs

Please refer to these for detailed summaries of the discussion and general points of agreement amongst the Working Group members.

[1] http://www.mvlwb.ca/Boards/slwb/Registry/2013/S13L1-007%20-%20Imperial%20Oil%20Resources%20Ltd/S13L1-007%20-%20CR%20Plan%20-%20Minutes%20and%20Action%20Items%20WG2%20-%20Sept%2023_15.pdf

NEXT STEPS

The Working Group is requested to provide any further comments and feedback to Imperial before **February 17, 2016** so we can ensure that any additions or clarifications are included in the submission of the Closure and Reclamation Plan on March 5, 2016.

Pending approval of the Closure and Reclamation Plan by the SLWB, Imperial plans to begin the permitting process for the LTMF. Imperial will also carry on with its current progressive reclamation in 2016. Ongoing C&R planning will also include the study of the Mackenzie River and the modeling of the natural erosion for the Artificial Islands.

CLOSING

Imperial would like to acknowledge members for their contributions to the Working Group. The group's commitment to active participation, a constructive approach, and an atmosphere of honesty, respect and trust has been evident throughout the process. Members have played a critical role in ensuring input in areas of community values and technical expertise related to the C&R Plan have been clearly provided and well-considered. Thank you for your time, interest and involvement to date.

S13L1-007 Imperial Oil
Closure and Reclamation Working Group
Attendees Working Group Session #3

Attendees (per sign-in sheet):

- Paul Dixon - Sahtu Land and Water Board (SLWB) (both days)
- Bonnie Bergsma - SLWB (both days)
- Walter Bezha - Deline Land Corp (both days)
- Isidore Manuel - Yamoga Land Corp (both days)
- Roger Boniface - Yamoga Land Corp/Fort Good Hope RRC (both days)
- Ruby McDonald - Norman Wells RRC (second day)
- Gilly McNaughton - ENR – GNWT (both days)
- Kelly Fischer - ENR – GNWT (both days)
- Laurel McDonald - ENR – GNWT (both days)
- Rick Walbourne - ENR – GNWT (both days)
- Jeff Mercer - AANDC (both days)
- Katherine Roblin - NEB (both days)
- Mark D'Aguiar - DFO (both days)
- Ayan Chakraborty - Imperial Oil (both days)
- Heather Hynes - Imperial Oil (both days)
- Lindsay Hollands - Imperial Oil (both days)
- Susan Scott - Imperial Oil (both days)
- Tobiah Newton - Imperial Oil (both days)
- Cliff Pearson - ExxonMobil (both days)
- Brian Geddes - Amec Foster Wheeler (both days)
- Chris Wenzel - Amec Foster Wheeler (both days)
- Rachel Powell - Amec Foster Wheeler (both days)

Appendix H

Soil Background Data (from Imperial 2015)

APPENDIX D
DETERMINATION OF SOIL GEOCHEMICAL BACKGROUND AND GLOSSARY OF SOIL QUALITY PARAMETERS

1. DETERMINATION OF SOIL GEOCHEMICAL BACKGROUND CONDITIONS

Soil and bedrock analytical results from several Phase 2 Environmental Site Assessments within the Norman Wells Field have indicated that there are concentrations of hydrocarbons, salts and metals in certain stratigraphic units that are naturally elevated above generic federal environmental quality guidelines (CCME 1999 and updates, CCME 2008). Understanding background (pre-industrial disturbance) soil quality is required to determine appropriate site remediation criteria for the Norman Wells Field. This section reviews available data with the objective of determining background soil and bedrock geochemical conditions for the different near surface (i.e. <10 mbgs) stratigraphic units present within the Norman Wells Field.

Shale material from the Town of Norman Wells quarry has been crushed to varying degrees and used as fill material across the Norman Wells Field, to allow construction on the unstable muskeg areas. Further, the underlying siltstone bedrock is at or very close to surface along the lower terrace of the Mackenzie River on the Mainland portion of the Norman Wells Site. Given the potential for the shale and siltstone bedrock to be influencing soil chemistry at this site, bedrock (siltstone and shale) chemical conditions are also summarized herein.

The available data for background soil and bedrock chemistry collected between 1998 and 2012 have been compiled and assessed to confirm maximum reported values, as well as 95th percentile values where sufficient data existed within a specific stratigraphic unit. For the purposes of the Norman Wells environmental assessment programs, soil and bedrock data were summarized into the following general categories/stratigraphic units:

- surface organic soil (generally upper 0.5 m of soil profile);
- surface mineral soil (generally upper 0.5 m of soil profile):
  - mainland; and
  - islands.
- subsurface mineral soil (> 0.5 m below ground surface [bgs] to bedrock contact):
  - mainland; and
  - islands.
- bedrock;
  - mainland (Siltstone); and

– shale (Fill Material from Quarry).

1.1 Available Background Soils Data

The majority of the background soils/bedrock data was collected in 1998, 2003, 2010 and 2012. Data were collected for a range of environmental projects and it is possible that a location considered suitable for background purposes for a groundwater or subsurface soils investigation may not necessarily provide suitable background surface soils data due to disturbance of surface soils, or due to the presence of shale fill material. Only data from those background locations considered to have minimal or no potential industrial impact were included in the attached summary table. Selected background locations are provided in Table App-1A. In addition to the reduced number of locations, not all stratigraphic units were sampled or analyzed at each location. As a result, there is a reduced amount of background data that can be utilized for the specific objectives of this project.

As indicated in Table App-1A, the suitable data set (i.e. number of analyzed samples) for each stratigraphic unit comprised the following:

Stratigraphic Unit	No. of Sampling Locations	No. of Analyzed Samples
Mainland Surface Organic Soil	10	10
Mainland Surface Mineral Soil	5	10
Mainland Subsurface Mineral Soil	20	43
Mainland Siltstone Bedrock	4	8
Mainland Shale Bedrock	4	4
Islands Surface Mineral Soil	5	5
Islands Subsurface Mineral Soil	9	30

There were insufficient samples to characterize Islands Surface Organic Soil, and no bedrock was encountered or sampled during intrusive investigations on the Islands.

The data summarized in Table App-1B (provided in this appendix) have been screened against generic contaminated sites guidelines for fine-grained soils that were selected to be a conservative screening tool for the likely post-industrial use of the Norman Wells Field. Maximum parameter concentrations as well as 95th percentile concentrations have been provided for each stratigraphic unit when sufficient data were available for statistical analysis. This land use assumes Imperial Oil will maintain ownership of the land but will not prevent occasional access by people or wildlife and as such is modified from CCME Industrial and Residential/Parkland land use conceptual models. In general terms, the Industrial land use guidelines were applied to Mainland areas, whereas Residential/Parkland guidelines were applied to the Natural Islands (Bear, Frenchy's and Goose). The majority of the soils assessed at the Norman Wells Site were

determined to be fine-grained, especially on the Mainland and Bear Island. On Goose Island, both coarse- and fine-grained alluvial deposits have been identified.

1.2 Background Soil Chemistry

As noted above, the background data compiled to date for the Norman Wells Field have been compiled by geographic area (Mainland versus Islands) and by general stratigraphic unit as follows: surface organic soil, surface mineral soil, subsurface mineral soil, and bedrock. The first bedrock interval encountered in the subsurface is siltstone, although layers of shale are present deeper in the profile.

1.2.1 Mainland

Surface Organic Soil

Between 1998 and 2012, surface organic soil or peat was sampled at the ten locations noted in Table App-1A. Ten samples were subject to laboratory analysis for some or all of the following general characterization parameters:

- detailed salinity (pH, electrical conductivity [EC], major soluble ions [calcium, sodium, magnesium, potassium, sulphate and chloride], and sodium adsorption ratio [SAR]);
- trace elements and metals (antimony [Sb], arsenic [As], barium [Ba], beryllium [Be], boron [B], cadmium [Cd], chromium [Cr], cobalt [Co], copper [Cu], lead [Pb], mercury [Hg], molybdenum [Mo], nickel [Ni], selenium [Se], thallium [Tl], uranium [U], vanadium [V], and zinc [Zn]);
- petroleum hydrocarbon fractions 1 through 4G (PHC F1 through F4G); and
- benzene, toluene, ethylbenzene and xylenes (BTEX).

Analytical data are summarized in Table App-1B. The analyzed parameters which were measured at concentrations/levels exceeding the generic CCME soil quality guidelines included:

Parameter	Range of Values	95th Percentile Value
EC	0.25 to 2.7 dS/m	2.35 dS/m
As	2.6 to 17.1 mg/kg	16.6 mg/kg
Cr	6.7 to 65 mg/kg	48.5 mg/kg
Cu	5.0 to 98.1 mg/kg	76.2 mg/kg
Mo	1.0 to 46.8 mg/kg	45.4 mg/kg
Ni	11 to 239 mg/kg	231 mg/kg

Parameter	Range of Values	95th Percentile Value
Se	0.53 to 81.6 mg/kg	68.6 mg/kg
Tl	0.15 to 2.5 mg/kg	Not Calculated (NC)
Zn	30 to 435 mg/kg	357 mg/kg

It is also noteworthy that concentrations of one or more BTEX and PHC parameters below the applicable CCME guidelines were present in all of the samples analyzed.

In general, it is not uncommon to find elevated hydrocarbon and metals concentrations in association with peat/organic material at the Site. Metals tend to bond strongly to organic matter, and the lower pH of the peat may also increase metals concentrations in pore water. The elevated EC values are not associated with chloride, a typical indicator of industrial impact. Based on the available data set, it is considered likely that the above listed parameters and concentrations are naturally occurring.

Surface Mineral Soil

The natural soil profile on the Site (excluding muskeg areas) generally consists of a thin organic layer underlain by varying combinations of silts and clays, which are underlain by siltstone bedrock.

Between 1998 and 2012, surface mineral soil was sampled at the five locations noted in Table App-1A. Ten samples were subject to laboratory analysis for some or all of the following general characterization parameters:

- detailed salinity (pH, EC, major soluble ions [calcium, sodium, magnesium, potassium, sulphate and chloride], and SAR);
- trace elements and metals (antimony [Sb], arsenic [As], barium [Ba], beryllium [Be], boron [B], cadmium [Cd], chromium [Cr], cobalt [Co], copper [Cu], lead [Pb], mercury [Hg], molybdenum [Mo], nickel [Ni], selenium [Se], thallium [Tl], uranium [U], vanadium [V], and zinc [Zn]);
- PHC F1 through F4G;
- BTEX compounds; and
- PAH's.

Analytical data are summarized in Table App-1B. None of the analyzed parameters were measured at concentrations/levels exceeding the generic CCME soil quality guidelines for unrestricted land use.

Very low concentrations of PHC F2, F3 and F4 were present in the three samples analyzed for petroleum hydrocarbons. BTEX and PHC F1 concentrations were below the analytical method detection limits.

Although there is a limited background data set for the Mainland Surface Mineral Soil interval, based on the available data, the analyzed parameters and concentrations meet CCME guidelines for unrestricted land use.

Subsurface Mineral Soil

The natural soil profile on the Site (excluding muskeg areas) generally consists of a thin organic layer underlain by varying combinations of silts and clays, which are underlain by siltstone bedrock. The mineral subsurface soil texture ranges from silty clay to loam, and is consistently fine-grained. Permafrost was encountered within the upper 3 m of the soil profile at the majority of background locations, and where a thick organic layer is present, permafrost may be less than 1 m below ground surface.

Between 1998 and 2012, subsurface mineral soil was sampled at the 20 locations noted in Table App-1A. Forty-three samples were subject to laboratory analysis for some or all of the following general characterization parameters:

- detailed salinity (pH, electrical conductivity [EC], major soluble ions [calcium, sodium, magnesium, potassium, sulphate and chloride], and sodium adsorption ratio [SAR];
- trace elements and metals (antimony [Sb], arsenic [As], barium [Ba], beryllium [Be], boron [B], cadmium [Cd], chromium [Cr], cobalt [Co], copper [Cu], lead [Pb], mercury [Hg], molybdenum [Mo], nickel [Ni], selenium [Se], thallium [Tl], uranium [U], vanadium [V], and zinc [Zn];
- petroleum hydrocarbon fractions 1 through 4G (PHC F1 through F4G);
- benzene, toluene, ethylbenzene and xylenes (BTEX); and
- polycyclic aromatic hydrocarbons (PAHs).

Analytical data are summarized in Table App-1B. The analyzed parameters which were measured at concentrations/levels exceeding the generic CCME soil quality guidelines included:

Parameter	Range of Values	95th Percentile Value
pH	6.11 to 8.1	8.1
EC	0.26 to 2.4 dS/m	1.82 dS/m
SAR	0.17 to 22	2.26
As	4 to 49 mg/kg	27.1 mg/kg
Mo	0.2 to 11.0 mg/kg	6.1 mg/kg
Ni	16 to 127 mg/kg	63 mg/kg

Parameter	Range of Values	95th Percentile Value
Se	0.25 to 2.7 mg/kg	1.3 mg/kg
Zn	31 to 350 mg/kg	156 mg/kg

In addition to the above noted guideline exceedances at background locations, concentrations of one or more BTEX and PHC parameters below the applicable CCME guidelines were present in all of the samples analyzed. Maximum reported values for Mainland Subsurface Soil included: Benzene (0.019 mg/kg), Toluene (0.18 mg/kg), Ethylbenzene (0.059 mg/kg), Xylenes (0.34 mg/kg), PHC F1 (21 mg/kg), PHC F2 (72 mg/kg), PHC F3 (530 mg/kg) and PHC F4 (220 mg/kg). The naturally occurring levels of PHC F3, in particular, should be considered when determining appropriate soil remediation objectives relative to background conditions.

In general, it is not uncommon to find elevated select hydrocarbon and metals concentrations in association with mineral subsurface soil at the Mainland portion of the Site. The few locations with EC values above CCME Parkland guidelines are not associated with chloride, a typical indicator of industrial impact. Based on the available data set, it is considered likely that the above listed parameters and concentrations are naturally occurring.

1.2.2 Islands

Surface Mineral Soil

Due to the relatively small background soil chemistry data set for the Islands, and the relative similarity between samples collected on Bear and Goose Islands, the data were pooled for a resulting five surface mineral soil sampling points (Table App-1A). Five samples from these locations were analyzed for chemical characterization. As the natural islands comprise alluvial deposits, there is significant variability in the soil texture. The majority of the background soils sampled to date have been fine-grained, with intermittent lenses/layers of coarser sands at depth.

The Island surface soils, particularly on Goose Island, are influenced by ice scouring of the surface soils during spring breakup on the Mackenzie River. Although an organic rich ‘A’ horizon may be present in some non-scoured locations, profile development is relatively limited within these alluvial deposits.

Island mineral surface soil samples were analyzed for some or all of the following general characterization parameters:

- detailed salinity (pH, EC, major soluble ions [calcium, sodium, magnesium, potassium, sulphate and chloride], and SAR);
- trace elements and metals (antimony [Sb], arsenic [As], barium [Ba], beryllium [Be], boron [B], cadmium [Cd], chromium [Cr], cobalt [Co], copper [Cu], lead [Pb], mercury [Hg], molybdenum [Mo], nickel [Ni], selenium [Se], thallium [Tl], uranium [U], vanadium [V], and zinc [Zn]);

- PHC F1 through F4G;
- BTEX compounds; and
- PAH's.

Analytical data are summarized in Table App-1B. The analyzed parameters which were measured at concentrations/levels exceeding the generic CCME soil quality guidelines included:

Parameter	Range of Values	95th Percentile Value
EC	0.49 to 2.9 dS/m	2.7 dS/m

Reported metals concentrations for Island mineral surface soils were within generic guidelines.

In addition to the above noted guideline exceedances at background locations, concentrations of one or more BTEX and PHC parameters below the applicable CCME guidelines were present in all of the samples analyzed. Maximum reported values for Island Surface Soil included: Benzene (0.0025 mg/kg), Toluene (0.01 mg/kg), Ethylbenzene (0.019 mg/kg), Xylenes (0.087 mg/kg), PHC F1 (14 mg/kg), PHC F2 (72 mg/kg), PHC F3 (370 mg/kg) and PHC F4 (140 mg/kg). The naturally occurring levels of PHC F3, in particular, should be considered when determining appropriate soil remediation objectives relative to background conditions.

The few locations with EC values above CCME Parkland guidelines are not associated with chloride, a typical indicator of industrial impact. Based on the available data set, it is considered likely that the above listed parameters and concentrations are naturally occurring.

Subsurface Mineral Soil

Due to the relatively small background soil chemistry data set for the Islands, and the relative similarity between samples collected on Bear and Goose Islands, the data were pooled for a resulting nine subsurface mineral soil sampling points (Table App-1A). Thirty samples from these locations were analyzed for chemical characterization. As the natural islands comprise alluvial deposits, there is significant variability in the soil texture. The majority of the background soils sampled to date have been fine-grained, with intermittent lenses/layers of coarser sands at depth.

Whereas permafrost is often reached within 3 m of ground surface on the mainland locations, permafrost was only reported at one of the island background sampling locations, at 4.3 m below ground surface. Island subsurface mineral soil samples were analyzed for some or all of the following general characterization parameters:

- detailed salinity (pH, electrical conductivity [EC], major soluble ions [calcium, sodium, magnesium, potassium, sulphate and chloride], and sodium adsorption ratio [SAR];