APPENDIX I

GLOSSARY OF TERMS AND DEFINITIONS

GLOSSARY

The following terminology is utilized in this document following the definitions provided in the Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007) and the DDMI Class "A" Water License [License Number: W2007L2-0003])

"A154 Pit": The developed open pit and underground mine workings for the mining of the A154 North and South Kimberlite Pipes.

"A21 Pit": The developed open pit for the mining of the A21 Kimberlite Pipe.

"A418 Pit": The developed open pit and underground mine workings for the mining of the A418 Kimberlite Pipe.

Abandonment: The permanent dismantlement of a facility so it is permanently incapable of its intended use. This includes the removal of associated equipment and structures.

Acid rock drainage: The production of acidic leachate, seepage or drainage from underground workings, pits, ore piles, rockwaste, 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.

Alkalinity: A measure of the buffering capacity of water, or the capacity of bases to neutralize acids.

"Aquatic Effects Monitoring Program": A monitoring program designed to determine the short and long-term effects in the water environment resulting from the Project, to evaluate the accuracy of impact predictions, to assess the effectiveness of impact mitigation measures and to identify additional impact mitigation measures to reduce or eliminate environmental effects.

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 onsite activity.

Baseline: A surveyed condition and reference used for future surveys.

Benign: Having little or no detrimental effect

Berm: A mound of rock or soil used to retain substances or to prevent substances from entering an area.

Best Management Practices: Any program, technology, process, operating method, measure, or device that controls, prevents, removes, or reduces pollution and impact on the environment.

Biodiversity: The variety of plants and animals that live in a specific area.

Bioremediation: The use of micro organisms or vegetation to reduce contaminant levels in soil or water.

Biotite schist: A metamorphic rock containing a significant proportion of biotite (black) mica flakes, which are aligned in one main direction.

Board: The Mackenzie Valley Land and Water Board established under Part 4section 57.1 of the *Mackenzie Valley Resource Management Act*.

Borrow Pit: A source of fill or embanking material.

Canadian Dam Safety Guidelines: The Canadian Dam Association's Dam Safety Guidelines (January 1999) or subsequent approved editions. The scope and applicability of the DSG referred to in this Licence, is presented in Section 1 of the DSG.

Carat: A unit weight for precious stones: 1 carat = 200 mg.

Care and maintenance: A term to describe the status of a mine when it undergoes a temporary shutdown.

Closure: When a mine ceases operations without the intent to resume mining activities in the future.

Closure Criteria: Detail to set precise measures of when the objective has been satisfied.

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.

Construction: Activities undertaken to construct or build any components of, or associated with, the development of the Diavik Diamond Mine.

Contaminant: Any physical, chemical, biological or radiological substance in the air, soil or water that has an adverse effect. Any chemical substance with a concentration that exceeds background levels or which is not naturally occurring in the environment.

Contouring: The process of shaping the land surface to fit the form of the surrounding land.

County rock: The rock surrounding an intrusive igneous rock such as kimberlite.

Criteria: Detail to set precise measures of when an objective has been satisfied.

Cryoconcentration: Concentration of solutes due to exclusion by ice.

Cryosols: An order of mineral or organic soils that generally have permafrost within 1 m of the ground surface and soil layers that are frequently disrupted by freezing.

Cryoturbation: Mixing of soil due to freezing and thawing.

Decommission: The process of permanently closing a site and removing equipment, buildings and structures. Reclamation and plans for future maintenance of affected land and water are also included.

Dewatering: The removal or draw down of water from any water body or from ground water table by pumping or draining.

Diabase: A dark-gray to black, fine-textured igneous rock composed mainly of feldspar and pyroxene.

Dike: Temporary water-retaining structure designed for water control to enable safe open-pit and underground mining.

Dike cutoff wall: Seepage barrier constructed within a dike.

Dike seepage: Any water which passes through a dike.

Discharge: The release of any water or waste to the receiving environment.

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 ground water runoff from land.

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.

"East Island": The large eastern-most island in Lac de Gras.

Ecodistrict: A subdivision of an ecoregion which is characterized by distinctive assemblages of relief, geology, landforms, soils, vegetation, water and fauna.

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 (nonliving) 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 (nonliving) and biotic (living) factors.

Effluent: Treated or untreated liquid waste material that is discharged into the environment from a treatment plant.

End Land Use: The allowable use of disturbed land following reclamation. Municipal zoning and/or approval may be required for specific land uses.

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.

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.

Environmental Management System (EMS): A management system that incorporates environmentally and socially responsible practices into project operations.

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.

Extensometer: An instrument used to monitor ground displacements.

Fish habitat: Areas used by fish for spawning, nursery, rearing, foraging and overwintering.

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.

Geothermal analysis: The analysis of temperature conditions below the ground surface.

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. Consist primarily of course to medium grained sands, gravels, cobbles, and boulders.

Glaciolacustrine deposits: Material moved by glaciers and deposited in glacial lakes. Consist primarily of fine sands, silts and clay.

Ground Thermal Regime: Temperature conditions below the ground surface. A condition of heat losses and gains from geothermal sources and the atmosphere.

Groundwater: All subsurface water that occurs in rocks, soil and other geologic formations that are fully saturated.

Habitat: The place where an animal or plant naturally lives and grows.

Hummock: A bulging mound of soil having a silty of clay core that often develops in wet and/or permafrost conditions and shows evidence of movement due to regular frost action.

Hydrology: The science that deals with water, its properties, distribution and circulation over the Earth's surface.

Hydraulic conductivity: Measure of the capacity of an aquifer to transmit water.

Igneous rock: Rock formed when molten rock cools and solidifies.

Inclinometer: A tilt sensor used to monitor the angle of an object with respect to gravity.

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.

Inukshuk: A stone representation of a person, used as a milestone or directional marker by the Inuit of the Canadian Arctic.

Kame: An irregularly shaped hill or mound composed chiefly of poorly sorted sand and gravel deposited by a sub-glacial stream as an alluvial fan or delta.

Kimberlite: A type of ancient rock that travelled up to the earth's surface where it formed mini-volcanoes.

Kimberlite pipes: Volcanic deposits contained in steep-walled, cone-shaped cylinders.

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.

Lifts: A layer of rock placed to raise the height of a large rock pile.

Metal leaching: The mobilization and migration of metals from underground workings, pitwalls, ore piles, waste rock, tailings, and overburden.

Metal migration: The movement of dissolved metals in flowing water or vapour.

Migration: The movement of chemicals, bacteria, and gases in flowing water or vapour.

Mine design: The detailed engineered designs for all mine components stamped by a design engineer

Mine plan: The plan for development of the mine, including the sequencing of the development.

Mine water: Any water that accumulates in any underground working or open pits.

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.

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 Canada's fisheries resources.

"North Inlet Facility": The containment facility that is constructed within the North Inlet of East Island of Lac de Gras.

“**North Inlet Treatment Facility**: Includes the treatment plant designated for the treatment of waters associated with the North Inlet Facility and mine workings.

Objectives: Objectives describe what select activities are aiming to achieve.

Passive Treatment: Treatment technologies that can function with little or no maintenance over long periods of time.

Pegmatite: A very coarse-grained igneous rock that has a grain size of 20 mm or more;

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 acidy of a solution, related to hydrogen ion concentration; a pH of 7.0 being neutral.

Piezometer: An instrument used to monitor pore water pressure.

Pit water: Water that seeps into and/or is collected within the pit.

Pore water pressure: The pressure of groundwater held within the spaces between sediment particles.

Pore water: The groundwater present within the spaces between sediment particles.

Post-closure: The period of time after closure of the mine.

Processed Kimberlite (PK): Processed material rejected from the process plant after the recoverable minerals have been extracted.

Processed Kimberlite Containment (PKC): A storage area for the kimberlite remaining after diamonds have been removed during processing.

Progressive reclamation: Actions that can be taken during mining operations before permanent closure, to take advantage of cost and operating efficiencies by using the resources available from mine operations to reduce the overall reclamation costs incurred. Progressive reclamation enhances environmental protection and shortens the timeframe for achieving the reclamation objectives and goals.

Project: The Diavik Diamonds Project, a joint venture between Aber Resources Inc. and Diavik Diamond Mines Inc.

Quaternary glaciation: Glaciation that occurred during Quaternary period or the geologic time period from the end of the Pliocene Epoch roughly 1.8-1.6 million years ago to the present.

Reclamation: The process of returning a disturbed site to a condition consistent with the original natural state or one for other productive uses that minimizes any adverse effects on the environment or threats to human health and safety.

Rehabilitation: Activities to ensure that the land will be returned to a form and productivity in conformity with a prior land use plan, including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values.

Remediation: The removal, reduction, or neutralization of substances, wastes or hazardous material from a site in order to minimize any adverse effects on the environment and public safety now or in the future.

Restoration: The renewing, repairing, cleaning-up, remediation or other management of soil, groundwater or sediment so that its 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: Reviewing risk analysis and options 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.

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 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.

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.

Sewage: All toilet wastes and greywater.

“Sewage Treatment Facilities”: Comprises the engineered structures that are designed to contain and treat sewage at the North and South Camps during the construction period, and the main accommodations complex during operations,

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 water body.

Slurry: A mixture of fine rock and water that can be pumped.

Solifluction: The slow creeping of soil down a slope promoted by the presence of permafrost and caused by a combination of frost creep and the downslope movement of wet, unfrozen soil.

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.

Substrate: The material that comprises the bottom of a water body.

Supernatant: The clear liquid that floats about the sediment or precipitate.

Surficial material: Deposits on/at the earth’s surface.

Sump: A catch basin where water accumulates before being pumped elsewhere for storage, treatment or release.

Surface waters: Natural water bodies such as rivers, streams, brooks, ponds and lakes, as well as artificial watercourses, such as drainage ditches and collection ponds.

Sustainable development: The design, development, operation and closure of all mining activities so as to ensure the optimisation of post closure outcomes in terms of social, environmental and economic development needs and expectations.

Tailings: Material rejected from a mill after most of 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 water bodies.

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 shallow pits and depressions caused by selective thawing of ground ice, or permafrost.

Total dissolved solids (TDS): A measure of the amount of dissolved substances in a waterbody:

Total suspended solids (TSS): A measure of the particulate matter suspended in the water column.

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.

Turbidity: The degree of clarity in the water column typically reflected as the amount of suspended particulate matter in a waterbody.

Waste RockWasterock: All unprocessed rock materials produced as a result of mining operations that have no economic value.

Wasterock storage facilities: Includes the engineered facilities for the disposal of rock and till, which are designated as the North and South Wasterock piles.

Water equivalent: Depth of water contained within accumulated snow and ice.

Watershed: A region or area bordered by ridges of higher ground that drains into a particular watercourse or body of water.

Water Table: The level below where the ground is saturated with water.

"Waste Treatment Facilities": Includes all facilities designated for the treatment and/or disposal of waters or wastes, and includes the North Inlet Treatment Facility, the Processed Kimberlite Containment Treatment Facility

Wetland: A swamp. Marsh, bog, fen or other land that is covered by water during at least three consecutive months of the year.

APPENDIX II

LIST OF ACRONYMS

ACRONYMS

Acronym	Description
AEMP	Aquatics Effects Monitoring Program
ARD	acid rock drainage
BHPB	BHP Billiton
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DDMI	Diavik Diamond Mine Inc.
DFO	Department of Fisheries and Oceans (Fisheries and Oceans Canada)
DIAND	Department of Indian Affairs and Northern Development (Indian and Northern Affairs Canada)
DTC	Diavik Technical Committee
EA	Environmental Assessment
EER	Environmental Effects Report
EMAB	Environmental Monitoring Advisory Board
EMPR	Department of Energy Mines and Petroleum Resources
ESWG	Ecological Stratification Working Group
HADD	Harmful alteration, disruption or destruction (of fish habitat)
HSEQMS	Health, Safety and Environment Quality Management Systems
HW	Harry Winston Diamond Limited Partnership
ICRP	Interim Closure and Reclamation Plan
ICRP	Interim Closure and Reclamation Plan
INAC	Indian and Northern Affairs Canada
LSA	Local Study Area
MLch	Metal Leaching
MVLWB	Mackenzie Valley Land and Water Board
NI	North Inlet
NIWTP	North Inlet Water Treatment Plant
NKSL	Nishi Khon-SNC Lavalin
NTU	Nephelometric Turbidity Unit
NWT	Northwest Territories

Acronym	Description
PK	Processed Kimberlite
PKC	Processed Kimberlite Containment
ROM	Run of Mine
RSA	Regional Study Area
SARA	*Species at Risk Act*
SGP	Slave Geological Province
SNP	Surveillance Network Program
TDS	total dissolved solids
TOC	Total Organic Carbon
TSS	total suspended solids
UCAF	Underhand cut and fill
VLC	vegetation/land cover
WKSS	West Kitikmeot Slave Study Society
WLWB	Wek’èezhìi Land and Water Board
WTA	Waste Transfer Area
WWF	World Wildlife Fund
ZOI	Zone of Influence

APPENDIX III

LIST OF ABBREVIATIONS

ABBREVIATIONS

Abbreviation	Description
EBA	EBA Engineering Consultants Ltd.
Golder	Golder Associates Ltd.
Kennecott	Kennecott Canada Inc.
The Mine	Diavik Diamond Mine

APPENDIX IV

LIST OF UNITS AND SYMBOLS

UNITS

Unit	Description
°C	degrees Celsius
° '	degrees, minutes
$\mu g/m^3$	microgram per cubic metre
µS/cm	micro Siemens per centimetre
cm	centimetre
FeSi	ferro-silicon
ha	Hectare
mg/kg	milligrams per kilogram
$mg/dm^2/yr$	milligrams per square decimetre per year
km	kilometre
km^2	square kilometres
km/hr	kilometres per hour
kV	kilovolts
m	metre
masl	metres above sea level
m^3	cubic metres
m^3/day	cubic metres per day
$m^3//s$	cubic metres per second
m/s	metres per second
mg/L	milligrams per litre
ML	Million litres
mm	millimetre
Mm^3	Million cubic m
Mt	Million tonnes (1 tonne = 1,000 kilogram)
NTU	Nephelometric Turbidity Units
%	percent
v	Zonal Velocity Ratio (seismicity)
wt. %	percent by weight
Z_a	Acceleration Related Seismic Zone
Z_v	Velocity Related Seismic Zone
$<$	less than
$>$	greater than

APPENDIX V

DETAILED TABULATION OF CLOSURE OBJECTIVES AND CRITERIA

Table V-1 Closure Objectives and Criteria - Open Pit, Underground and Dike Areas

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
44. Water quality in the flooded pit and dike area that is sustainable for aquatic life.	Table V-8 criteria met.	Post-closure sampling of water quality in previously diked off areas.	N/A	Appendix VI-1
45. Water quality in the flooded pit and dike area that is as similar to Lac de Gras as possible.	▪ Lac de Gras used as final flood water source. ▪ Initial flood rates reduced to limit TSS generation. ▪ Flood water outlet located to limit TSS generation. ▪ Monitoring results indicate that additional settling time would not significantly improve water quality.	Mathematical modeling of water quality during and after flooding. Engineering design of siphon flooding system. Water quality monitoring during and after flooding.	Appendix VIII-5	Appendix VI-1
46. Water quality in the flooded pit area, underground mine and dike area that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.	Table V-6 criteria met.	Post-closure sampling of flooded pit area prior to breaching dikes.	N/A	Appendix VI-1
47. Enhanced lake-wide fish habitat to off-set fish habitat temporarily lost during operations.	Ratio of fish habitat units gains to fish habitat units lost of 1.2:1 or better as per Fisheries Authorization.	Submission of as-built drawings signed by a Professional engineer.	Appendix VIII-7 Appendix VIII-6	Appendix VI-1
48. Safe small craft navigation through pit area.	Breaks in dikes to be a minimum of 30m wide by 2 m deep as per Transport Canada approval.	Submission of as-built drawings signed-off by a Professional engineer.	N/A	Appendix VI-1
49. Pit area, dike area, and islands are safe for use by people and wildlife.	Satisfactory final inspection by a professional engineer.	Area inspected and as-built drawing signed-off by a professional engineer.	N/A	Appendix VI-1
50. Dust levels safe for	Mean TSP concentrations	Post-closure TSP and dust	Appendix VIII-12	Appendix VI-1

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
people, vegetation, aquatic life, and wildlife.	less than 60 ug/m^3 annual and 120 ug/m^3 24 hr maximum acceptable (Canadian Ambient Air Quality Objectives and NWT Ambient Air Quality Standards) or risk-based criteria	deposition/quality measurement.		
51. Dust levels do not affect palatability of vegetation to wildlife.	Monitoring evidence of post-closure wildlife use of area.	Post-closure monitoring of wildlife use in area	N/A	Appendix VI-1
52. Physically stable pit walls, islands and shorelines to limit risk of a failure impacting people, aquatic life or wildlife.	Satisfactory final inspection by a professional engineer.	Area inspected and as-built drawing signed-off by a professional engineer.	N/A	Appendix VI-1
53. Pit fill rate that will not cause adverse effects on water levels in Lac de Gras and Coppermine River.	Water levels in Lac de Gras and Coppermine River remain within natural fluctuations.	Monitoring of fill rate and calculation of change to lake level.	N/A	N/A
54. Pit fill rate that will not cause adverse effects on fish or fish habitat in Lac de Gras and Coppermine River.	Water levels in Lac de Gras and Coppermine River remain within natural fluctuations.	Monitoring of fill rate and calculation of change to lake level.	N/A	N/A
55. Wildlife safe during filling of pits	No mortalities to wildlife VEC caused by filling of pits.	Monitoring of wildlife in pit area during filling.	N/A	Appendix VI-1
56. Underground area is not a source of contamination to groundwater or Lac de Gras.	Decommissioning complies with Canada wide CCME Guidelines (Industrial) for Contaminated Site Remediation or risk-based criteria are met.	Decommissioning Environmental Site Assessment	Appendix VIII-12	N/A

Table V-2 Closure Objectives and Criteria - Wasterock and Till Area

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
23. Surface runoff and seepage water quality that is safe for humans and wildlife.	Human – Table V-7 criteria or risk-based criteria met. Wildlife – Risk-based criteria met.	Post-closure sampling of runoff/seepage at representative locations where human/wildlife consumption is likely.	Appendix VIII-12	Appendix VI-2
24. Surface runoff and seepage water quality that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.	Table V-6 criteria met.	Post-closure sampling of runoff/seepage at locations where seepage/runoff enters Lac de Gras.	N/A	Appendix VI-2
25. Safe passage and use of the area by caribou.	No repeated harm to caribou as a direct result of passage through or use of the area.	Post-closure monitoring of caribou use in area. Post-closure assessment of area hazards to caribou.	N/A	Appendix VI-2
26. Physically stable slopes to limit risk of failure that would impact the safety of people or wildlife.	Satisfactory final inspection by a professional engineer	Area inspected and as-built drawing signed-off by a professional engineer.	N/A	Appendix VI-2
27. Rock and till pile features (shape and appearance) that match aesthetics of the surrounding natural area, where appropriate.	▪ Maximum pile elevation of 500 m ▪ Surface of native material	Submission of Final As Built drawings.	N/A	NA
28. Re-vegetate rock and till pile where appropriate.	▪ Surface of native material. ▪ Final re-vegetation procedures applied to till pile area. ▪ Change in biodiversity (richness and diversity units) of Regional Study Area less than 1%.	Submission of Final As Built drawings. Post-closure assessment of change in biodiversity.	Appendix VIII-2 Appendix VIII-10	Appendix VI-2

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
29. Dust levels safe for people, vegetation, aquatic life, and wildlife.	Mean TSP concentrations less than 60 *u*g/m^3 annual and 120 *u*g/m^3 24 hr maximum acceptable (Ref 4- Canadian Ambient Air Quality Objectives and NWT Ambient Air Quality Standards) or risk-based criteria	Post-closure TSP and dust deposition/quality measurement.	Appendix VIII-12	Appendix VI-2
30. Dust levels do not affect palatability of vegetation to wildlife.	Monitoring evidence of post-closure wildlife use of area.	Post-closure monitoring of wildlife use in area	N/A	Appendix VI-2
31. Ground surface designed, where appropriate, to drain naturally and follow pre-development drainage patterns to protect water quality, limit erosion and enable safe use by wildlife and people.	▪ Pre-development drainage channels re-established at Ponds 1, 2 and 3. ▪ Satisfactory final inspection of drainage construction by a professional engineer.	Drainage construction inspected and as-built drawing signed-off by a Professional engineer.	N/A	Appendix VI-2
32. No increased opportunities for predation of caribou compared to pre-development conditions.	Caribou predation directly attributable to a landscape feature unique to this area does not result in increased overall predation on the herd.	Post-closure monitoring of wildlife use in area. Post-closure assessment of predation rates.	N/A	Appendix VI-2
33. Areas in and around the site that are undisturbed during operation of the mine should remain undisturbed during and after closure.	Disturbed area of mine footprint less than 13 km^2 post-closure.	Post-closure assessment of final mine footprint size.	N/A	N/A
34. Contaminated soils and waste disposal areas that cannot contaminate land and water.	Remediation complies with Canada wide CCME Guidelines (Industrial) for Contaminated Site Remediation or risk-based	Post-closure Environmental Site Assessment Post-closure sampling of runoff/seepage/soil at	Appendix VIII-12	Appendix VI-2

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
	criteria are met.	representative locations where human/wildlife consumption of water/vegetation/soil is likely.		

Table V-3 Closure Objectives and Criteria - Processed Kimberlite Containment Area

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
35. Surface runoff and seepage water quality that is safe for humans and wildlife.	Human – Table V-7 criteria or risk-based criteria met. Wildlife – Risk-based criteria met	Post-closure sampling of runoff/seepage at representative locations where human/wildlife consumption is likely.	Appendix VIII-12	Appendix V-3
36. Surface runoff and seepage water quality that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.	Table V-6 criteria met.	Post-closure sampling of runoff/seepage at locations where seepage/runoff enters Lac de Gras.	N/A	Appendix V-3
37. No adverse affects on people, wildlife or vegetation.	Human – Table V-7 criteria or risk-based criteria met. Wildlife – Risk-based criteria met CCME Guidelines (Industrial) for Contaminated Site Remediation met.	Post-closure sampling of runoff/seepage/dust deposition at representative locations where human/wildlife consumption of water/vegetation/dust is likely.	Appendix VIII-12	Appendix V-3
38. Physically stable processed kimberlite containment area to limit risk of failure that would affect safety of people or wildlife.	Satisfactory final inspection by a professional engineer	Area inspected and as-built drawing signed-off by a professional engineer.	N/A	Appendix V-3
39. Safe passage and use of the area by caribou.	No repeated harm to caribou as a direct result of passage through or use of the area.	Post-closure monitoring of caribou use in area. Post-closure assessment of area hazards to caribou.	N/A	Appendix V-3
40. Dust levels safe for people, vegetation, aquatic life, and wildlife.	Mean TSP concentrations less than 60 *u*g/m^3 annual and 120 *u*g/m^3 24 hr maximum acceptable	Post-closure TSP and dust deposition/quality measurement.	Appendix VIII-12	Appendix V-3

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
	(Canadian Ambient Air Quality Objectives and NWT Ambient Air Quality Standards) or risk-based criteria			
41. Dust levels do not affect palatability of vegetation to wildlife.	Monitoring evidence of post-closure wildlife use of area.	Post-closure monitoring of wildlife use in area. Post-closure assessment of wildlife use of area.	N/A	Appendix V-3
42. Ground surface designed, where appropriate, to drain naturally and follow pre-development drainage patterns to protect water quality, limit erosion and enable safe use by wildlife and people.	▪ Pre-development drainage channels re-established at Ponds 4, 5 and 7. ▪ Satisfactory final inspection of drainage construction by a professional engineer.	Drainage construction inspected and as-built drawing signed-off by a Professional engineer.	N/A	Appendix V-3
43. Prevent processed kimberlite from entering the surrounding terrestrial and aquatic environments.	▪ A rock cover constructed over PK material. ▪ Filter drain constructed. ▪ Satisfactory final inspection of cover and filter drain construction by a professional engineer.	Cover and filter drain construction inspected and as-built drawing signed by a Professional engineer.	N/A	Appendix V-3

Table V-4 Closure Objectives and Criteria - North Inlet Area

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
57. Reconnect the north inlet with Lac de Gras if possible, depending on sediment quality.	North inlet east dam deconstructed to leave a minimum 30m wide by 2 m depth of water opening.	Ecological risk assessment of NI sediment quality prior to deconstructing dam. Submission of as-built drawings signed by a professional engineer.	Appendix VIII-9	N/A
Objectives if reconnection is not possible				
58. Water quality in the north inlet that is safe for humans and wildlife.	▪ Human – Table V-7 criteria or risk-based criteria met. ▪ Wildlife – Risk-based criteria met.	Post-closure sampling of north inlet water.	Appendix VIII-12	N/A
59. The North Inlet will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.	Table V-6 criteria met.	Post-closure sampling of any North Inlet water discharged to Lac de Gras.	N/A	N/A
60. The north inlet will not cause adverse effects on wildlife or people.	Satisfactory final inspection of area by a professional engineer.	Final landscape inspected and submission of an as-built drawing signed by a Professional engineer.	N/A	N/A
61. Fish will not be able to enter the north inlet.	Construction of permeable rock fill section in the east dam. Satisfactory final inspection of construction by a professional engineer.	Permeable rock fill construction inspected and as-built drawing signed by a Professional engineer submitted.	N/A	N/A
Objectives if reconnection is possible				
62. Water quality and sediment quality in the	Reconnection is possible	Ecological risk assessment of NI sediment quality prior	Appendix VIII-9	N/A

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
north inlet that is safe for aquatic life, wildlife, and people.		to deconstructing dam.		
63. Suitable fish habitat in the north inlet.	Reconnection is possible	Ecological risk assessment of NI sediment quality prior to deconstructing dam.	Appendix VIII-9	N/A
64. Water quality in the north inlet that is as similar to Lac de Gras as possible.	Monitoring results indicate that drawing more Lac de Gras water into the NI and treating and releasing more NI water will not significantly improve water quality.	Monitoring change in NI water quality over time.	N/A	Appendix VI-4
65. Water and sediment quality in the North Inlet that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.	Table V-6 criteria met.	Post-closure sampling of any North Inlet water discharged to Lac de Gras.	N/A	Appendix VI-4
66. The north inlet is safe for humans and wildlife.	Satisfactory final inspection of area by a professional engineer.	Final landscape inspected and submission of an as-built drawing signed by a Professional engineer.	N/A	Appendix VI-4
Other North Inlet Objectives				
67. Physically stable banks of the north inlet (and any modification to the north inlet dam) to limit risk of failure that would impact the safety of people or wildlife.	Satisfactory final inspection of area by a professional engineer.	Final landscape inspected and submission of an as-built drawing signed by a Professional engineer.	N/A	Appendix VI-4
68. Dust levels safe for people, vegetation, aquatic life, and wildlife.	Mean TSP concentrations less than 60 ug/m^3 annual and 120 ug/m^3 24 hr maximum acceptable (Ref 4- Canadian Ambient Air	Post-closure TSP and dust deposition/quality measurement.	Appendix VIII-12	Appendix VI-4

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
	Quality Objectives and NWT Ambient Air Quality Standards) or risk-based criteria			
69. Dust levels do not affect palatability of vegetation to wildlife.	Monitoring evidence of post-closure wildlife use of area.	Post-closure monitoring of wildlife use in area. Post-closure assessment of wildlife use of area.	N/A	Appendix VI-4

Table V-5 Closure Objectives and Criteria - Mine Infrastructure Areas

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
9. Surface runoff and seepage water quality that is safe for humans and wildlife.	Human – Table V-7 criteria or risk-based criteria met. Wildlife – Risk-based criteria met	Post-closure sampling of runoff/seepage at representative locations where human/wildlife consumption is likely.	Appendix VIII-12	Appendix VI-5
10. Surface runoff and seepage water quality that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.	Table V-6 criteria met.	Post-closure sampling of runoff/seepage at locations where seepage/runoff enters Lac de Gras.	N/A	Appendix VI-5
11. Opportunities for communities to re-use infrastructure, where appropriate, allowable under regulation and where liability is not a significant concern.	Conditions of Socio-Economic Monitoring Agreement and Participation Agreements met.	Third-party post closure audit to confirm.	N/A	N/A
12. A final landscape guided by pre-development conditions.	▪ Surface of scarified native material. ▪ Disturbed area of mine footprint less than 13 km^2 post-closure. ▪ Final re-vegetation procedures applied to mine infrastructure areas. ▪ Change in biodiversity (richness and diversity units) of Regional Study Area less than 1%. ▪ No surface visible buildings, equipment or non-local materials.	Submission of Final As Built drawings. Post-closure assessment of change in biodiversity. Post-closure assessment of final mine footprint.	Appendix VIII-2 Appendix VIII-10	Appendix VI-5
13. A final landscape that is safe for people and wildlife.	Satisfactory final inspection by a professional engineer.	Area inspected and as-built drawing signed by a professional engineer.	N/A	NA

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
14. Landscape features (topography and vegetation) that match aesthetics and natural conditions of the surrounding natural area, where appropriate.	▪ Surface of scarified native material. ▪ Disturbed area of mine footprint less than 13 km^2 post-closure. ▪ Final re-vegetation procedures applied to mine infrastructure areas. ▪ Change in biodiversity (richness and diversity units) of Regional Study Area less than 1%. ▪ No surface visible buildings, equipment or non-local materials.	Submission of Final As Built drawings. Post-closure assessment of change in biodiversity. Post-closure assessment of final mine footprint.	Appendix VIII-2 Appendix VIII-10	Appendix VI-5
15. On-site disposal areas are safe for people, wildlife, and vegetation.	Risk-based criteria are met. CCME Guidelines (Industrial) for Contaminated Site Remediation met.	Post-closure sampling of runoff/seepage/soil at representative locations where human/wildlife consumption of water/vegetation/soil is likely. Post-closure Environmental Site Assessment of on-site disposal area.	Appendix VIII-12	Appendix VI-5
16. Ground surface designed, where appropriate, to drain naturally and follow pre-development drainage patterns to protect water quality, limit erosion and enable safe use by wildlife and people.	▪ Pre-development drainage channels re-established at Ponds 10, 11, 12 and 13. ▪ Two pre-development drainage channels re-established in airstrip. ▪ Satisfactory final inspection of drainage construction by a professional engineer.	Drainage construction inspected and as-built drawing signed-off by a Professional engineer.	N/A	Appendix VI-5

Closure Objective	Closure Criteria	Actions - Measurements	Reclamation Research Reference	Monitoring Reference
17. Safe passage and use for caribou and other wildlife.	No repeated harm to caribou as a direct result of passage through or use of the area.	Post-closure monitoring of caribou use in area. Post-closure assessment of area hazards to caribou.	N/A	Appendix V-5
18. No increased opportunities for predation of caribou compared to pre-development conditions.	Caribou predation directly attributable to a landscape feature unique to this area does not result in increased overall predation on the herd.	Post-closure monitoring of wildlife use in area. Post-closure assessment of predation rates.	N/A	Appendix VI-5
19. Dust levels safe for people, vegetation, aquatic life, and wildlife.	Mean TSP concentrations less than 60 ug/m^3 annual and 120 ug/m^3 24 hr maximum acceptable (Canadian Ambient Air Quality Objectives and NWT Ambient Air Quality Standards) or risk-based criteria	Post-closure TSP and dust deposition/quality measurement. Post-closure assessment of TSP and dust levels.	Appendix VIII-12	Appendix VI-5
20. Dust levels do not affect palatability of vegetation to wildlife.	Monitoring evidence of post-closure wildlife use of area.	Post-closure monitoring of wildlife use in area	N/A	Appendix VI-5
21. Areas in and around the site that are undisturbed during operation of the mine should remain undisturbed during and after closure.	Disturbed area of mine footprint less than 13 km^2 post-closure.	Submission of Final As Built drawings. Post-closure assessment of final mine footprint.	N/A	N/A
22. Prevent infrastructure from contaminating land or water.	Remediation complies with Canada wide CCME Guidelines (Industrial) for Contaminated Site Remediation	Post-closure Environmental Site Assessment	N/A	N/A

Table V-6 Closure water quality criteria for waters entering Lac de Gras.

Parameter	Units	Criteria
Total suspended solids	mg/L	92
Turbidity	NTU	46
Total ammonia	mg/L	49.8
Nitrite	mg/L	1.31
Total phosphorus	kg/yr	1000
Aluminum (dissolved)	mg/L	0.179
Arsenic	mg/L	0.110
Cadmium	mg/L	0.0015
Copper	mg/L	0.0207
Chromium	mg/L	0.0292
Lead	mg/L	0.0184
Manganese	mg/L	1.11
Molybdenum	mg/L	1.64
Nickel	mg/L	0.437
Selenium	mg/L	0.0207
Uranium	mg/L	2.3
Zinc	mg/L	0.552
pH		5.0 to 8.4
Acute toxicity		LC50 >100

Sources:

1. Table 2 Comparison of Effects-Based EQCs to BATT-Based EQCs (Technical Advisory Committee April 2000).
2. Water License WL2007L2-0003.

Table V-7 Closure water quality criteria for drinking water.

Parameter	Units	Criteria
Total dissolved solids	mg/L	500
Chloride	mg/L	250
Sodium	mg/L	200
Sulphate	mg/L	500
Nitrate	mg/L	10
Aluminum (total)	mg/L	0.1/0.2
Antimony	mg/L	0.006
Arsenic	mg/L	0.005
Barium	mg/L	1
Cadmium	mg/L	0.005
Copper	mg/L	1.0
Chromium	mg/L	0.05
Iron	mg/L	0.3
Lead	mg/L	0.01
Manganese	mg/L	0.05
Mercury	*u*g/L	1
Molybdenum	mg/L	0.25
Selenium	mg/L	0.01
Thallium	mg/L	0.0017
Uranium	mg/L	0.02
Zinc	mg/L	5
pH		6.5 to 8.5

Source: Table 4.3-11 Revised Water Quality Benchmarks for Parameters Measured during the AEMP (DDMI December 2007).

Table V-8 Closure water quality criteria for Lac de Gras – Aquatic Life

Parameter	Units	Criteria
Total suspended solids	mg/L	+5 (24hr to 30 Days) +25 (24hr period)
Chloride	mg/L	230
Total ammonia	mg/L	4.73
Nitrate	mg/L	30.1
Nitrite	mg/L	0.06
Total phosphorus	mg/L	0.005
Aluminum (dissolved)	mg/L	0.088
Arsenic	mg/L	0.05
Cadmium	mg/L	0.0001
Copper	mg/L	0.002
Chromium (Cr vi)	mg/L	0.001
Iron	mg/L	0.3
Lead		0.001
Mercury	*u*g/L	0.026 (inorganic) 0.004 (methyl)
Molybdenum	mg/L	0.073
Nickel	mg/L	0.025
Selenium	mg/L	0.001
Thallium	mg/L	0.0008
Zinc	mg/L	0.03
pH		6.5 to 9.0
Dissolved oxygen	mg/L	9.5 (early life stages) 6.5 other life stages

Source: Table 4.3-11 Revised Water Quality Benchmarks for Parameters Measured during the AEMP (DDMI December 2007).

APPENDIX VI

POST CLOSURE MONITORING AND REPORTING

VI-1 Open Pit, Underground and Dike Areas

VI-2 Wasterock and Till Area

VI-3 Processed Kimberlite Containment Area

VI-4 North Inlet Area

VI-5 Mine Infrastructure Areas

Appendix VI-1 Post Closure Monitoring and Reporting - Open Pit, Underground And Dike Areas

DDMI anticipates that there would be two types of post-closure monitoring programs: performance monitoring specific to the open-pit, underground, dike areas and environmental effects monitoring which would include combined effects from all post-closure areas. The scope of the performance monitoring would include:

- Surface water quality in mine areas and depth profiles;
- TSP and dust deposition/quality measurement;
- Geotechnical inspections including observations of subsidence, erosion, thermal condition, etc..; and
- Wildlife use of the area.

In addition to area specific monitoring, environmental effects post-closure would be monitored through a continuation of a Post-Closure Aquatic Effects Monitoring Program in Lac de Gras and a Post-Closure Wildlife Effects Monitoring Program. Monitoring methods would be drawn from the operations monitoring programs and revised along with the monitoring frequency as appropriate to focus on post-closure monitoring questions.

Results of all monitoring and inspections would be documented in post-closure monitoring and inspection reports. These reports would include any recommendations for future corrective actions or changes to monitoring programs.

The anticipated monitoring and reporting schedule for this area is as follows:

Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Performance Monitoring										
Engineering Inspections										
Effects Monitoring										
Reporting										

Appendix VI-2 Post Closure Monitoring and Reporting - Wasterock and Till Area

DDMI anticipates that there would be two types of post-closure monitoring programs: performance monitoring specific to the wasterock and till area and environmental effects monitoring which would include combined effects from all post-closure areas. The scope of the performance monitoring would include:

- Seepage quality and quantity using a system similar to the Surveillance Network Program;
- Geotechnical inspections including observations of settlement, erosion, surface drainage, thermal condition, etc. as described above;
- TSP and dust deposition/quality measurement of any dust generated from the closed wasterock and till area; and
- Wildlife use of the area.

In addition to area specific monitoring, environmental effects post-closure would be monitored through a continuation of a Post-Closure Aquatic Effects Monitoring Program in Lac de Gras and a Post-Closure Wildlife Effects Monitoring Program. Monitoring methods would be drawn from the operations monitoring programs and revised along with the monitoring frequency as appropriate to focus on post-closure monitoring questions.

Results of all monitoring and inspections would be documented in post-closure monitoring and inspection reports. These reports would include any recommendations for future corrective actions or changes to monitoring programs.

The anticipated monitoring and reporting schedule for this area is as follows:

Activity	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Performance Monitoring																					
Engineering Inspections																					
Effects Monitoring																					
Reporting																					

Appendix VI-3 Post Closure Monitoring and Reporting - Processed Kimberlite Containment Area

DDMI anticipates that there would be two types of post-closure monitoring programs: performance monitoring specific to the PKC area and environmental effects monitoring which would include combined effects from all post-closure areas. The scope of the performance monitoring would include:

- seepage and runoff quality and quantity using a system like the Surveillance Network Program;
- TSP and deposition/quality measurement of any dust generated from the closed PKC;
- Geotechnical inspections including observations of settlement, erosion, surface drainage, thermal condition, etc.; and
- Wildlife use of the area.

In addition to area specific monitoring, environmental effects post-closure would be monitored through a continuation of a Post-Closure Aquatic Effects Monitoring Program in Lac de Gras and a Post-Closure Wildlife Effects Monitoring Program. Monitoring methods would be drawn from the operations monitoring programs and revised along with the monitoring frequency as appropriate to focus on post-closure monitoring questions.

Results of all monitoring and inspections would be documented in post-closure monitoring and inspection reports. These reports would include any recommendations for future corrective actions or changes to monitoring programs.

The anticipated monitoring and reporting schedule for this area is as follows:

Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Performance Monitoring	■	■	■	■	■	■				
Engineering Inspections				■	■	■			■	
Effects Monitoring			■			■			■	
Reporting			■	■	■	■			■	

Appendix VI-4 Post Closure Monitoring and Reporting - North Inlet Area

DDMI anticipates that there would be two types of post-closure monitoring programs: performance monitoring specific to the North Inlet area and environmental effects monitoring which would include combined effects from all post-closure areas. The scope of the performance monitoring would include:

- Water and sediment quality using a system similar to the Surveillance Network Program;
- Geotechnical inspections including observations of settlement, erosion, thermal condition, etc.;
- TSP and deposition/quality measurement of any dust generated from the closed North Inlet area; and
- Wildlife use of the area.

In addition to area specific monitoring, environmental effects post-closure would be monitored through a continuation of a Post-Closure Aquatic Effects Monitoring Program in Lac de Gras and a Post-Closure Wildlife Effects Monitoring Program. Monitoring methods would be drawn from the operations monitoring programs and revised along with the monitoring frequency as appropriate to focus on post-closure monitoring questions.

Results of all monitoring and inspection would be documented in post-closure monitoring and inspection reports. These reports would include any recommendations for future corrective actions or changes to monitoring programs.

The anticipated monitoring and reporting schedule for this area is as follows:

Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Performance Monitoring										
Engineering Inspections										
Effects Monitoring										
Reporting										

Appendix VI-5 Post Closure Monitoring and Reporting - Mine Infrastructure Areas

DDMI anticipates that there would be two types of post-closure monitoring programs: performance monitoring specific to mine infrastructure areas and environmental effects monitoring which would include combined effects from all post-closure areas. The scope of the performance monitoring would include:

- Re-vegetation success;
- TSP and dust deposition/measurements of dust generated from mine infrastructure areas;
- Monitoring of levels of reuse, recycle versus landfill;
- Runoff water quality;
- Geotechnical inspections including observations of cracking, erosion, thermal condition, etc.; and
- Wildlife use of the area.

In addition to area specific monitoring, environmental effects post-closure would be monitored through a continuation of a Post-Closure Aquatic Effects Monitoring Program in Lac de Gras and a Post-Closure Wildlife Effects Monitoring Program. Monitoring methods would be drawn from the operations monitoring programs and revised along with the monitoring frequency as appropriate to focus on post-closure monitoring questions.

Results of all monitoring and inspection would be documented in post-closure monitoring and inspection reports. These reports would include any recommendations for future corrective actions or changes to monitoring programs.

The anticipated monitoring and reporting schedule for this area is as follows:

Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Performance Monitoring										
Engineering Inspections										
Effects Monitoring										
Reporting										

APPENDIX VII

EXPECTED COST OF CLOSURE AND RECLAMATION

Appendix VII – Expected Cost of Closure and Reclamation

Diavik will work with Indian and Northern Affairs Canada to reassess the expected cost of closure and reclamation following the approval of this ICRP update. Included in this Appendix is the most recent INAC reassessment based on the 2006 Interim Closure and Reclamation Plan. Diavik understands that outcome of the final reassessment will then be used by the WLWB and INAC to consider the amounts of security provisions required under the Water License, Land Leases and the Environmental Agreement.

Indian and Northern Affairs Canada | Affaires indiennes et du Nord Canada

Box 1500
Yellowknife, NT X1A 2R3

June 21, 2007

Zabey Nevitt
Executive Director
Wek'èezhìi Land and Water Board
#1 4905-48th Street
Yellowknife, NT X1A 3S3

Re: Diavik Diamond Mines Inc. Mine Site Security Reassessment – Information for ICRP Process

Dear Mr. Nevitt:

Indian and Northern Affairs Canada (INAC) made a commitment to provide a security reassessment for the Diavik Diamond Mines Inc. mine site and retained John Brodie of Brodie Consulting Ltd. to perform this review. Mr. Brodie's report is attached for your consideration. Please note that this submission is intended to provide the Wek'èezhìi Land and Water Board (the Board) with information for consideration under the ICRP process. It is not intended that this submission be considered for the draft water licence. INAC apologizes for the delay in providing this information.

The security reassessment is based in part on the Mine Plan as well as the proposed or most recent version of the *Interim Closure and Reclamation Plan* (ICRP) submitted by Diavik on September 29, 2006. It should be noted that this security reassessment may be subject to adjustment in the future in view of the fact that the proposed ICRP has not been formally reviewed by the parties and has not been approved by the Board.

The security reassessment report details the total estimated reclamation liability figures for the years 2007 and 2022 on page 8. These total figures are then separated into land related liability and water related liability estimates:

YEAR	TOTAL LIABILITY	LAND RELATED LIABILITY	WATER RELATED LIABILITY
2007	**$131,472,279**	$25,102,309	$106,369,970
2022	**$133,235,938**	$26,545,614	$106,690,323

As per Part B clause 2 (b) of the current water licence, the water licence security held by INAC will increase by $23 million ($116 million total) in August 2007. INAC currently holds $11.08 million for land lease securities.

INAC is prepared to assist and work with the Board regarding the coordination of land and water security. INAC is also currently considering the potential implications of Mr. Brodie's estimates on the Environmental Agreement security provisions.

INAC trusts that the information enclosed is useful to the Board and INAC looks forward to participating in and receiving further details regarding the Board's intentions for an ICRP process.

Sincerely,

David Livingstone
Director
Renewable Resources and Environment

DIAVIK DIAMOND MINE
RECLAMATION REVIEW
&
COST ESTIMATE

Prepared for:

Indian Affairs & Northern Development
Water Resources Division
Yellowknife, Northwest Territories

Prepared by:

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March, 2007

DIAVIK DIAMOND MINE
LAC DE GRAS, NORTHWEST TERRITORY

RECLAMATION REVIEW
&
COST ESTIMATE

1. INTRODUCTION

This report presents a review of the Interim Closure and Reclamation Plan (ICRP) for the Diavik Diamond Mine, on East Island in Lac de Gras. A cost estimate to carry out the proposed work has also been developed as part of this review. It is expected that this cost estimate will be considered in the security requirements for the project. Separate totals for the land and water-related elements of the estimated reclamation liability are developed.

2. INFORMATION SOURCES

The information sources for this review include the following:

- Interim Closure and Reclamation Plan (ICRP) – Version 2, Diavik Diamonds Mine Inc. (DDMI), September 2006,
- Country Rock And Till Storage – Update Design Report, DDMI, August 2001
- Rock Management Plan – Version 3, DDMI, September 2004,
- Rock, Water and Seepage Management Plan, DDMI,
- Processed Kimberlite Containment Facility – Phase 3 Construction As-Built Report, DDMI, February 2005,
- Waste Management Plan – Operational Phase, DDMI, March 2006,
- Comments from other reviewers on acid rock drainage (ARD), permafrost issues, and geotechnical issues.

In addition, a site inspection was conducted on Aug. 2, 2006.

3. REVIEW OF CLOSURE PLAN

3.1. GENERAL COMMENTS

DDMI has developed the mine substantially as planned during the permitting process. The major modification to the mine plan is the improved waste rock management plan. The site inspection did not identify any unexpected conditions that would result in additional reclamation liability.

3.2. INTERIM CLOSURE & RECLAMATION PLAN

The following sections present a review of the ICRP. Previous reviews (BCL, letter to INAC, Sept. 2002 – Appendix A) have identified concerns with the plan. All of the comments presented then are still valid. Only key concerns and new comments are presented below.

DDMI's ICRP addresses all elements of the mine and, although somewhat lacking in specifics or details, is acceptably comprehensive for this stage of the mine development.

ICRP Section 3.2.1 – Terrestrial Habitat

The mine development has affected a variety of habitats, including;

1. heath/tundra,
2. bog/shallow water/wetlands,
3. riparian shoreline,
4. rock outcrop/boulder.

It is recommended that DDMI identify the area and relative value of these various habitats (possibly in a manner similar to that done for fish habitat in ICRP Section 4.2.2 – last paragraph). The purpose of this would be to identify the amount of high value habitat which should be re-established as part of the reclamation activities.

ICRP Section 5.6 – Processed Kimberlite Containment

It is noted that the percentage of fine processed kimberlite (PK) is greater than expected. This may result in a greater area of unfrozen slimes. Even if the pond area is maintained as small as practical, the high moisture content of the fines will impede the frost penetration. Allowance for covering a greater area with "rock spacer" to contain the expelled pore water may be required. As the mine approaches closure, drilling should be conducted to determine the actual extent of unfrozen material.

ICRP Section 7.6 – Country Rock & Till Storage Areas

The thermal modeling of the NCRP indicates that the zero degree isotherm will be situated immediately on top of the till layer. Progression of the zero degree isotherm into the till could allow solifluction or down slope creep of the rock cover to occur. This concern is greatest for the southwest facing slope which will receive greater solar warming due to its aspect. An allowance for a slightly thicker rock cover may be required on the south slopes over the Type III rock.

The Type II rock is addressed in 7.6.4. DDMI states "On the basis of present assessment, it is anticipated that a till cover will not be required for the Type II rock." What criteria will be used to confirm this prediction?

Caribou access ramps are proposed for the rock piles. Will these be composed of fresh rock placed at the specified locations or by dozing the crest of the rock pile? In either case, it may be necessary to provide a till cap to the ramp as these surfaces will not be compacted like the mine haul roads. Without a layer of fine grain material, the animals may injure their hooves.

Rock and till are to be placed in the South CRTSA. Will these materials be segregated such that the till could be used in reclamation if needed?

Section 8.3.3 – Pit Closure

The median pit water quality (DDMI Water Licence Application) suggests that the flooded pits will have acceptable water quality after flooding, considering the significant dilution which will occur. However, the reported values are sump discharge which includes significant dilution from dike seepage and does not actively flush all ARD zones. What predictive activities are planned to demonstrate final water quality prior to breaching the dikes? What contingency measures could be implemented?

Section 8.7.3 PKC Closure

Hydraulic placement of the coarse PK is planned for filling the PKC pond. This material may be frozen and slightly cohesive. No details are provided as to how the coarse PK will be put into slurry form.

Section 8.9.3 Plant Site

It is assumed that regulatory approval would be obtained for on-site disposal of inert waste (steel, concrete, wood, glass, plastic); subject to a suitable location being identified, development of an appropriate QA/QC for materials being disposed, and a satisfactory cover for the waste. DDMI should develop these details and an estimate of the potential disposal volume.

Section 8.9.4 – Plant Site Closure

It is stated that concrete slabs are to be covered with rock. If available, a till cover may enhance natural or assisted revegetation. There did not appear to be erosion issues in the revegetation trial areas; however, erosion should be considered in the placement of till covers.

Section 10.4.5 – PKC Closure

It is suggested that closure monitoring address the water quality and volume of expelled PK pore water which accumulates in the rock spacer. Due to cryo-concentration, this water could be much more concentrated than the PKC pore water. This water may not ever freeze. Monitoring should verify that all expelled water will be contained. It may be acceptable to remove and treat the expelled water rather than try to contain it.

3.3. SUMMARY OF ICRP REVIEW

There are no major or critical flaws in the ICRP for the Diavik Mine. Although more detail would be beneficial, the plan is acceptable for this stage of the mine development (approximately 14 ½ years of operation remaining). Outstanding issues should be addressed in the next update to the plan. Development and operation of the mine appears to be based upon conservative criteria and detailed engineering. Resolution of the outstanding issues does not seem likely to materially affect the overall reclamation plan or cost.

4. RECLAMATION COST ESTIMATE

4.1. GENERAL

The primary purpose of the assessment presented in this report is to estimate the reclamation liability. This estimate is to form the basis of financial security so that in the event that the company does not fulfill its obligations then the Government is able to do so without any burden to the citizens of Canada.

An estimate of the cost to carry out reclamation of the Diavik Diamond Mine was to be developed for various stages in the mine life. However, as noted below, there is very little difference between the current and the ultimate liability (assuming no progressive reclamation) due to the relatively minor additional liability associated with the A21 pit and rock pile development. Consequently, only the current and ultimate liabilities have been estimated.

These estimates are based on the following assumptions:

- the company goes bankrupt or abandons the property,
- no allowance for progressive reclamation until after it is completed,
- all work is based on independent contractor rates,
- all costs are 2007 Canadian dollars,
- the cost estimate does not include revenue from recovery of assets,
- the mine is developed substantially as planned,
- the estimate does not include costs for catastrophic events such as failure of dams, dikes or dump slopes.

It has been assumed that, should the company abandon the site, an interim receiver would be responsible for the site for a period of 2 years. After this period, government managed care and maintenance would be carried out for period of 3 years in order to carry out final permitting of the closure plan and tendering of contracts for closure work. The closure work is assumed to take an additional 2 years. This elapsed period of 7 years is assumed to be sufficient for freeze back of the waste rock pile such that no ongoing or post-closure collection and treatment of seepage is required.

This estimate generally assumes that the mine construction continues to proceed as proposed. It does not assume departures from plan such as dump construction without set-back on terraces for overall slope stability, expansion of the dumps beyond the indicated limits or significant departures from the current understanding on geochemical issues. Any such departure from the mine plan is likely to increase the reclamation liability.

It is recognized that calculation of the reclamation liability without allowance for progressive reclamation is financially punitive to the company. However, until this work is completed it is still an outstanding liability just like any reclamation which is put off until final closure of the mine. Therefore, financial security should be established to ensure that this work is conducted as proposed.

The estimate has been developed using the RECLAIM model, a spreadsheet developed for DIAND for estimation of mine reclamation costs. The model is based, as much as possible, upon costs from other mine reclamation activities completed in the north.

Detailed comments regarding the specific reclamation measures for each component and the detailed reclamation cost estimate are presented in Appendices C and D, for the years 2007 and 2022. General comments regarding the closure measures and the summary total cost are presented in the following sections.

In keeping with conventional engineering practice, and considering the stage of closure planning and the above uncertainties, this estimate includes a contingency of 20%. A lower contingency would be indicative of a plan based on a comprehensive data base of site specific parameters, detailed engineering, and proven reclamation measures. A brief discussion on the issue of uncertainty at it affects reclamation security is presented in Appendix B.

4.2. MARKET FACTOR PRICE ADJUSTMENT

Since its inception, RECLAIM has been updated annually based upon Canadian Consumer Price Index (CPI) as reported by Statistics Canada, and when new reclamation specific unit cost data is available. However, the recent surge in industrial activity in northern Canada has resulted in construction costs reportedly rising at a very high annual rate. There is virtually no statistical data on northern mining related (and reclamation specific) construction trends for this recent period. Some information from other sources can provide some insight. For example, Statistics Canada (CANSIM Table 327-0039) report that Non-residential building costs for Edmonton (the nearest major center for which data is collected) have risen by 30% over the period 2003 to 2006 (index value rose from 118.4 to 154.4 over 3 years). Examination of the rise in costs for the Giant Mine Care & Maintenance program suggest that costs for labor and equipment (parts) are up by 7 – 8 % over each of the past several years. Considering that northern contractors appear to be at their capacity for providing services, it is likely that contractors are seeking higher profits to conduct work.

It is intended that the estimate presented here will provide a reasonable evaluation of the cost in today's dollars should it be necessary to conduct the work. Considering the above, and recognizing that the cost increase may be short term, this estimate includes a "market factor price adjustment" of 20% to reflect the current economic situation in northern Canada. Should there be a decline in economic activity, this factor may be reduced or eliminated in future assessments of reclamation security.

4.3. ESTIMATED RECLAMATION LIABILITY

The estimated total reclamation liability for the Diavik Diamond Mine is listed by mine component for the years 2007 and 2022 is summarized in Table 1. Details are presented in Appendices C and D.

TABLE 1
ESTIMATED RECLAMATION LIABILITY
DIAVIK DIAMOND MINE

COMPONENT	2007	2022
Open Pits	$325,191	$477,787
Underground	$0	$632,184
PKC	$32,117,360	$32,117,360
Rock Dumps	$23,896,609	$24,287,602
Buildings & Equipment	$15,697,151	$15,697,151
Chemicals & Contam. Soil	$837,430	$837,430
Water Management	$1,114,935	$1,114,935
sub-total	**$73,988,676**	**$75,164,449**
Mob./Demob.	$10,260,412	$10,260,412
Monitoring & Maintenance	$10,228,853	$10,228,853
Market Factor Price Adjustment @ 20%	$14,797,735	$15,032,890
Project Management @ 5%	$3,699,434	$3,758,222
Engineering @ 5%	$3,699,434	$3,758,222
Contingency @ 20%	$14,797,735	$15,032,890
Total Capital Costs	**$131,472,279**	**$133,235,938**

The estimated reclamation liability is separated into costs for land-related reclamation and water-related reclamation. This segregation is generally easy to define. However, in some cases it is not clear and in these instances the segregation is split equally into land and water portions. Table 2 presents the total land and water-related reclamation liability for the years 2007 and 2022.

TABLE 2
ESTIMATED LAND & WATER-RELATED RECLAMATION LIABILITY
DIAVIK DIAMOND MINE

YEAR	TOTAL LIABILITY	LAND RELATED LIABILITY	WATER RELATED LIABILITY
2007	**$131,472,279**	$25,102,309	$106,369,970
2022	**$133,235,938**	$26,545,614	$106,690,323

4.4. COMPARISION TO 1999 SECURTY ESTIMATE

The ultimate reclamation liability presented here is significantly lower than the amount estimated for the 1999 Water Licence ($187 million at end of mine life). Key changes are summarized below:

- Pits

  - Provision for fish habitat construction has been substantially completed in the A154 pit. Furthermore, this liability is assumed to be covered under the Fisheries authorization. Major change is minus $2.75 million
  - Water quality in the pit does not suggest that measures to mitigate ARD upon flooding will be required. Major change is minus $4.65 million.
- U/G
  - Addition of numerous vent raise caps
  - Expanded scope of removal of hazardous materials
  - Major change is plus $0.5 million
- Tailings
  - Re-evaluation of unit costs as short-fall of inert rock has been precluded due to improved waste segregation and assumptions concerning methodology for placement of course PK.
  - Major change is minus $13.2 million
- Rock Piles
  - Change in waste management leading to reduction in area to be covered with till and inert rock.
  - Change in unit costs and reduction in area to be covered.
  - Major change is minus $36.1 million
- Buildings & Equipment
  - Re-evaluation of demolition costs.
  - Inert demolition waste disposed of on-site.
  - Net change is plus $5.0 million.
- Chemicals & Contaminated Soil
  - Reduction in quantity of contaminated soil due to observations of site management practices. Major change is minus $1.5 million
- Water Management
  - Removal of short-term post-closure water treatment from rock pile. Major change is minus $2.96 million
- Mobilization
  - Reduced due to reductions in scope of work in primary reclamation activities. Major change is minus $4.2 million

- Monitoring & Maintenance
    - Scope of post-closure monitoring increased.
    - Addition of interim care and maintenance.
    - Major change is plus $5.4 million.
- Engineering & Project Management
    - Percentage increased from 3% to 5% of direct costs to reflect current industry practice. Net change is nil, due to reduction in direct costs as above.
- Contingency
    - Percentage reduced to 20% from 25% due to site development being conducted substantially as planned with only beneficial improvements (waste rock management). Net change is minus $18.4 million.

4.5. SECURITY DEPOSIT

These estimates of the reclamation liability for the Diavik Mine are expected to be considered in the establishment of a security deposit to be provided by Diavik. Inspections should be conducted to ensure that the development is progressing as planned. Where departures are noted (such as dump instability, short fall in the quantity of non-acid generating waste rock, problems with the water balance or retained water content in the PKC, etc.) it may be appropriate to re-assess the security requirements.

Any substantial changes to the mine development plan may affect the reclamation liability. If changes are proposed, then they should serve as a trigger mechanism for re-assessment of the reclamation liability.

These estimates assume that the company does not carry out any of the proposed progressive reclamation. When the company does complete this work, it may be appropriate to re-assess the reclamation security requirements.

5. CONCLUSIONS

Based on the information reviewed and the above assessment, the following conclusions have been reached.

1. There are no major or critical flaws in the ICRP for the Diavik Mine. Although more detail would be beneficial, the plan is acceptable for this stage of the mine development. A number of minor issues should be addressed in future updates to the plan.
2. The estimated total reclamation liability is:

Year 2007	\$ 131.5 million
Year 2022	\$ 133.2 million

3. A segregation of the reclamation liability into land-related and water-related reclamation activities has been made. The water-related reclamation liability is approximately 80% of the total, and rises from \$106.4 million in 2007 to \$106.7 million in 2022.
4. Regular inspections of the mine operation should be conducted by the Land Administration and Water Resources divisions of DIAND. Departures from the approved mine plan could be trigger points, at the discretion of DIAND, for the re-assessment of the closure liability.

This report presents a review of the reclamation issues and an estimate of the cost for reclamation of the Diavik Diamond Mine. Should there be any questions regarding the approach or conclusion of the report, please contact the undersigned.

Yours truly,
Brodie Consulting Ltd.

M. J. Brodie, P. Eng.

APPENDIX A

REVIEW COMMENTS – September 2002

February 8, 2002

Mr. Sevn Bohnet

Department of Indian Affairs and Northern Development

Water Resources Division

Box 1500

4914 - 50th Street

Yellowknife, NT, X1A 2R3

RE: DIAVIK PROJECT – REVIEW OF UPDATED MINING AND A&R PLANS

Dear Sevn,

Introduction

This report presents a review of the updated mining plans and A & R plan for the Diavik Project. The objectives of this review are to:

1. review the updated reports including:
   - Waste Rock Storage Plan,
   - PKC Plan,
   - Interim A & R Plan,
   - Cost Estimates for Interim & Final Restoration Plan, and,
   - comments from other reviewers as may be provided by DIAND.
2. provide comments on the project plans and the revised objectives of the A & R plan.
3. provide comments on the anticipated approach and scope of the A & R work.
4. provide a brief review and comments on the cost estimate.
5. identify any issues and assumptions with the potential to affect the cost estimate.

An update to the RECLAIM estimate is not required at this time because mining has not commenced.

Information Sources

The following documents were reviewed in preparation of this report:

- Country Rock And Till Storage Updated design Report, August 2001,
- Processed Kimberlite Containment Facility Updated Design Report, Volumes I and II, April 2001
- Interim Abandonment And Restoration Plan, October 2001,
- Cost Estimates For Interim And Final Restoration Plan, August 2001.

There has not been a site inspection associated with this review.

General Comments

Diavik Diamond Mines Inc. (Diavik) has made several significant modifications to the mine plan, primarily with respect to management of potentially acid generating waste rock. These changes will reduce the environmental risk of the proposed development and the effort required to produce an acceptable closure configuration. The modifications which facilitate progressive reclamation are fully supported in that ultimate closure costs are reduced and there will significant opportunity during operations to evaluate the effectiveness of the closure measures.

Despite the improvements there are still several areas of concern which are described in the following sections.

Review of Country Rock & Till Storage

The design objectives and considerations for the country rock piles are supported. These clear statements provide a good basis for evaluation of any changes to the design of the rock piles, should any be proposed.

A review of the schedule of production of the main rock types suggests that there will always be a surplus of Type I rock in excess of that required to cover the Type III rock. Therefore, premature closure would not require quarrying to produce the necessary cover material.

During the period up to 2007 when the quarry cell is filled, there will be limited opportunity for progressive reclamation of the cell. As was discussed during the permitting phase, construction of the covers on the sides while the internal area is being raised in lifts may prove to be more difficult than expected. No details are provided as to how this work will be conducted. At least the modified mine plan now allows this work to be conducted during the operating period rather than delayed until the end of the mine life. No specifications are provided with respect to moisture content or degree of compaction of the till.

Slope Stability

The potential for creep failure of the foundation was investigated by Diavik. Twelve samples of ice rich soil from 9 boreholes were tested for determination of creep strength. Of these, 2 were from the process plant area, 7 were from the PKC dam areas and 3 were from the north end of the north country rock pile. None were tested from the south-west area of the rock pile. The soil type and ice of the material in this area is similar to that which was tested. The slopes over the quarry in this area are up to 80 m high and 4H:1V. Offsetting this concern is the conservative approach which has been taken by Diavik in evaluating the creep strength of the soils. Therefore the risk of problems is probably low. It would have been better if at least one sample from this area had been tested.

The slope stability objectives for the NCRP are to achieve a minimum factor of safety of >1.3. This objective is appropriate for low to very low risk situations, primarily as it relates to the potential for runout failure from a geotechnical perspective. Failure of sections of the quarry cover over the biotite schist is not a low risk situation with respect to environmental protection. In my opinion, a higher factor of safety, such as >1.5, should be considered for these areas.

Quarry Cover

In the southwest area of the NCRP, there are two additional concerns relating to the till and rock cover. The first relates to the geometry and the second to the thermal stability and potential for solifluction.

Drawings 4200-41D9-4025 to 4027 show the plan view geometry of the NCRP at the years 2008, 2009 and 2013. The geometry and rock management in the SW area of the quarry cell is unclear. In 2008, the top of the schist appears to be at 495 m elevation and horizontal (at 7,152,500N and 534,750E). In 2009, this area is covered to elevation 500 m. However, in 2013 at the same location the top of the cover is about 480 m elevation. The placement of schist and cover material in this area need to be re-assessed to ensure that the final slopes are not too steep or flattened to extend beyond the perimeter road.

A second concern with this area relates to the thermal stability and the potential for solifluction failure of the cover. The thermal modeling indicates that the zero degree isotherm will be situated immediately on top of the till layer. Progression of the zero degree isotherm into the till could allow solifluction or down slope creep of the rock cover to occur.

The thermal modeling of the NCRP and cover is based upon current climatic conditions, not long term scenarios which consider the potential for global warming. In addition, this southwest facing slope at 4H:1V will receive greater solar warming due to its aspect than other sections of the cover (which are mostly north facing or horizontal). This area may have a deeper active layer than an equivalent horizontal surface in the mine area. Finally, some snowmelt and rainwater from the top surface of the NCRP will drain down this slope.

It is possible that the combination of potential thermal factors could cause the zero degree isotherm to be within the till layer. Solifluction could occur, however considering the relatively flat slopes this process is likely to be extremely slow. The risk of degradation of the cover is low. Monitoring of site thermal conditions and progressive reclamation should allow sufficient opportunity for any changes to the design. Modifications do not seem warranted at this time.

Later in the mine life the company should demonstrate that the cover in this area will be stable considering the potential adverse effects of: global warming, direct solar heating, and heating from runoff water. A slightly thicker cover could be required in south west area of the NCRP.

The south country rock pile design is described as conceptual only. This is probably acceptable at this time as construction of this pile will not commence for another 11 years and it is expected to be composed of inert rock. The design objectives for this pile should be the same as for the NCRP.

Review of Processed Kimberlite Containment Facility

Long-term stability of the dams and cover on the PKC are critical to ensuring environmental protection. The design of the PKC is essentially unchanged from the permit application except for changes to dam geometry to accommodate a shorter construction period.

During the permitting stage of the project, a number of issues were identified with respect to water management in the fine PK deposition area. The company has recognized that the requirements for a deeper pond in the winter for inventory of process water below the ice could result in tailings discharge onto the ice during this period. Unless the water management issues with respect to ice formation and beach width can be resolved during operations, it is possible that the pond may be larger than envisioned (as was assumed by the reviewers during the permitting stage).

There is some uncertainty as to the input parameters for the thermal modeling. Page 44 of the PKC design report describes a pond depth of 3.0 to 4.5 m in the center of the PKC. However, on page 53 in the thermal analyses section, a depth of 6 m has been used. If this greater depth occurs then the area of the pond will be much greater. At closure there will be more water, a greater pond depth to infill, a larger volume of expelled water to manage, and possibly greater settlement (which could cause ditch failure). The company should monitor and maintain a record of the pond depth and area with time in order that future adjustments to the closure plan are based upon operating data.

Slope Stability

Slope stability analyses are presented in Section 9 of the PKC design report. It is not clear why different seismic parameters (0.015g to 0.020g) are used for the stability evaluations.

The slope stability analyses have considered frozen, partially thawed and fully thawed cases for the foundation. However, it appears that the center of the slip circles do not allow for the potential of a failure of the toe of the dams under partially or fully thawed cases. An insulating blanket may be required to ensure that the foundation material under the toe remains frozen. The partially and fully thawed analyses should consider seismic conditions as these cases apply to long-term stability.

At closure, the seepage collection dams below the East and West dams should be removed. This will prevent a pool of water forming at the base of the dams which could cause thawing of the ice rich soil in the foundation.

Fine PK Cover

Settlement of the fine PK is expected to be 1.5 to 2.0 m, and possibly up to 4 m once the cover is placed. The design and slope of the runoff ditches on the cover must be carefully planned to ensure that they will continue to perform under the influence of differential settlement. It may be necessary to provide for a drilling investigation prior to placement of the cover in order to determine the extent of the unfrozen slimes. There is no design for the runoff ditches over the PKC cover. The design should demonstrate that frozen conditions will exist below the ditch bottom.

The routing of the spillway from the crest of the West Dam down to Lac de Gras is not shown on the drawings.

It is expected that there will be a discharge of pore water from the slimes area as it freezes. Freezing is anticipated to take 50 to 100 years. Have the thermal analyses considered the effect of the depressed freezing point of the pore water?

The volume of expelled pore water will depend upon the extent of unfrozen material, which in turn will depend on the pond area during operations. No calculations are presented as to the volume of expelled water and the contingency to be provided in the volume of the rock spacer. No details are provided in regards to the proposal to install wells for withdrawal of the initially expelled water. This concept should be more fully developed before it is considered as a viable reclamation strategy.

Future information should identify the number of wells, their location, pump capacity and plans for treatment of the expelled water. This water is likely to be elevated in dissolved constituents due to the freeze concentration effect. It may be beneficial to conduct some tests of the cover, water expulsion and well dewatering concept, such as by constructing and dewatering below a similar cover over the material in the on-land dredged sediment area of the NCRP.

There are some differences in the elevations reported for the final cover. Drawing 4200-41D9-3137 indicates the top of the cover at 463.5 m. Drawing 4200-41D9-3188 shows 5 m of rock and a 4 m cover placed over a filled pond at 451 m elevation. There is a 4.5 m difference. How is the cover thickness adjusted for the expected settlement of the slimes?

Review of Interim Abandonment and Restoration Plan

General

The updated Interim Abandonment and Restoration Plan (A & R) presents several improvements over the original plans presented at the permitting stage. The A & R objectives are reasonable and should be supported by DIAND.

The most important of the changes is the modification of the NCRP which requires less cover area and now allows considerable progressive reclamation to be conducted. In addition, the ability to commence construction of the quarry cover while the A418 pit is being excavated allows placement of the till layer with unfrozen material, which reduces the progressive reclamation cost.

Concerns

The A & R plan (nor the PKC or NCRP plans) does not substantiate why different areas have different thickness of till in the cover. In the NCRP the till over the quarry is to be 1.5 m thick. In the PKC it is 1.0 m thick over the pond and 0.5 m over the coarse PK. If these are a reflection of the designers introducing varying degrees of conservatism in consideration of risk, it may be better to increase the thickness of the insulating rock cover rather than the till in critical areas.

Biotite schist may be exposed in the pit walls in the A154 and A418 pits. No measures to manage poor water quality associated with flushing of contaminants from these areas upon pit flooding are described. Only monitoring is proposed. A contingency plan should be developed.

It is proposed that progressive reclamation of the PKC may start in about 2020 when the production rate decreases. This may be impractical depending upon how the water management is conducted. This activity may result in the beach on one side of the pond being elevated with respect to the other. Design of the pond closure must consider the discharge scenario of the final years of operation.

There is no description as to how the North Inlet Water Treatment Plant will be modified at closure to deal with expelled pore water. There is no description as to how the accumulated sediments in the eight collection ponds will be managed at closure.

This A & R plan introduces the plan for a landfill to contain inert waste upon closure. The inert waste would be buried and capped to introduce permafrost, rather than transported off-site for disposal. This is a reasonable modification. Should there be disposal of worn-out mobile equipment in this landfill then a plan for decontamination prior to disposal should be developed.

The proposal for post–closure monitoring of 5 years seems too short. Provision should be made for longer term monitoring of thermally sensitive elements of the closure plan. These include the cover on the Type III rock and PKC pond area.

Note that this review of the A & R plan does not consider the implications of changes in the mine plan which may arise due to the mining of reserves. It is recognized that there are additional reserves and the PKC has been designed with considerable capacity for expansion. Should the minable reserves be increased then a revised A & R plan should be submitted for review.

Review of Cost Estimates For Interim And Final Restoration Plan

Diavik has presented an estimate of the cost of mine closure in a comprehensive document based on the recently updated mine plans. This document clearly presents the company's rationale and approach to the estimation of the closure cost. Figure 13-1 presents visually the anticipated growth in reclamation liability and the effect of the proposed progressive reclamation. Diavik has done a commendable job in preparation of this document.

A few comments regarding the scope and approach are presented as follows. Note that an independent estimate of the cost of closure for the mine development has not been prepared at this time. The comments provided here are intended to give perspective to the estimate prepared by the company.

A key aspect of the Diavik estimate is that the company has provided for management, monitoring and contingency costs for only the difference between the total and the progressive reclamation cost. However, should the company default on the progressive reclamation, then the cost for conducting the progressive reclamation would be low by the amount of these provisions. In other words, for the purpose of estimating reclamation security amounts, these provisions should be added to the liability which is to addressed by progressive reclamation until that reclamation is complete. At any point in time, the reclamation security should be set at an amount sufficient to address all of the outstanding liability assuming that the company does not carry out the progressive reclamation.

The company's approach to calculation of the liability also creates some confusion in presentation of the summary of closure costs. The total cost minus the progressive reclamation credit does not equal the net liability.

It is important to note that the cost to the government would be higher than the total cost calculated by the company if the company fails to carry out the reclamation work. A few factors which cause this are:

- the cover on the rock pile and coarse PK would not be constructed with till and rock which was already loaded on to trucks, the cost of this work would increase by the cost of loading the material,
- there would be additional effort for thawing of the till before it could be excavated,
- there could be other liabilities such as accumulations of hazardous materials.

There should be a provision for engineering costs associated with the reclamation effort. At a minimum, engineering will be required to design the final cover on the PKC pond, thermal assessments, design caps for shafts, design of erosion control measures on the till piles and to carry out surveying of the general reclamation work.

Diavik has proposed a 10% contingency for the reclamation liability estimate. Considering that there are still a number of outstanding issues with respect to the mine and reclamation plans, a larger contingency is appropriate.

Some specific comments relating to the components of the cost estimate are:

- the activities in table 6-2, PKC closure, do not show the cost of the wells and associated water treatment (these may be included in the water management section however those activity descriptions are misleading and do not appear to include the dewatering wells),
- the unit costs for dike breaching around the pits may be low, especially for the work below the mean water level of the lake,
- the rock pile reclamation costs do not include dozing for surface preparation before cover placement or for the caribou ramps,
- the slope contouring allowance for the till piles seems light and becomes zero by the end of the mine life,
- the costs for construction of the channel on the surface of the PKC cover are low and not respective of the effort to construct a thermally stable ditch on a cover which will be subjected to differential settlement,
- there is no allowance for removal and treatment of the PKC supernatant,
- the cost for hydraulically placing coarse PK in the drained PKC pond is low, this operation may be severely affected by ice or frozen material in the placed coarse PK material,
- the demolition equipment cost of only $75/hr is low, a single demolition shear will cost more than $250/hr to operate,
- the cost for removal of contaminated soil is low, (presumably this is for excavation and on-site burial), costs will be higher once on-site engineering and testing costs are included, and the cost of the cap to induce permafrost is added,

- the descriptions in the water management section associated with the NIWTP and monitoring are confusing,
- the total cost for construction management of the reclamation work is about 1% of the total cost, this is low.

Conclusions

Based on the review of the documents provided the following conclusions are presented:

1. Diavik has favorably modified the mine development plans. These modifications have integrated reclamation objectives and issues into the mine plan to reduce environmental risk and closure costs. There is much greater opportunity for progressive reclamation.
2. There are some minor issues to be addressed in the development of the NCRP.
3. Some issues associated with the operation of the PKC pond and the effects on the construction of the PKC cover are still outstanding. These may not be resolvable until after several years of operation. Additional data may need to be collected by drilling in the fine PK area before the cover is constructed.
4. The A & R plan is comprehensive. There are few issues with the proposed reclamation measures.
5. The company's estimate of the anticipated cost for mine closure is well presented. It is thorough and reasonably complete. There are some minor omissions. If it became necessary for the government to carry out the reclamation work, it is likely that the costs would be slightly higher than estimated by the company. This is due to the approach taken by the company in preparing its estimate and the issues identified above.
6. None of the issues identified here seem sufficient to hold up the ongoing development of the project. Resolution of these issues should be pursued through monitoring of the project performance as development and progressive reclamation is carried out.

I trust that this review addresses your current requirements. Please call if you have any questions.

Yours truly,
Brodie Consulting Ltd.

M. J. Brodie, P. Eng.

APPENDIX B

UNCERTAINTY FACTORS
IN
RECLAMATION COST ESTIMATES

Uncertainty and Selection of Contingency in Reclamation Cost Estimates

Modified from: Issues and Methods in Mine Reclamation Cost Estimating, Brodie, 2005.

Uncertainty and selection of an appropriate contingency amount is often the most controversial aspect of rehabilitation security. As with any type of cost estimating process, there is potential for the actual cost to be different from the estimated cost. This arises from a number of factors which introduce uncertainty in the assumed scope and effort of the work. In the case of mine rehabilitation security, uncertainty really means; "What is the likelihood that the actual cost will vary from the estimated cost?"

Factors which may introduce uncertainty into a reclamation cost estimate can be grouped into three broad areas, each of which are described below. It should be recognized that this is not intended to be an exhaustive list. Every mine is a special case and identification and evaluation of uncertainty factors should be conducted on a case by case basis.

Uncertainty factors pertaining to the mine plan consider the:

- Data base of geology and geochemistry (which may result in ARD or metal leaching problems),
- Characterization of critical foundations (such as under dams and waste dumps),
- Application of a new technology or unique application of an existing technology,
- Use of optimistic control strategies (such as blending of acid generating and acid consuming rocks), and,
- Predictions concerning the effectiveness of control measures (such as cyanide degradation in tailings impoundment water).

Uncertainty factors pertaining to the rehabilitation plan are:

- Variability in the extent and type of disturbance at the time of mine closure,
- Expectations for the success of rehabilitation measures, and,
- Potential for difficulty in implementing the closure measures.

Uncertainty factors pertaining to the cost of the rehabilitation work are:

- Cost of equipment, manpower, and consumables such as lime and fuel,
- Duration of time required to complete the work (and the effect on the associated site support costs),
- Availability of qualified contractors to carry out the work.

It is only through consideration of the above factors can the cost estimator select an appropriate contingency. The final determination is still a matter of professional judgment, however the factors described above will help to guide the professional.

APPENDIX C
RECLAMATION COST ESTIMATE
2007

SUMMARY OF COSTS

			YEAR	2,007
COMPONENT TYPE	**COMPONENT NAME**	**TOTAL COST**	**Land Liability**	**Water Liability**
OPEN PIT	A514,A418,A21	$325,191.36	$0	$325,191
UNDERGROUND MINE	0	$0.00	$0	$0
TAILINGS	0	$32,117,360.00	$5,100	$32,112,260
ROCK PILE	0	$23,896,609.00	$1,405,757	$22,490,853
BUILDINGS AND EQUIPMENT	0	$15,697,151.08	$12,715,974	$2,981,177
CHEMICALS AND SOIL MANAGEMENT	0	$837,430.00	$0	$837,430
WATER MANAGEMENT	0	$1,114,934.85	$0	$1,114,935
POST-CLOSURE SITE MAINTENANCE		$0.00	$0	$0
SUBTOTAL		**$73,988,676**	**$14,126,831**	**$59,861,845**
		Percentages	19.1	80.9
MOBILIZATION/DEMOBILIZATION	0	$10,260,412	$1,959,044	$8,301,367
MONITORING AND MAINTENANCE	0	$10,228,853	$1,953,019	$8,275,834
Market Factor Price Adjustment	20 %	$14,797,735	$2,825,366	$11,972,369
PROJECT MANAGEMENT	5 %	$3,699,434	$706,342	$2,993,092
ENGINEERING	5 %	$3,699,434	$706,342	$2,993,092
CONTINGENCY	20 %	$14,797,735	$2,825,366	$11,972,369
GRAND TOTAL - CAPITAL COSTS		**$131,472,279**	**$25,102,309**	**$106,369,970**

1 Open Pit Name: *A514,A418,A2* Pit # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: CONTROL ACCESS								
	Fence	m		#N/A	0	$0		$0	$0
.	Signs	each		#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Berm	m3		#N/A		$0		$0	$0
B	Block roads	m3		#N/A					
.	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: STABILIZE SLOPES			#N/A	0	$0		$0	$0
	excavate 2 breaches in dike	m3	10560	sc1h	7.803	$82,400		$0	$82,400
	break concrete guides & wall	m3	600	brcl	33.66	$20,196		$0	$20,196
.	construct fish habitat	m3	0	sb1h	4.947	$0		$0	$0
.	A 418	m3		#N/A	0	$0		$0	$0
C	excavate 2 breaches in dike	m3	10560	sc1h	7.803	$82,400		$0	$82,400
	break concrete guides & wall	m3	600	brcl	33.66	$20,196		$0	$20,196
.	construct fish habitat	m3	0	sb1h	0	$0		$0	$0
	A21	m		#N/A	0	$0		$0	$0
.	excavate 2 breaches in dike	m3	0	sc1h	7.803	$0		$0	$0
	break concrete guides & wall	m3	0	brcl	33.66	$0		$0	$0
.	construct fish habitat	m3	0	sb1h	4.947	$0		$0	$0
		kWh		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
.				#N/A					
.	OBJECTIVE: COVER/CONTOUR SLOPES			#N/A	0	$0		$0	$0
.	Fill, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
E	Other			#N/A					
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: SPILLWAY			#N/A	0	$0		$0	$0
.	Excavate channel, mat'l A	m3		#N/A	0	$0		$0	$0
	, mat'l B	m3		#N/A				$0	$0
.	Concrete	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
F				#N/A					
.	OBJECTIVE: FLOOD PIT			#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Embankment, mat'l A	m3		#N/A	0	$0		$0	$0
H	, mat'l B	m3		#N/A	0	$0		$0	$0
	siphon installation/operation	each	2	#N/A	50000	$100,000		$0	$100,000
	remove pipes,wires etc	each	2	#N/A	0	$20,000		$0	$20,000
	make milk of lime, meter into pit	tonne		#N/A	0	$0		$0	$0

1 **Open Pit Name:** ***A514,A418,A*** **Pit #** ***1***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
	tonne		ilmh	504.9	$0		$0	$0
	km		mherh	8.5884	$0		$0	$0
OBJECTIVE: BACKFILL PIT			#N/A	0	$0		$0	$0
Fill, mat'l A	m3		#N/A	0	$0		$0	$0
, mat'l B	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
OBJECTIVE: DEVELOP WETLAND			#N/A	0	$0		$0	$0
Earthworks, mat'l A	m3		#N/A	0	$0		$0	$0
, mat'l B	m3		#N/A	0	$0		$0	$0
Vegetate	ha		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
SPECIALIZED ITEMS			#N/A	0	$0		$0	$0
.			#N/A	0	$0		$0	$0
Subtotal					$325,191	0%	$0	$325,191
					Total Pits	Percent Land	Total Land	Total Water

1 Underground Mine Name ____ UG Mine # 1

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: CONTROL ACCESS								
	Fence	m		#N/A	0	$0		$0	$0
.	Signs	each		#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Berm	m3		#N/A	0	$0		$0	$0
.	Block adits	m3		#N/A	0	$0		$0	$0
.	Cap shaft	m3		#N/A	0	$0		$0	$0
.	Cap raises at A154/A418	m3	0	SRL	540.6	$0	100%	$0	$0
	soil cover on raise cap	m3	0	SB1L	3.264	$0	100%	$0	$0
.	Cap raises at A 21	m3	0	SRL	540.6	$0	100%	$0	$0
	soil cover on raise cap		0	SB1L	3.264	$0	100%	$0	$0
.	Backfill adit A154	m3	0	SCSS	16.065	$0	100%	$0	$0
	Contour portal area, A154	m3	0	SB1L	3.264	$0	100%	$0	$0
.	Backfill adit, A21	m3	0	SCSS	16.065	$0	100%	$0	$0
	Contour portal area, A21		0	SB1L	3.264	$0	100%	$0	$0
.	concrete bulkhead, pit portal, A154	allow	0	#N/A	75000	$0	100%	$0	$0
.	concrete bulkhead, pit portal, A21	allow	0	#N/A	75000	$0	100%	$0	$0
.	Backfill open stopes	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
B	OBJECTIVE: STABILIZE GROUND SURFACE								
.	Backfill mine	m3		#N/A	0	$0		$0	$0
.	Collapse crown pillar	m3		#N/A	0	$0		$0	$0
.	Contour, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Maintain dewatering (see "MONITORING/MAINTENANCE" c			#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
C	OBJECTIVE: FLOOD MINE								
.	Plug adits	m3		#N/A	0	$0		$0	$0
.	Plug drillholes to surface	each		#N/A	0	$0		$0	$0
.	Grouting	m3		#N/A	0	$0		$0	$0
.	LIme addition, kg/m3 of water	tonne		#N/A	0	$0		$0	$0
.	Lime, purchase and shipping	tonne		#N/A	0	$0		$0	$0
D	OBJECTIVE: HAZARDOUS MATERIALS								
.	remove hazardous materials, LABOUR	each	0	LLUGGL	35.7	$0	50%	$0	$0
.	remove/decontam. Equipment, electrical	each	0	LUGEL	51	$0	50%	$0	$0
.	Other			#N/A	0	$0		$0	$0
E	SPECIALIZED ITEMS								
.				#N/A	0	$0	0%	$0	$0
	Subtotal					$0	#DIV/0!	$0	$0
						Total U/G	Percent Land	Total Land	Total Water

1 lings Impoundment Name: Impoundment # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: CONTROL ACCESS								
	Fence	m		#N/A	0	$0		$0	$0
.	Signs	each		#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Berm	m3		#N/A	0	$0		$0	$0
.	Block roads	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
B				#N/A	0	$0		$0	$0
.	OBJECTIVE: STABILIZE EMBANKMENT			#N/A	0	$0		$0	$0
.	breach east dam	m3		#N/A	0	$0		$0	$0
.	, fill mat'l A	m3		#N/A	0	$0		$0	$0
.	, fill mat'l B	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
.	Raise crest	m3		#N/A	0	$0		$0	$0
.	Flatten slopes	m3		#N/A	0	$0		$0	$0
C	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: COVER TAILINGS			#N/A	0	$0		$0	$0
	coarse PK, doze to slurry sump	m3	2625000	DSL	0.7956	$2,088,450		$0	$2,088,450
.	coarse PK - slurry pumping	m3	2625000		0.5	$1,312,500		$0	$1,312,500
.	Rock for expelled water from N or S dum	m3	1875000	#N/A	3.6	$6,750,000		$0	$6,750,000
D	Rock for expelled water from roads	m3		#N/A					
.	Rock for expelled water from new quarry	m3		#N/A	8.25	$0		$0	$0
.	Soil cover, till	m3	1416000	#N/A	4.46	$6,315,360		$0	$6,315,360
.	Cover rock from N or S dump	m3	4247000	#N/A	3.6	$15,289,200		$0	$15,289,200
.	Cover rock from roads	m3		#N/A		$0		$0	$0
E	Cover rock from new quarry	m3		#N/A					
.	Remove & treat supernatant	m3	270000	otpl	0.25	$67,500		$0	$67,500
.	OBJECTIVE: FLOOD TAILINGS			#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
F	Raise crest	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: DEVELOP WETLAND			#N/A	0	$0		$0	$0
.	Earthworks, mat'l A	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
G	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: UPGRADE SPILLWAY			#N/A	0	$0		$0	$0
.	Excavate channel, mat'l A	m3	18000	sc3h	10.6	$190,800		$0	$190,800
H	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Concrete	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3	13000	#N/A	5.65	$73,450		$0	$73,450
.	geotextile over ice rich soil	m2	2500	#N/A	10	$25,000		$0	$25,000
I				#N/A	0	$0		$0	$0

1 lings Impoundment Name: ____ Impoundment # 1

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: STABILIZE DECANT SYSTEM			#N/A	0	$0		$0	$0
Remove	m3		#N/A	0	$0		$0	$0
Plug/backfill	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
OBJECTIVE: REMOVE TAILINGS DISCHARGE			#N/A	0	$0		$0	$0
Cyclones	m3		#N/A	0	$0		$0	$0
Pipe	m	5000	PPLL	1.02	$5,100	100%	$5,100	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
SPECIALIZED ITEMS			#N/A	0	$0		$0	$0
.			#N/A	0	$0		$0	$0
Subtotal					$32,117,360	0.00016	$5,100	$32,112,260
					Total Tailings	Percent Land	Total Land	Total Water

1 Rock Pile Name: ____ Rock Pile #: *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: STABILIZE SLOPES								
	Flatten slopes with dozer, rock pile, north	m3	1501500	dsl	0.71	$1,066,065.00	50%	$533,033	$533,033
.	Flatten slopes with dozer, till pile	m3	479000	dsl	0.71	$340,090.00	100%	$340,090	$0
.	Flatten slopes with dozer, till pile, south	m3	0	dsl	0.71	$0.00	100%	$0	$0
.	Toe buttress, drain mat'l	m3		#N/A	0	$0.00		$0	$0
.	, fill mat'l A	m3		#N/A	0	$0.00		$0	$0
.	, fill mat'l B	m3		#N/A	0	$0.00		$0	$0
.	Other			#N/A	0	$0.00		$0	$0
B									
.	OBJECTIVE: COVER DUMP					$0.00		$0	$0
.	till on biotite schist	m3	1031000	#N/A	4.82	$4,969,420.00		$0	$4,969,420
.	rock on mixed rock & biotite schist	m3	4290000	#N/A	3.96	$16,988,400.00		$0	$16,988,400
.	till on caribou ramps	m3	6400	#N/A	4.82	$30,848.00	100%	$30,848	$0
.	rock cover from roads, etc.	m3	0	#N/A	5.65	$0.00		$0	$0
C	rock cover from new quarry	m3	0						
.	rock cover on 2.5:1 slopes, incr. cost	m3		#N/A	0.15	$0.00		$0	$0
.	till islands for reveg.	m3	93300	#N/A	4.82	$449,706.00	100%	$449,706	$0
.	till islands for reveg., south dump	m3	0	#N/A	4.78	$0.00	100%	$0	$0
.	OBJECTIVE: UNDERWATER DISPOSAL			#N/A		$0.00		$0	$0
D	Move material	m3		#N/A	0				
.	Add lime	m3		#N/A	0	$0.00		$0	$0
E	Add crushed limestone	m3		#N/A	0				
.	Other			#N/A	0	$0.00		$0	$0
.				#N/A		$0.00		$0	$0
.	OBJECTIVE: COLLECT AND TREAT			#N/A		$0.00		$0	$0
.	See "ONGOING TREATMENT" costing component			#N/A		$0.00		$0	$0
F				#N/A		$0.00		$0	$0
	OBJECTIVE: DEVELOP WETLAND			#N/A		$0.00		$0	$0
	Earthworks, mat'l A	m3		#N/A	0	$0.00		$0	$0
	, mat'l B	m3		#N/A	0	$0.00		$0	$0
	Vegetate, till pile	ha	31	vhsl	1680	$52,080.00	100%	$52,080	$0
	Other			#N/A	0	$0.00		$0	$0
				#N/A		$0.00		$0	$0
	SPECIALIZED ITEMS			#N/A		$0.00		$0	$0
.						$0.00		$0	$0
				#N/A	0	$0.00		$0	$0
	Subtotal					$23,896,609	5.9%	$1,405,757	$22,490,853
						Total for Rock Pile	Percent Land	Total Land	Total Water

1 Building / Equip Name: ____ Bldg / Equip #: *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: DISPOSE MOBILE EQUIPMENT								
	Decontaminate and ship off-site	km	320000	mherh	8.5884	$2,748,288	50%	$1,374,144	$1,374,144
.	Decontaminate, dispose on-site	each		#N/A	0	$0		$0	$0
.	Other	each		#N/A	0	$0		$0	$0
B	OBJECTIVE: DISPOSE STATIONARY EQUIPMENT								
.	Decontaminate and ship off-site	km	353857	mherh	8.5884	$3,039,065	50%	$1,519,533	$1,519,533
.	Decontaminate, dispose on-site	each		#N/A	0	$0		$0	$0
.	Other	each		#N/A	0	$0		$0	$0
C	OBJECTIVE: DISPOSE ORE CONCENTRATION EQUIPMENT								
.	Decontaminate crushing plant	each		#N/A	0	$0		$0	$0
.	Decontaminate tanks & plumb.	each		#N/A	0	$0		$0	$0
.	Remove tanks & plumbing	each		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
D	OBJECTIVE: DISPOSE WATER TREATMENT EQUIPMENT								
.	Decontaminate tanks & plumb.	each		#N/A	0	$0		$0	$0
.	Remove tanks & plumbing	each		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
E	OBJECTIVE: DECONTAMINATE BUILDINGS & TANKS								
.	site wide allowance	each	1	#N/A	75000	$75,000	50%	$37,500	$37,500
.	clean explosives facility	each	1	#N/A	50000	$50,000		$0	$50,000
.		each		#N/A	0	$0		$0	$0
.		each		#N/A	0	$0		$0	$0
.		each		#N/A	0	$0		$0	$0
				#N/A	0	$0		$0	$0
.		each		#N/A	0	$0		$0	$0
F	OBJECTIVE: MOTHBALL BUILDINGS								
.	Building 1	m2		#N/A	0	$0		$0	$0
.	Building 2	m2		#N/A	0	$0		$0	$0
.	Building 3	m2		#N/A	0	$0		$0	$0
.	Building 4	m2		#N/A	0	$0		$0	$0
.	Building 5	m2		#N/A	0	$0		$0	$0
.	Other	m2		#N/A	0	$0		$0	
G	OBJECTIVE: REMOVE BUILDINGS								
.	Process plant	m2	54000	brs1h	53.856	$2,908,224	100%	$2,908,224	$0
.	Maintenance plant	m2	31500	brs1h	53.856	$1,696,464	100%	$1,696,464	$0
.	Camp	m3	13275	brs1l	35.904	$476,626	100%	$476,626	$0
.	Bulk fuel storage	m2	39375	brs1l	35.904	$1,413,720	100%	$1,413,720	$0
.	Power plant/boiler house	m3	11000	brs1h	53.856	$592,416	100%	$592,416	$0
.	Ammonium nitrate fuel storage	m2	22500	brs1l	35.904	$807,840	100%	$807,840	$0
.	Explosives/cap storage & mixing	m3	600	brs1h	53.856	$32,314	100%	$32,314	$0
.	Remove boneyard waste	m2	1700	brs1l	35.904	$61,037	100%	$61,037	$0
.	Other			#N/A	0	$0		$0	$0
H	OBJECTIVE: BREAK BASEMENT SLABS								
.	Building 1	m2		#N/A	0	$0		$0	$0
.	Building 2	m2		#N/A	0	$0		$0	$0
.	Building 3	m2		#N/A	0	$0		$0	$0
.	Building 4	m2		#N/A	0	$0		$0	$0
.	Building 5	m2		#N/A	0	$0		$0	$0

1 Building / Equip Name: ____ Bldg / Equip #: *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
.	Other			#N/A	0	$0		$0	$0
I	OBJECTIVE: REMOVE BURIED TANKS								
.	Tank 1, decontaminate	m3		#N/A	0	$0		$0	$0
.	, excavate & dispose	m3		#N/A	0	$0		$0	$0
.	Tank 2, decontaminate	m3		#N/A	0	$0		$0	$0
.	, excavate & dispose	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
J	OBJECTIVE: LANDFILL FOR DEMOLITION WASTE								
.	Place soil cover	m3	187500	#N/A	5.65	$1,059,375	100%	$1,059,375	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
.	Landfill disposal fee	tonne		#N/A	0	$0		$0	$0
K	OBJECTIVE: GRADE AND CONTOUR								
.	Grade mill area	m2	30750	dsl	0.7956	$24,465	100%	$24,465	$0
.	Place soil cover	m3	34050	#N/A	5.65	$192,383	100%	$192,383	$0
.	Rip rap on ditches	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
L	OBJECTIVE: RECLAIM ROADS								
	Haul roads, A 154 & A418 lease	ha	3.71	scfyl	3595.5	$13,339	100%	$13,339	$0
	Service roads, A154 & A418 lease	ha	1.6	scfyl	3595.5	$5,753	100%	$5,753	$0
	Haul roads, A21 lease	ha	1.8	scfyl	3595.5	$6,472	100%	$6,472	$0
	Service roads, A21 lease	ha	1.65	scfyl	3595.5	$5,933	100%	$5,933	$0
	Haul roads, PKC & dumps lease	ha	10.13	scfyl	3595.5	$36,422	100%	$36,422	$0
	Service roads, PKC & dumps lease	ha	23.2	scfyl	3595.5	$83,416	100%	$83,416	$0
	Haul roads, infrastructure lease	ha	14.85	scfyl	3595.5	$53,393	100%	$53,393	$0
	Service roads, infrastructure lease	ha	5.4	scfyl	3595.5	$19,416	100%	$19,416	$0
.	Haul roads, airstrip lease	ha	0	scfyl	3595.5	$0	100%	$0	$0
.	Service roads, airstrip lease	ha	2.9	scfyl	3595.5	$10,427	100%	$10,427	$0
.				#N/A	0	$0	100%	$0	$0
K	SPECIALIZED ITEMS								
	RECLAIM AIRSTRIP	ha	11	scfyl	3215	$35,365	100%	$35,365	$0
	YELLOWKNIFE LANDFILL DISPOSAL FEE		1		250000	$250,000	100%	$250,000	$0
.				#N/A	0	$0		$0	$0
	Subtotal					$15,697,151	81.0%	$12,715,974	$2,981,177
						Total Buildings	Percent Land	Total Land	Total Water

1 Chemicals and Soil Contamination: 1

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
	Note: The procedures, equipment and packaging for clean up anc removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.								
A	LABORATORY CHEMICALS	km	494	mherh				$0	
.		pallet	50	#N/A	1000	$50,000		$0	$50,000
B	PCB, hauling	litre		#N/A	0	$0		$0	$0
.	PCB, disposal	litre		#N/A	0	$0		$0	$0
C	FUEL			#N/A		$0		$0	$0
.	Type 1, 200 tonnes	km		mherh	8.5884	$0		$0	$0
.	Type 2	kg		#N/A	0	$0		$0	$0
.	Type 3	kg		#N/A	0	$0		$0	$0
D	WASTE OIL								
.	Oils/lubricants - burn on-site	litre		#N/A	0	$0		$0	$0
.	Oils/lubricants - ship off-site	litre	650000	#N/A	0.027	$17,550		$0	$17,550
.	removal glycol	litre	20,000		1.25	$25,000		$0	$25,000
E	remove batteries	kg	25,000		0.5	$12,500		$0	$12,500
.	remove paints	litre	1500		0.27	$405		$0	$405
.	remove solvents	litre	7500		0.75	$5,625		$0	$5,625
.	Oils/lubricants - disposal fee	litre		#N/A	0	$0		$0	$0
.	PROCESS OR TREATMENT CHEMICALS								
F	Type 1	km		mherh	8.5884	$0		$0	$0
	Type 2	kg		#N/A	0	$0		$0	$0
	Type 3	kg		#N/A	0	$0		$0	$0
	Type 4	kg		#N/A	0	$0		$0	$0
	EXPLOSIVES	kg							
		allow	1	#N/A	10000	$10,000		$0	$10,000
	CONTAMINATED SOILS								
.	Type 1, light fuel	m3	5000	CSRL	39.27	$196,350		$0	$196,350
G	Type 2, heavy fuel and oil	m3	2500	#N/A	100	$250,000		$0	$250,000
.	Type 3, metals	m3	250	#N/A	100	$25,000		$0	$25,000
.	Haz. Mat. testing & assessment								
.	Technician and analyses	each	1	#N/A	110000	$110,000		$0	$110,000
H	Drilling	each	1	#N/A	75000	$75,000		$0	$75,000
.	Reporting		1		20000	$20,000		$0	$20,000
.	Other			#N/A	0	$0		$0	$0
.	OTHER								
.	remove nuclear densometers from mill	each	10	#N/A	4000	$40,000		$0	$40,000
	Subtotal					$837,430	0.0%	$0	$837,430
						Total Chemical	Percent Land	Total Land	Total Water

1 /ater Management Project: Project # *1*

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A OBJECTIVE: STABILIZE EMBANKMENT								
Toe buttress, drain mat'l	m3		#N/A	0	$0		$0	$0
, fill mat'l A	m3		#N/A	0	$0		$0	$0
, fill mat'l B	m3		#N/A	0	$0		$0	$0
Rip rap	m3		#N/A	0	$0		$0	$0
Vegetate	ha		#N/A	0	$0		$0	$0
Raise crest	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
B OBJECTIVE: UPGRADE SPILLWAY								
Excavate channel	m3	680	dsh	2.83	$1,924		$0	$1,924
Place rip rap	m3	190	#N/A	5.65	$1,074		$0	$1,074
Excavate channel	m3	14400	dsh	2.83	$40,752		$0	$40,752
Place rip rap	m3	10400	#N/A	5.65	$58,760		$0	$58,760
Other			#N/A	0	$0		$0	$0
C OBJECTIVE: STABILIZE SEDIMENT CONTAINMENT PONDS								
Place soil cover	m3		#N/A	0	$0		$0	$0
Place geotextile	m2		#N/A	0	$0		$0	$0
Vegetate	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
D OBJECTIVE: BREACH EMBANKMENT								
Remove Fill	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
E OBJECTIVE: COLLECTION PONDS								
Breach 4 dams	m3	2200	dsh	2.83	$6,226		$0	$6,226
place geotextile, 4 by 15,000 m2	m2	60000	#N/A	10	$600,000		$0	$600,000
place rock over geotextile	m3	60000	#N/A	5.65	$339,000		$0	$339,000
Other			#N/A	0	$0		$0	$0
F OBJECTIVE: BREACH DITCHES								
Excavate	m3	7875	dsh	3.1722	$24,981		$0	$24,981
Backfill/recontour	m3	2625	sc1h	7.803	$20,483		$0	$20,483
Vegetate	ha		#N/A	0	$0		$0	
Other			#N/A	0	$0		$0	$0
G OBJECTIVE: REMOVE PIPELINES								
Remove pipes	m		#N/A	0	$0		$0	$0
Concrete plug deep pipes	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
H OBJECTIVE: NORTH INLET EAST DIKE								
Excavate/construct spillway	m3	4500	sb3h	4.83	$21,735		$0	$21,735
Excavate & backfill	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
I OBJECTIVE: COLLECT DRAINAGE FOR TREATMENT								
Excavate collection ditches	m3		#N/A	0	$0		$0	$0
Rip rap ditches	m3		#N/A	0	$0		$0	$0
Pipes	m		#N/A	0	$0		$0	$0
Pumps	each		#N/A	0	$0		$0	$0
Collect'n pond, exc. mat'l A	m3		#N/A	0	$0		$0	$0
, exc. mat'l B	m3		#N/A	0	$0		$0	$0
Collect'n pond, fill mat'l A	m3		#N/A	0	$0		$0	$0

1 /ater Management Project: ____ Project # 1

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
	, fill mat'l B	m3		#N/A	0	$0		$0	$0
	Collect'n pond, liner	m2		#N/A	0	$0		$0	$0
J	OBJECTIVE: TREAT DRAINAGE (see "ONGOING TREATMENT" for operating costs)								
	Build treatment plant	lump sum		#N/A	0	$0		$0	$0
				#N/A	0	$0		$0	$0
	Subtotal					$1,114,935	0.0%	$0	$1,114,935
						Total Water	Percent Land	Total Land	Total Water

1 Mobilization Name: ____ Mob # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost
A	MOBILIZE HEAVY EQUIPMENT					
	Equipment to regional centre					
.	Excavators	km		#N/A	0	$0
.	Dump trucks	km		#N/A	0	$0
.	Dozers	km		#N/A	0	$0
.	Demolition shears	km		#N/A	0	$0
	Equipment, regional centre to site					
.	Excavators - 2	km	4800	MHERH	8.59	$41,224
.	Dump trucks - 15	km	120000	MHERH	8.59	$1,030,608
.	Dozers - 4	km	16000	MHERH	8.59	$137,414
	Demolition shears - 2		9600	MHERH	8.59	$82,449
	Front end loader 2		4800	MHERH	8.59	$41,224
	cranes - 2		1600	MHERH	8.59	$13,741
	service vehicles -10		16000	MHERH	8.59	$137,414
.		km				
B	MOBILIZE CAMP					
.		allowance	1	#N/A		$150,000
C	MOBILIZE WORKERS					
.	rotations over reclamatio period	m-hrs	26000	#N/A	45	$1,170,000
D	MOBILIZE MISC. SUPPLIES					
.	Fuel	litre	7000000	#N/A	0.78	$5,460,000
.	Minor tools and equipment	owance	1	#N/A	0	$500,000
.	Truck tires	owance	1	#N/A	0	$500,000
E	MOBILIZE & HOUSE WORKERS	person days				
.	20800 man-days	month	740	accml	1346.4	$996,336
.	WINTER ROAD					
.	Full winter use	km		#N/A	0	$0
.	Limited winter use	km		#N/A	0	$0
.				#N/A	0	$0
F	BONDING lump sum					
.				#N/A		$0
G	TAXES lump sum					
.				#N/A		$0
H	INSURANCE lump sum					
.				#N/A		$0
	Subtotal					$10,260,412
						Total Mob.

Equipment Mobilization	# of machines	loads/machine	round trip km	total road mileage
excavator	2	3	800	4800
dump trucks	15	10	800	120000
dozers	4	5	800	16000
demolition shears	2	6	800	9600
front end loader	2	3	800	4800
cranes	2	1	800	1600
service vehicles	10	2	800	16000

1 Monitoring & Maintenance Mon / Mtce # 1

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost
A	OBJECTIVE: POST-CLOSURE INSPECTIONS					
	Annual geotechnical insp.	each	8	VIH	$7,242	$57,936
.	Survey inspection	each		#N/A	$0	$0
.	Water sampling	yrs	10	#N/A	$250,000	$2,500,000
.	Reporting	yrs	10	#N/A	$100,000	$1,000,000
.	Other			#N/A	$0	$0
B	OBJECTIVE: INTERIM CARE & MAINTENANCE					
.	annual C&M	yrs	3	#N/A	$2,223,639	$6,670,917
.		month		accml		$0
.		month		#N/A	$0	$0
.		each		#N/A	$0	$0
.		allowance				
				#N/A		$0
	Subtotal					$10,228,853

Total Mon./Maint.

ANNUAL INTERIM CARE & MAINTENANCE

	No.	hrs/year	Rate	Annual Cost	
Site supervisor	1	3650	$61.20	$223,380	
laborers	3	3650	$38.76	$141,474	
equipment operators	2	3650	$56.10	$204,765	
mechanic	1	3650	$61.20	$223,380	
electrician	1	3650	$70.00	$255,500	
envir. coodinator	1	3650	$61.20	$223,380	
				$1,271,879	total staff
Fuel, power & heat	L/hr	mon/yr	fuel		
	50	3	108000		
	40	7	201600		
	25	2	36000		
Fuel, mobile equipment	15	12	129600		
			475200	total fuel	
air charter	flights/yr		cost/flight		
	52		4500	234000	
camp costs	108	m-months	1320	142560	
misc. supplies, allowance				50000	
reagents				50000	
		Total annual C&M		$2,223,639	

Unit Cost Table

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	COMMENTS
1	**excavate Rock, Bulk**						
	drill, blast, load short haul (<500m) Dump	RB1	m3	9.54	14.28	#N/A	quarry operations for bulk fill
	RB1 + long haul, up to 1500 m	RB2	m3	10.10	14.89	#N/A	
	RB1 + spread and compact	RB3	m3	10.10	14.89	#N/A	
	RB1 + long haul + spread and compact	RB4	m3	10.66	25.76	#N/A	
	RB1 + Specified activity	RBS	m3	#N/A	#N/A	#N/A	
2	**excavate Rock, Controlled**			0.00	0.00	0.00	
	drill, blast, load short haul (<500m) Dump	RC1	m3	22.44	33.66	#N/A	spillway excavation
	RC1 + long haul, up to 1500 m	RC2	m3	10.66	15.40	#N/A	
	RC1 + spread and compact	RC3	m3	10.10	14.89	#N/A	
	RC1 + long haul + spread and compact	RC4	m3	11.32	16.04	#N/A	
	RC1 + Specified activity	RCS	m3	#N/A	#N/A	147.90	$145/M3-drift excavation
3	**excavate Soil, Bulk**			0.00	0.00	0.00	
	excavate, load short haul (<500m) dump	SB1	m3	3.26	4.95	#N/A	LOW cost: excavation of loose soil, high volume
	SB1 + long haul, up to 1500 m	SB2	m3	4.06	6.09	#N/A	LOW cost: excavation of loose soil, 1.5 km haul, high volume
	SB1 + spread and compact	SB3	m3	3.77	5.42	#N/A	
	SB1 + long haul + spread and compact	SB4	m3	4.59	9.13	#N/A	LOW cost: excavation of loose soil, 1.5 km haul, high volume, const. of simple soil cover
				0.00	0.00	0.00	
	SB1 + Specified activity	SBS	m3	2.36	6.51	11.17	LOW cost: rehandle waste rock dump into pit, >500,000 m3, 2 km haul
				0.00	0.00	0.00	SPECIFIED cost: rehandle waste rock, haul 3 km, place & compact on dam
				0.00	0.00	0.00	
	Soil, tailings	SBT	m3	3.09	7.29	0.00	LOW cost: doze tailings, HIGH cost: excavate & short haul
4	**excavate Soil, Controlled**			0.00	0.00	0.00	
	excavate, load short haul (<500 m), dump	SC1	m3	5.72	7.80	#N/A	
	SC1 + long haul, up to 1500 m	SC2	m3	7.09	9.83	#N/A	
	SC1 + spread and compact	SC3	m3	5.72	11.89	#N/A	HIGH cost: for simple soil covers
	SC1 + long haul + spread and compact	SC4	m3	6.43	19.43	#N/A	HIGH cost: for complex covers & dam construction, spillway repair, LOW volume
	SC1 + Specified activity	SCS	m3	#N/A	#N/A	16.07	SPECIFIED cost: backfill adit with waste rock
	Geo-synthetics			0.00	0.00	0.00	
	geotextile, filter cloth	GST	M2	1.01	2.02	#N/A	FOB Edmonton, add shipping & installation
	geogrid	GSG	M2	4.82	0.00	#N/A	

Unit Cost Table

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	
	liner, HDPE	GSHDPE	M2	6.01	0.00	#N/A	
	liner, PVC	GSPVC	M2	0.00	0.00	#N/A	
	geosynthetic installation	GSI	m2	0.85	1.02	#N/A	
	bentonite soil ammendment	GSBA	tonne	258.06	291.72	#N/A	FOB Edmonton, add shipping & mixing
	Shaft, Raise & Portal Closures			0.00	0.00	0.00	
	Shaft & Raises	SR	m2	540.60	1785.00	#N/A	LOW cost: pre-cast concrete slabs, little site prep. HIGH cost: for hand construction, remote site
	Portals	POR	m3	0.00	209.10	1020.00	HIGH cost: for excavate & backfill collapsed portal SPECIFIED cost: installed pressure plug
				0.00	0.00	0.00	
				0.00	0.00	0.00	
				0.00	0.00	0.00	
				0.00	0.00	0.00	
				0.00	0.00	0.00	
				0.00	0.00	0.00	
5	**Concrete work**			0.00	0.00	0.00	
	Small pour, no forms	CS	m3	302.94	606.90	#N/A	
	Large pour, no forms	CL	m3	239.70	357.00	#N/A	
	Small pour, Formed	CSF	m3	357.00	1785.00	#N/A	
	Large pour, Formed	CLF	m3	295.80	418.20	#N/A	
6	**Vegetation**			0.00	0.00	0.00	
	Hydroseed, Flat	VHF	ha	1626.90	5049.00	#N/A	
	Hydroseed, Sloped	VHS	ha	1884.96	5666.10	#N/A	
	veg. Blanket/erosion mat	VB	ha	11220.00	13464.00	#N/A	
	Tree planting	VT	ha	11220.00	13464.00	#N/A	
	Wetland species	VW	ha	56100.00	84150.00	#N/A	
7	**Pumps**			0.00	0.00	0.00	
	Small, <	PS	each	3060.00	6120.00	#N/A	
	Large, >	PL	each	5100.00	########	#N/A	large - 250 hp Gould w/diesel motor
8	**PiPes**			0.00	0.00	0.00	
	Small, < 6 inch diameter	PPS	m	0.51	5.10	#N/A	LOW cost: pipe removal, HIGH cost: supply new pipe SPECIFIED: small, heat traced & insulated pipe
	Large, > 6 inch diameter	PPL	m	1.02	183.60	#N/A	LOW cost: pipe removal, HIGH cost: supply 24" 100 psi HDPE pipe, FOB Edm.
				0.00	0.00	0.00	add shipping & installation

Unit Cost Table

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	
9	**pump sand BackFill**	BF	m3	5.61	16.83	#N/A	
10	**Fence**	F	m	11.22	168.30	#N/A	
11	**Signs**	S	each	11.22	33.66	#N/A	
12	**rock, Drill and Blast only**	DB	m3	11.22	22.44	#N/A	
	(flatten slope, collapse drift)			0.00	0.00	0.00	
13	**excavate Rip Rap**			0.00	0.00	0.00	
	drill, blast, load short haul (<500 m) dump and spread	RR1	m3	11.17	16.68	#N/A	
	RR1 + long haul	RR2	m3	11.32	17.29	#N/A	HIGH cost: quarry & place rip rap in channel
	excavate rock from waste dump, short haul, spread	RR3	m3	4.28	5.90	#N/A	LOW cost: removal of 18 in minus from dump, long haul and spread
				0.00	0.00	0.00	HIGH cost: removal of coarse rock from dump, long haul, armour spillway
	RR3 + long haul	RR4	m3	4.77	6.38	#N/A	
	specified rip rap source	RR5	m3	#N/A	#N/A	#N/A	
14	**Import LimeStone**	ILS	tonne	8.98	13.46	#N/A	
15	**Import LiMe**	ILM	tonne	168.30	504.90	#N/A	LOW cost: bulk shipping, high volume, FOB Vancouver/Edmonton
				0.00	0.00	0.00	HIGH cost: bags delivered to central Yukon, small volume
16	**Grouting**	G	m3	201.96	244.80	#N/A	HIGH cost: cement, FOB Yellowknife
17	**Dozing**			0.00	0.00	0.00	
	doze Rock piles	DR	m3	0.87	1.99	#N/A	LOW cost: doze crest off dump
	doze overburden/Soil piles	DS	m3	0.80	3.17	#N/A	HIGH cost: push up to 300 m
18				0.00	0.00	0.00	
				0.00	0.00	#N/A	
				0.00	0.00	#N/A	
19				0.00	0.00	0.00	
				0.00	0.00	#N/A	
				0.00	0.00	#N/A	
20				0.00	0.00	0.00	
			each	0.00	0.00	#N/A	
			each	0.00	0.00	#N/A	
21	**Buildings - Decontaminate**			0.00	0.00	0.00	

Unit Cost Table

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	
	Chemicals	BDC	m3	#N/A	#N/A	#N/A	
	Asbestos	BDA	m2	21.42	42.84	#N/A	LOW cost: removal of asbestos siding & flooring HIGH cost: removal of insulated pipes, friable asbestos
				0.00	0.00	0.00	
22	**Buildings - Remove**			0.00	0.00	0.00	
	areas are per floor on 3 m average height			0.00	0.00	0.00	LOW cost: removal and on-site disposal - small wooden structures
	Wood - teardown	BRW1	m2	21.93	33.66	#N/A	
	Wood - burn	BRW2	m2	5.61	11.22	#N/A	
	Masonry	BRM	m2	24.12	33.66	#N/A	
	Concrete	BRC	m	33.66	50.49	6.12	LOW cost: removal of building perimeter walls, HIGH cost: per m3 for bulk concrete SPECIFIED cost: $/m2 to break floor slab
	Steel - teardown	BRS1	m2	35.90	53.86	244.80	SPECIFIED cost: demolition shear $/hour operating
	Steel - salvage	BRS2	m2	56.10	84.15	#N/A	
23	**Power & Pipe Lines**			0.00	0.00	0.00	
	Power lines, remove	POWR	each	21.32	4712.40	#N/A	
	Small, < 6 inch diameter	PPS	m	0.51	5.10	#N/A	LOW cost: pipe removal, HIGH cost: supply new pipe
	Large, > 6 inch diameter	PPL	m	1.02	183.60	#N/A	LOW cost: pipe removal, HIGH cost: supply 24" 100 psi HDPE pipe, FOB. Add shipping
24	**Laboratory Chemicals**			0.00	0.00	0.00	
	Remove from site	LCR	pallet	1785.00	2366.40	#N/A	
	Dispose on site	LCD	each	#N/A	#N/A	#N/A	
25	**PCB - Remove from site**	PCBR	litre	33.66	39.27	#N/A	LOW cost: shipping, handling & disposal from Yellowknife
				0.00	0.00	0.00	
26	**Fuel**			0.00	0.00	0.00	
	Remove from site	FR	kg	0.00	1.04	#N/A	
	Burn on site	FB	kg	#N/A	#N/A	#N/A	
27	**Oil**			0.00	0.00	0.00	
	Remove from site	OR	litre	0.36	1.04	#N/A	
	Burn on site	OB	litre	0.36	0.56	#N/A	
28	**Process Chemicals**			0.00	0.00	0.00	
	Remove from site	PCR	kg	0.36	2.09	#N/A	
	Dispose on site	PCD	kg	#N/A	#N/A	#N/A	
29	**Explosives**			0.00	0.00	0.00	
	Remove from site	ER	kg	0.00	2.24	#N/A	

Unit Cost Table

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	
	Dispose on site	ED	kg	#N/A	#N/A	#N/A	
30	**Contaminated Soils**			0.00	0.00	0.00	
	Remediate on site	CSR	m3	39.27	122.40	#N/A	LOW cost: bio-remediate on-site. HIGH cost: ship off-site to landfil as haz. waste
	consolidate & cover	Use cost code iter		0.00	0.00	0.00	
	cover in place	Use cost code iter		0.00	0.00	0.00	
31	**Mobilize Heavy Equipment**			0.00	0.00	0.00	
	Road access	MHER	$/km	2.87	8.59	2.09	SPECIFIED cost: $/tonne/km in cargo plane
	Air access	MHEA	each	#N/A	#N/A	1402.50	SPECIFIED cost: helicopter cost, $/hr of operation
32	**Mobilize Camp**			0.00	0.00	0.00	MHERH - winter road usage $/km
	<20 persons Road access	MC<R	each	#N/A	#N/A	#N/A	
	<20 persons Air access	MC<A	each	#N/A	#N/A	#N/A	
33	**Mobilize Workers**			0.00	0.00	0.00	
	mobilize	MM<	person	196.86	1009.80	#N/A	LOW cost: road access. HIGH cost: transport by Twin Otter aircraft
	>20 persons	MM>	person	1009.80	1346.40	#N/A	
34	**ACCoModation**	ACCM	month	1346.40	2019.60	#N/A	LOW cost, accom in existing camp, per man, HIGH cost: - supply new camp
35	**Mobilize Misc. Supplies**	MMS	each	#N/A	#N/A	#N/A	LOW cost: winter road - limited use, LOW snowfall
36	**Winter Road**	WR	km	1346.40	2672.40	#N/A	
37	**Visual site Inspection**	VI	each	3590.40	7242.00	10200.00	
38	**Survey site Inspection**	SI	each	#N/A	#N/A	#N/A	
39	**Water Sampling**	WS	each	5610.00	9180.00	#N/A	
40	**site inspection RePorT**	RPT	each	#N/A	11220.00	#N/A	
41	**Security Guard**	SG	pers/mc	5610.00	7854.00	#N/A	
42	**Maintain Pumping**	MP	month	3366.00	#N/A	#N/A	
43	**Clear SpillWay**	CSW	each	1907.40	5385.60	#N/A	
44	**Build Treatment Plant**			0.00	0.00	0.00	
	Small (< 1000 m3/d)	BTPS	lump su	########	########	#N/A	
	Large (> 1000 m3/d)	BTPL	lump su	########	########	#N/A	
45	**Operate Treatment Plant**	OTP	m3	0.30	1.68	#N/A	
46	**SCariFY road and**	SCFY	km	3595.50	5049.00	#N/A	
	install water breaks			0.00	0.00	0.00	

Unit Cost Table

ITEM Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $
			0.00	0.00	0.00
water treatment chemicals			0.00	0.00	0.00
ferric sulphate	ferric	kg	0.68	0.00	0.00
ferrous sulphate	ferrous	kg	0.45	0.00	0.00
lime	lime	kg	0.31	#VALUE!	0.00
hydrogen peroxide, 50%	hperox	kg	1.46	0.00	0.00
Sodium Metabisulfate	Nametab	kg	1.01	0.00	0.00
Caustic soda, 50%	caustic	kg	0.63	0.00	0.00
Sulfuric acid, 93%	sulfuric	kg	0.27	0.00	0.00
flocculant	flocc	kg	5.50	0.00	0.00
copper sulphate	copper	kg	0.00	0.00	0.00
typical shipping, to Whitehorse or Yellowknife		kg	0.07	0.00	0.00
			0.00	0.00	0.00
Typical Labour & Equipment Rates			0.00	0.00	0.00
Site manager		$/hr	71.40	81.60	0.00
Mine superintendent		$/hr	0.00	61.20	0.00
Environmental coordinator		$/hr	0.00	61.20	0.00
Journeyman (mech, elec, weld)	LUGE	$/hr	51.00	61.20	0.00
Equipment operator		$/hr	45.90	56.10	0.00
labour - skilled	LLUGG	$/hr	35.70	38.76	0.00
labour - unskilled		$/hr	32.64	35.70	0.00
Security / first aid		$/hr	38.76	48.96	0.00
Admin.		$/hr	42.84	49.98	0.00
			0.00	0.00	0.00
average			45.46	0.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00
Front end loader, ?, Cat992		$/hr	0.00	336.60	0.00
excavator, Cat235		$/hr	0.00	178.50	0.00
dump truck - tandem		$/hr	0.00	0.00	0.00
dump truck off road, Cat 777		$/hr	270.30	0.00	0.00
dozer, D8, D10		$/hr	173.40	306.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00
			0.00	0.00	0.00

APPENDIX D

RECLAMATION COST ESTIMATE
2022

SUMMARY OF COSTS

COMPONENT TYPE	COMPONENT NAME	TOTAL COST	Land Liability	Water Liability
			YEAR	2022
OPEN PIT	A514,A418,A21	$477,787.04	$0	$477,787
UNDERGROUND MINE	0	$632,183.78	$457,764	$174,420
TAILINGS	0	$32,117,360.00	$5,100	$32,112,260
ROCK PILE	0	$24,287,602.00	$1,796,750	$22,490,853
BUILDINGS AND EQUIPMENT	0	$15,697,151.08	$12,715,974	$2,981,177
CHEMICALS AND SOIL MANAGEMENT	0	$837,430.00	$0	$837,430
WATER MANAGEMENT	0	$1,114,934.85	$0	$1,114,935
POST-CLOSURE SITE MAINTENANCE		$0.00	$0	$0
SUBTOTAL		**$75,164,449**	**$14,975,588**	**$60,188,861**
		Percentages	19.9	80.1
MOBILIZATION/DEMOBILIZATION	0	$10,260,412	$2,044,260	$8,216,151
MONITORING AND MAINTENANCE	0	$10,228,853	$2,037,973	$8,190,880
Market Factor Price Adjustment	20 %	$15,032,890	$2,995,118	$12,037,772
PROJECT MANAGEMENT	5 %	$3,758,222	$748,779	$3,009,443
ENGINEERING	5 %	$3,758,222	$748,779	$3,009,443
CONTINGENCY	20 %	$15,032,890	$2,995,118	$12,037,772
GRAND TOTAL - CAPITAL COSTS		**$133,235,938**	**$26,545,614**	**$106,690,323**

1 **Open Pit Name:** ***A514,A418,A:*** **Pit #** ***1***

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: CONTROL ACCESS								
	Fence	m		#N/A	0	$0		$0	$0
.	Signs	each		#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Berm	m3		#N/A		$0		$0	$0
B	Block roads	m3		#N/A					
.	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: STABILIZE SLOPES			#N/A	0	$0		$0	$0
	excavate 2 breaches in dike	m3	10560	sc1h	7.803	$82,400		$0	$82,400
	break concrete guides & wall	m3	600	brcl	33.66	$20,196		$0	$20,196
.	construct fish habitat	m3	0	sb1h	4.947	$0		$0	$0
.	A 418	m3		#N/A	0	$0		$0	$0
C	excavate 2 breaches in dike	m3	10560	sc1h	7.803	$82,400		$0	$82,400
	break concrete guides & wall	m3	600	brcl	33.66	$20,196		$0	$20,196
.	construct fish habitat	m3	0	sb1h	0	$0		$0	$0
	A21	m		#N/A	0	$0		$0	$0
.	excavate 2 breaches in dike	m3	10560	sc1h	7.803	$82,400		$0	$82,400
	break concrete guides & wall	m3	600	brcl	33.66	$20,196		$0	$20,196
.	construct fish habitat	m3	0	sb1h	4.947	$0		$0	$0
		kWh		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
.				#N/A					
.	OBJECTIVE: COVER/CONTOUR SLOPES			#N/A	0	$0		$0	$0
.	Fill, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
E	Other			#N/A					
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: SPILLWAY			#N/A	0	$0		$0	$0
.	Excavate channel, mat'l A	m3		#N/A	0	$0		$0	$0
	, mat'l B	m3		#N/A				$0	$0
.	Concrete	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
F				#N/A					
.	OBJECTIVE: FLOOD PIT			#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Embankment, mat'l A	m3		#N/A	0	$0		$0	$0
H	, mat'l B	m3		#N/A	0	$0		$0	$0
	siphon installation/operation	each	3	#N/A	50000	$150,000		$0	$150,000
	remove pipes,wires etc	each	3	#N/A	0	$20,000		$0	$20,000
	make milk of lime, meter into pit	tonne		#N/A	0	$0		$0	$0

1 **Open Pit Name: *A514,A418,A:*** **Pit # *1***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
	tonne		ilmh	504.9	$0		$0	$0
	km		mherh	8.5884	$0		$0	$0
OBJECTIVE: BACKFILL PIT			#N/A	0	$0		$0	$0
Fill, mat'l A	m3		#N/A	0	$0		$0	$0
, mat'l B	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
OBJECTIVE: DEVELOP WETLAND			#N/A	0	$0		$0	$0
Earthworks, mat'l A	m3		#N/A	0	$0		$0	$0
, mat'l B	m3		#N/A	0	$0		$0	$0
Vegetate	ha		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
SPECIALIZED ITEMS			#N/A	0	$0		$0	$0
.			#N/A	0	$0		$0	$0
Subtotal					$477,787	0%	$0	$477,787
					Total Pits	Percent Land	Total Land	Total Water

1 Underground Mine Name ____ UG Mine # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: CONTROL ACCESS								
	Fence	m		#N/A	0	$0		$0	$0
.	Signs	each		#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Berm	m3		#N/A	0	$0		$0	$0
.	Block adits	m3		#N/A	0	$0		$0	$0
.	Cap shaft	m3		#N/A	0	$0		$0	$0
.	Cap raises at A154/A418	m3	72	SRL	540.6	$38,923	100%	$38,923	$0
	soil cover on raise cap	m3	708	SB1L	3.264	$2,311	100%	$2,311	$0
.	Cap raises at A 21	m3	72	SRL	540.6	$38,923	100%	$38,923	$0
	soil cover on raise cap		798	SB1L	3.264	$2,605	100%	$2,605	$0
.	Backfill adit A154	m3	100	SCSS	16.065	$1,607	100%	$1,607	$0
	Contour portal area, A154	m3	2500	SB1L	3.264	$8,160	100%	$8,160	$0
.	Backfill adit, A21	m3	2500	SCSS	16.065	$40,163	100%	$40,163	$0
	Contour portal area, A21		200	SB1L	3.264	$653	100%	$653	$0
.	concrete bulkhead, pit portal, A154	allow	1	#N/A	75000	$75,000	100%	$75,000	$0
.	concrete bulkhead, pit portal, A21	allow	1	#N/A	75000	$75,000	100%	$75,000	$0
.	Backfill open stopes	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
B	OBJECTIVE: STABILIZE GROUND SURFACE								
.	Backfill mine	m3		#N/A	0	$0		$0	$0
.	Collapse crown pillar	m3		#N/A	0	$0		$0	$0
.	Contour, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Maintain dewatering (see "MONITORING/MAINTENANCE" c			#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
C	OBJECTIVE: FLOOD MINE								
.	Plug adits	m3		#N/A	0	$0		$0	$0
.	Plug drillholes to surface	each		#N/A	0	$0		$0	$0
.	Grouting	m3		#N/A	0	$0		$0	$0
.	LIme addition, kg/m3 of water	tonne		#N/A	0	$0		$0	$0
.	Lime, purchase and shipping	tonne		#N/A	0	$0		$0	$0
D	OBJECTIVE: HAZARDOUS MATERIALS								
.	remove hazardous materials, LABOUR	each	9600	LLUGGL	35.7	$342,720	50%	$171,360	$171,360
.	remove/decontam. Equipment, electrical	each	120	LUGEL	51	$6,120	50%	$3,060	$3,060
.	Other			#N/A	0	$0		$0	$0
E	SPECIALIZED ITEMS								
.				#N/A	0	$0	0%	$0	$0
	Subtotal					$632,184	72%	$457,764	$174,420
						Total U/G	Percent Land	Total Land	Total Water

1 ings Impoundment Name: ____ Impoundment # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: CONTROL ACCESS								
	Fence	m		#N/A	0	$0		$0	$0
.	Signs	each		#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Berm	m3		#N/A	0	$0		$0	$0
.	Block roads	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
B				#N/A	0	$0		$0	$0
.	OBJECTIVE: STABILIZE EMBANKMENT			#N/A	0	$0		$0	$0
.	breach east dam	m3		#N/A	0	$0		$0	$0
.	, fill mat'l A	m3		#N/A	0	$0		$0	$0
.	, fill mat'l B	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
.	Raise crest	m3		#N/A	0	$0		$0	$0
.	Flatten slopes	m3		#N/A	0	$0		$0	$0
C	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: COVER TAILINGS			#N/A	0	$0		$0	$0
	coarse PK, doze to slurry sump	m3	2625000	DSL	0.7956	$2,088,450		$0	$2,088,450
.	coarse PK - slurry pumping	m3	2625000		0.5	$1,312,500		$0	$1,312,500
.	Rock for expelled water from N or S dum	m3	1875000	#N/A	3.6	$6,750,000		$0	$6,750,000
D	Rock for expelled water from roads	m3		#N/A					
.	Rock for expelled water from new quarry	m3		#N/A	8.25	$0		$0	$0
.	Soil cover, till	m3	1416000	#N/A	4.46	$6,315,360		$0	$6,315,360
.	Cover rock from N or S dump	m3	4247000	#N/A	3.6	$15,289,200		$0	$15,289,200
.	Cover rock from roads	m3		#N/A		$0		$0	$0
E	Cover rock from new quarry	m3		#N/A					
.	Remove & treat supernatant	m3	270000	otpl	0.25	$67,500		$0	$67,500
.	OBJECTIVE: FLOOD TAILINGS			#N/A	0	$0		$0	$0
.	Ditch, mat'l A	m3		#N/A	0	$0		$0	$0
.	, mat'l B	m3		#N/A	0	$0		$0	$0
F	Raise crest	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: DEVELOP WETLAND			#N/A	0	$0		$0	$0
.	Earthworks, mat'l A	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
G	Other			#N/A	0	$0		$0	$0
.				#N/A	0	$0		$0	$0
.	OBJECTIVE: UPGRADE SPILLWAY			#N/A	0	$0		$0	$0
.	Excavate channel, mat'l A	m3	18000	sc3h	10.6	$190,800		$0	$190,800
H	, mat'l B	m3		#N/A	0	$0		$0	$0
.	Concrete	m3		#N/A	0	$0		$0	$0
.	Rip rap	m3	13000	#N/A	5.65	$73,450		$0	$73,450
.	geotextile over ice rich soil	m2	2500	#N/A	10	$25,000		$0	$25,000
I				#N/A	0	$0		$0	$0

1 ings Impoundment Name: ____ Impoundment # 1

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: STABILIZE DECANT SYSTEM			#N/A	0	$0		$0	$0
Remove	m3		#N/A	0	$0		$0	$0
Plug/backfill	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
OBJECTIVE: REMOVE TAILINGS DISCHARGE			#N/A	0	$0		$0	$0
Cyclones	m3		#N/A	0	$0		$0	$0
Pipe	m	5000	PPLL	1.02	$5,100	100%	$5,100	$0
Other			#N/A	0	$0		$0	$0
			#N/A	0	$0		$0	$0
SPECIALIZED ITEMS			#N/A	0	$0		$0	$0
.			#N/A	0	$0		$0	$0
Subtotal					$32,117,360	0.00016	$5,100	$32,112,260
					Total Tailings	Percent Land	Total Land	Total Water

1 Rock Pile Name: ____ Rock Pile #: 1

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: STABILIZE SLOPES								
	Flatten slopes with dozer, rock pile, north	m3	1501500	dsl	0.71	$1,066,065.00	50%	$533,033	$533,033
.	Flatten slopes with dozer, till pile	m3	479000	dsl	0.71	$340,090.00	100%	$340,090	$0
.	Flatten slopes with dozer, till pile, south	m3	234000	dsl	0.71	$166,140.00	100%	$166,140	$0
.	Toe buttress, drain mat'l	m3		#N/A	0	$0.00		$0	$0
.	, fill mat'l A	m3		#N/A	0	$0.00		$0	$0
.	, fill mat'l B	m3		#N/A	0	$0.00		$0	$0
.	Other			#N/A	0	$0.00		$0	$0
B									
.	OBJECTIVE: COVER DUMP					$0.00		$0	$0
.	till on biotite schist	m3	1031000	#N/A	4.82	$4,969,420.00		$0	$4,969,420
.	rock on mixed rock & biotite schist	m3	4290000	#N/A	3.96	$16,988,400.00		$0	$16,988,400
.	till on caribou ramps	m3	6400	#N/A	4.82	$30,848.00	100%	$30,848	$0
.	rock cover from roads, etc.	m3	0	#N/A	5.65	$0.00		$0	$0
C	rock cover from new quarry	m3	0						
.	rock cover on 2.5:1 slopes, incr. cost	m3		#N/A	0.15	$0.00		$0	$0
.	till islands for reveg.	m3	93300	#N/A	4.82	$449,706.00	100%	$449,706	$0
.	till islands for reveg., south dump	m3	46650	#N/A	4.82	$224,853.00	100%	$224,853	$0
.	OBJECTIVE: UNDERWATER DISPOSAL			#N/A		$0.00		$0	$0
D	Move material	m3		#N/A	0				
.	Add lime	m3		#N/A	0	$0.00		$0	$0
E	Add crushed limestone	m3		#N/A	0				
.	Other			#N/A	0	$0.00		$0	$0
.				#N/A		$0.00		$0	$0
.	OBJECTIVE: COLLECT AND TREAT			#N/A		$0.00		$0	$0
.	See "ONGOING TREATMENT" costing component			#N/A		$0.00		$0	$0
F				#N/A		$0.00		$0	$0
	OBJECTIVE: DEVELOP WETLAND			#N/A		$0.00		$0	$0
	Earthworks, mat'l A	m3		#N/A	0	$0.00		$0	$0
	, mat'l B	m3		#N/A	0	$0.00		$0	$0
	Vegetate, till pile	ha	31	vhsl	1680	$52,080.00	100%	$52,080	$0
	Other			#N/A	0	$0.00		$0	$0
				#N/A		$0.00		$0	$0
	SPECIALIZED ITEMS			#N/A		$0.00		$0	$0
.						$0.00		$0	$0
				#N/A	0	$0.00		$0	$0
	Subtotal					$24,287,602	7.4%	$1,796,750	$22,490,853
						Total for Rock Pile	Percent Land	Total Land	Total Water

1 Building / Equip Name: ____ Bldg / Equip #: *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: DISPOSE MOBILE EQUIPMENT								
	Decontaminate and ship off-site	km	320000	mherh	8.5884	$2,748,288	50%	$1,374,144	$1,374,144
.	Decontaminate, dispose on-site	each		#N/A	0	$0		$0	$0
.	Other	each		#N/A	0	$0		$0	$0
B	OBJECTIVE: DISPOSE STATIONARY EQUIPMENT								
.	Decontaminate and ship off-site	km	353857	mherh	8.5884	$3,039,065	50%	$1,519,533	$1,519,533
.	Decontaminate, dispose on-site	each		#N/A	0	$0		$0	$0
.	Other	each		#N/A	0	$0		$0	$0
C	OBJECTIVE: DISPOSE ORE CONCENTRATION EQUIPMENT								
.	Decontaminate crushing plant	each		#N/A	0	$0		$0	$0
.	Decontaminate tanks & plumb.	each		#N/A	0	$0		$0	$0
.	Remove tanks & plumbing	each		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
D	OBJECTIVE: DISPOSE WATER TREATMENT EQUIPMENT								
.	Decontaminate tanks & plumb.	each		#N/A	0	$0		$0	$0
.	Remove tanks & plumbing	each		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
E	OBJECTIVE: DECONTAMINATE BUILDINGS & TANKS								
.	site wide allowance	each	1	#N/A	75000	$75,000	50%	$37,500	$37,500
.	clean explosives facility	each	1	#N/A	50000	$50,000		$0	$50,000
.		each		#N/A	0	$0		$0	$0
.		each		#N/A	0	$0		$0	$0
.		each		#N/A	0	$0		$0	$0
				#N/A	0	$0		$0	$0
.		each		#N/A	0	$0		$0	$0
F	OBJECTIVE: MOTHBALL BUILDINGS								
.	Building 1	m2		#N/A	0	$0		$0	$0
.	Building 2	m2		#N/A	0	$0		$0	$0
.	Building 3	m2		#N/A	0	$0		$0	$0
.	Building 4	m2		#N/A	0	$0		$0	$0
.	Building 5	m2		#N/A	0	$0		$0	$0
.	Other	m2		#N/A	0	$0		$0	
G	OBJECTIVE: REMOVE BUILDINGS								
.	Process plant	m2	54000	brs1h	53.856	$2,908,224	100%	$2,908,224	$0
.	Maintenance plant	m2	31500	brs1h	53.856	$1,696,464	100%	$1,696,464	$0
.	Camp	m3	13275	brs1l	35.904	$476,626	100%	$476,626	$0
.	Bulk fuel storage	m2	39375	brs1l	35.904	$1,413,720	100%	$1,413,720	$0
.	Power plant/boiler house	m3	11000	brs1h	53.856	$592,416	100%	$592,416	$0
.	Ammonium nitrate fuel storage	m2	22500	brs1l	35.904	$807,840	100%	$807,840	$0
.	Explosives/cap storage & mixing	m3	600	brs1h	53.856	$32,314	100%	$32,314	$0
.	Remove boneyard waste	m2	1700	brs1l	35.904	$61,037	100%	$61,037	$0
.	Other			#N/A	0	$0		$0	$0
H	OBJECTIVE: BREAK BASEMENT SLABS								
.	Building 1	m2		#N/A	0	$0		$0	$0
.	Building 2	m2		#N/A	0	$0		$0	$0
.	Building 3	m2		#N/A	0	$0		$0	$0
.	Building 4	m2		#N/A	0	$0		$0	$0
.	Building 5	m2		#N/A	0	$0		$0	$0

1 Building / Equip Name: ____ Bldg / Equip #: *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
.	Other			#N/A	0	$0		$0	$0
I	OBJECTIVE: REMOVE BURIED TANKS								
.	Tank 1, decontaminate	m3		#N/A	0	$0		$0	$0
.	, excavate & dispose	m3		#N/A	0	$0		$0	$0
.	Tank 2, decontaminate	m3		#N/A	0	$0		$0	$0
.	, excavate & dispose	m3		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
J	OBJECTIVE: LANDFILL FOR DEMOLITION WASTE								
.	Place soil cover	m3	187500	#N/A	5.65	$1,059,375	100%	$1,059,375	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
.	Landfill disposal fee	tonne		#N/A	0	$0		$0	$0
K	OBJECTIVE: GRADE AND CONTOUR								
.	Grade mill area	m2	30750	dsl	0.7956	$24,465	100%	$24,465	$0
.	Place soil cover	m3	34050	#N/A	5.65	$192,383	100%	$192,383	$0
.	Rip rap on ditches	m3		#N/A	0	$0		$0	$0
.	Vegetate	ha		#N/A	0	$0		$0	$0
.	Other			#N/A	0	$0		$0	$0
L	OBJECTIVE: RECLAIM ROADS								
	Haul roads, A 154 & A418 lease	ha	3.71	scfyl	3595.5	$13,339	100%	$13,339	$0
	Service roads, A154 & A418 lease	ha	1.6	scfyl	3595.5	$5,753	100%	$5,753	$0
	Haul roads, A21 lease	ha	1.8	scfyl	3595.5	$6,472	100%	$6,472	$0
	Service roads, A21 lease	ha	1.65	scfyl	3595.5	$5,933	100%	$5,933	$0
	Haul roads, PKC & dumps lease	ha	10.13	scfyl	3595.5	$36,422	100%	$36,422	$0
	Service roads, PKC & dumps lease	ha	23.2	scfyl	3595.5	$83,416	100%	$83,416	$0
	Haul roads, infrastructure lease	ha	14.85	scfyl	3595.5	$53,393	100%	$53,393	$0
	Service roads, infrastructure lease	ha	5.4	scfyl	3595.5	$19,416	100%	$19,416	$0
.	Haul roads, airstrip lease	ha	0	scfyl	3595.5	$0	100%	$0	$0
.	Service roads, airstrip lease	ha	2.9	scfyl	3595.5	$10,427	100%	$10,427	$0
.				#N/A	0	$0	100%	$0	$0
K	SPECIALIZED ITEMS								
	RECLAIM AIRSTRIP	ha	11	scfyl	3215	$35,365	100%	$35,365	$0
	YELLOWKNIFE LANDFILL DISPOSAL FEE		1		250000	$250,000	100%	$250,000	$0
.				#N/A	0	$0		$0	$0
	Subtotal					$15,697,151	81.0%	$12,715,974	$2,981,177
						Total Buildings	Percent Land	Total Land	Total Water

1 **Chemicals and Soil Contamination:** **1**

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
	Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have								
.	been conducted.								
A	LABORATORY CHEMICALS	km	494	mherh				$0	
.		pallet	50	#N/A	1000	$50,000		$0	$50,000
B	PCB, hauling	litre		#N/A	0	$0		$0	$0
.	PCB, disposal	litre		#N/A	0	$0		$0	$0
C	FUEL			#N/A		$0		$0	$0
.	Type 1, 200 tonnes	km		mherh	8.5884	$0		$0	$0
.	Type 2	kg		#N/A	0	$0		$0	$0
.	Type 3	kg		#N/A	0	$0		$0	$0
D	WASTE OIL								
.	Oils/lubricants - burn on-site	litre		#N/A	0	$0		$0	$0
.	Oils/lubricants - ship off-site	litre	650000	#N/A	0.027	$17,550		$0	$17,550
.	removal glycol	litre	20,000		1.25	$25,000		$0	$25,000
E	remove batteries	kg	25,000		0.5	$12,500		$0	$12,500
.	remove paints	litre	1500		0.27	$405		$0	$405
.	remove solvents	litre	7500		0.75	$5,625		$0	$5,625
.	Oils/lubricants - disposal fee	litre		#N/A	0	$0		$0	$0
.	PROCESS OR TREATMENT CHEMICALS								
F	Type 1	km		mherh	8.5884	$0		$0	$0
	Type 2	kg		#N/A	0	$0		$0	$0
	Type 3	kg		#N/A	0	$0		$0	$0
	Type 4	kg		#N/A	0	$0		$0	$0
	EXPLOSIVES	kg							
		allow	1	#N/A	10000	$10,000		$0	$10,000
	CONTAMINATED SOILS								
.	Type 1, light fuel	m3	5000	CSRL	39.27	$196,350		$0	$196,350
G	Type 2, heavy fuel and oil	m3	2500	#N/A	100	$250,000		$0	$250,000
.	Type 3, metals	m3	250	#N/A	100	$25,000		$0	$25,000
.	Haz. Mat. testing & assessment								
.	Technician and analyses	each	1	#N/A	110000	$110,000		$0	$110,000
H	Drilling	each	1	#N/A	75000	$75,000		$0	$75,000
.	Reporting		1		20000	$20,000		$0	$20,000
.	Other			#N/A	0	$0		$0	$0
.	OTHER								
.	remove nuclear densometers from mill	each	10	#N/A	4000	$40,000		$0	$40,000
	Subtotal					$837,430	0.0%	$0	$837,430
						Total Chemical	Percent Land	Total Land	Total Water

1 /ater Management Project: ____ Project # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: STABILIZE EMBANKMENT								
	Toe buttress, drain mat'l	m3		#N/A	0	$0		$0	$0
	, fill mat'l A	m3		#N/A	0	$0		$0	$0
	, fill mat'l B	m3		#N/A	0	$0		$0	$0
	Rip rap	m3		#N/A	0	$0		$0	$0
	Vegetate	ha		#N/A	0	$0		$0	$0
	Raise crest	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
B	OBJECTIVE: UPGRADE SPILLWAY								
	Excavate channel	m3	680	dsh	2.83	$1,924		$0	$1,924
	Place rip rap	m3	190	#N/A	5.65	$1,074		$0	$1,074
	Excavate channel	m3	14400	dsh	2.83	$40,752		$0	$40,752
	Place rip rap	m3	10400	#N/A	5.65	$58,760		$0	$58,760
	Other			#N/A	0	$0		$0	$0
C	OBJECTIVE: STABILIZE SEDIMENT CONTAINMENT PONDS								
	Place soil cover	m3		#N/A	0	$0		$0	$0
	Place geotextile	m2		#N/A	0	$0		$0	$0
	Vegetate	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
D	OBJECTIVE: BREACH EMBANKMENT								
	Remove Fill	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
E	OBJECTIVE: COLLECTION PONDS								
	Breach 4 dams	m3	2200	dsh	2.83	$6,226		$0	$6,226
	place geotextile, 4 by 15,000 m2	m2	60000	#N/A	10	$600,000		$0	$600,000
	place rock over geotextile	m3	60000	#N/A	5.65	$339,000		$0	$339,000
	Other			#N/A	0	$0		$0	$0
F	OBJECTIVE: BREACH DITCHES								
	Excavate	m3	7875	dsh	3.1722	$24,981		$0	$24,981
	Backfill/recontour	m3	2625	sc1h	7.803	$20,483		$0	$20,483
	Vegetate	ha		#N/A	0	$0		$0	
	Other			#N/A	0	$0		$0	$0
G	OBJECTIVE: REMOVE PIPELINES								
	Remove pipes	m		#N/A	0	$0		$0	$0
	Concrete plug deep pipes	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
H	OBJECTIVE: NORTH INLET EAST DIKE								
	Excavate/construct spillway	m3	4500	sb3h	4.83	$21,735		$0	$21,735
	Excavate & backfill	m3		#N/A	0	$0		$0	$0
	Other			#N/A	0	$0		$0	$0
I	OBJECTIVE: COLLECT DRAINAGE FOR TREATMENT								
	Excavate collection ditches	m3		#N/A	0	$0		$0	$0
	Rip rap ditches	m3		#N/A	0	$0		$0	$0
	Pipes	m		#N/A	0	$0		$0	$0
	Pumps	each		#N/A	0	$0		$0	$0
	Collect'n pond, exc. mat'l A	m3		#N/A	0	$0		$0	$0
	, exc. mat'l B	m3		#N/A	0	$0		$0	$0
	Collect'n pond, fill mat'l A	m3		#N/A	0	$0		$0	$0

1 /ater Management Project: ____ Project # 1

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
	, fill mat'l B	m3		#N/A	0	$0		$0	$0
	Collect'n pond, liner	m2		#N/A	0	$0		$0	$0
J	OBJECTIVE: TREAT DRAINAGE (see "ONGOING TREATMENT" for operating costs)								
	Build treatment plant	lump sum		#N/A	0	$0		$0	$0
				#N/A	0	$0		$0	$0
	Subtotal					$1,114,935	0.0%	$0	$1,114,935
						Total Water	Percent Land	Total Land	Total Water

1 **Mobilization Name:** ____ **Mob # *1***

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost
A	MOBILIZE HEAVY EQUIPMENT					
Equipment to regional centre						
.	Excavators	km		#N/A	0	$0
.	Dump trucks	km		#N/A	0	$0
.	Dozers	km		#N/A	0	$0
.	Demolition shears	km		#N/A	0	$0
Equipment, regional centre to site						
.	Excavators - 2	km	4800	MHERH	8.59	$41,224
.	Dump trucks - 15	km	120000	MHERH	8.59	$1,030,608
.	Dozers - 4	km	16000	MHERH	8.59	$137,414
	Demolition shears - 2		9600	MHERH	8.59	$82,449
	Front end loader 2		4800	MHERH	8.59	$41,224
	cranes - 2		1600	MHERH	8.59	$13,741
	service vehicles -10		16000	MHERH	8.59	$137,414
.		km				
B	MOBILIZE CAMP					
.		allowance	1	#N/A		$150,000
C	MOBILIZE WORKERS					
.	rotations over reclamatio period	m-hrs	26000	#N/A	45	$1,170,000
D	MOBILIZE MISC. SUPPLIES					
.	Fuel	litre	7000000	#N/A	0.78	$5,460,000
.	Minor tools and equipment	owance	1	#N/A	0	$500,000
.	Truck tires	owance	1	#N/A	0	$500,000
E	MOBILIZE & HOUSE WORKERS	person days				
.	20800 man-days	month	740	accml	1346.4	$996,336
.	WINTER ROAD					
.	Full winter use	km		#N/A	0	$0
.	Limited winter use	km		#N/A	0	$0
.				#N/A	0	$0
F	BONDING lump sum					
.				#N/A		$0
G	TAXES lump sum					
.				#N/A		$0
H	INSURANCE lump sum					
.				#N/A		$0
	Subtotal					$10,260,412
						Total Mob.

Equipment Mobilization	# of machines	loads/machine	round trip km	total road mileage
excavator	2	3	800	4800
dump trucks	15	10	800	120000
dozers	4	5	800	16000
demolition shears	2	6	800	9600
front end loader	2	3	800	4800
cranes	2	1	800	1600
service vehicles	10	2	800	16000

1 Monitoring & Maintenance Mon / Mtce # *1*

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost
A	OBJECTIVE: POST-CLOSURE INSPECTIONS					
	Annual geotechnical insp.	each	8	VIH	$7,242	$57,936
.	Survey inspection	each		#N/A	$0	$0
.	Water sampling	yrs	10	#N/A	$250,000	$2,500,000
.	Reporting	yrs	10	#N/A	$100,000	$1,000,000
.	Other			#N/A	$0	$0
B	OBJECTIVE: INTERIM CARE & MAINTENANCE					
.	annual C&M	yrs	3	#N/A	$2,223,639	$6,670,917
.		month		accml		$0
.		month		#N/A	$0	$0
.		each		#N/A	$0	$0
.		allowance				
				#N/A		$0
	Subtotal					$10,228,853

Total Mon./Maint.

ANNUAL INTERIM CARE & MAINTENANCE

	No.	hrs/year	Rate	Annual Cost	
Site supervisor	1	3650	$61.20	$223,380	
laborers	3	3650	$38.76	$141,474	
equipment operators	2	3650	$56.10	$204,765	
mechanic	1	3650	$61.20	$223,380	
electrician	1	3650	$70.00	$255,500	
envir. coodinator	1	3650	$61.20	$223,380	
				$1,271,879	total staff
Fuel, power & heat	L/hr	mon/yr	fuel		
	50	3	108000		
	40	7	201600		
	25	2	36000		
Fuel, mobile equipment	15	12	129600		
			475200	total fuel	
air charter	flights/yr		cost/flight		
	52		4500	234000	
camp costs	108	m-months	1320	142560	
misc. supplies, allowance				50000	
reagents				50000	
		Total annual C&M		$2,223,639	

APPENDIX VIII

RECLAMATION RESEARCH AND/OR ENGINEERING STUDY PLANS

Appendix VIII-1 – Processed Kimberlite Properties Research

1. Uncertainty

The processed kimberlite (PK) properties research consists of a geotechnical characterization program and a geochemical characterization program. Geotechnical characterization is required to understand better the consolidation rate and magnitude of the PKC slimes as well as the thermal evolution of the PKC beaches. Geochemical characterization is required to understand better current and long-term pore water quality in the PKC slimes, which may be released during consolidation.

1.1 Specific Research Questions

1. To what extent are the slimes of the fine processed kimberlite (FPK) able to consolidate? What is the proportion and influence of clay minerals in the FPK slimes?
2. What is the thermal evolution of the PKC beaches?
3. What is the geochemical water quality of the water in the slimes? Does the water chemistry change spatially and/or temporally? To what extent will this water be expelled during consolidation?

2. Research/study objectives

The overall goals of the program are to:

1. Characterize the geotechnical properties of the FPK slimes to evaluate rate and extent of consolidation;
2. Determine the rate of permafrost formation and active zone thickness in the coarse fraction of the FPK, exposed as beaches in the PKC facility; and
3. Characterize the primary and secondary mineralogy of FPK; and
4. Characterize the chemistry of the pore water that may be expelled during consolidation.

3. Research/study plan overview

3.1 Tasks completed

The geotechnical and geochemical studies have been recently initiated. Completed tasks are limited but include:

- Engaged competent consultants for geochemistry and geotechnical characterization studies;
- Data review of available geochemistry data;
- Preliminary sampling and instrument installation in FPK for pore water chemistry characterization;
- Sampling for FPK mineralogical characterization related to in situ geochemical reactions and pore water chemistry; and
- Data review of available geotechnical data related to consolidation and thermal regimes.

3.2 Tasks remaining

Tasks remaining for the PKC characterization program include:

- Pore water chemistry data analysis and interpretation;
- Ongoing monitoring of pore water chemistry;
- In situ FPK mineralogy analysis;
- Initiation of field and/or laboratory studies for geotechnical characterization related to consolidation rates;
- Determine feasible options to promote consolidation, including alternate long-term deposition plans; and
- Installation of thermistors for thermal regime monitoring.

4. Findings of research/studies completed

4.1 Summary of relevant results

Results are not available currently.

4.2 Applications of lessons learned

Results and characterizations are not available but will be reviewed and applied to PKC facility management and closure planning.

4.3 Description of data and information still missing

- Results and interpretation from a piezocone program;
- Consolidation properties based on laboratory testing;
- Thermal evolution of PKC beaches;
- Pore water chemistry;
- Primary and secondary mineralogy of the FPK

4.4 Recommendations for future work

Future work will be identified after results from the preliminary investigations are available. It is anticipated that results from these preliminary investigations will extend to evaluation alternate management options for the PKC facility and possible ongoing monitoring to confirm changes in properties over time.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

Current scopes of work for PKC characterization project include:

- Geochemistry analysis and interpretation;
- Mineralogical analysis and interpretation;
- Review existing geotechnical data and conduct laboratory analyses as required;
- Plan and conduct additional field investigations, including piezometer and thermistor installation and additional piezocone testing;
- Analysis of geotechnical data, including estimates of pore water expulsion rates;
- Consideration of trial wick-drain program, dependent on geotechnical data results.

5.2 Conceptual scopes of work

Additional scopes of work may be added or amended as data is collected and reviewed.

6. Linkages to other research/studies and LOM plan

In addition to closure planning, outcomes from this research has potential links with:

- PKC operation plans;
- Water management plans; and
- PKC construction plans;

7. Project tracking and schedule

Progress of the overall PKC characterization study is evaluated by work scope. Final reports and/or technical memos are required for each work scope. A general project schedule is provided in Table 1.

Table 1: Completed and planned project activities

Year	Activities
2009	• Initial field investigations for PKC geochemistry including sample collection and data analysis • Data review and program planning for PKC geotechnical characterization
2010	• Data analysis and reporting for PKC geochemistry characterization • Additional field investigations for PKC geochemistry characterization, if required • Laboratory testing of FPK for geotechnical parameters • Field program for PKC geotechnical characterization including piezometer and thermistor installation • Data analysis, reporting and/or modelling for preliminary PKC geotechnical characterization • Additional data collection and program planning for PKC geotechnical characterization, as required • Planning for 2011 wick drain trial, pending results of field and laboratory geotechnical investigations
2011	• Initiate wick drain trial, if required
2012	• Continuation, if required, of wick drain trial • Reporting of wick drain trial

8. Costs

The PKC characterization study was initiated in Q2, 2009. Costs to date have been under $50,000. A cost estimate to complete the study is not available at this time.

9. References

No references to date.

Appendix VIII-2 – Wildlife Movement – Traditional Knowledge and Science

1. Uncertainty

There are numerous options regarding the preferred route(s) for caribou movement through a post-closure landscape. The uncertainty at this time is the selection of routes to incorporate into the final post-closure landscape design. DDMI expects that there are both Traditional Knowledge and science views on this.

1.1 Specific Research Questions

1. What are the best routes to enhance for caribou movement through a post closure landscape to minimize hazards to caribou?

2. What aspects of the post-closure landscape present risks to caribou safety?

3. What practical mitigation options exist to reduce hazards?

2. Research/study objectives

The overall goal of the program is to identify the preferred route(s) for caribou through a post-closure landscape.

3. Research/study plan overview

3.1 Tasks completed

To date DDMI has completed an initial review of issues and options with communities at an on-site workshop (see Appendix IX-5).

3.2 Tasks remaining

To be determined

4. Findings of research/studies completed

4.1 Summary of relevant results

Caribou will occasionally use disturbed areas such as roads, airstrips and tailings ponds to rest (Gunn, 1998), returning to these areas after foraging on nearby tundra. This behaviour has been observed at other mines in the Bathurst range, such as Lupin and Ekati. It has been suggested that this is to take advantage of the view and to make it difficult for predators to conceal themselves, similar to their habit of bedding on frozen lakes in the winter. Further, these areas have fewer mosquitoes and blackflies (Gunn, 1998). Although it is not clear that these disturbed areas are used preferentially to undisturbed areas (Gunn, 1998), it is possible that the waste rock piles and Processed Kimberlite Containment (PKC) area may be used by caribou following closure.

Eventually, it is possible that the waste rock piles and PKC will revegetate, providing forage for caribou and other wildlife. During winter, caribou forage primarily on lichen, which is slow to recover. Studies of caribou behaviour in relation to forest fires indicate that caribou select areas which have remained un-burnt for at least 50 years (Dalerum et al. 2007; Joly et al.

2007). Shrubs and forbs may colonize the waste rock piles in a much shorter period, and these may be used by caribou during the late summer and fall months.

In many respects, the waste rock piles and PKC dams are similar to the boulder associations present in the Lac de Gras area and the larger central Canadian Arctic (described and mapped in Matthews et al. 2001). Both Traditional Knowledge and aerial surveys in the Lac de Gras area have indicated that caribou avoid these areas.

At the initial site workshop in 2009 three options in particular were developed during the course of discussion by the Participants:

Leave the rock piles and PKC as they are now. Participants stated that they view the East Island as dead because of the development so caribou will not return. Also, the current rock pile and PKC dams prevent access to most caribou due to the steep sides and large rocks.

Cover the entire surface of the waste rock pile and PKC with fine, smooth gravel. This would allow access for caribou to pass freely over the waste rock piles and PKC. Further, the waste rock piles should be contoured to mimic the surrounding landscape.

Design passages or corridors over or around the waste rock pile and PKC area. This would allow movement of caribou around, over and across the structures, but at specific areas. It was recommended that the general layout of these corridors should correspond to historic caribou trails on the island.

4.2 Applications of lessons learned

To be determined.

4.3 Description of data and information still missing

To be determined.

4.4 Recommendations for future work

Future work has not been determined. Initial recommendations from the 2009 workshop include:

- Further community consultations on closure options are required;
- Ensure that good interpreters are available who know some technical terminology;
- Keep participants for the camp consistent from year to year;
- Diavik needs to communicate consistent participant requirements to the communities when requesting participants;
- Each group needs to now relay information from this camp to their respective organizations;
- Further discussion of the camp should take place during the meetings between Diavik representatives and community Chief & Council being planned for September 2009 in each community; and
- A summary PowerPoint presentation should be provided to community representatives so they can share with their communities.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

To be determined.

5.2 Conceptual scopes of work

To be determined.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Re-vegetation Research;
- Re-mining plan for wasterock area; and
- Landscape design all mine closure areas.

7. Project tracking and schedule

To be determined

Table 1: To Completed and planned project activities – To be determined

Year	Activities
2009	•
2010	•

8. Costs

To be determined.

9. References

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Appendix VIII-3 – Diavik Wasterock Test Pile Research

The Diavik Wasterock Test Pile Research is a complementary laboratory and field study to measure and compare low sulphide waste rock and drainage characteristics at various scales. The project is collaborative, multidisciplinary, multi-year project. The field portion is hosted by Diavik and with research lead by the University of Waterloo, University of Alberta, University of British Columbia

1. Uncertainty

The project aims to answer academic research questions about physical, microbiological and geochemical behaviour of waste rock, as well as questions specific to Diavik waste dump behaviour and closure.

Research is focused on thermal regimes, gas transport, hydrology, microbiological populations and geochemical behaviour of low sulphide waste rock.

1.2 Specific Research Questions

1. To what extent is water able to infiltrate through an unsaturated, coarse grained rock mass where interior temperatures may be below the freezing point of pure-phase water? If (discontinuous) zones of ice form within the pore spaces of the waste rock, how much water can percolate downward beneath the active zone that will form each summer on the top surface of a waste rock pile? If infiltration occurs, what are the flow mechanisms? What is the role of solute exclusion during freezing on suppression of the freezing point?

2. For waste rock with an acid generation potential approximately equal to its neutralization potential, to what degree are the rates of oxidative dissolution of sulphide minerals and rates of dissolution of carbonates and aluminosilicate minerals influenced by the thermal state within the test piles?

3. To what degree do predictions of the magnitude and timing of solute loads derived from laboratory tests on small volumes of waste rock yield results that can be used to predict the behaviour observed in a controlled, large-scale field experiment?

4. Do bacteria colonize and survive in waste rock piles where interior temperatures fall below the freezing point and what role do bacteria play in the biogeochemical evolution of water chemistry under these conditions?

5. Can existing numerical models of flow and transport in unsaturated porous media simulate the hydrologic and geochemical behaviour observed in the test piles under Arctic conditions?

6. How effective is a thermal blanket (Type I cover material) and a low-permeability layer (a till layer beneath the thermal cover) in modifying hydrologic, thermal, and geochemical conditions inside a waste rock pile?

7. To what degree could a warming climate in northern Canada modify the hydrologic and geochemical behaviour of mine waste stockpiles, with consequent impacts on environmental loadings? How robust are current design concepts?

2. Research/study objectives

The overall goals of the program are to:

1. Characterize the flow, thermal, and gas transport regimes, and the geochemical and microbiological processes in low sulphide waste rock piles in a continuous permafrost environment; and

2. Quantitatively assess the application of small-scale laboratory column experiments in the prediction of the effluent quality of unsaturated waste rock stockpiles.

3. Research/study plan overview

3.1 Tasks completed

Completed tasks for field portion of the Diavik Waste Rock Test Piles studies include:

- Construction of three 15-m high waste rock piles completed in 2007. One pile consists of Type I material, one pile consists of Type III material and the third pile consists of a Type III core contoured and capped with 1.5 m of till and 3 m of Type I as per the previous interim closure plan;
- Construction of three sets of 2 m scale experiments;
- Installation of a comprehensive suite of instrumentation including basal drainage collection system, basal collection lysimeter systems, suction lysimeters, thermistors, probes to measure moisture content, tensiometers, gas sampling tubing, gas pressure measurement system, air permeability probes, and microbiological growth media;
- Collection and analysis of waste rock samples for physical and geochemical characteristics;
- Tracer and applied rainfall tests;
- Permeameter construction and experimentation;
- On-going data collection and initial interpretation of all data types.

3.2 Tasks remaining

Diavik has tentatively agreed to continue the project through 2014. Task remaining for the field portion of the study continuation include:

- Continuation of data collection and monitoring;
- Installation of instrumentation in the waste dumps;

- Interpretation of field measurements;
- Deconstruction of one of the test piles for direct observations.
- Characterize water flow processes;
- Determine gas transport processes;
- Delineate the thermal regime within the piles;
- Measure and interpret pore water and effluent chemistry;
- Characterize bacterial populations;
- Examine primary and secondary mineral formation; and
- Interpret the integrated effects of the physicochemical processes.

4. Findings of research/studies completed

4.1 Summary of relevant results

Data collection started in May 2007. Field data collection is an on-going activity, often with delayed analysis and interpretation. Preliminary interpretations of the available data include:

- The test piles are cooling but freezing and thawing annually;
- The till layer on one of the test piles acts as a thermal blanket, reducing cooling rates;
- Type I and Type III piles are permeable to air with wind induced gas transport enhancing oxygen transport;
- Oxygen supply does not limit sulfide mineral oxidation;
- Type I sulphur concentrations are low and sulphide oxidation is balanced by acid neutralization;
- Type III sulphur concentrations are low, but at levels where sulphide oxidation rates exceed acid neutralization rates;
- Preliminary hydrology regimes indicate preferential flow is limited to high intensity rainfall events;
- The test piles have not attained dynamic equilibrium with to date.

Initial characterization and interpretations have been presented in numerous papers, conference proceedings and conferences, listed in the reference section.

4.2 Applications of lessons learned

Initial results and characterizations from the field portion of the Diavik Wasterock Test Piles Project have contributed to refining and revising the dump closure plan for the Interim Closure and Reclamation Plan, in addition to waste ock management practices, and short-term, mid-term and long-term dump planning.

4.3 Description of data and information still missing

The physicochemical processes occurring in the test piles have not reached dynamic equilibrium. Additional data collection and monitoring will permit evaluation of the evolution of thermal, hydrological and gas transport regimes, and the geochemical and microbiological responses.

4.4 Recommendations for future work

Recommendations for future work have been captured in detailed scopes of work.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

Expected scopes of work for the university researchers associated with the field portion of the Diavik Waste Rock Test Piles project include:

- Determine loading rates from 2 m scale experiments and test piles;
- Mineralogical characterization of reaction products of field experiments;
- Characterization of gas transport regime and determination of transport mechanisms;
- Characterization of the hydrology of the 2 m scale experiments and the test piles;
- Characterization of the thermal system in the test piles;
- Microbiology in effluent;
- Assessment of the pile heterogeneity using gas transport measurements;
- Integrate sulphide oxidation rates and gas transport rates;
- Determine the effects of wind-driven gas transport on the thermal regime;
- Conduct numerical modelling that integrates gas transport, geochemistry and flow mechanisms; and
- Conduct numerical modelling of thermal systems, including simulations with climate change scenario(s).

5.2 Conceptual scopes of work

Additional scopes of work may be added or amended as data is collected and reviewed.

6. Linkages to other research/studies and LOM plan

Research associated with the Diavik Test Piles Wasterock Research is related to long-term waste rock management, seepage management and dump closure. Specific linkages include:

- Thermal modelling of waste dumps;
- LOM dump planning;
- Dump closure configuration and progressive reclamation; and
- Water management decision-making and planning.

7. Project tracking and schedule

Progress reports are provided by the University research team annually. The research team meets with Diavik personnel at the beginning of each field season to discuss up-coming activities, and conference calls are held weekly to ensure task are being completed and research objectives are being met. The research team and Diavik mutually agree upon a comprehensive list of project milestones and deliverables, which are required for on-going funding.

A general project schedule for the field portion of the project from project inception is provided in Table 1.

Table 1: Field activities from project inception

Year	Activities
2004	Preliminary earthworks and project planning
2005	Initiation of construction and finalization of design
2006	Construction of test piles and 2 m scale experiment
2007	Completion of test pile construction and first season of data collection
2008	Data collection and installation maintenance
2009	Data collection and installation maintenance
2010	Installation of instruments in the full-scale dump, data collection and installation maintenance
2011	Data collection and installation maintenance
2012	Data collection and installation maintenance
2013	Deconstruction of one test pile, data collection and installation maintenance
2014	Data collection and installation decommissioning

8. Costs

8.1 Approximate costs to date

In-kind costs and direct cash costs to Diavik from the project initiation in 2004 to the end of 2008 were approximately CAD$ 3,680,000. Additional funding contributed by other sponsors (CFI, NSERC, INAP, MEND) is not included in this cost estimate.

8.2 Estimated costs to project completion

An additional CAD$ 1,735,000 (approx.) has been conditionally committed by Diavik for 2009-2014, the expected completion date. Additional funding contributed by other sponsors is not included in this cost estimate.

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A description of the Diavik project was incorporated into Birdsall-Dreiss lectures presented at approximately 25 academic institutions in Canada, the United States, Australia and Germany.

Appendix VIII-4 – Waste Material Sources for Underground Backfill

1. Uncertainty

Sizeable quantities of materials are required to create backfill for the underground mine. Backfill is used to provide ground stability and as such there are specific requirements for the physical properties of the materials. Some of the material used to make the backfill will be sourced from the mine site waste and could include wasterock and/or processed kimberlite. Studies to date have confirmed the applicability of Type I wasterock for use in backfill. It may be beneficial (environmentally) to use Type III or processed kimberlite instead of or in addition to Type I wasterock, if it is technically feasible and economically practical to do so.

1.1 Specific Research Questions

1. Are there lithological or geochemical characteristics of the DDMI wasterock that would limit use in underground backfill?

2. Are there geochemical or physical characteristics of processed kimberlite that would limit use in underground backfill?

3. Are there other site waste materials that could be used in underground backfill?

2. Research/study objectives

To determine the applicability of different site waste materials as sources for the underground backfill.

3. Research/study plan overview

3.1 Tasks completed

Testing of underground backfill prepared using Type I wasterock.

3.2 Tasks remaining

To be determined

4. Findings of research/studies completed

4.1 Summary of relevant results

Type I rock can be used in the preparation of a suitable underground backfill.

4.2 Applications of lessons learned

To be determined.

4.3 Description of data and information still missing

To be determined.

4.4 Recommendations for future work

To be determined.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

To be determined.

5.2 Conceptual scopes of work

To be determined.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Wasterock re-mining plan;
- PKC deposition plan; and
- Closure designs.

7. Project tracking and schedule

To be determined.

Table 1: Completed and planned project activities – to be determined

Year	Activities
2009	•
2010	•

8. Costs

To be determined.

9. References

No references to date.

Appendix VIII-5 – Predicted Water Quality in a Flooded A154/A418 Pit/Dike Area

1. Uncertainty

Final water quality in the flooded A418 and A154 pits were calculated to be similar to Lac de Gras water quality (Blowes and Logsdon 1998) based on information available at that time. Final water quality was governed by the water quality of Lac de Gras because the very large volume of this water diluted any influence from other contributing sources. The other contributing sources are primarily groundwater inflow and geochemical loading from the exposed pit wall surfaces. More information is becoming available over time to better define these sources.

The initial calculations did not consider the mixing conditions within the final water body, something that will need to be determined to assist in planning the flooding rate.

1.1 Specific Research Questions

1. Is the water quality in a flooded A418/A154 pit/dike expected to achieve the water quality closure criteria (Appendix V Table V-1)?

2. Is there any additional information that could be practically obtained that would significantly improve the reliability of the water quality prediction?

3. Is the pit/dike area expected to behave like a meromictic lake?

4. Does the rate of flooding, within a practical range, impact significantly on chemocline development?

2. Research/study objectives

The overall goals of the program are to:

1. Confirm that the closure water quality criteria for the flooded pits are likely to be achieved.

2. Provide information to be used in a final determination of flooding rates for the final closure design.

3. Research/study plan overview

3.1 Tasks completed

Completed tasks include:

- Initial estimates of water quality in flooded A154/A418 pit areas.
- Ongoing monitoring of mine water inflow water quality/quantity.

- Ongoing research on geochemical loadings from exposed rock.
- Documentation of rock lithologies within each mine pit.

3.2 Tasks remaining

Tasks remaining to predict flooded pit water quality include:

- Ongoing monitoring of mine water inflow water quality/quantity.
- Ongoing research on geochemical loadings from exposed rock.
- Complete documentation of rock lithologies within each mine pit.
- Application of a mathematical model to simulate water quality and mixing characteristics of a final pit lake area.
- Prediction of surface water quality, deep water quality and mixing conditions under a range of defined input conditions for: flood rate, groundwater quality/quantity, geochemical contribution from rock surfaces.
- Sensitivity analysis to assess benefits of improved information.

4. Findings of research/studies completed

4.1 Summary of relevant results

- Blowes and Logsdon (1998) provides predicted water quality for the A154 and A418 open pits in comparison with Lac de Gras water quality in Table 7 (copy attached). These initial estimates show that the predicted water quality in the flooded pits is similar to Lac de Gras.
- Ongoing monitoring results from mine water inflows are included with the Surveillance Network Monitoring (SNP) regulatory reporting and Annual Water License Reports. Results continue to support initial estimates that show that mine inflow water will not be a significant determinant of surface water quality in a flooded pit.
- Ongoing research on geochemical loading from exposed rock is also described in Appendix VIII-3. Results continue to support initial estimates that geochemical loading from the pit wall is not a significant determinant of surface water quality in a flooded pit.
- Lithology of pit walls are within the anticipated range.

4.2 Applications of lessons learned

None at this time.

4.3 Description of data and information still missing

- As underground mine development proceeds deeper, the quality of the inflow water could contain higher levels of TDS. The quality of this deeper groundwater inflow will be obtained over time from ongoing monitoring.
- Final lithology of exposed pit walls will not be available until completion of open-pit mining in 2012.

4.4 Recommendations for future work

Future work may be identified from the results of the simulation modelling and modelling sensitivity analysis.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

The following scopes of work have been defined and are ongoing:

- Ongoing monitoring of mine water inflow water quality/quantity (Surveillance Network Program).
- Ongoing research on geochemical loadings from exposed rock (Appendix VIII-3).
- Ongoing documentation of rock lithologies within each mine pit.

5.2 Conceptual scopes of work

The following conceptual scopes of work are planned:

- Application of a mathematical model to simulate water quality and mixing characteristics of a final pit lake area.
- Prediction of surface water quality, deep water quality and mixing conditions under a range of defined input conditions for: flood rate, groundwater quality/quantity, geochemical contribution from rock surfaces.
- Sensitivity analysis to assess benefits of improved information.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Life of Mine Plan – Development Schedule;
- Wasterock management;
- Diavik Test Pile Research Program (Appendix VIII-3); and
- Surveillance Network Program;

7. Project tracking and schedule

Progress of the overall program study is tracked by tasks. Final reports and/or technical memos will be prepared for specific work scope. A general project schedule is provided in Table 1.

Table 1: Completed and planned project activities

Year	Activities
2009-2014	• Ongoing mine inflow monitoring and test pile research, pit lithology documentation
2014	• Mathematical model application, simulation, sensitivity analysis
2015	• Final closure design

2015-2022	• Ongoing mine inflow monitoring to verify quality and quantity

8. Costs

To be determined.

9. References

Blowes,W.D and M.J. Logsdon. 1998. Site Water Quality Estimates for the Proposed Diavik Project. Prepared for Diavik Diamond Mines Inc. September 1998.

Table 7. Expected water quality of water filled open pits at closure

		Lac de Gras concentration	A154 Final flooded pit water quality	A418 Final Flooded pit water quality	
Component	**units**				
pH	su	6-7	6-7	6-7	6-8
Aluminum	mg/L	2.20E-02	2.23E-02	2.27E-02	
Silver	mg/L	5.00E-05	5.01E-05	5.02E-05	
Alkalinity	mg/L	5.30E+00	5.31E+00	5.32E+00	
Arsenic	mg/L	1.00E-04	1.01E-04	1.01E-04	
Boron	mg/L	1.20E-02	1.20E-02	1.20E-02	
Barium	mg/L	1.00E-03	1.01E-03	1.01E-03	
Beryllium	mg/L	1.00E-04	1.01E-04	1.01E-04	
Calcium	mg/L	9.60E-01	9.61E-01	9.62E-01	
Cadmium	mg/L	1.00E-04	1.01E-04	1.01E-04	
Chloride	mg/L	2.00E-01	2.01E-01	2.00E-01	
Cobalt	mg/L	1.50E-04	1.84E-04	2.09E-04	
Chromium	mg/L	6.80E-03	6.80E-03	6.79E-03	
Copper	mg/L	1.50E-03	1.57E-03	1.62E-03	
Iron	mg/L	5.00E-03	5.67E-03	6.17E-03	
Mercury	mg/L	2.50E-05	2.50E-05	2.50E-05	
Potassium	mg/L	4.40E-01	4.41E-01	4.42E-01	
Magnesium	mg/L	4.80E-01	4.81E-01	4.81E-01	
Manganese	mg/L	5.00E-04	5.53E-04	5.85E-04	
Molybdenum	mg/L	1.00E-04	1.09E-04	1.11E-04	
Sodium	mg/L	4.80E-01	4.83E-01	4.83E-01	
Nickel	mg/L	3.80E-03	3.94E-03	4.05E-03	
Ortho-PO4	mg/L	1.50E-03	1.50E-03	1.50E-03	
Lead	mg/L	1.50E-04	1.51E-04	1.51E-04	
Sulphate	mg/L	1.00E+00	1.01E+00	1.01E+00	
Selenium	mg/L	1.00E-04	1.00E-04	1.00E-04	
Silica	mg/L	2.50E-02	2.80E-02	4.01E-02	
Strontium	mg/L	5.00E-03	5.02E-03	5.08E-03	
Thallium	mg/L	5.00E-04	5.01E-04	5.02E-04	
Uranium	mg/L	2.00E-04	2.04E-04	2.10E-04	
Vanadium	mg/L	5.00E-04	5.01E-04	5.02E-04	
Zinc	mg/L	3.00E-04	3.31E-04	4.06E-04	

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Sources: Blowes and Logsdon (1998)

Appendix VIII-6 – Traditional Knowledge Review/Modification of Fish Habitat Designs – A154/A418 Pit Area

1. Uncertainty

Fish habitat has been designed for the A154/A418 pit area (Golder (2003), Golder (2008) - see Appendix X). The designs were prepared by qualified fisheries biologist and engineers and reviewed by the Department of Fisheries and Oceans. Communities have provided comment on the fish habitat work in general. The purpose of this study is to obtain a review and any recommended modifications to the proposed fish habitat designs from a Traditional Knowledge perspective.

1.1 Specific Research Questions

1. Are the proposed fish habitat designs consistent with Traditional Knowledge views?

2. Are there any recommended modifications to the proposed fish habitat designs base on Traditional Knowledge?

3. What is the appropriate final habitat design?

2. Research/study objectives

The overall goal of this study is to finalize the design of the fish habitat for the A154/A418 pit area.

3. Research/study plan overview

3.1 Tasks completed

- Fish habitat designs for A154 and A418 pit areas.

3.2 Tasks remaining

- To be determined.

4. Findings of research/studies completed

4.1 Summary of relevant results

Habitat designs are included in Appendix X.

4.2 Applications of lessons learned

None at this time.

4.3 Description of data and information still missing

- review and any recommended modifications to the proposed fish habitat designs from a Traditional Knowledge perspective.

4.4 Recommendations for future work

To be determined.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

- To be determined.

5.2 Conceptual scopes of work

- To be determined.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Life of Mine Plan – schedule to direct haul materials;
- Final closure design

7. Project tracking and schedule

To be determined.

Table 1: Completed and planned project activities – to be determined

Year	Activities
2009	•
2010	•

8. Costs

To be determined.

9. References

Golder Associtaes Ltd. 2003. Fish Habitat Design for the Pit Shelf Areas at the Diavik Diamond Mine. Submitted to Diavik Diamond Mines Inc. March 2003.

Golder Associates Ltd. 2008. Fish Habitat Design for the A418 Pit Shelf Area at the Diavik Diamond Mine. Submitted to Diavik Diamond Mines Inc. December 2008.

Appendix VIII-7 – Fish Use of Dike Exterior Slopes

1. Uncertainty

Water retention dikes constructed in Lac de Gras were expected to be useable fish habitat both during operation and post-closure (DDMI 1998). During operation habitat use would be limited to the exterior slopes of the dikes but with the flooding of the pit areas at closure, habitat would also be available on the interior slopes of the dikes. Use of the fish habitat on the exterior of the A154 and A418 dikes has not been documented. This documentation and any learnings from it could be useful in assessing likely habitat use on the interior slopes of the dike, post-closure.

2. Research/study objectives

The overall goals of the program are to:

1. Document use of fish habitat on the exterior slopes of the A154/A418 dikes.
2. Apply any learnings to the assessment of fish habitat use on the interior slopes of the dikes.

3. Research/study plan overview

3.1 Tasks completed

- None

3.2 Tasks remaining

Tasks remaining to determine fish use of exterior of dikes:

- Review methods such as underwater video, angling, etc. to determine fish use.
- Canvass communities to determine if there is an appropriate Traditional Knowledge approach that could be applied to determining fish use.
- Develop study approach and apply.
- Document findings and distribute for review and comment.

4. Findings of research/studies completed

4.1 Summary of relevant results

Results are not available currently.

4.2 Applications of lessons learned

None at this time.

4.3 Description of data and information still missing

- See section 3.2

4.4 Recommendations for future work

Additional work beyond what is described in Section 3.2 would be identified following the completion of this study.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

- To be determined

5.2 Conceptual scopes of work

- Review methods such as underwater video, angling, etc. to determine fish use.
- Canvass communities to determine if there is an appropriate Traditional Knowledge approach that could be applied to determining fish use.
- Develop study approach and apply.
- Document findings and distribute for review and comment.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Final fish habitat design for A154/A418 open-pit/dike area.

7. Project tracking and schedule

Progress of the study is evaluated by task. Final reports and/or technical memos are required for each work scope. A general project schedule is provided in Table 1.

Table 1: Completed and planned project activities

Year	Activities
2011	• Review science and Traditional Knowledge methods. • Develop study approach.
2012	• Apply study approach
2013	• Apply study approach
2014	• Apply Study Approach • Document findings and distribute for review and comment

8. Costs

A cost estimate is not available at this time

9. References

DDMI. 1998. Diavik Diamonds Project "No Net Loss" Plan. August 1998.

Appendix VIII-8 – Physical and Ecological Characteristics of Settled A21 Kimberlite

1. Uncertainty

Wet mining techniques currently anticipated for mining the A21 kimberlite, would generate localized suspended solids in the water adjacent to the mining activities. This water would be isolated from Lac de Gras. The primary material that would become suspended would be A21 kimberlite material. Over time and prior to closure this water would clarify. The rate of clarification and the ecological characteristics of the settled kimberlite are not specifically known for the A21 kimberlite.

2. Research/study objectives

The overall goals of the program are to:

1. Determine the rate of clarification A21 kimberlite particles in Lac de Gras water.

2. Determine the physical, chemical and ecological (aquatic) characteristics of settled A21 kimberlite particles.

3. Research/study plan overview

3.1 Tasks completed

No tasks completed to date.

3.2 Tasks remaining

Tasks remaining for this study include:

- Preparation of a water samples representative of the possible concentration range and particle size distribution anticipated for A21 mine area.
- Conduct column settling tests to determine clarification rates.
- Conduct physical, chemical and aquatic toxicological characterization testing on the settled materials.
- Document and distribute final report for review and comment.
- Determine any additional work scopes resulting from the study.

4. Findings of research/studies completed

4.1 Summary of relevant results

Results are not available currently.

4.2 Applications of lessons learned

None at this time.

4.3 Description of data and information still missing

- See Section 3.2

4.4 Recommendations for future work

Any requirements for future work will be identified in the review of the study findings.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

- To be determined

5.2 Conceptual scopes of work

- Preparation of a water samples representative of the possible concentration range and particle size distribution anticipated for A21 mine area.
- Conduct column settling tests to determine clarification rates.
- Conduct physical, chemical and aquatic toxicological characterization testing on the settled materials.
- Document and distribute final report for review and comment.
- Determine any additional work scopes resulting from the study.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Closure design for A21 mine area;
- Mining plan for A21.

7. Project tracking and schedule

Progress of the study is evaluated by task. Final reports and/or technical memos are required for each task. A general project schedule is provided in Table 1.

Table 1: Completed and planned project activities

Year	Activities
2010 Q1	• Prepare study design and engage contractors
2010 Q2	• Prepare test solutions • Conduct column testing
2010 Q3	• Conduct physical, chemical and toxicological testing.
2010 Q4	• Complete documentation and distribute for review.

8. Costs

A cost estimate is not available at this time

9. References

No references to date.

Appendix VIII-9 – Ecological Characterization of North Inlet Water Treatment Backwash

1. Uncertainty

The North Inlet Water Treatment Plant removes particulate material and phosphorus from water before discharging the water to Lac de Gras. The material that is removed is sent as a backwash sludge to the North Inlet. Concern has been expressed about the ecological characteristics of this backwash material and potential for impacts on reconnecting the North Inlet with Lac de Gras at closure. This study is to provide further characterization of the backwash material to determine if the characteristics change with change sin mine operations.

1.1 Specific Research Questions

1. Is the backwash sludge or leachates from the backwash sludge likely to have toxicological effects on aquatic ecosystems

2. Are there chemical constituent of toxicological concern that are present in the backwash sludge that could leach into the overlaying North Inlet water.?

2. Research/study objectives

To provide further characterization of backwash sludge from the North Inlet Water Treatment Plant.

3. Research/study plan overview

3.1 Tasks completed

A first round of characterization testing was completed in 2005 (de Rosemond and Liber 2005).

3.2 Tasks remaining

Characterization testing is to be repeated in 2014 and 2019 following the methods developed by de Rosemond and Liber (2005).

4. Findings of research/studies completed

4.1 Summary of relevant results

The initial ecological characterization (de Rosemond and Liber, 2005) did not identify any material properties that would be expected to prohibit the establishment of productive aquatic habitat. Ammonia was identified as the main constituent of toxicological concern in the sludge, sludge porewater and sludge leachate.

4.2 Applications of lessons learned

To be determined.

4.3 Description of data and information still missing

Additional characterization work to determine if changes in mine operations impact the backwash sludge characterization.

4.4 Recommendations for future work

Additional work scopes may be identified pending review of future characterization studies.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

Characterization testing is to be repeated in 2014 and 2019 following the methods developed by de Rosemond and Liber (2005).

5.2 Conceptual scopes of work

None

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- North Inlet Closure Design; and
- North Inlet sediment microbiological characterization.

7. Project tracking and schedule

Projects are tracked by final reports. Each iteration of testing will produce a final report describing methods used and results obtained. Table 1 shows the expected schedule.

Table 1: Completed and planned project activities

Year	Activities
2014	• Characterization testing and reporting
2019	• Characterization testing and reporting

8. Costs

To be determined.

9. References

de Rosemond, S. and K. Liber. 2005. Ecological Characterization of the Effluent Produced by the North Inlet Water Treatment Plant at the Diavik Diamond Mine. Prepared for Diavik Diamond Mines. April 1, 2005.

Appendix VIII-10 Field Experiments to Develop a Revegetation Procedure for the Diavik Mine

1. Uncertainty

The Diavik Re-vegetation Study is a complementary field study and laboratory (greenhouse) program. This is a multi-year study where the field portion is hosted by Diavik with research lead by the University of Alberta. Funding for the project has been provided by Diavik and the National Science and Engineering Research Council (NSERC).

Little research has been conducted on revegetation of disturbed mine sites in the North American arctic. Establishment of native plant cover is often slow in arctic environments, particularly if adjacent native seed sources are not present (Bishop and Chapin III 1989).

Research is focused on improving knowledge of soil and plant characteristics and processes on disturbed and reference sites at the mine to develop ecologically and economically effective methods to enhance the re-establishment of tundra communities following mine closure (Naeth and Wilkinson 2008).

1.1 Specific Research Questions

1. Which substrates are most effective for enhancing soil properties and native plant community development?
2. Which soil amendments are most effective at enhancing substrate properties (texture, organic matter and nutrient contents and water holding capacities), native plant establishment and community development?
3. Which groups and individual native plant species can establish and survive on a variety of soil substrates and amendments?
4. What is the effect of microtopography including boulders, rocks, soil mounds and pockets on plant emergence and establishment?
5. Which methods are most effective in establishing native shrubs with wild collected seed and stem cuttings?
6. What is the effect of stem cuttings collection time on shrub establishment and survival?
7. Is there an effect on stockpiling salvaged topsoil on its prospective use as a soil amendment and source of native propagules for reclamation of disturbed sites?

2. Research/study objectives

The overall goals of the program are to:

- Identify substrates, amendments, plant species and microtopography treatments that may be appropriate for revegetation of northern mine sites

- Assess soil and plant characteristics and processes on disturbed and reference sites at the mine

- Investigate the potential for shrub species, common on the tundra on East Island, to establish from cuttings under ideal conditions in a greenhouse.

3. Research/study plan overview

3.1 Tasks completed

Completed tasks for the Diavik revegetation study include:

- Establishment of research sites on raised gravel pads. Design of study area included a randomized incomplete block design, divided into three blocks in each area. Five substrate treatments, 5 amendment treatments, 2 seasons of seeding treatments and 6 plant treatments were applied.
- Substrates, amendments and plant species were applied to each substrate. Substrates included glacial till, fine processed kimberlite and gravel. Amendments included salvaged topsoil, inorganic fertilizer and sewage sludge. Plant species included seed mixes of native cultivars and locally-collected cuttings.
- Installation of climate stations in each plot (HOBO stations).
- Collection of softwood cuttings were obtained, transported to Edmonton and potted in a greenhouse environment using randomly assigned treatments.
- Implementation of microtopography treatments such as soil mounds, depressions and boulders.
- Intensive soil sampling and vegetation assessments completed during 2009.

3.2 Tasks remaining

Diavik has agreed to continue the project through to the end of 2011. Tasks remaining for the study include:

- Continuation of data collection and monitoring for study;
- Interpretation of field measurements & lab study;
- Generation of a report summarizing the study findings & recommendations;
- Determination of long-term monitoring requirements for the study areas; and,
- Assess confidence in developing a revegetation procedure based on information identified in the report; identify any additional research that may be required.

4. Findings of research/studies completed

4.1 Summary of relevant results

Data collection started in 2004. Field data collection is an on-going activity, often with delayed analysis and interpretation. Preliminary interpretations of the available data include:

- In 2008, vegetation growth was considerably greater than observed in previous years, and cover was influenced by treatment substrate and soil amendment;

- Processed Kimberlite (PK) continues to be a poor substrate for plant growth, regardless of soil amendment or species sown;

- The addition of salvaged top soil, north inlet water treatment plant sludge or sewage sludge is consistently a component of the top three performing treatments for any given substrate;

- Spring seeding resulted in greater plant cover than fall seeding across all soil treatments; and,

- Grass-dominated seed mixes consistently perform better than those dominated by forbs or shrubs.

- References that are directly or indirectly linked to Diavik's revegetation efforts are included in the References section.

4.2 Applications of lessons learned

To be determined.

4.3 Description of data and information still missing

To be determined.

4.4 Recommendations for future work

Recommendations for future work will be based on the results and recommendations that will be included in the 2011 report.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

It is expected that additional scopes of work for the university researchers associated with the Diavik revegetation study will be required, but have yet to be determined.

5.2 Conceptual scopes of work

Additional scopes of work may be added or amended as data are collected and reviewed.

6. Linkages to other research/studies and LOM plan

Linkages of the Diavik revegetation study with other research or planning is related to planning mine development, actively identifying areas that no longer require use and recognizing material storage opportunities. Specific linkages include:

- Minimizing the mine footprint to reduce impacted areas requiring revegetation;
- Identifying opportunities and areas to begin revegetation; and
- Decision-making and planning relating to stockpiling of various wastes (vegetation, top soil, sewage sludge, north inlet sludge, fine PK, etc.).

7. Project tracking and schedule

Progress reports are provided by the University research team annually. The research team meets with Diavik personnel at the beginning and end of each field season to discuss up-coming activities and ensure research objectives are being met. The research team and Diavik mutually agree upon a list of project milestones and deliverables, which are required for on-going funding.

A general project schedule for the field portion of the project from project inception is provided in **Error! Reference source not found.**.

Table 1: Field activities from project inception

Year	Activities
2004	Material gathering and site preparation
2005	Plot treatments applied & data collection
2006	Data collection – soil sampling, vegetation assessments
2007	Data collection – vegetation assessments, greenhouse experiment
2008	Establishment of microtopography sites and data collection
2009	Data collection – soil sampling and vegetation assessments
2010	Data collection
2011	Data collection and final report preparation
2012	Data collection and installation maintenance
2013	Deconstruction of one test pile, data collection and installation maintenance
2014	Data collection and installation decommissioning

8. Costs

In-kind costs and direct cash costs to Diavik from the project initiation in 2004 to the end of 2009 were approximately $ 246,065, plus in-kind contributions. Funding contributed by other sponsors (NSERC) is not included in this cost estimate.

An additional $ 117,183 has been committed by Diavik for 2009-2011, the expected completion date. Funding contributed by other sponsors is not included in this cost estimate

9. References

ABR, Inc. 2001. Revegetation of mining disturbances in the north: Literature review and identification of research opportunities for the Diavik Diamond Mine, NWT, Canada. Prepared for Diavik Diamond Mines, Inc. Fairbanks AK. 35 pp.

Bishop, S.C. and F.S. Chapin III. 1989. Patterns of natural revegetation on abandoned gravel pads in arctic Alaska. Journal of Applied Ecology 26(3):1073-1081.

Bishop, S.C., J.G. Kidd, T.C. Cater, L.R. Rossow and M.T. Jorgenson. 1999. Land rehabilitation studies in the Kuparuk Oilfield, Alaska, 1998. Thirteenth annual report prepared for ARCO Alaska, Inc. Anchorage, Alaska by ABR Inc. Fairbanks AK. Cited in: ABR, Inc. 2001.

Bishop, S.C., J.G. Kidd, T.C. Cater, K.N. Max and P.E. Seiser. 2000. Land rehabilitation studies in the Kuparuk Oilfield, Alaska 1999. Fourteenth annual report prepared for PHILLIPS Alaska, Inc. and Kuparuk River Unit, Anchorage AK by ABR Inc. Fairbanks AK. 38 pp. Cited in: ABR, Inc. 2001.

Crawford, R.M. 1989. Studies in plant survival: ecological case histories of plant adaptation to adversity. Studies in Ecology. Volume 11. Blackwell Scientific Publications. Palo Alto CA. Pp. 47-75.

Diavik Diamond Mines Inc. 2002. Reclamation research plan, June 2002. Yellowknife NT.

Forbes, B.C. and R.L. Jefferies. 1999. Revegetation of disturbed arctic sites: Constraints and applications. Biological Conservation 88(1):15-24.

Jorgenson, M.T. and M.R. Joyce. 1994. Six strategies for rehabilitating land disturbed by oil development in arctic Alaska. Arctic 47(4):374-390.

Kidd, J.G. and K.N. Max. 2001. Soil topdressing and revegetation testing. In: Ekati Diamond Mine reclamation research program 2000, NT, Canada. Prepared for BHP Diamonds, Inc.. Yellowknife NT by ABR, Inc. Fairbanks AK. Pp. 1-11. Cited in: ABR, Inc. 2001.

Lyle, R.R. 2001. Preliminary in-situ tailings vegetation study, Giant Mine, Yellowknife NT. University of Waterloo. Prepared for EBA Engineering Consultants Ltd., Indian and Northern Affairs Canada, Miramar Giant Mine Ltd., and National Research Council of Canada, Yellowknife NT. Cited in: ABR, Inc. 2001.

Naeth, M.A. and Wilkinson, S.R. 2008. Diamond Mine Reclamation in the NWT: Substrates, Soil Amendments and Native Plant Community Development, 2007 Annual Report.

Porsild, A.E. and W.J. Cody. 1980. Vascular plants of the continental Northwest Territories, Canada. National Museums of Canada. Ottawa ON. 667 pp.

Reid, N.B. and M.A. Naeth. 2005a. Establishment of a vegetation cover on tundra kimberlite mine tailings: A greenhouse trial. Restoration Ecology 13(4):593-600.

Reid, N.B. and M.A. Naeth. 2005b. Establishment of a vegetation cover on tundra kimberlite mine tailings: a field trial. Restoration Ecology 13(4):601-608.

Appendix VIII-11 Development of Standard Operating Procedures – On-site Landfill – Closure Phase

1. Uncertainty

Despite best efforts to reuse, sell, recycle materials at closure, materials will remain. Some will be suitable for on-site disposal others may not be suitable. It is important to identify how this will be determined in advance of final closure to enable more accurate planning.

2. Research/study objectives

The overall goal is to develop a Standard Operating Procedure (SOP) that at a minimum addresses the following:

1. What are the criteria for determining if a material is appropriate for on-site landfilling?
2. How can these materials be reliably identified?
3. Are there pre-treatments that can be applied to certain materials to make them suitable for on site landfilling?
4. Are there any material-specific disposal procedures?

3. Research/study plan overview

3.1 Tasks completed

- No tasks completed to date

3.2 Tasks remaining

- To be determined

4. Findings of research/studies completed

4.1 Summary of relevant results

Results are not available currently.

4.2 Applications of lessons learned

None at this time.

4.3 Description of data and information still missing

To be determined

4.4 Recommendations for future work

To be determined.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

- To be determined

5.2 Conceptual scopes of work

- To be determined

6. Linkages to other research/studies and LOM plan

- To be determined.

7. Project tracking and schedule

To be determined

Table 1: Completed and planned project activities – to be determined

Year	Activities
2009	•
2010	•

8. Costs

To be determined.

9. References

No references to date.

Appendix VIII-12 - Development of Site-Specific Risk-Based Closure Reference Concentrations

1. Summary of Uncertainty.

Specific closure criteria are not available in the form of NWT or Federal Standards for some parameters, mediums or valued ecosystem components. Where there are NWT and/or Federal Standards they may or may not be relevant to the Diavik site. Reference concentrations can be developed using a standardized approach. Reference concentrations once developed can be compared with predicted or measures post-closure concentrations and assist in understanding the significance of a result.

1.1 Specific Research Questions

1. What are the contaminants of potential concern in a post-closure environment?

2. What are the valued ecosystem components (VEC) post-closure?

3. What are the appropriate exposure scenarios for each VEC?

4. What are appropriate site-specific risk based reference concentrations for water, soil, dust, plants and prey that will be protective of wildlife species post-closure?

5. What are appropriate site-specific risk based reference concentrations for water and soil that will be protective of people post-closure?

2. Research/study objectives

The overall goal of the program is to develop reference concentration that are risk-based and site-specific and that are appropriate for the protection of wildlife and people.

3. Research/study plan overview

3.1 Tasks completed

No tasks have been completed specific to this program however a similar program was conducted in 1998 (Mucklow and Swanson 1998) and will be used as a starting point for this work.

3.2 Tasks remaining

Tasks remaining for the reference concentration program include:

- Literature and Data Review. DDMI would conduct a review and nominate chemicals of potential concern, receptors, toxicity reference values and risk estimate equations generally following the approach used in Mucklow and Swanson (1998). This document would be circulated for review/revision.

- Wildlife/Human Receptor Parameters. DDMI would host a workshop to jointly develop receptor-specific and area-specific receptor parameters such as time an animal/person might spend in an area, food/water ingestion rates, body weight, etc. We suggest this would be an excellent opportunity to merge both science information and Traditional Knowledge to make a best representation of these parameters for northern populations. Listings of the types of information requirements would be distributed to all workshop participants in advance so that all participants can contribute whatever information they might have.

- Calculation of Reference Concentrations. DDMI would take the outcomes from Phases I and II and complete initial calculations of risk-based criteria. These criteria will be compared against possible water/dust/rock/prey/vegetation concentrations to identify parameters and media of greatest risk. Documentation of these results will be distributed and a discussion workshop held to review and discuss the results.

4. Findings of research/studies completed

4.1 Summary of relevant results

Results are not available from this study however a similar program was conducted in 1998 (Mucklow and Swanson 1998) and will be used as a starting point for this work. Table 5 attached from Mucklow and Swansen (1998) is a relevant result from that work.

4.2 Applications of lessons learned

None at this time.

4.3 Description of data and information still missing

- List of post-closure contaminants of potential concern
- Updated and expanded literature review
- Traditional Knowledge input on wildlife/human receptor parameters

4.4 Recommendations for future work

Future work will be identified after results from the preliminary investigations are available.

5. Remaining research/studies to be completed

5.1 Detailed scopes of work

Current scopes of work for this reference concentration project include:

- Selection of a qualified contractor/consultant.

- Literature and Data Review. DDMI would conduct a review and nominate chemicals of potential concern, receptors, toxicity reference values and risk estimate equations generally following the approach used in Mucklow and Swanson 1998 (1998). This document would be circulated for review/revision.

- Wildlife/Human Receptor Parameters. DDMI would host a workshop to jointly develop receptor-specific and area-specific receptor parameters such as time an animal/person might spend in an area, food/water ingestion rates, body weight, etc. We suggest this would be an excellent opportunity to merge both science information and Traditional Knowledge to make a best representation of these parameters for northern populations. Listings of the types of information requirements would be distributed to all workshop participants in advance so that all participants can contribute whatever information they might have.

- Calculation of Reference Concentrations. DDMI would take the outcomes from Phases I and II and complete initial calculations of risk-based criteria. These criteria will be compared against possible water/dust/rock/prey/vegetation concentrations to identify parameters and media of greatest risk. Documentation of these results will be distributed and a discussion workshop held to review and discuss the results.

5.2 Conceptual scopes of work

Additional scopes of work may be added or amended as data is collected and reviewed.

6. Linkages to other research/studies and LOM plan

Specific linkages include:

- Surface seepage/runoff water quality criteria.
- Dust deposition criteria.
- Contaminated soils and waste disposal criteria.
- North Inlet reconnection assessment.
- Post-closure environmental site assessment.

7. Project tracking and schedule

Progress of the overall reference concentration study is evaluated by task. Technical memos are required for each task. A general task schedule is provided in Table 1.

Table 1: Completed and planned project activities

Year	Activities
2010 Q2	• Literature and Data Review
2010 Q3	• Wildlife/Human Receptor Parameters
2010 Q4	• Calculation of Reference Concentrations

8. Costs

A cost estimate is not available at this time

9. References

Mucklow, L. and S. Swanson. 1998. Technical Memorandum: Risk-Based Reference Concentrations for Protection of Wildlife. Prepared for Diavik Diamond Mines Inc June 18, 1998.

The following Tables are from Mucklow and Swanson (1998).

TABLE 5 RISK-BASED REFERENCE CONCENTRATIONS (RBRC) FOR PLANTS, PREY, WATER, SOIL AND DUST FOR WILDLIFE RECEPTORS

Chemicals	Risk-Based Reference Concentration for Plants (mg/kg dry weight)	Risk-Based Reference Concentration for Prey (mg/kg dry weight)	Risk-Based Reference Concentration for Dust (ug/m^3)	Risk-Based Reference Concentration for Soil (mg/kg dry weight)	Risk-Based Reference Concentration for Water (mg/L)
Caribou					
Barium	170	n/a	2400	4000	130
Cadmium	8	n/a	370	200	20
Chromium (III)	28000	n/a	1000000	680000	68000
Cobalt	12	n/a	690	300	30
Copper	150	n/a	17000	3800	380
Lead	81	n/a	1300	2000	200
Molybdenum	1.6	n/a	180	40	4
Nickel	400	n/a	46000	10000	1000
Uranium	17	n/a	1900	410	41
Vanadium	2	n/a	230	50	5
Zinc	1600	n/a	180000	40000	4000
Northern Red-Backed Vole					
Barium	21	n/a	420	850	2.6
Cadmium	1.2	n/a	76	50	0.5
Chromium (III)	3400	n/a	180000	140000	1300
Cobalt	1.6	n/a	130	68	0.6
Copper	19	n/a	3000	780	7
Lead	10	n/a	220	410	4
Molybdenum	0.2	n/a	28	7	0.1
Nickel	50	n/a	7800	2000	19
Uranium	2	n/a	320	84	0.8
Vanadium	0.2	n/a	38	10	0.1
Zinc	200	n/a	31000	8200	77
Red Fox					
Arsenic	n/a	0.4	n/a	n/a	n/a
Barium	n/a	80	500	2800	6
Beryllium	n/a	3	n/a	n/a	n/a
Cadmium	n/a	5	90	160	1
Chromium (III)	n/a	13000	216750	460000	3250
Cobalt	n/a	6	158	225	2
Copper	n/a	72	3600	2600	18
Lead	n/a	38	270	1350	9
Manganese	n/a	420	n/a	n/a	n/a
Mercury	n/a	6	n/a	n/a	n/a
Molybdenum	n/a	0.6	32	23	0.2
Nickel	n/a	190	9450	6750	47

TABLE 5 RISK-BASED REFERENCE CONCENTRATIONS (RBRC) FOR PLANTS, PREY, WATER, SOIL AND DUST FOR WILDLIFE RECEPTORS

Chemicals	Risk-Based Reference Concentration for Plants (mg/kg dry weight)	Risk-Based Reference Concentration for Prey (mg/kg dry weight)	Risk-Based Reference Concentration for Dust (ug/m^3)	Risk-Based Reference Concentration for Soil (mg/kg dry weight)	Risk-Based Reference Concentration for Water (mg/L)
Selenium	n/a	0.9	n/a	n/a	n/a
Strontium	n/a	1250	n/a	n/a	n/a
Uranium	n/a	8	387	280	2
Vanadium	n/a	0.9	45	32	0.2
Zinc	n/a	760	38025	27000	190
Oldsquaw					
Barium	1100	480	4700	12500	140
Cadmium	78	11	320	280	9
Chromium III	54	7	190	190	6.5
Cobalt	38	5	200	130	4.5
Copper	2500	350	26000	9000	300
Lead	200	28	310	740	25
Molybdenum	190	26	2000	670	23
Nickel	4200	570	43000	15000	500
Uranium	870	120	9000	3100	100
Vanadium	620	84	6400	2200	74
Zinc	780	110	8100	2800	94
Ptarmigan					
Barium	120	n/a	2300	1300	100
Cadmium	2.7	n/a	160	29	7
Chromium III	1.8	n/a	91	20	5
Cobalt	1.3	n/a	96	14	3
Copper	87	n/a	13000	940	230
Lead	7	n/a	150	77	18
Molybdenum	6.5	n/a	950	70	17
Nickel	140	n/a	21000	1500	370
Uranium	30	n/a	4400	320	77
Vanadium	21	n/a	3100	230	55
Zinc	27	n/a	4000	290	70

APPENDIX IX

SUMMARY OF COMMUNITY ENGAGEMENT AND CONSULTATION

IX-1 EMAB Closure Workshop

- IX-1.1 DDMI Presentation – Closure Planning History
- IX-1.2 DDMI Presentation – Closure Planning Future
- IX-1.3 EMAB Closure Workshop Report

IX-2 DDMI Closure Site Visit – January 14, 2009

IX-3 WLWB Objectives Workshop – February 25 & 26, 2009

IX-4 DDMI Options and Criteria Workshop – May 12&13, 2009

IX-5 DDMI Site Workshop – Post-Closure Caribou Movement – August 17-21, 2009

IX-6 DDMI Presentation to Communities – September to December 2009

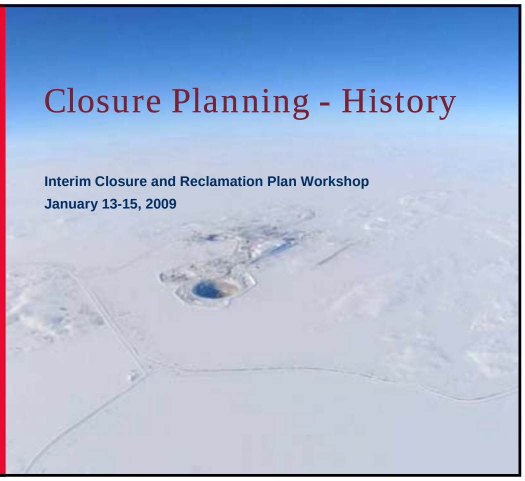
Appendix IX-1.1

DDMI Presentation – Closure Planning History

EMAB Closure Workshop – January 13-15, 2009

Closure Planning - History

Interim Closure and Reclamation Plan Workshop
January 13-15, 2009



Presentation Outline

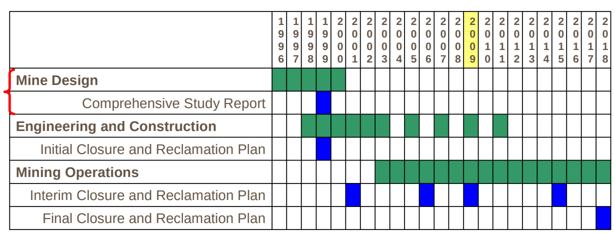
Vision Statement:

- We will close the Diavik Mine responsibly and progressively, leaving a positive community and environmental legacy.

Closure Objectives:

- Land and water that is safe for people, wildlife and aquatic life.
- Enhanced capacities for northerners and northern businesses.
- No long term care and maintenance.

Closure Planning - Schedule and Phases



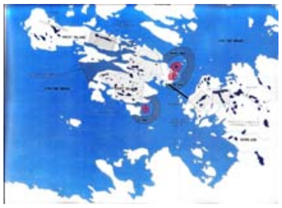
Closure Alternatives – Mine Design Phase

Human Resources Options

Mining Method Options

Siting Options

- PKC
- Wasterock



Design Options

- Water management
- Water treatment
- Processed kimberlite containment

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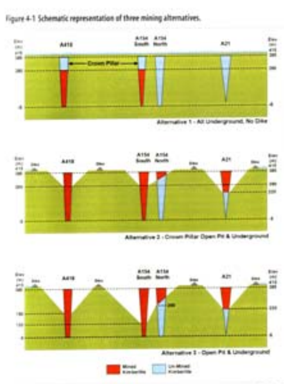
Human Resources Alternatives

#1: southern head office – employing northerners opportunistically.	• Minimal northern socio-economic impacts at closure because of limited involvement
✓ **#2 – northern head office** – actively seeking northern involvement	• Greater socio-economic impact at closure but mitigated through progressive participation and capacity building

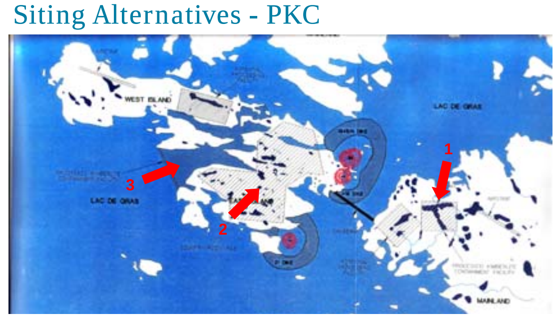
6

Mining Method Alternatives

#1: All underground – not economical, technically risky and shorter mine life	• Easier closure option due to smallest environmental disturbance.
#2: Smaller open pits & underground – more underground mining, fewer northern opportunities, reduced economics	• Moderate closure – less wasterock than #3
✓ **#3: Larger open pits & underground** – best balance of economics and environment	• Moderate closure – more wasterock.



Siting Alternatives - PKC



#1: T-Lake on mainland – causeway and larger footprint	• Better closure option than #2 due to location.
✓ **#2: East Island valley** – closest to mine	• Most technically challenging closure
#3: Lac de Gras – preferred geochemical option – unacceptable from communities perspective.	• Technically most secure closure option.

Siting Alternatives - Wasterock

- ✓ **#1: Near open pits** – most practical
  - More difficult closure option.
- **#2: Backfill completed pits** – mining sequence issue, geochemical problems, double handling
  - Better closure option if placed directly into flooded pits.
- **#3: Lac de Gras** – widening of dikes – best geochemical control – fish habitat and communities concerns.
  - Technically most secure closure option.

Design Alternatives – Water Management

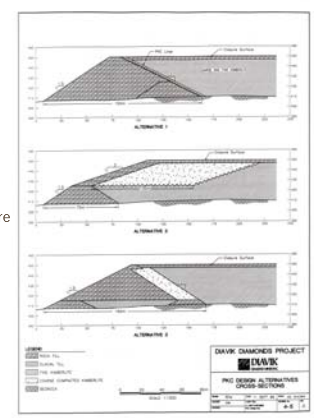
- **#1: treat and release PKC water** – use mine water for make-up
  - Better option for closure due to minimal water remaining in PKC
- ✓ **#2 – treat and release mine water** – use PKC as make-up water as it is the poorer quality water.
  - More difficult closure option

Design Alternatives – Water Treatment

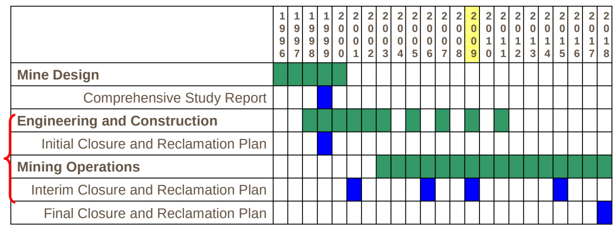
- **#1: settling ponds** – variable performance
  - Minimal closure issues – settled solids
- ✓ **#2: clarification/filtration** – low chemical use/waste – good performance – limited parameters.
  - Minimal closure issues – settled solids and backwash
- **#3: hydroxide/sulphide precipitation** – adds metals treatment but uses chemicals and generates waste.
  - Increased closure issues – removed metals precipitates
- **#4: reverse osmosis** – excellent treatment performance but high waste generation
  - Significant closure issues – large waste volumes
- **#5: ion exchange** – good treatment performance but high waste generation
  - Significant closure issues – large waste volumes

Design Alternatives - PKC

- ✓ **#1: rock dam with PVC liner** – most expensive – best operational seepage control
  - Possible long-term/closure seepage if liner degrades
- ✓ **#2: upstream construction with coarse PK liner** – no PVC liner, smaller footprint and capacity
  - Smaller closure area and better long-term/closure seepage management
- ✓ **#3: rock with PK liner** – seepage managed during operations with collection ponds
  - Best long term/closure seepage management



Closure Planning - Schedule and Phases



Socio-economic Aspects

Proposed Closure Objectives:

- Capacity building during operations to enable communities to best adapt to post closure socio-economic conditions.
- Sustainable capacities in communities

Existing Closure Plan:

- Implement participation agreements
- Implement socio-economic agreements
- Communicate

Underground, Open Pit and Dike

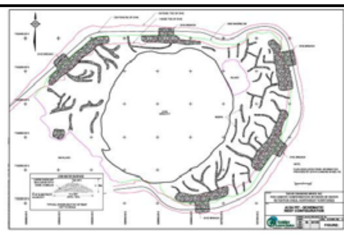
Proposed Closure Objectives:

- Provide sustainable water quality in flooded pit areas for aquatic life.
- Develop physical habitat that enhances lake-wide characteristics.
- Enable safe small craft navigation.
- Ensure geotechnical stability.
- Eliminate public and wildlife access to underground.

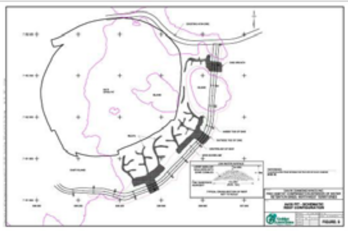
Underground, Open Pit and Dike

- Existing Closure Plan
  - Construct fish habitat reefs on pit crest.
  - Remove mobile mining equipment, seepage wells, unused AN, explosives, fuel, lubricants, thermosyphons, mounted instruments, and pit dewatering system.
  - Fixed UG equipment that cannot be salvaged will be cleaned an left in place – piping, wiring, ventilation.
  - Ventilation raises and decline access closed with cement plug.
  - Flood pit by controlled siphons to minimize erosion.
  - 7 cuts (30m wide x 2m deep) in dike once water quality is acceptable.

A154



A418



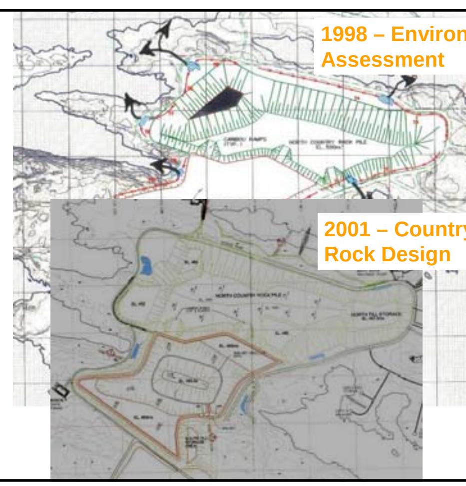
Wasterock Area

Proposed Closure Objectives:

- Freeze Type III rock – no active zone.
- Keep drainage quality safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
- Ensure geotechnical stability.
- No water retaining structures.
- Provide safe passage for caribou but not attract caribou.
- Incorporate practical wildlife habitat features in final landscape.

Wasterock Area

- Existing Closure Plan
  - A418/A154 wasterock segregation and storage into six drainage basins.
  - Grading of outer slopes to produce a stable final slope.
  - Type III covered with 1.5m till and 3m Type I rock.
  - Type II covered with 4m Type I rock.
  - Till contoured with erosion protection – flow breaks and rock lined ditches.
  - Ponds 1,2,3 converted to sediment settling ponds with spillways converted to discharge channels
  - South side and north side caribou ramps – 40-80m wide maximum 4:1 slope



RioTinto

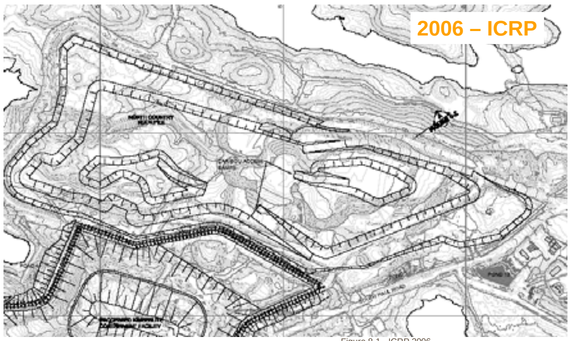


Figure 8-1 - ICRP 2006

21

RioTinto

Processed Kimberlite Containment

Proposed Closure Objectives:

- Maximize freezing of processed kimberlite.
- Keep drainage quality (runoff and seepage) safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
- Ensure geotechnical stability.

22

RioTinto

Processed Kimberlite Containment

- Existing Closure Plan
  - Minimize pond size towards end of operations then pump out
  - Pond area filled hydraulically with coarse PK and/or beach material
  - Pond area then pre-load with 5m thick rock spacer to cause consolidation over 2-years
  - Final pond cover of 1m till and 3 m rock over spacer dome
  - Processed kimberlite (coarse and fine) covered by 0.5 m thick till and 3m thick Type I rock cap graded to direct any surface runoff.
  - Surface runoff will exit the PKC area through a channel in the southern area via ponds 6,7 and/or 12 which will act as sedimentation ponds.
  - Ponds 4,5,6,7,12 transformed to sediment ponds with outlets to LDG.

23

RioTinto

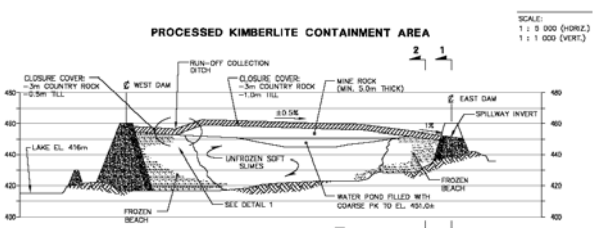


Figure 8-2 ICRP 2006

24

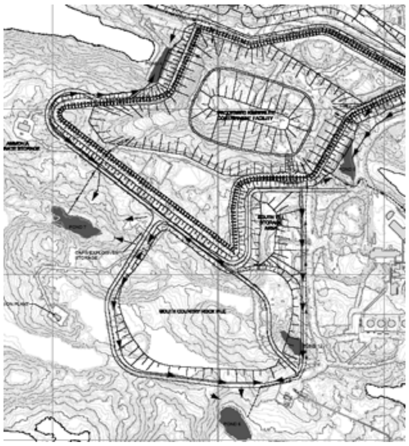


Figure 8-1 ICRP 2006

25

Buildings and Roads

Proposed Closure Objectives:

- Maximize use of assets for regional benefits.
- Maximize use of on-site disposal.
- Provide a final landscape with restored drainage patterns and enhancements to encourage indigenous vegetation.
- Incorporate practical wildlife habitat features in final landscape

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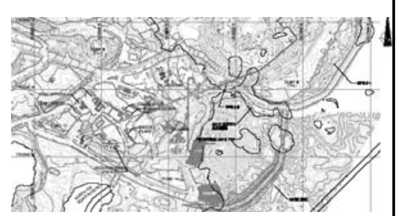
Buildings and Roads

- Existing Closure Plan
  - Demobilization of major buildings to near ground level.
  - Concrete demolished to foundation level.
  - Demobilization/dismantling for off-site disposal or recycling.
  - Inert material for disposal either *in-situ* or in approved landfill area.
  - Sale of intact items to northern and southern-based enterprises, Donation of intact items for regional development, sale or donation to demolition and reclamation contractors
  - Contaminated soil placed within coarse PK and covered.
  - Hazardous material packaged and shipped off-site for disposal
  - Re-establishment of drainage – removal of culverts – scarify surfaces and targeted re-establishment of indigenous vegetation.

27



Figures 5-8 and 5-9 ICRP 2006

28

RioTinto

North Inlet

Proposed Closure Objectives:

- Water quality safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
- Hydrologic connectivity to keep levels equal to Lac de Gras.
- Evaluate opportunities to reconnect for fish habitat.

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North Inlet

- Existing Closure Plan
  - Evaluate suitability of sediment and water quality for sustainable aquatic life in north inlet.
  - Hydrologic connection (through permeable rock fill section in east dam) to Lac de Gras to manage water levels.
  - Option to breach east dam and have full connection for fish and water.

RioTinto

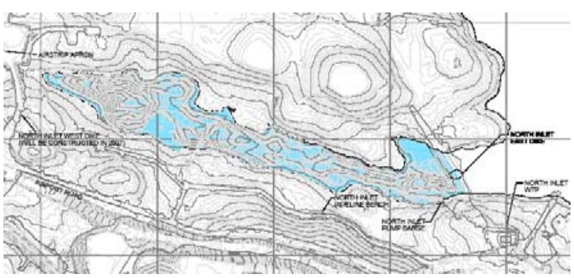


Figure 5-6 ICRP 2006

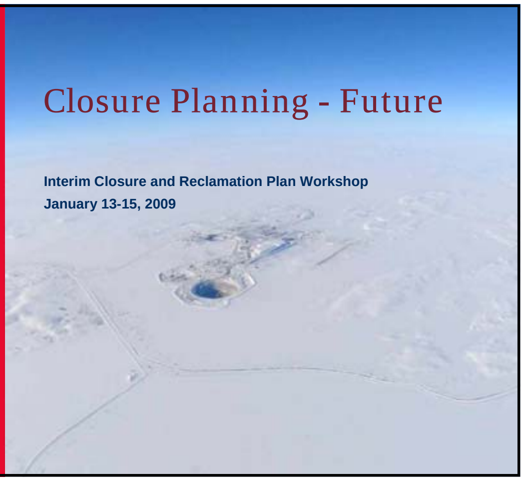
RioTinto

Questions?

Appendix IX-1.2

DDMI Presentation – Closure Planning Future

EMAB Closure Workshop – January 13-15, 2009



Closure Planning - Future

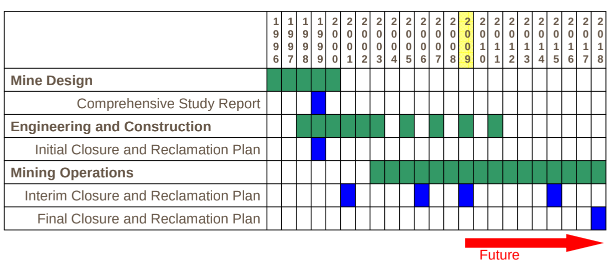
Interim Closure and Reclamation Plan Workshop
January 13-15, 2009

Presentation Outline

Discussion on future closure planning directions.

1. Closure Vision and Objectives
2. Socio-economic Aspects
3. Underground, Open Pits and Dikes
4. Wasterock Area
5. Processed Kimberlite Containment
6. Buildings and Roads
7. North Inlet

Closure Planning - Schedule and Phases



Vision Statement:

- We will close the Diavik Mine responsibly and progressively, leaving a positive community and environmental legacy.

Closure Objectives:

- Land and water that is safe for people, wildlife and aquatic life.
- Enhanced capacities for northerners and northern businesses.
- No long term care and maintenance.
- Other?

Socio-economic Aspects

Closure Objectives:

- Capacity building during operations to enable communities to best adapt to post closure socio-economic conditions.
- Sustainable capacities in communities.
- Other?

Future Closure Planning :

- Specifics in agreements are well defined
- Need to work on:
  - Timing and method of socio-economic aspects of closure communication
- Other?

5

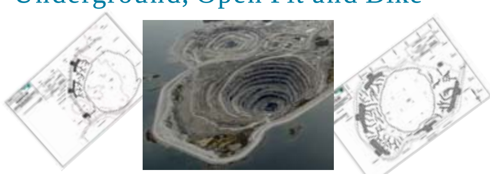
Underground, Open Pit and Dike

Closure Objectives:

- Provide sustainable water quality in flooded pit areas for aquatic life.
- Develop physical habitat that enhances lake-wide characteristics.
- Enable safe small craft navigation.
- Ensure geotechnical stability.
- Eliminate public and wildlife access to underground.
- Other?

6

Underground, Open Pit and Dike



- Future Closure Planning
  - Plans are generally well advanced for this area – there are no significant new alternatives currently being considered.
  - Need to work on:
    - Details of what makes sense to place in pit area/underground before flooding.
    - Design details of siphon system.
    - Update forecast of flooded water quality.
    - Details of closure specific monitoring programs.
    - Water quality criteria for breaching dike.
    - Caribou access/exclusion on dike.
  - Other?

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Wasterock Area

Closure Objectives:

- Freeze Type III rock – no active zone.
- Keep drainage quality safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
- Ensure geotechnical stability.
- No water retaining structures.
- Provide safe passage for caribou but not attract caribou.
- Incorporate practical wildlife habitat features in final landscape.
- Other?

8

Wasterock Area

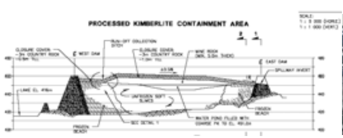
- Future Closure Planning
  - First area that will be available for significant progressive closure.
  - Closure design alternatives under review.
  - Need to work on:
    - Details for safe caribou travel – traditional knowledge input
    - Re-forecasting thermal conditions to guide cover design
    - Geotechnical analysis of final slope designs
    - Integration with final years of open-pit mining and use of wasterock for underground backfill.
    - Progressive reclamation opportunities
    - Seepage and runoff water quality criteria.
    - Options for other wildlife habitat.
    - Details of closure specific monitoring programs
  - Other?

Processed Kimberlite Containment

Closure Objectives:

- Maximize freezing of processed kimberlite.
- Keep drainage quality (runoff and seepage) safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
- Ensure geotechnical stability.
- Other?

Processed Kimberlite Containment



- Future Closure Planning
  - Existing plan is conceptual – practical alternatives to be considered
  - Need to work on:
    - Possible operational changes to facilitate closure – deposition planning, water management, dam raise construction
    - Alternative closure designs
    - Caribou travel routes
    - Continue to investigate properties of deposited processed kimberlite and kimberlite water
    - Progressive reclamation opportunities and material availability
    - Seepage and runoff water quality criteria
    - Details of closure specific monitoring plans
  - Other?

Buildings and Roads

Closure Objectives:

- Maximize use of assets for regional benefits.
- Maximize use of on-site disposal.
- Provide a final landscape with restored drainage patterns and enhancements to encourage indigenous vegetation.
- Incorporate practical wildlife habitat features in final landscape
- Other?

Buildings and Roads

- Future Closure Planning
  - Existing plan is appropriately at concept level.
  - Need to work on:
    - Options for regional uses for assets
    - On-site disposal planning
    - Progressive closure using back-hauls
    - Final landscape designs – drainage, re-vegetation, scarified roads
    - Re-vegetation procedures
    - Wildlife habitat opportunities – process plant wall?
  - Other?

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North Inlet

Closure Objectives:

- Water quality safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
- Hydrologic connectivity to keep levels equal to Lac de Gras.
- Evaluate opportunities to reconnect for fish habitat.
- Other?

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North Inlet

- Future Closure Planning
  - Existing plan is appropriately at concept level.
  - Need to work on:
    - Design options for both hydrologic and fish connectivity to Lac de Gras
    - Water and/or sediment criteria for determining connectivity
  - Other?

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Questions?

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Appendix IX-1.3

EMAB Closure Workshop Report

ARKTIS SOLUTIONS INCORPORATED
:: 117 Loutitt Street :: Yellowknife, NT:: X1A 3M2 ::
:: Phone: 867.446.0036 :: Fax 866.475.1147 ::

MEMORANDUM	
File:	**Environmental Monitoring Advisory Board – Diavik Diamond Mine Closure and Reclamation Workshop**
To:	**Environmental Monitoring Advisory Board**
Attention:	**Mr. John McCullum (Executive Director)**
Subject:	**Workshop Final Report**
Author:	**Joe Murdock, Jamie VanGulck, Ph.D., P.Eng.**
Page Total:	**12 + Annexes**
Date:	**February 4th, 2009**

Preamble

Further to the Environmental Monitoring Advisory Board (EMAB) November 7th, 2008 issued *Terms of Reference*, Arktis Solutions Incorporated (ASI) was retained to provide approximately ten (10) person days of service to organize, develop, present and report on a *Closure and Reclamation Workshop* (hereafter referred to as the "*Workshop*"). The Workshop aimed and achieved in introducing Workshop participants to the first principles of mine closure and reclamation, the definitions of closure objective and closure criteria, and provided an outlet for community members to vocalize generalized concern. The Workshop also allowed for participant input on how communities believe they can best be involved in the review of Rio Tinto Limited's Diavik Diamond Mine Interim Closure and Reclamation Plan (ICRP).

This *Memorandum*, to be submitted within three (3) weeks following the Workshop closing, provides a summary of the Workshop, held January 13th, 2009 – January 15th, 2009 at the Explorer Hotel, Yellowknife and at the Diavik Diamond Mine. The Workshop was coordinated by Mr. John McCullum and was attended by EMAB board members and staff, community members, federal and territorial government employees, and representatives from Rio Tinto Limited.

1.0 - Introduction

EMAB was created pursuant to **Article IV** of the Environmental Agreement[1] ("*Agreement*") and mandated[2], in short, to implement an integrated and co-operative approach to achieve *Agreement* purposes and implement the *Agreement* guiding principles as per **Article I**. Signatories to the *Agreement* include the Government of Canada, Government of the Northwest Territories, Diavik Diamond Mines Inc., Tlicho Government, Lutsel K'e Dene First Nation, Yellowknives Dene First Nation, North Slave Métis Alliance and the Kitikmeot Inuit Association. To fulfill its responsibilities, EMAB serves as a public regulatory watchdog offering recommendations to the Minister of DIAND on matters including wildlife harvesting, the participation of Aboriginal Peoples through environmental training initiatives and monitoring programs and the need for and design of traditional knowledge and other studies. EMAB also acts as a vehicle to provide a meaningful role for each of the Aboriginal Peoples[3] in the review and implementation of Diavik Diamond Mine environmental monitoring plans. Finally, EMAB functions as an independent advisory body (apart from the *Agreement* Signatories), who provides an unbiased review of environmental documents. These reviews form interventions filed and considered by Institutes of Public Government (i.e., Wek'eézhíí Land and Water Board) as per federal legislation. An EMAB hosted Workshop also satisfies EMAB's mandate to facilitate programs and disseminate information to community members and the general public on matters relating the state of the environment.

This *Memorandum* serves to develop recommendations related to participant and the group development of closure objectives and closure criteria, ways in which communities can be involved in the development and review of the, yet to be submitted, third iteration of the ICRP. This *Memorandum* will also report on generalities from the workshop. As explicitly scoped, this project was to engage and inform participants on introductory mine closure and reclamation first principles and was not geared towards the specifics of the Diavik Diamond Mine. ASI exercises did include elements of the Diavik Diamond Mine, but as stated to EMAB and all participants, these elements were to be considered hypothetical in nature and viewed in similar light to any other mine development. Participants were to be exposed to the commonalities found in general mine closure and reclamation scenarios, with the concepts of closure objectives and criteria explained in detail and reinforced through instruction and applied exercises. The hypothetical exercises were to support delivered concepts and give participants experience in forming their own mine closure objectives and criteria.

ASI has not interpreted or evaluated Rio Tinto Limited's specific plans and strategies for the closure and reclamation of the Diavik Diamond Mine, nor has ASI reported or commented on participant opinions of how Diavik should be reclaimed. These aspects lie outside of the

[1] Created March 8th, 2000 and found at http://www.emab.ca/pdfs/diavik_enviro_agree.pdf.
[2] For a more thorough and accurate portrayal of EMAB's mandate, the Reader is referred to **Part 2** of **Article IV** in the *Agreement*.
[3] As defined under **Article III** of the *Agreement*.

scope of this Workshop and are to be completed through successive efforts by Rio Tinto Limited and the Wek'eézhíí Land and Water Board. Outlets under these groups may prove to be a more responsible forum to discuss and evaluate Diavik Diamond Mine closure and reclamation specifics. EMAB is also staging an independent review of the next iteration of the ICRP at a later date.

2.0 – Workshop Objectives

ASI's primary objective was to successfully engage participants into a discussion centered towards closure and reclamation principles. Workshop material and delivery format was developed to satisfy the following Workshop objectives set out in the ASI's *Proposal for Consulting Services*:

i. Discussions on the basic concepts of closure and reclamation and associated scientific first principles and Traditional Knowledge related to closure and reclamation engineering and strategy;
ii. A review of closure and reclamation elements through aerial photographs, schematics, other visual materials and resulting discussions. Regulatory elements and discussion can also be examined;
iii. Roundtable discussions on closure objectives and closure criteria with aim and intent to establish individual participant viewpoints and opinions on the subjects;
iv. Roundtable discussions identifying potential community and participant concern over closure and reclamation practices and future development. This discussion will aim to understand how communities may be involved in the development and review of a revised Diavik ICRP; and,
v. Presentations from Rio Tinto Limited, Department of Indian Affairs and Northern Development (DIAND), Wek'ézhíí Land and Water Board (WLWB) with accompanying question and answer periods.

As reported in **3.0 Workshop Summary**, a series of ASI and guest lectures, alongside interactive applied breakout sessions, formed the backbone of material delivery.

3.0 – Workshop Summary

On December 3rd, 2008 a project initiation meeting between ASI and Mr. John McCullum confirmed Workshop objections and direction. A draft Workshop agenda was then created and presented to EMAB on December 12th, 2008 for approval. Frameworks for breakout session exercises were then developed and provided to Mr. John McCullum for review on December 15th, 2008 – December 19th, 2008.

ASI contacted DIAND and WLWB on December 16th, 2008 to request their involvement in the Workshop and seek out their respective interest in presenting material. Both parties consented to providing a presentation to participants. Rio Tinto Limited was also contacted, on December 17th, 2008, to provide two Workshop presentations. Rio Tinto Limited agreed to present history of closure at the site and associated techniques employed to date and future Diavik reclamation plans such as those proposed in the third iteration of the ICRP.

On December 23rd, 2008, ASI met with Mr. Doug Ashbury, of Rio Tinto Limited, at his Yellowknife office to view photographs of Diavik made available for ASI breakout session exercises. Although initially considered, and offered by Rio Tinto Limited, ASI determined that the use of the Rio Tinto Limited large scale magnet model and/or conceptual physical model would not adequately complement Workshop material. These models were not used in the Workshop.

ASI met with EMAB on January 7th, 2009 to provide a general update on progress and solicit other visual materials for the Workshop. A final agenda, adopted for use, was provided to participants via email January 7th, 2009 and a pre-Workshop meeting was held on January 12th, 2009 between ASI and EMAB staff to outline ASI presentation materials and seek Client input.

The following ASI materials were provided for the Workshop and are annexed to this *Memorandum*:

i. Workshop Agenda (**Annex A**)
ii. Breakout Session *Briefing Notes* (**Annex B**)
iii. Breakout Session Instructions (**Annex C**)
iv. Breakout Session Participant Notes (**Annex D**)
v. Rio Tinto Limited, DIAND and WLWB PowerPoint Presentations (**Annex E**)
vi. Registered Participant List (**Annex F**)

The Workshop format included two *in-class* activity days that sandwiched a site visit to the Diavik Diamond Mine. A summary of each day of activities is provided below.

[Day One – January 13th, 2009]

Day One of the Workshop was held in Katimavik A of the Explorer Hotel in Yellowknife, NT. The Workshop began with general opening remarks from ASI facilitator Mr. Joe Murdock, EMAB Chairman Mr. Doug Crossley and an opening prayer led by Tlicho community member Mr. Michel-Louie Rabesca. Roundtable introductions followed where Workshop participants outlined expectations, desired outcomes and their personal conceptions on mine closure and reclamation.

The importance of terminology, definitions and translation was discussed and reiterated throughout the entire Workshop. Even though this was not a translation workshop, participants were given the opportunity to flag any topic that is not completely understood with respect to language translation. This was done to ensure that Workshop elements were not lost in translation. During the breakout session exercises, ASI provided additional attention to groups where technical translation was most needed.

Workshop participants were eased into the concept of mine closure through an ASI-led lecture module that introduced the mine life cycle, along with, mine operations and typical infrastructure found at mine sites. This included a ten (10) minute excerpt from the Natural Resources Canada-Ontario Ministry of Northern Development and Mines joint video production[4] which demonstrated mineral extraction and processing activities.

Participants were given an overview of the four (4) main phases of mining (exploration, development, operation and closure) and on the importance of incorporating the idea of closure throughout the entire mining cycle. Mine operations, through the stages of excavation, separation/milling and the production of end products, were discussed and participants acknowledged that mine by-products generally exist as waste that must be managed and considered at the mine end-of-life.

Participants were then lectured on, and provided examples of, various mine infrastructure that generally exist at site. Familiarizing participants with infrastructure generally found at mines serves a twofold reason. Firstly, an infrastructure review allowed for visualization of various mine components and activities that may be viewed during the Diavik Diamond Mine site visit and, secondly, introduced participants to the concept that the type of infrastructure at site, or to be installed in the future at site, plays a role in the development of closure objectives and criteria. The understanding and knowledge of infrastructure inventory and quantities and qualities of waste at site assists those in determining appropriate paths of action through closure criteria and closure objectives. Elements of a reclamation plan, reclamation stages, and the topic of mine financial assurance/security were also discussed.

Mr. Gord Macdonald and Ms. Colleen English (Rio Tinto Limited) provided participants with a general facilities overview and a history of closure and reclamation at the Diavik Diamond Mine Site. During the latter, Rio Tinto Limited outlined the decision path in evaluating and determining a selected alternative for such aspects as mining method, infrastructure siting and infrastructure design (water management and treatment, processed kimberlite containment area), and outlined past closure objectives stated in earlier iterations of the ICRP. PowerPoint slides for these presentations have been attached to this *Memorandum* via **Annex E**.

Throughout the Workshop, participants referred to the phrase "*the land and site should return to how it was before a mine*" when communicating closure objectives and criteria. The rationale behind Breakout Session One (1) allowed participants to examine and communicate their personal perspective on this commonly used phrase and offer a definition through illustration and/or a listing of spatially delineated characteristics/trends

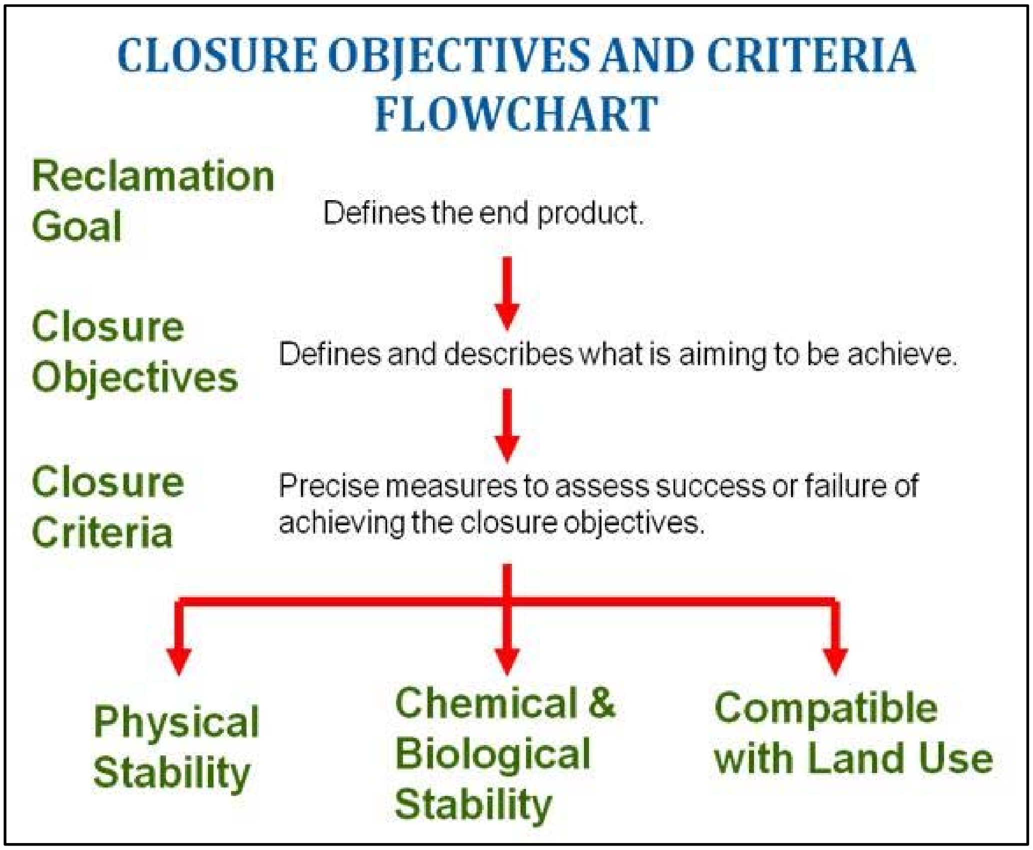
[4] NRCAN "Our Community... Our Future: Mining and Aboriginal Communities" (2005)

with respect to the Diavik Diamond Mine site and surrounding area. Participants were instructed to use personal experiences, Traditional Knowledge or Western Science through small group discussion. The framework for the breakout session is provided in **Annex B** and supplemental instructions provided to participants in **Annex C**. Example plots generated through Breakout Session One (1) are depicted in **Annex D**. Hardcopies of the participant plots have been provided to EMAB for future reference. Participants were then asked to share information they may have learned through the exercise. It was noted that participants observed a loose correlation between cabin location and traditional caribou migration in the area. Participants also expressed that there was a demonstrated knowledge of the land through their small group discussions and acknowledged that consideration, at a grand scale, should be given to other mining developments when considering the Diavik development.

Dr. Jamie VanGulck (ASI) provided an instructional session on environmental impacts through the definition of environment and compartmentalized environmental components of concern (ECC). ECC's include, but are not limited to, hydrology, water and air quality, noise, groundwater, fish and fish habitat, soils and landforms, vegetation and wildlife. These ECC subgroups assist an assessor to evaluate environmental impact. Participants were lectured on the definition of closure objective and closure criteria and their relationship within the closure process. As highlighted in **Figure 1**, participants were introduced to the concept of a reclamation goal. The reclamation goal, often referred to as reclamation vision, typically contains general *soft* statements that can not be quantifiably evaluated. Participants were shown that closure objectives provide a macroscopic definition on what is aimed to be achieved. Typically objectives include a definitive statement focussed towards specific infrastructure. Participants were asked to discretely consider each piece of infrastructure when defining closure objectives. Closure criteria were defined as the precise measures, or *goalposts*, used to assess the success or failure in achieving a closure objective. An effluent limit set out in a water licence would be an example of such criterion. Participants were also lectured on how environmental impact can be minimized by ensuring that mine components are physically, chemically and biologically stable, and compatible with end land use. In determining closure criteria participants were asked to establish goals that aim to achieve physical, chemical and biological stability, and the compatibility of end land use with respect to ECC's.

Unfortunately, due to time constraints imposed by active discussion throughout the day by workshop participants, Breakout Session Two (2) was not conducted on Day One (1) of the Workshop. This session was developed to engage participants in an applied exercise where participants in a small group arrangement, would review pre and post closure photographs of a mine component (from an unnamed mine). During this exercise, participants would develop possible closure objectives and criteria for various mine components and share findings through roundtable discussion. Instructions and a framework for this session can be found in **Annex C** and **B**.

Figure 1 – Flowchart Identifying the Process of Determining Closure Objectives and Criteria



[Day Two – January 14th, 2009]

Day Two involved a site visit to the Diavik Diamond Mine. The tour, led under the direction and plan of Mr. Gord Macdonald (Rio Tinto Limited), allowed participants the opportunity to visualize infrastructure and the Diavik site as a whole. Some participants had visited the site before, so the site visit allowed these participants to view how things have changed since their last visit. For other participants, the site visit acted as their first time viewing of the Diavik Diamond Mine. To feed into Day Three (3) events, Workshop participants were reminded to review site infrastructure in light of the concepts of closure objectives and criteria learned in Day One (1). Following in-house health and safety orientation, the mine site tour generally followed the route provided by Rio Tinto Limited, which is included in **Annex E** (Title: *Interim Closure and Reclamation Plan – Site Visit, January 14th, 2009*). This route provided an opportunity to view Diavik specific infrastructure. The tour bus made stops allowing participants to exit the vehicle and view infrastructure. Unfortunately visibility was limited in the tour bus due to frosted windows. Mr. Gord Macdonald and Ms. Colleen English (Rio Tinto Limited) addressed site specific questions posed by participants and Mr. Joe Murdock (ASI) was available to field participant general questions and concerns. ASI was also tasked, by EMAB, to create a photographic record of participant activity and engagement during the site visit.

[Day Three – January 15th, 2009]

The Workshop recommenced in Katimavik A of the Explorer Hotel with general opening remarks by Mr. Joe Murdock (ASI) and an opening prayer led by Tlicho community member Mr. Michel-Louie Rabesca. Participants provided general remarks on the Day Two (2) site visit through a roundtable discussion.

Day Three (3) provided a series of presentations including one from Mr. Nathen Richea of DIAND Water Resources Division. The DIAND presentation explained the Crown's role in mine closure and reclamation. This included defining the Minister's responsibilities, through appropriate legislation, in approving mines in the Northwest Territories and his role in providing expert advice on technical and regulatory matters related to mine closure before Administrative Tribunals such as the WLWB. Mr. Richea discussed the role of financial security and how the WLWB would set the monetary amount under a water licence through testimony and/or interventions provided by Interested Parties. He outlined that DIAND, under its responsibilities, would file a security estimate, through an intervention, that represents the *actual* cost to reclaim a mine site. Mr. Richea also explained that security amounts are held by, and furnished in a form deemed acceptable to, the Minister. He also explained that security held in trust by the Minister is legislatively available for the purpose of mine site reclamation only. Mr. Richea discussed DIAND's 2002 Mine Reclamation Policy and its main objectives and guiding principles and presented a series of guidance documents, including Mine Site Reclamation guidelines, prepared by DIAND to assist proponents in developing, operating and closing a mine site. PowerPoint slides for this presentation have been attached to this *Memorandum* in **Annex E**.

Mr. Ryan Fequet of the WLWB presented a background on the Board's mandate, and provided a comprehensive discussion on how community members could be involved and participate in the review of the Diavik Diamond Mine ICRP. This included reviewing material listed on the WLWB public registry, attending public hearings, and filing written interventions. The WLWB provided a WLWB definition of *closure objective* and *closure criteria* and provided examples for an open pit and waste rock pile. Mr. Fequet briefly outlined proposed closure and reclamation guidelines that are being developed under a working group formed by the Mackenzie Valley Land and Water Board. The WLWB has a seat on this working group and is contributing to the development of a guidance document. PowerPoint slides for this presentation have been attached to this *Memorandum* in **Annex E**. Mr. Fequet also circulated the inaugural version of The Wek'èzhìí News, a WLWB publication, and a Diavik ICRP work plan schedule to Workshop participants for their reference.

The definitions for closure objectives and criteria were re-examined as a group to prepare participants for the third breakout exercise. Breakout Session Three (3) was an interactive participant driven exercise where Workshop participants had a small group forum to vocalize viewpoints on closure objectives and criteria for specific infrastructure at the Diavik Diamond Mine. The exercise gave participants an opportunity to apply the definitions of closure objectives and criteria learned during the ASI lecture module to infrastructure they may encounter through the review of the Diavik ICRP. Although the infrastructure viewed was found at the Diavik Diamond Mine in the past, participants were instructed that the exercise was still hypothetical in nature and the objectives and criteria developed in small group discussion may or may not be considered by Rio Tinto Limited. The framework for the breakout session is provided in **Annex B** and supplemental instructions provided to participants in **Annex C**. Example plots generated through Breakout Session Three (3) are depicted in **Annex D**. Hardcopies of the participant plots have been provided to EMAB for future reference. In general, group discussions to develop objectives and criteria followed the framework of examining each piece of infrastructure and identifying the ECC. For each ECC, specific closure criteria were developed. A wide variety of discussions developed between various groups. Some focused on water quality impacts, others on caribou and fish impacts, or landform configuration. The diversity of the discussions and level of detail of the closure criteria developed is reflective of the various backgrounds of the workshop participants. Participants shared their results, generated through their small group discussions, to all Workshop participants.

Mr. Gord Macdonald of Rio Tinto Limited closed off the set of presentations with a concise presentation on future closure planning of the Diavik Diamond Mine. Here he briefly discussed an anticipated schedule for closure planning, Rio Tinto defined closure objectives, and outlined plans where additional closure planning work is required. PowerPoint slides for this presentation have been attached to this *Memorandum* via **Annex E**.

An ASI presentation on reclamation research planning was prepared but not presented due to time constraints imposed by active discussion throughout the day by workshop participants. This lecture aimed at providing participants with an understanding of the information typically found in a reclamation research plan, components of the research program and how the plan determines a scientific pathway needed to achieve set closure criteria.

Day Three (3) was closed off with concluding comments from Mr. Joe Murdock (ASI) and EMAB's Chair Mr. Doug Crossley. Mr. Francis Williah, a Tlicho community elder, provided the closing prayer to end the Workshop.

4.0 – Recommendations

The following recommendations and associated commentary reflect ASI's observations and opinions:

[Recommendation #1]

To avoid any confusion community members may have in future regulatory or industry sessions on closure and reclamation, EMAB should adopt a definition for closure objective and closure criteria and request that all parties (WLWB, Rio Tinto Limited etc.) accept and use these definitions in their future dealings. In some instances a reclamation goal/vision was viewed as a closure objective; however, a goal/vision lacks a definitive description on what is being achieved. At times reclamation goals that are misinterpreted as closure objectives are presented as *feel good* statements which are broadly based and can not be appropriately gauged and evaluated. For example ASI would classify a statement such as "*Ensuring that land and water is safe for people, wildlife and aquatic life*" as a closure goal/vision for it lacks a specific tag to mine infrastructure and is too broad based to develop clear focussed closure criteria. To avoid possible ambiguity and to allow for greater consistency in future discussions, EMAB, as a watchdog, should develop and endorse what they view as appropriate definitions for closure vision, closure objective and closure criteria and state complementary standards or guidance in how to develop these closure statements.

[Recommendation # 2]

Rio Tinto Limited should consider hosting another site visit during spring freshet and/or the summer season. Snow covering parts of the site made it difficult for participants to differentiate infrastructure components and other important features, such as water management (flows, spatial and temporal dimensioning), wildlife observation, and dust suppression/management. To concentrate efforts and allow for a more focussed discussion, these site visits should not include a wide range of participants, but rather specific smaller groups at a time. For example, a site visit accommodating only community members may allow for better scoped discussion on community concerns. This information may also pose useful to Rio Tinto Limited when integrating community input into future closure plans.

[Recommendation #3]

The Workshop participants, en masse, had a wide range of backgrounds, experiences and skill sets. Corralling together the views, concerns, knowledge and efforts of various internal stakeholder parties, with an aim to achieve outcomes that are beneficial to both Industry and the communities hosting the mine site, allows for a more effective mine closure plan. The following discussion provides some context to this statement.

As expressed by EMAB Chair Mr. Doug Crossley, through his general remarks, community involvement is imperative. As per participant testimony, there was an expressed sensitivity to mine closure and reclamation by community members. This mindset may be in large part due to legacy environmental practices carried through at Rae Rock, Colomac, Giant and Port Radium mines; these sites were discussed by workshop participants. Community members exhibited a desire to communicate their history and lessons learned from past mining experiences in the Workshop forum.

Workshop participants, particularly elder community members, expressed concern and the need for a precautionary approach in developing reclamation plans for mines and demonstrated an interest in working with Rio Tinto Limited through community engagement exercises. Rio Tinto Limited acknowledged community opinion and thanked participants for sharing their thoughts and feelings; however, numerous workshop participants repeatedly stated that information sessions, breakout exercises, and associated discussions should be held within affected communities so greater community input and participation can be sought out. This seemed to be the preferred community method in participating in the Diavik mine closure process. Additional effort could be made to integrate greater community input and opinion into Diavik specific closure options through a series of community meetings/presentations. These sessions could act as a resource base for Rio Tinto Limited, with the Crown[5], and/or EMAB. Additionally these sessions could allow community members to outlet their concerns, identify preferred closure options and environmental practice, and provide an update into the proposed changes set within the next iteration of the ICRP. Community meetings may have been completed in the past by various parties, but given the dynamic and ongoing nature of mine operation and closure, community concern and opinion should be of significant value. Understandably there are planned community sessions through the WLWB plan and mandate; however, consideration could be given to a separate set of community sessions where community members can be engaged and informed by Rio Tinto Limited and/or EMAB.

[Recommendation # 4]

From a community member perspective, there lacks a clear public understanding of what regulatory mechanisms exist with respect to mine reclamation and financial security. Terms and conditions related to reclamation water use, impacts to water through the deposition of waste in a reclamation effort, and the mine financial security amount, are dictated through the water licence instrument. Since the WLWB is a quasi-judicial administrative tribunal, it must adhere to the rules of procedural fairness and natural justice and thus it may <u>only</u> consider the evidence presented by Interested Persons before it during a public hearing or through written intervention. If community members, Aboriginal Governments/Organizations, First Nations and other Interested Persons do not participate in the WLWB process then their opinions, concerns, testimony and evidence will not be included and/or considered in the water licence. Even though this fact was presented during the DIAND and WLWB presentations and may be re-communicated by these organizations in the future, EMAB should reinforce this important fact through its community communications and meetings.

[Recommendation # 5]

EMAB, Aboriginal Governments/Organizations and First Nations, should consider conducting an evaluation of the Diavik ICRP and mine financial security assessment. This evaluation can form a WLWB intervention, with respect to closure and reclamation, which

[5] DIAND had stated that they may join Rio Tinto Limited on a community tour if the company undertakes this task.

combines Western Science technical opinions with Traditional Knowledge, community and personal experience and social will.

5.0 – Closing

ASI was pleasantly surprised with the conversation generated on the topic of mine closure and reclamation and believes the main focus of the Workshop, to generate participant discussion and lessons so participants can make more informed choices in the future, was satisfactorily accomplished. Although participant discussion did at times steer the group away from the planned agenda, it was considered appropriate and respectful to allow discussion on personal experiences and how previous mining developments have affected communities and individuals. The Workshop did not achieve a full consensus amongst participants on closure outcomes. This was not the intent nor was this an aim to be achieved. The Workshop did prepare, at an introductory level, the basic concepts of closure and stirred discussion and primed participants for future discussions through other regulatory and/or industry efforts.

ASI would like to thank EMAB for the opportunity to provide these services. Should you have any questions whatsoever about its contents please feel free to contact the undersigned at 867.446.0036 or murdock@arktissolutions.com.

Sincerely,

Joe Murdock,
Chief Executive Officer

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ANNEX A – Workshop Agenda

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BRIEFING NOTE

File:	**001-EMAB- Closure and Reclamation Workshop**
To:	**Environmental Monitoring Advisory Board**
Attention:	**Mr. John McCullum, Executive Director**
Subject:	**Final Agenda for Closure and Reclamation Workshop**
Authors:	**Joe Murdock, Jamie VanGulck**
Page Total:	**2**
Date:	**January 12th, 2009**

Final Agenda

Further to the to the draft agenda filed with EMAB through the December 9th, 2008 *Briefing Note*, ASI has prepared a final agenda for the January 13th-15th, 2009 workshop to be held in Katimavik A of the Explorer Hotel, Yellowknife, NT and at the Diavik Diamond Mine. The three day workshop will sandwich a site visit to the Diavik Diamond Mine on Day 2 between Day 1 and Day 3 presentation seminars at the Explorer Hotel.

DAY 1 – January 13th, 2009

Time (MT) (approximate)	Presentation/Event	Speaker
9:00-9:30	Introduction to EMAB's Closure and Reclamation Workshop and Introduction Exercise	Joe Murdock/Jamie VanGulck (ASI)
9:30-9:45	Welcoming Remarks from EMAB	Doug Crossley (EMAB)
9:45-10:15	Closure and Reclamation Community Perspective, Concerns, Observations and Expectations[1]	Workshop Participants
10:15-10:30	**Coffee Break**	
10:30-12:00	An Introduction to Closure and Reclamation	Joe Murdock/Jamie VanGulck (ASI)
12:00-13:00	**Lunch**	
13:00-14:00	An Overview of the Diavik Diamond Mine Operations and Site Layout and a Brief History on Closure and Reclamation Performed to Date	Gord MacDonald (DDMI)
14:00-15:00	**Breakout Session**: Examination of the Diavik Diamond Mine Area and Site History Prior to Development	Workshop Participants
15:00-15:45	The Establishment of Closure Objectives and Criteria	Joe Murdock/Jamie VanGulck (ASI)
15:45-16:00	**Coffee Break**	

16:00-17:15	**Breakout Session**: Setting Closure Criteria and Objectives	Workshop Participants
17:15-17:30	Day 1 Closing Remarks	Joe Murdock/Jamie VanGulck (ASI)

DAY 2 – January 14th, 2009

DIAVIK DIAMOND MINE SITE VISIT

DAY 3 – January 15th, 2009

Time (MT) (approximate)	Presentation/Event	Speaker
9:00-9:20	Day 1 Recap, Highlights and Discussion with Q&A Session	Joe Murdock/Jamie VanGulck (ASI)
9:20-9:30	Outline for Day 3	Joe Murdock/Jamie VanGulck (ASI)
9:30-10:15	Department of Indian Affairs and Northern Development's Role in Closure and Reclamation of the Diavik Diamond Mine	Nathen Richea (DIAND)
10:15-10:30	**Coffee Break**	
10:30-11:15	Wek'eezhii Land and Water Board's Role in Closure and Reclamation of the Diavik Diamond Mine[1]	Ryan Fequet (WLWB)
11:15-12:00	The Closure and Reclamation Research Plan	Joe Murdock/Jamie VanGulck (ASI)
12:00-13:00	**Lunch**	
13:00-14:30	The Interim Closure and Reclamation Plan (ICRP) for the Diavik Diamond Mine[1]	Gord MacDonald (DDMI)
14:30-14:45	**Coffee Break**	
14:45-16:00	**Breakout Session**: The Closure and Reclamation of Diavik Diamond Mine Site Components	Workshop Participants
16:00-16:15	Final Workshop Comments and Roundtable Discussion on Workshop	Joe Murdock/Jamie VanGulck (ASI) and Workshop Participants
16:15-16:30	Closing Remarks from EMAB	Doug Crossley (EMAB)

[1] Workshop Participants will have an opportunity to provide input to DDMI and WLWB about how communities feel it would be best to involve them in the ICRP review process.

Annex B – Breakout Session *Briefing Notes*

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BRIEFING NOTE

File:	**001-EMAB- Closure and Reclamation Workshop**
To:	**Environmental Monitoring Advisory Board**
Attention:	**Mr. John McCullum, Executive Director**
Subject:	**Breakout Session I – An Overview of the Diavik Diamond Mine Operations and Site Layout**
Author:	**Joe Murdock**
Page Total:	**3**
Date:	**December 17th, 2008**

BREAKOUT SESSION I

Preamble

Further to the Arktis Solutions Inc. (ASI) *Briefing Note* dated December 9th, 2008, ASI was to produce and present additional *Briefing Notes* on the individual Breakout Sessions planned for the Environmental Monitoring Advisory Board (EMAB) Closure and Reclamation (C+R) Workshop. The function of this *Briefing Note* is to dually serve as an instructional framework for the exercise and provide EMAB the exercise rationale.

Further to **Section 2(d)(ii)** and **Section 2(d)(iv)** of the EMAB accepted *Proposal for Consulting Services (PCS)*, ASI proposed to develop an exercise which examines C+R elements through aerial photographs, site plans and other visual materials and roundtable discussions identifying potential community and participant concern and opinion.

Breakout Session I aims to satisfy the provisions of the *PCS* through an interactive participant driven exercise where workshop participants have an opportunity to review the Diavik Diamond Mine site and associated operations through visual aid and provide comment on personal experience.

Objective

Building on the Diavik Diamond Mine Inc. (DDMI) introductory presentation on the Diavik Diamond Mine site and operation, this exercise (completed in small groups) will familiarize workshop participants with the mine site and surroundings (Lac de Gras area) and also allow participants to vocalize their understanding of the current and past state of the site and surrounding area. **Breakout Session I**, through a desktop examination of the site and engaged discussion, will prepare participants for the Day 2 Site Visit and provide

EMAB and ASI with participant perspectives on the mine site area prior to, during, and after closure.

Participants

This exercise will involve all workshop participants. Work groups can be created once a final list of workshop participants is developed and made available by EMAB.

Outline

Duration: One hour (1:00h).
Group Organization: Ideally groups of three (3) or four (4) individuals will be formed.

Pre-chosen, before workshop start, groups will break away and assemble at separate tables where they will be provided with a short instruction sheet outlining directions for the exercise. This will be reinforced with verbal instructions communicated by ASI facilitators. ASI will illustrate, through a demonstration for all groups, how the exercise can be completed.

Workshop participants will be asked to observe site plans and aerials of the Diavik Diamond Mine and the surrounding areas (appropriately scaled to allow for discussion of areas proximal to the mine site) and offer discussion on their experiences and knowledge of the site prior to and during the operation of the Diavik Diamond Mine. Workshop participants will also be asked to highlight land, water, air, wildlife, fish, vegetation, topography aspects that may be impacted as a result of mine construction and operations and where they feel appropriate attention could be focused during closure and reclamation. Each group will be provided with an individual set of site visuals (aerial photographs, site plans) and will be advised that illustrations (such as denoting migration routes or identifiable areas of concern) on site plans and aerials are welcomed.

Mr. Joe Murdock and Dr. Jamie VanGulck will circulate around the room fielding questions and interacting with groups. If groups are having difficulty in getting started one of the Facilitators will join the group to initiate group discussion. Groups will have forty (40) minutes to engage in the exercise and five (5) to ten (10) minutes to present point form notes on individual group discussion to all workshop participants.

Required Materials

To best carry out this exercise the following materials are required:

i. Table-top versions (large sized) of mine site plans and aerial figures.
ii. Writing instruments (markers) and large chart paper for group presentation.

Closing

Should you have any questions whatsoever about the contents of this *Briefing Note* or if revisions are needed please feel free to contact the undersigned at 867.446.0036 or murdock@arktissolutions.com. ASI will continue to move forward with the development of this breakout session and other exercises as committed to in the *PCS*.

Sincerely,

Joe Murdock,
Chief Executive Officer

ARKTIS SOLUTIONS INCORPORATED
:: 117 Loutitt Street :: Yellowknife, NT:: X1A 3M2 ::
:: Phone: 867.446.0036 :: Fax 866.475.1147 ::

BRIEFING NOTE

File:	**001-EMAB- Closure and Reclamation Workshop**
To:	**Environmental Monitoring Advisory Board**
Attention:	**Mr. John McCullum, Executive Director**
Subject:	**Breakout Session II – The Establishment of Closure Objectives and Criteria**
Author:	**Joe Murdock**
Page Total:	**3**
Date:	**December 18th, 2008**

BREAKOUT SESSION II

Preamble

Further to the Arktis Solutions Inc. (ASI) *Briefing Note* dated December 9th, 2008, ASI was to produce and present additional *Briefing Notes* on the individual Breakout Sessions planned for the Environmental Monitoring Advisory Board (EMAB) Closure and Reclamation (C+R) Workshop. The function of this *Briefing Note* is to dually serve as an instructional framework for the exercise and provide EMAB the exercise rationale.

Further to **Section 2(d)(i)** and **Section 2(d)(iii)** of the EMAB accepted *Proposal for Consulting Services (PCS)*, ASI is to build awareness on the basic concepts of C+R, scientific first principles and Traditional Knowledge related to C+R engineering and strategy and hold roundtable discussions on closure objectives and criteria.

Breakout Session II aims to introduce workshop participants, in a small group setting, to closure objectives and criteria through observation and discussion of mining closure scenarios at anonymous mining sites.

Objective

Following ASI's presentation on setting mining closure objectives and criteria, workshop participants will be tasked to review photographs of a mine site or mine infrastructure (not including Diavik), such as waste rock piles, open pits, etc., that illustrate the site activities pre- and post-closure. Participants will be given the opportunity to discuss and collectively establish closure objectives for the presented case and detail how these objectives could be achieved (closure criteria). This exercise will aid in developing capacity by exposing participants to past C+R situations and having them understand terminology and define objectives and criteria.

Breakout Session II, through a review of real life closure scenarios and engaged discussion, will ease participants into **Breakout Session III**, where they will examine Diavik specific infrastructure and establish hypothetical closure criteria and objectives.

Participants

This exercise will involve all workshop participants. Work groups can be created once a final list of workshop participants is developed and made available by EMAB.

Outline

Duration: One hour (1:15h).
Group Organization: Ideally groups of three (3) or four (4) individuals will be formed.

Groups will break away and assemble at separate tables where they will be provided with a short instruction sheet outlining directions for the exercise. This will be reinforced with verbal instructions communicated by ASI facilitators. ASI will illustrate, through a demonstration for all groups, how the exercise can be completed.

Workshop participants will be asked to review photographs from C+R programs conducted at mine sites (not including Diavik). At minimum, the photographs will include a pre- and post-closure depiction of a site or infrastructure at site (e.g., waste rock pile). The participants will be asked to detail differences in the photographs that relate to reclamation (e.g., differences in land topography, vegetation cover, etc.), as well as, hypothesize how the post-closure case would impact the environment (e.g., wildlife, fish, water quality) compared to the pre-closure case. From the discussion results, the participants will be asked to summarize the objective of the closure scenario and detail what criteria may have be used to attain the closure condition. Each group will be assigned three to six pre- and post-closure photographs. All groups will be assigned the same set of figures.

Mr. Joe Murdock and Dr. Jamie VanGulck will circulate around the room fielding questions and interacting with groups. If groups are having difficulty in getting started one of the Facilitators will join the group to initiate group discussion. Groups will have forty (40) minutes to engage in the exercise and five (5) to ten (10) minutes to present point form notes on individual group discussion to all workshop participants.

Required Materials

To best carry out this exercise the following materials are required:

i. Large coloured photographs of mining C+R examples (chosen by ASI).
ii. Writing instruments (markers) and large chart paper for group presentation.

Closing

Should you have any questions whatsoever about the contents of this *Briefing Note* or if revisions are needed please feel free to contact the undersigned at 867.446.0036 or murdock@arktissolutions.com. ASI will continue to move forward with the development of this breakout session and other exercises as committed to in the *PCS*.

Sincerely,

Joe Murdock,
Chief Executive Officer

ARKTIS SOLUTIONS INCORPORATED
:: 117 Loutitt Street :: Yellowknife, NT:: X1A 3M2 ::
:: Phone: 867.446.0036 :: Fax 866.475.1147 ::

BRIEFING NOTE

File:	**001-EMAB- Closure and Reclamation Workshop**
To:	**Environmental Monitoring Advisory Board**
Attention:	**Mr. John McCullum, Executive Director**
Subject:	**Breakout Session III - The Closure and Reclamation of Diavik Diamond Mine Site Components**
Author:	**Joe Murdock**
Page Total:	**3**
Date:	**December 15th, 2008**

BREAKOUT SESSION III

Preamble

Further to the Arktis Solutions Inc. (ASI) *Briefing Note* dated December 9th, 2008, ASI was to produce and present additional *Briefing Notes* on the individual Breakout Sessions planned for the Environmental Monitoring Advisory Board (EMAB) Closure and Reclamation (C+R) Workshop. The function of this *Briefing Note* is to dually serve as an instructional framework for the exercise and provide EMAB the exercise rationale.

As explicitly stated in **Section 2(d)(iii)** of the EMAB accepted *Proposal for Consulting Services (PCS)*, ASI proposed to develop an exercise which includes:

"*Roundtable discussions on closure objectives and closure criteria with aim and intent to establish individual participant viewpoints and opinions on the subjects.*"

Breakout Session III, the final breakout session on Day 2, aims to satisfy this commitment through an interactive participant driven exercise where workshop participants have a forum to vocalize viewpoints on closure objectives and criteria for specific infrastructure at the Diavik Diamond Mine.

Objective

The main focus of this exercise is to have participants act in the role of "*Decision Maker*" and institute the lessons learned through **Breakout Session I** and **II** where participants examine the Diavik Diamond Mine area and operation and set closure objectives and criteria. In this breakout session, participants will be provided two infrastructure components (e.g., waste rock pile, processed kimberlite containment, road networks) to restore into a form they deem acceptable for closure. This will be completed through small group discussion and presentation. This exercise allows participants to apply the concepts developed during the workshop and mine site visit, and will act as an appropriate closing exercise to the workshop session.

Participants

It is preferable if all Workshop Participants, DDMI Representatives and Government Officials partake in this session. To encompass differing viewpoints, each group should have one DDMI Representative or Government Official. Work groups can be created once a final list of Workshop participants is developed and made available by EMAB.

Outline

Duration: One hour and fifteen minutes (1:15h).
Group Organization: Ideally groups of three (3) or four (4) individuals will be formed.

Groups will break away and assemble at separate tables where they will be provided with a short instruction sheet outlining directions for the exercise. This will be reinforced with verbal instructions communicated by ASI facilitators. ASI will provide a sample run through of a piece of infrastructure to give participants and example on how they may complete the exercise.

Each group will assigned two pieces of infrastructure and will be tasked to answer the following question:

"*If you were the C+R Specialist at the Diavik Diamond Mine how would you restore the* ***(insert piece of infrastructure)*** *for closure?*"

Mr. Joe Murdock and Dr. Jamie VanGulck will circulate around the room fielding questions and interacting with groups. If some groups are having difficulty in getting started, one of the Facilitators will join the group to initiate group discussion. The groups will have forty (40) minutes to develop closure objectives and criteria specific to the infrastructure assigned. They will be asked to take point form notes and list: what their closure objectives are and their reasoning; when this objective should be achieved; and, why and how this objective will be completed (what criteria). Finally, each group will have the opportunity to present their points to all others in the workshop.

Required Materials

To best carry out this exercise the following materials are required:

i. Table-top versions (large scaled) of mine site plans and photographic figures of specific mine infrastructure[1].
ii. Writing instruments (markers) and large chart paper for group presentation.

Closing

Should you have any questions whatsoever about the contents of this *Briefing Note* or if revisions are needed please feel free to contact the undersigned at 867.446.0036 or murdock@arktissolutions.com. ASI will continue to move forward with the development of this breakout session and other exercises as committed to in the *PCS*.

Sincerely,

Joe Murdock,
Chief Executive Officer

[1] A list of Diavik specific infrastructure will be provided to EMAB and DDMI following a more comprehensive review of the ICRP. ASI will contact EMAB and DDMI in the intermediate future.

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:: 117 Loutitt Street :: Yellowknife, NT:: X1A 3M2 ::
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Annex C – Breakout Session Instructions

ARKTIS SOLUTIONS INCORPORATED
:: 117 Loutitt Street :: Yellowknife, NT:: X1A 3M2 ::
:: Phone: 867.446.0036 :: Fax 866.475.1147 ::

BREAKOUT SESSION INSTRUCTIONS

File:	001-EMAB- Closure and Reclamation Workshop

BREAKOUT SESSION I

- Examine the large sized maps and satellite image of the area in and around the Diavik Diamond Mine.
- Ask yourself "*What do I know about the area on the map and mine site*?". This can include personal experiences at the mine site, on the land, through technical and other readings and other discussions you have had with people.
- Label areas on the figures (in marker) where you have personal knowledge of the site. On the chart paper write (in marker) your knowledge of these areas. Think of the following:
    - Where have you or friends and family personally visited? Are there any items of significance?
    - Is there any history that others may not know about on the areas on these maps? Are there protected or heritage areas? If so let others know.
    - How have things changed over time?
- Label areas on the figures (in marker) where you have an understanding of specifics of the site and region. On the chart paper provided write (in marker) your understanding of the area. Think of the following:
    - location and access;
    - climate and permafrost;
    - geology and the terrestrial environment (i.e. land types, topography, vegetation);
    - water quality and physical features (i.e. water depth, flow);
    - wildlife (i.e. migration and habitat types);
    - aquatic environment;
    - surface waters; and
    - anything else that comes to mind.
- Have you been to the Mine site before? Have you read about features of the mine site in reports? Label key features of the mine site (waste rock piles, dykes, lakes) on the satellite image of the mine with the markers provided.

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:: Phone: 867.446.0036 :: Fax 866.475.1147 ::

BREAKOUT SESSION II

- Examine the package of figures provided in envelope.
- Match up "before" and "after" reclamation photo sets. There is one "before" and one "after" photo in each set. There are 4 sets total.
- Examine the photo sets and develop the closure objectives and criteria. Discuss in your group and write down on the chart paper. This is a hypothetical exercise.

As previously defined in the workshop presentation,

OBJECTIVE: Defines and describes what is aimed to be achieved. This can be general in nature and include big general statements.

CRITERIA: Precise measures to assess success or failure of achieving the closure objectives. This could be a test that is performed.

BREAKOUT SESSION III

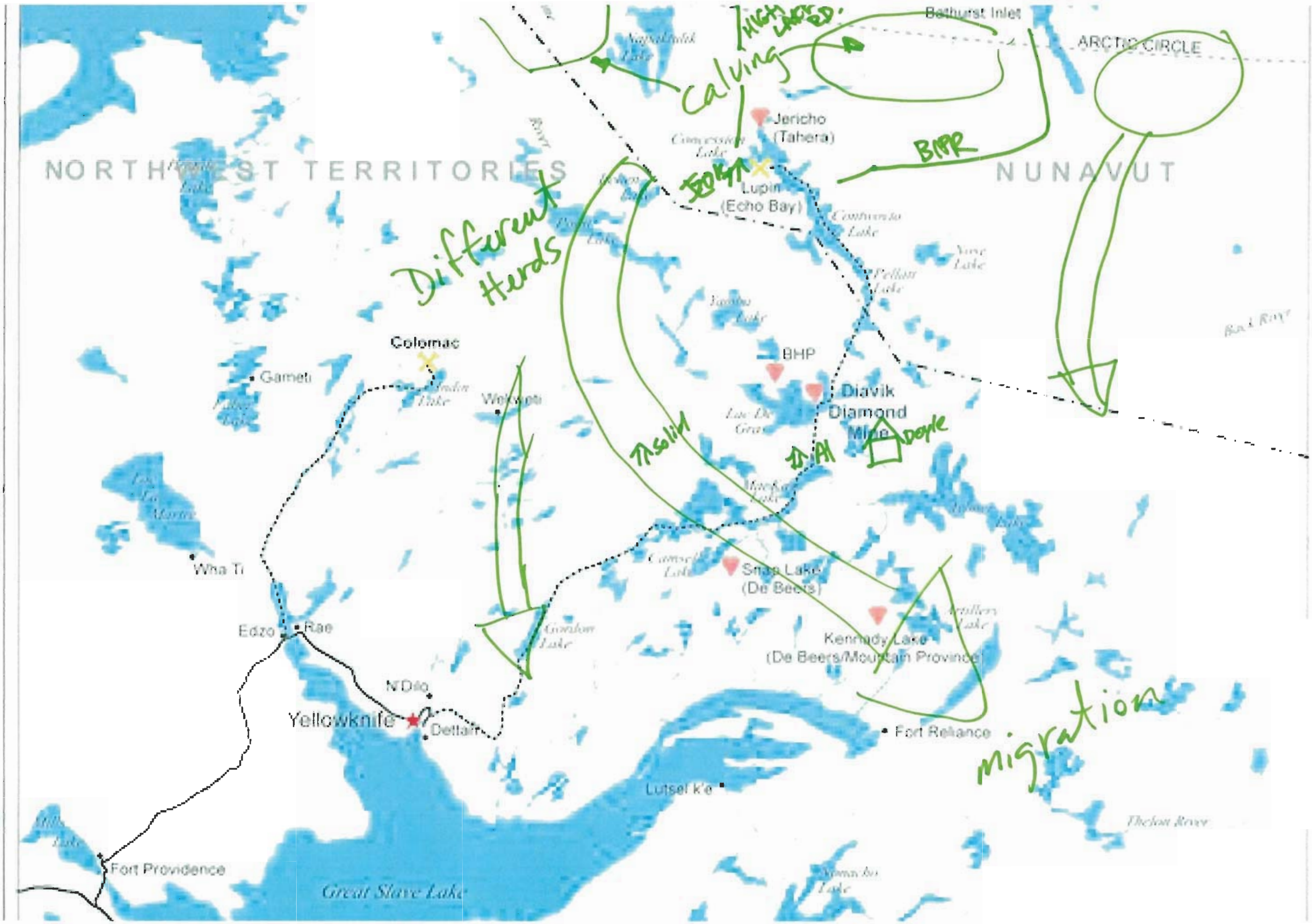
- Examine the large site figures and 11" x 17" figures of specific infrastructure. There is a large schematic listing the location of the infrastructure on the site.
- This is a hypothetical exercise. Develop closure objectives and criteria for the following pieces of infrastructure:
    - North Country Rock Pile
    - Processed Kimberlite Containment (PKC) Area and the PKC West Dam
    - Open Pit
- Discuss in your group and write down objectives and criteria. Feel free to add illustrations on the diagrams if you would like.

ARKTIS SOLUTIONS INCORPORATED
:: 117 Loutitt Street :: Yellowknife, NT:: X1A 3M2 ::
:: Phone: 867.446.0036 :: Fax 866.475.1147 ::

Annex D – Breakout Session Participant Notes

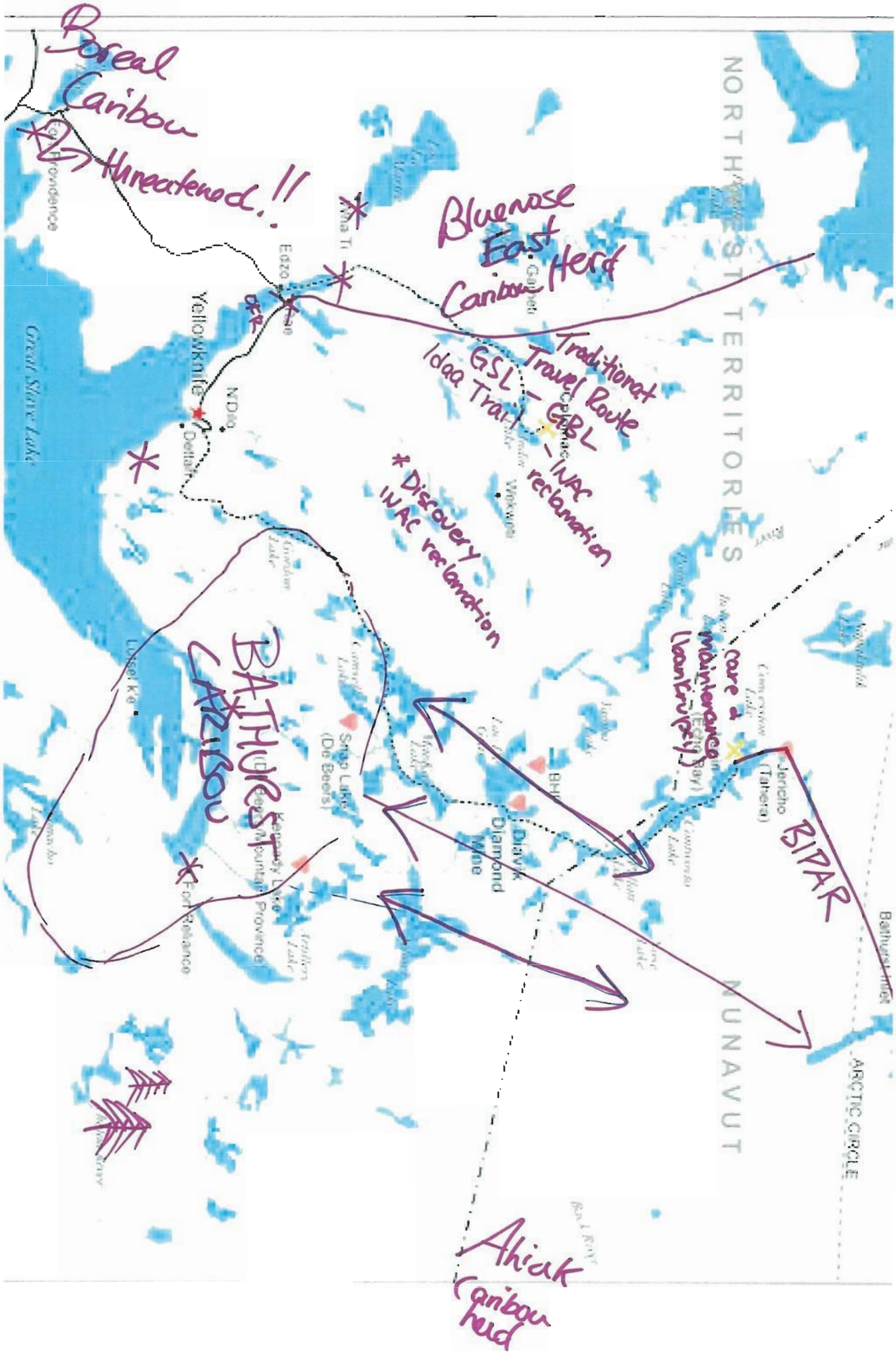
pot. Fish Habitat
Pot. Fish Habitat
Revegetation Plots
temp. accomodation - wolverine habitat
Tank
Waste Rock
Dust Suppressant
PKC -cap
A21 Waste rock
Emulsion
AN storage

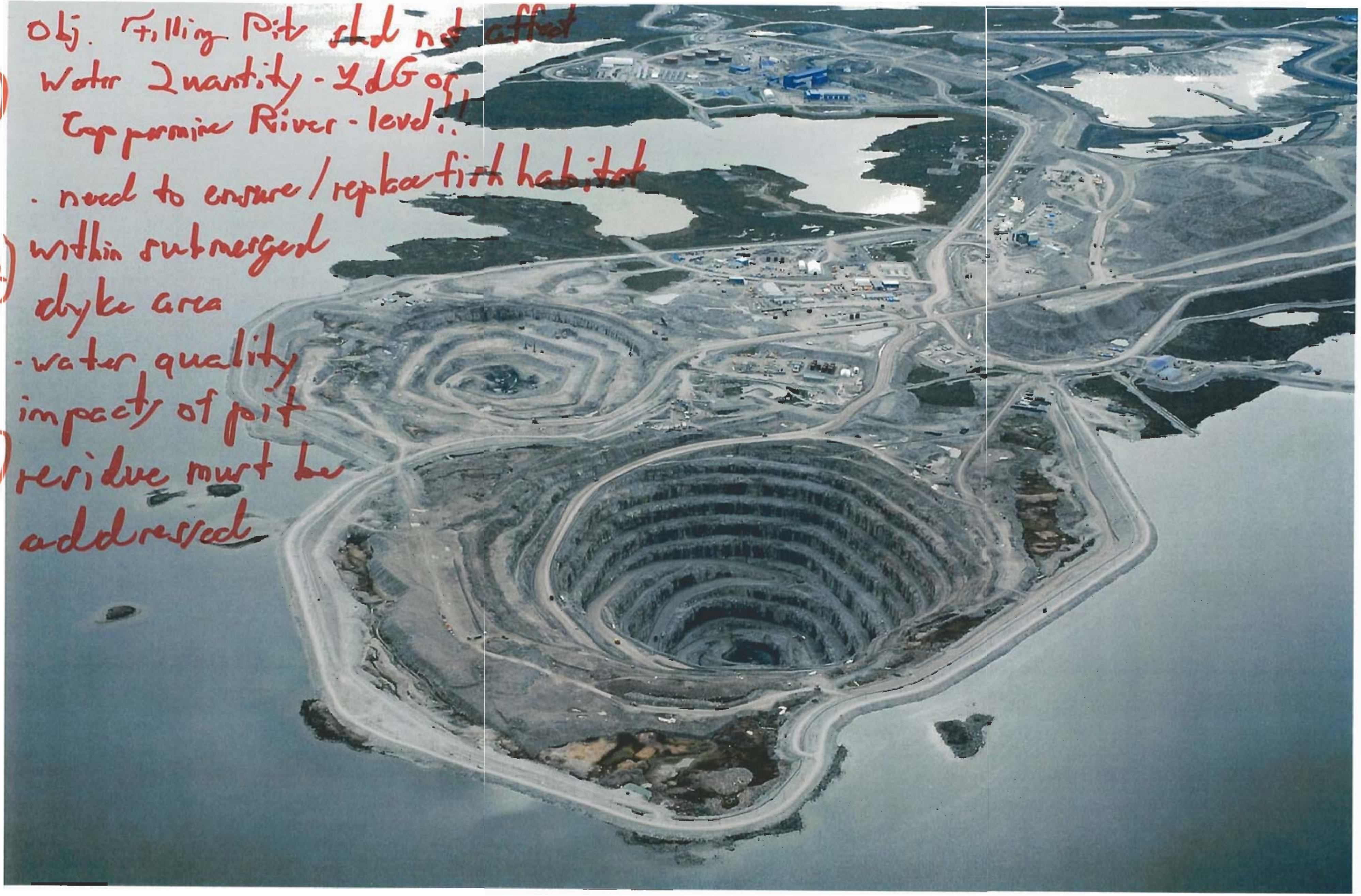
Diavik Diamond Mine Site

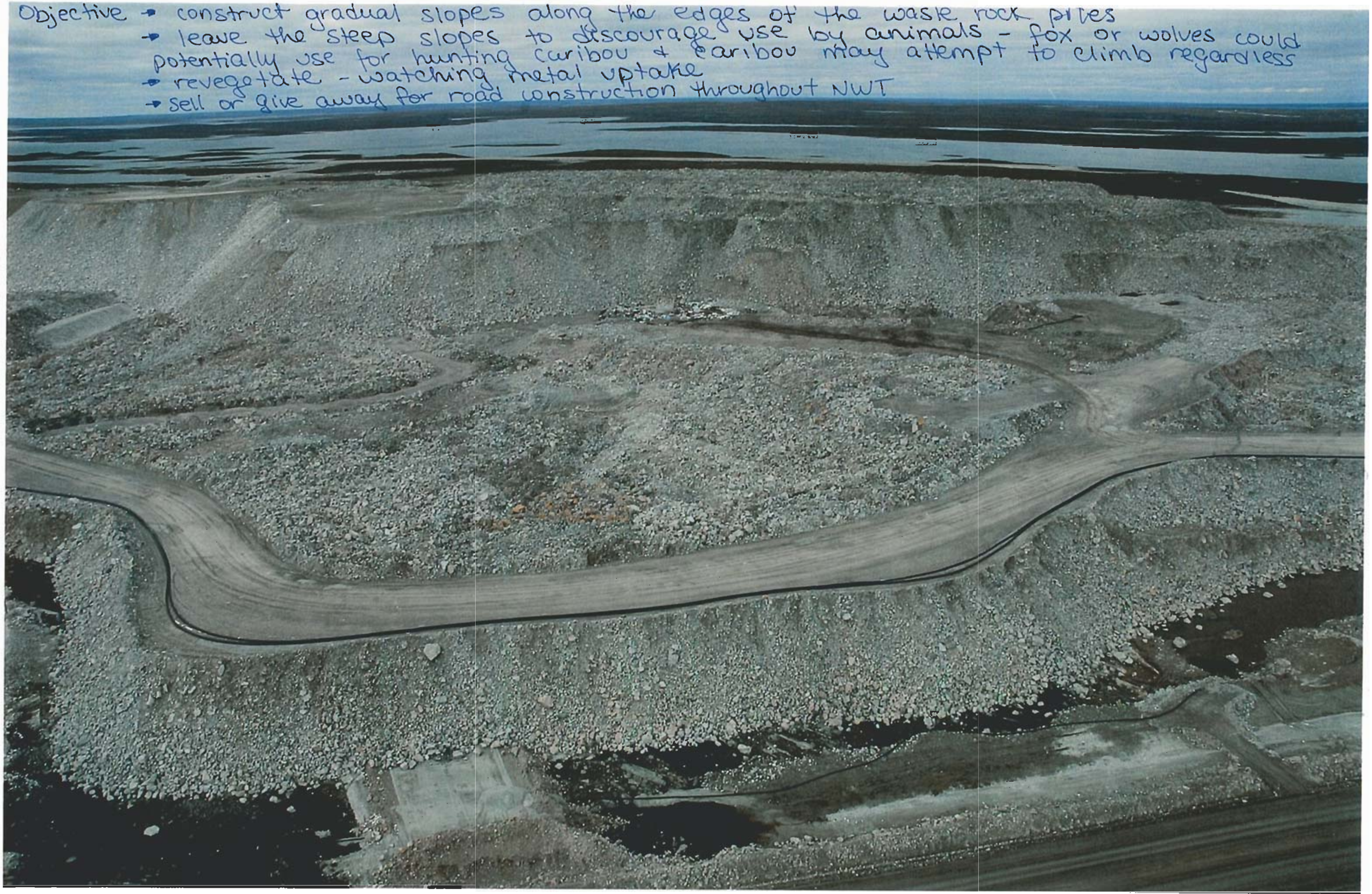


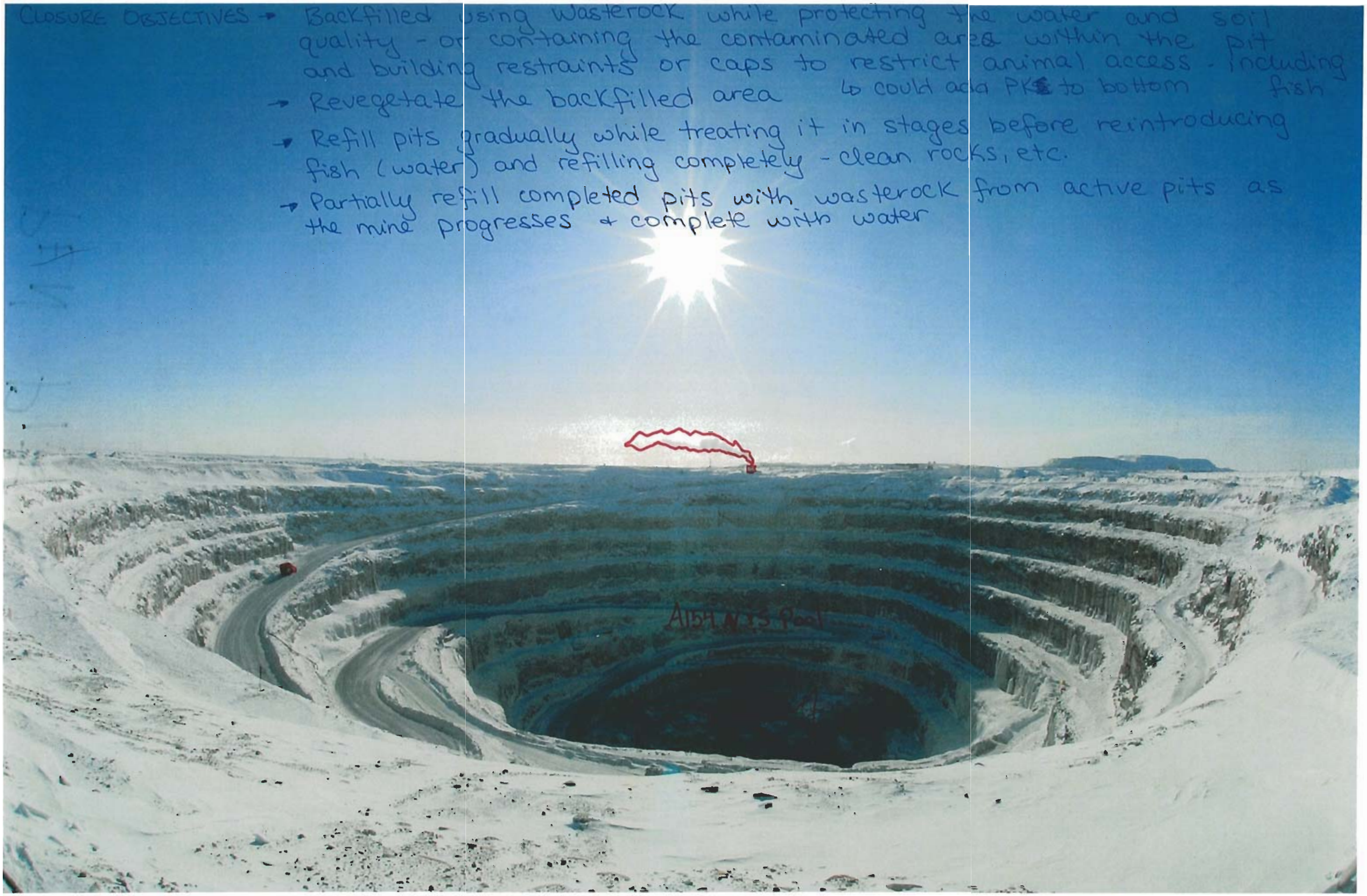
NORTHWEST TERRITORIES
NUNAVUT
Bathurst Inlet
ARCTIC CIRCLE
Jericho
(Tahera)
Lupin
(Echo Bay)
Colomac
Gameti
Wekweti
Wha Ti
BHP
Diavik
Diamond
Mine
Snap Lake
(De Beers)
Kennady Lake
(De Beers/Mountain Province)
Edzo
Rae
N'Dilo
Yellowknife
Dettah
Fort Reliance
Lutsel k'e
Fort Providence
Great Slave Lake
Thelon River
Different
Herds
Calving
migration
BNR

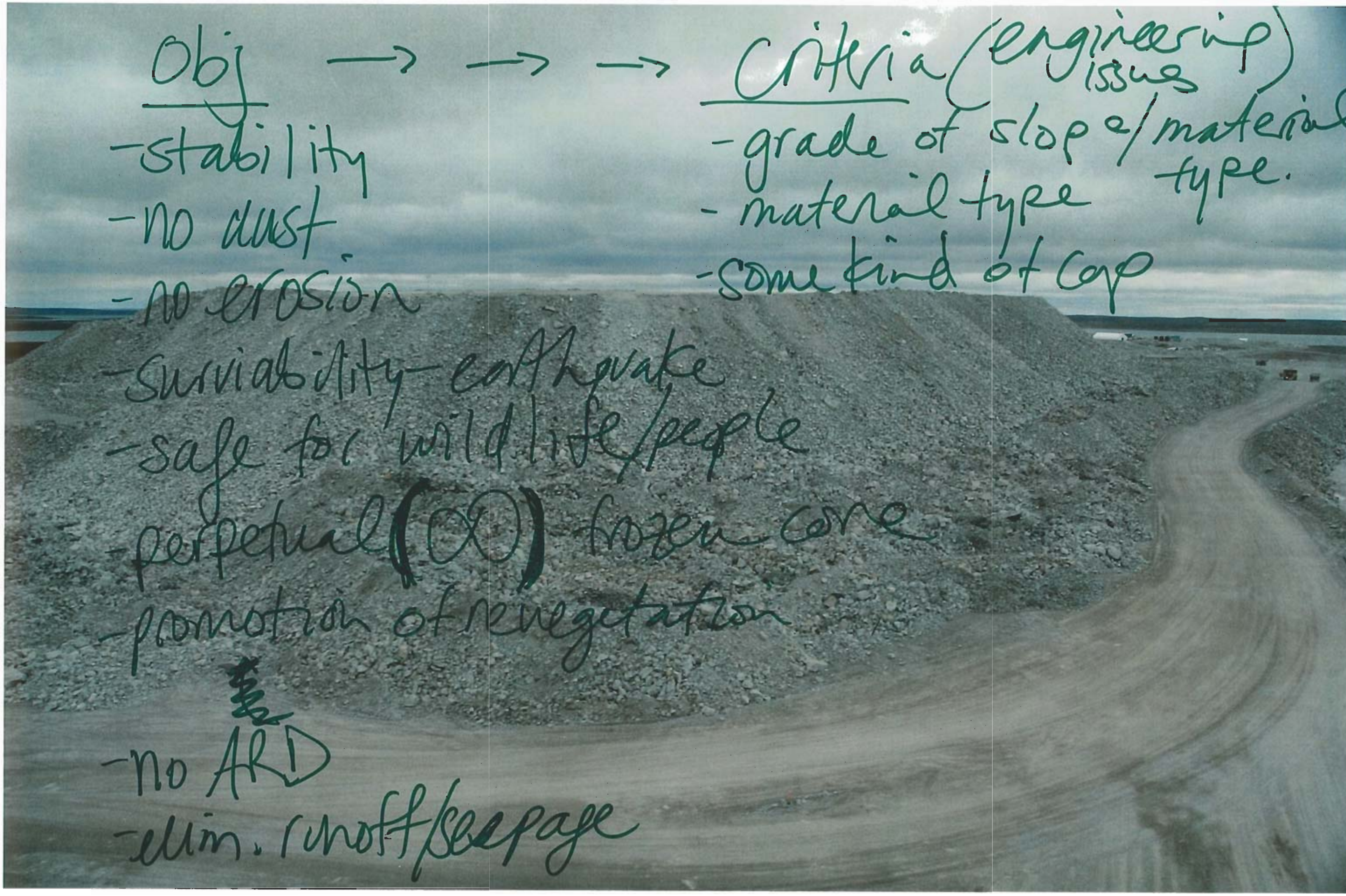
NORTHWEST TERRITORIES
NUNAVUT
Bathurst Inlet
ARCTIC CIRCLE
Jericho (Tahera)
Contwoyto Lake
Lupin (Echo Bay)
Pellatt Lake
BHP
Diavik Diamond Mine
Lac De Gras
MacKay Lake
Colomac
Gameti
Wekweeti
Wha Ti
Edzo
Rae
N'Dilo
Yellowknife
Dettah
Snap Lake (De Beers)
Kennady Lake (De Beers/Mountain Province)
Artillery Lake
Fort Reliance
Lutsel k'e
Thelon River
Fort Providence
Great Slave Lake
Gordon Lake
1996 wolverine no caribou grizzly dens
1950's hunting area.
2008
2001 – 2006
caribou since 2005
2006
2003

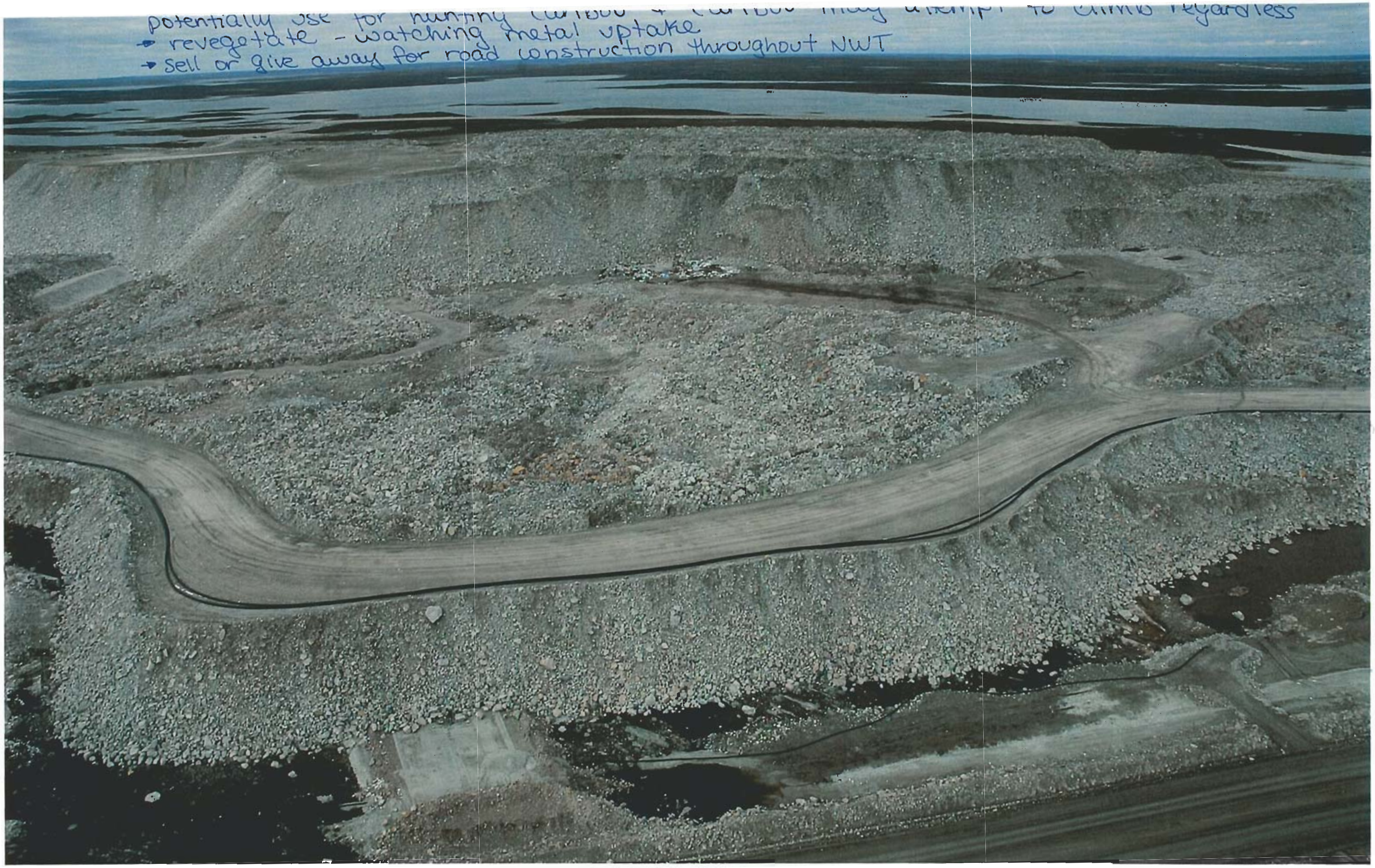

Boreal Caribou
threatened!!
Bluenose East Caribou Herd
Traditional Travel Route
GSL - GBL
Idaa Trail
- INAC reclamation
* Discovery INAC reclamation
BATHURST CARIBOU
care & maintenance (bankrupt)
BIPAR
Ahiak Caribou herd
NORTHWEST TERRITORIES
NUNAVUT
ARCTIC CIRCLE
Bathurst Inlet
Great Slave Lake
Yellowknife
Dettah
N'Dilo
Edzo
Gamèti
Wekweètì
Łutsel K'e
Fort Resolution
Fort Providence
Snap Lake (De Beers)
Kennady Lake (De Beers/Mountain Province)
Diavik Diamond Mine
BHP
Jericho (Tahera)
Lupin (Echo Bay)


Obj. Filling Pits shd not affect
1) Water Quantity - LdG of
Coppermine River - level!!
. need to ensure / replace fish habitat
2) within submerged
dyke area
- water quality
impacts of pit
3) residue must be
addressed


Objective → construct gradual slopes along the edges of the waste rock piles
→ leave the steep slopes to discourage use by animals - fox or wolves could potentially use for hunting caribou & caribou may attempt to climb regardless
→ revegetate - watching metal uptake
→ sell or give away for road construction throughout NWT


CLOSURE OBJECTIVES → Backfilled using wasterock while protecting the water and soil quality - or containing the contaminated area within the pit and building restraints or caps to restrict animal access - including fish
→ Revegetate the backfilled area ↳ could add PK to bottom
→ Refill pits gradually while treating it in stages before reintroducing fish (water) and refilling completely - clean rocks, etc.
→ Partially refill completed pits with wasterock from active pits as the mine progresses + complete with water
A154 N+S Pool


Obj → → → criteria (engineering issues)
- stability
- no dust
- no erosion
- surviability - earthquake
- safe for wildlife/people
- perpetual (∞) frozen core
- promotion of revegetation
- no ARD
- elim. runoff/seepage
- grade of slope w/ material type.
- material type
- some kind of cap


potentially use for hunting caribou + caribou may attempt to climb regardless
→ revegetate - watching metal uptake
→ sell or give away for road construction throughout NWT

Annex E – Rio Tinto Limited, DIAND and WLWB PowerPoint Presentations

Presentation Material Excluded by DDMI

Appendix IX-2

DDMI Closure Site Visit – January 14, 2009

Interim Closure and Reclamation Plan – Site Visit

January 14, 2009

Visitors

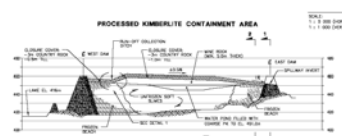
1	Francis Williah - Tlicho
2	Peter Huskey - Tlicho
3	Michel Louie Rabesca - Tlicho
4	Florence Catholique – LKDFN Representative – EMAB
5	Charlie Catholique _ LKDFN
6	James Marlowe - LKDFN
7	Lena Adjun - KIA
8	Stanley Anablak - KIA
9	Doug Crossley – KIA Representative – EMAB Member
10	Lawrence Goulet – YDFN Representative - EMAB
11	Floyd Adlem – EMAB Member - Cancelled
12	Bertha Drygeese - YDFN
13	Grant Beck – NSMA Representative – EMAB Member
14	Shannon Hayden - NSMA
15	George Mandeville - NSMA
16	Joe Murdock - EMAB Consultant
17	Nathan Richea - INAC
18	Erica Nyyssonen - GNWT
19	Ryan Fequet - WLWB
20	Gord Macdonald – Colleen English DDMI

2

Tour Route

3

1. Processed Kimberlite Containment



- Closure Objectives:
  - Maximize freezing of processed kimberlite.
  - Keep drainage quality (runoff and seepage) safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
  - Ensure geotechnical stability.
  - Other?

4

RioTinto

2. Wasterock Area

- Closure Objectives:
  - Freeze Type III rock – no active zone.
  - Keep drainage quality safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
  - Ensure geotechnical stability.
  - No water retaining structures.
  - Provide safe passage for caribou but not attract caribou.
  - Incorporate practical wildlife habitat features in final landscape.
  - Other?

5

RioTinto

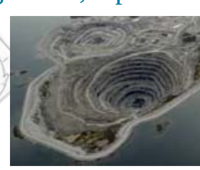
3. North Inlet

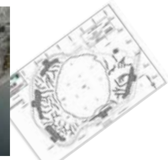
- Closure Objectives:
  - Water quality safe for human/wildlife and no significant adverse effects on water uses in Lac de Gras.
  - Hydrologic connectivity to keep levels equal to Lac de Gras.
  - Evaluate opportunities to reconnect for fish habitat.
  - Other?

6

RioTinto

4. Underground, Open Pit and Dike





- Closure Objectives:
  - Provide sustainable water quality in flooded pit areas for aquatic life.
  - Develop physical habitat that enhances lake-wide characteristics.
  - Enable safe small craft navigation.
  - Ensure geotechnical stability.
  - Eliminate public and wildlife access to underground.
  - Other?

7

RioTinto

5. Buildings and Roads

- Closure Objectives:
  - Maximize use of assets for regional benefits.
  - Maximize use of on-site disposal.
  - Provide a final landscape with restored drainage patterns and enhancements to encourage indigenous vegetation.
  - Incorporate practical wildlife habitat features in final landscape
  - Other?

8

9

Appendix IX-3

WLWB Objectives Workshop – February 25 & 26, 2009

Wek'èezhìı Land and Water Board

Box 32, Wekweètì, NT X0E 1W0
Tel: 867-713-2500 Fax: 867-713-2502
(Main)

#1-4905 48th Street, Yellowknife, NT X1A 3S3
Tel: 867-669-9592 Fax: 867-669-9593
(BHPB & Diavik)

March 12, 2009

DDMI and stakeholders,

Re: Draft Objectives for Diavik's Interim Closure and Reclamation Plan (ICRP)

The Wek'èezhìi Land and Water Board recently hosted a Closure Objectives Workshop as part of our Work Plan for the review of the DDMI Interim Closure and Reclamation Plan (ICRP). We wish to thank everyone for attending this workshop and for providing valuable input to the development of the ICRP. We greatly appreciate the constructive and respectful contributions made by everyone at the workshop.

As promised during the workshop, we are distributing draft ICRP objectives (attached) based on input received at the workshop for review. These draft objectives are based on what we heard and documented at the workshop, Diavik's proposed objectives, and input from our technical consultants. We also consulted the Comprehensive Study Report and the approved mine plan when we developed our suggested objectives. Our suggestions are draft and have not yet gone before the Board. We recognize that we may not have correctly captured all that was expressed at the workshop and welcome your recommendations for improving the objectives.

In addition to mine component objectives, our suggested objectives include global (or site wide) objectives. Although these were not explicitly discussed at the workshop, many of the suggestions made by workshop participants appeared to fall into this category. We have also included suggestions for key definitions (e.g., closure objectives, closure options, etc.) and welcome feedback on these.

Our original work plan for review of Diavik's ICRP did not include stakeholder review of the workshop results. This additional step was added after development of the Work Plan to allow enough time at the workshop for a more open discussion and to allow review by those who could not attend the workshop. As indicated in the attached updated Work Plan, your response to the attached draft material must be received by April 1, 2009.

If you have any further questions, please feel free to contact Patty Ewaschuk at pewaschuk@wlwb.ca or Ryan Fequet at rfequet@wlwb.ca.

Sincerely,

Patty Ewaschuk
Technical Coordinator
cc Diavik Distribution List

Introduction

As explained in our cover letter (March 12, 2009), we are distributing draft ICRP objectives (attached) based on input received at the workshop. These draft objectives are based on what we heard and documented at the workshop, Diavik's proposed objectives, and input from our technical consultants. We also consulted the Comprehensive Study Report and the approved mine plan. Our suggestions are draft and have not yet gone before the Board. We recognize that we may not have correctly captured all that was expressed at the workshop and welcome your recommendations for improving the objectives. We have also provided draft closure definitions for your review.

For any proposed closure objectives or definitions that you would like to see changed, please fill in BOTH empty columns of the table (reviewer recommendation and rationale).

All comments will then be sent to Rio Tinto for a response and the objectives will be taken to the Board, who will then provide direction to Rio Tinto.

Draft Closure Definitions

To ensure a common understanding of important closure and reclamation terminology, Board staff have proposed the definitions below for review. Below each proposed definition we have provided some clarification. Where definitions are available in Indian and Northern Affairs Canada (INAC)'s *Mine Site Reclamation Guidelines for the NWT* (January 2007), we have proposed to adopt those as a starting point. This will allow consistency with the water licence, since the water licence requires Rio Tinto to prepare the plan in accordance with INAC's guidelines.

Term	Board Staff Proposal	Reviewer's Recommended Change	Reviewer's Rationale for Recommended Change
Closure Goal	*The closure goal is a broad statement (or set of statements) that provides the vision and purpose of reclamation. The goal is met when the company has satisfied all closure objectives.* Clarification: The closure goal is a broad high-level statement and by its nature cannot be directly measured. The goal may be complimented by "global" or site-wide objectives which support the goal and apply to all mine components. The global objectives, while providing greater detail than the goal, are also not measureable; however they provide guidance in the development of criteria and consideration of options to meet mine component specific objectives.		

Closure Objectives (specific to mine components)	*"Objectives describe what the reclamation activities are aiming to achieve*." (INAC) Clarification: The mine component closure objectives should support or be consistent with the closure goal and global objectives. Closure objectives should take into consideration the physical stability, chemical stability, and future use and aesthetics at the site. Closure objectives specific to a mine component (e.g., waste rock pile) must be measurable to determine whether the objectives and site goal have been met.		
Closure Options	*Closure options are the actions that are proposed to successfully achieve the closure objective.* Clarification: A set of options (or alternatives) should be evaluated for each mine component objective. This definition is consistent with what is contained in the water licence.		
Closure Criteria	*"Detail to set precise measures of when the objective has been satisfied." (INAC)* Although in principle we prefer to adopt the definitions in the INAC guidelines, a better definition might be "standards that measure the performance of closure activities in successfully meeting closure objectives." We welcome comments on your preferred definition.		

Closure Goal

The closure goal for the Diavik site was not explicitly discussed at the workshop; however, we are presenting it here for completeness. Diavik's stated goal for the site is: "To close the Diavik Mine responsibly and progressively, leaving a positive community and environmental legacy." The company should also be guided by the INAC Mine Site Reclamation Policy for the NWT, which states that "the required standard of reclamation should be based on the 1994 Whitehorse Mining Initiative definition: 'returning mines sites and effected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities'." You may comment on Diavik`s goal; however, please consider that several site-wide issues are covered by the global objectives below.

Draft Closure Objectives

The following table is an extension of the tables distributed and presented on screen during the second day (February 26, 2009) of the Closure Objectives Workshop. Draft global objectives (as defined above) are presented first for review. These objectives were identified by participants and reasonably apply to all mine components. Draft mine component-specific objectives are then presented for each of the mine components discussed at the workshop.

Throughout the workshop, some participants recommended the use of traditional knowledge for the development of closure objectives or for closure options. We hope that these groups will provide traditional knowledge at this stage in the development of closure objectives, at the Closure Options and Criteria Workshop to be hosted by Rio Tinto in May this year and throughout the development of the current and future ICRPs.

Global Objectives

Diavik's Proposed Objective	Workshop Objective	Board Staff's Proposed Site-Wide Objective.	Reviewers Proposed Site- Wide Objective and Rationale
Land and Water that is safe for people, wildlife and aquatic life	Available for traditional harvesting for the future children. Returning as close to possible to natural topography. Aesthetic values as it relates to Aboriginal culture. Return site to as close as possible to the way it was – views, smells, interrelationships, spiritual, harvesting. Usability – is it safe, non- contaminating, same plants or different plants? Safe means no contamination and physical	1. The site condition is as close as possible to predevelopment conditions allowing for traditional use. 2. Land and water that is safe (physically and chemically) for aquatic life, wildlife and people. 3. The site is a neutral attractant for wildlife compared to surrounding environment. 4. The site is not a source of contamination. 5. Restore aesthetics of the site based on traditional knowledge.	

Global Objectives

Diavik's Proposed Objective	Workshop Objective	Board Staff's Proposed Site-Wide Objective.	Reviewers Proposed Site- Wide Objective and Rationale
	hazards. Caribou populations need to be same or better as today- site should not negatively affect caribou. Energy use of site by wildlife is neutral.		
Enhanced capacities for northerners and northern business	Need to involve Aboriginal people in the business aspect of reclamation.	6. Maximize northern business opportunities during closure. 7. Create enhanced capacity for northerners and northern businesses that remains after closure.	
Implementation of a closure design that does not require long term care and maintenance	Should be a "walk- away" situation.	8. Closure is final and does not require long term care.	
Agreement to remove financial security requirements.	INAC is solely responsible for this. Diavik's proposal is that parties other than INAC should agree to remove financial security requirements.	9. Obtain agreement from affected parties that financial security requirements should be removed by INAC.	

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Maximize use of assets for regional benefits.	Promote salvage/reuse of infrastructure with local communities.	An asset is anything that has value to the communities. Demolition to maximize usability of assets. Improve definition of regional?	1. Maximize re-use of infrastructure by local communities. 2. Maximize usability of assets during demolition. *Staff comment: Definition of ``asset`` can be addressed when developing options and criteria.*		
No water retaining structures.			3. No constructed water retaining structures remain. *Staff comment: the word "constructed" is added to clarify that natural depressions and water retaining structures present before development can remain.*		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
A final landscape without buildings, with restored drainage patterns and with enhancements to encourage indigenous vegetation.	Re-establish natural channels etc by removal of culverts, bridges. Remove buildings.	Should include removal of pipes and other infrastructure (but not roads?) Include wording on natural topography. Stronger wording than "enhancements" and "encourage".	4. All imported infrastructure removed. 5. Natural drainage and indigenous vegetation restored.		
Inclusion of practical wildlife habitat features in final landscape.		Wording: "healthy", "safe", "productive". -Difficulty with word "practical". -Better wording of "wildlife habitat feature". -Use of TK to improve the objective. -Needs to be more specific.	6. Include practical wildlife features in final landscape. *Staff comment: The word `practical` can be defined by the closure criteria.* *We welcome any traditional knowledge that will improve the development of this objective.*		
	Safe passage for wildlife	Return to useful habitat. "Passage" may be too specific or may need to be defined better. Positive net energy for wildlife.	7. Safe passage for wildlife.		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
	Restore topography, aesthetics Do not leave site "unsightly"	- Better word than aesthetics to capture spiritual and other aspects of being on the land. - More TK input for this objective. - Better wording for ``unsightly``, e.g., "eyesore".	*See Global Objective #5*		
	Road areas restored to natural topography and growth	See above.	*Staff comment: This issue was not sufficiently explored at the workshop to allow staff to propose an objective. How feasible is road removal? Where would the removed material go? Would the remaining landscape be better than reclaimed roads (e.g., slope adjustments, scarification, revegetation, etc.)? What other considerations exist? Recommendations (with rationale) would be appreciated.*		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Maximize use of on-site disposal.		Disposal should not have an impact on usability of the area. Need more information about what will be disposed and where. Must be done safely, and meet usability objectives. Residual contaminated soil to be addressed/remediated – soil doesn't negatively affect wildlife. Remove sources of contamination. Contamination addressed during infrastructure removal.	8. Remove hazardous materials (e.g., from explosives, fuels, chemicals, etc.) 9. Remediate contamination.		
		Add objective regarding dust Add objective regarding disturbance of undisturbed areas.	10. Dust levels safe for people, vegetation and wildlife. 11. Areas in and around the site that are undisturbed during operation of the mine should remain in their natural state during and after closure.		

MINE INFRASTRUCTURE – BUILDINGS AND ROADS

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Financially practical.		Okay, but statement is subjective and open to interpretation. May contradict other objectives. May not be an appropriate objective.	*Staff comment: Not a closure objective. Finances can be considered during selection of options.*		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Surface runoff and seepage water quality that is safe for human/wildlife and that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River.	Seepage quality is good – no deleterious substances would come out of the rock pile.	More specifics on how to deal with waste, etc. that is deleterious? -Deleterious substances can come out of the rock pile, but concentrations and loadings should not impact the use of the site or lake water quality. -Should also think about concentration and loading, not just presence of deleterious substance. -Water entering LDG should be of similar quality to LDG. Is this realistic?	1. Surface runoff and seepage water quality that is safe for humans and wildlife. 2. Surface runoff and seepage water quality that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River. *Staff comment: Diavik`s proposed objective was split into two since two separate criteria may be required. Use of the word deleterious implies the DFO definition of the word which addresses fish. This may be too narrow for WLWB purposes. Presence of contaminants, loading and concentration can be addressed through the criteria. The word `significant` is not problematic since it can be defined by closure criteria.*		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Safe passage for caribou through and around the area.	Slopes shouldn't be too steep (should be rest areas), rocks shouldn't be too big or too sharp – for travel and aesthetics Positive net energy for caribou	"neutral" net energy may be more appropriate, or that net energy is the same as in a natural landscape. Steep slopes or shallow slopes may be beneficial to caribou passage. Slope direction can influence where seepage goes. TK used to determine best options. Do not want to make obstructions that trap caribou. Should be safe passage to the top since caribou will go there when stressed.	3. Safe passage for wildlife. *(Staff comment: Steepness and direction of slopes, obstructions, and passage to the top can be addressed by closure options and criteria. Slope stability and safety is addressed in objective #4 ; caribou net energy is addressed in Global Objective #3. TK to determine best options can be provided at Rio Tinto`s upcoming Closure Criteria and Options Workshop.)*		
Area not a significant attractant for caribou.	Build trails around piles for caribou to use? Positive net energy for caribou	"neutral" net energy may be more appropriate, or that net energy is the same as in a natural landscape. Access and safety, etc. for caribou same as before the mine.	*Staff comment: See site wide objective #3 and country rock and till storage area objectives # 3 and 4.*		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Stable slopes safe for people and wildlife.	Slopes shouldn't be too steep (should be rest areas), rocks shouldn't be too big or too sharp – for travel and aesthetics	Should animal dens be on the slopes; would this jeopardize permafrost? May be better to talk about "practical habitat".	4. Stable and safe slopes for use by people and wildlife.		
Landform with more natural shapes versus sharp engineered angles.	Aesthetics – height, slopes, revegetation?		5. Pile features match aesthetics of surrounding area. 6. Till storage areas and rock piles re-vegetated where possible.		
	Any currently undisturbed areas left in their natural state.	Matches "smallest practical footprint". Competes with minimization of pile height, this can be worked out by balancing options.	7. Areas in and around the site that are undisturbed during operation of the mine should remain in their natural state during and after closure.		
	Erosion control in place, stable against wind scour and source of dust.	Geotechnically stable against wind AND water erosion.	8. Dust levels safe for people, vegetation and wildlife. 9. Erosion and sedimentation processes are minimized.		

COUNTRY ROCK AND TILL STORAGE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
	Should not support increased predation.	Should this be more neutral to allow for return of the site to state as it was before mine. Reclaimed sites will not improve predation success rate on caribou compared to site before mine.	10. No increased opportunities for predation compared to pre-development conditions.		
Smallest practical footprint.			*Staff comment: See above objective # 7.*		
No water retaining structures.		Addressed in infrastructure discussion.	11. No constructed water retaining structures remain. *Staff comment: the word "constructed" is added to clarify that natural depressions and water retaining structures present before development can remain.*		
Financially practical.		Addressed in infrastructure discussion.	*Staff comment: Not a closure objective. Finances can be considered during selection of options.*		

PROCESSED KIMBERLITE CONTAINMENT AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Surface runoff and seepage water quality that is safe for human/wildlife and that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River.	No deleterious seepage from PKC. Promote drainage collection away from the PKC to prevent water contamination.	See discussion under waste rock regarding deleterious substances. Do not want to create erosion problems during runoff diversion. Should address wind erosion as well. "Significant" could be removed. Significance is measured differently by different groups. Regardless, criteria will define better.	1. Surface runoff and seepage water quality that is safe for humans and wildlife. 2. Surface runoff and seepage water quality that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River. *Staff comment: Diavik`s proposed objective was split into two since two separate criteria may be required. Use of the word deleterious implies the DFO definition of the word which addresses fish. This may be too narrow for WLWB purposes. Presence of contaminants, loading and concentration can be addressed through the criteria. The word `significant` is not problematic since it can be defined by closure criteria. See objectives #8 and 9 regarding erosion.*		

PROCESSED KIMBERLITE CONTAINMENT AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Engineered containment of processed kimberlite material.		Note that this containment facility would remain permanently. Note that containment facility is meant to contain solids and not water. Objective is to keep solids permanently on-site. Use TK to design containment facility.	3. Processed kimberlite is permanently contained. 4. Processed kimberlite is not a source of contamination to Lac de Gras. *Staff comment: TK for the design of the containment facility can be provided at Rio Tinto`s upcoming Closure Options and Criteria Workshop.*		
Stable slopes safe for people and wildlife.		Similar to concerns for waste rock. Geotechnically stable as described under waste rock discussion.	5. Stable and safe slopes for use by people and wildlife.		
Financially practical.		See previous discussions.	*Staff comment: Not a closure objective. Finances can be considered during selection of options.*		

<u>PROCESSED KIMBERLITE CONTAINMENT AREA</u>

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Area not a significant attractant for caribou. Safe passage for caribou through and around the area.	Safe for caribou health. Positive net energy for caribou	Interface between PK beaches and water is a concern - negative energy for caribou. No access to PK for caribou. Also see discussion under waste rock.	6. No access to processed kimberlite by caribou and other wildlife. 7. Safe passage for wildlife.		
	No erosion, not a source of sediment to Lac de Gras.		8. Erosion and sedimentation processes are minimized.		
	Surfaces must be stable enough to have no dust flying around.		9. Dust levels safe for people, vegetation and wildlife.		
			10. No water retaining structures remain. *Staff comment: This addresses collection ponds associated with the PKC.*		

OPEN PITS, UNDERGROUND, DIKE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Water quality in flooded pit areas that is sustainable for aquatic life.	1. should not be a source of contamination to Lac de Gras 2. ensuring water quality of the pit water is as similar as possible to Lac de Gras	Note - sustainable will be defined by criteria. Water quality in tunnels should be addressed as well.	1. Water quality in flooded pit areas is sustainable for aquatic life and is as similar as possible to Lac de Gras. 2. Not a source of contamination to Lac de Gras.		
Physical features in the flooded pit areas that enhance lake-wide fish habitat characteristics.		Habitat requirements are in the Fisheries Authorization. Should include wording to address effectiveness. (DFO success criteria may already be defined. DFO has requirements for monitoring plans with community input.)	3. Enhance lake-wide fish habitat.		
Maximize safe use of pit area for landfill.	preferential use of underground tunnels for safe disposal	Use of pit area for landfill includes tunnels in the right circumstances. Concern about what will be disposed in underground tunnels and pit area.	4. Disposal of material in pits and underground is safe.		
Financially practical.			*Staff comment: Not a closure objective. Finances can be considered during selection*		

OPEN PITS, UNDERGROUND, DIKE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
			of options.		
Safe small craft navigation through pit areas.	dike islands would be safe for navigation		5. Safe small craft navigation through pit areas.		
Safe use of area for people and wildlife	safe use of pit area by winter harvesters	Address ice safety in winter.	6. Safe for use by people and wildlife. 7. Dust levels are safe for people and wildlife.		
Surfaces to be geotechnically stable	1. physical stability of the pit walls after pit flooding 2.stable islands from dikes - no erosion from dike islands		8. Pit walls, islands and shorelines are stable.		
water levels in the Coppermine River not impacted by rate of pit flooding		This will also achieve protection of littoral zones.	9. No negative impacts on water levels in Lac de Gras and Coppermine River from flooding of open pits.		
	re-flooding of pits should not have a negative impact on fish habitat in Lac de Gras	Rate of flooding should not suspend sediments at the bottom of the pit. Littoral habitat is unaffected by pit flooding.	10. No negative impacts on fish habitat in Lac de Gras and Coppermine River from flooding of open pits.		
	ensure safety of wildlife during pit flooding (caribou falling into pits or raptor nests being destroyed)	Raptor nests may be destroyed - breeding should not be disrupted.	11. Wildlife safe during flooding of pits.		
	Aesthetics.	- Better word than	*Staff comment: See Global*		

OPEN PITS, UNDERGROUND, DIKE AREA

Diavik's Proposed Objective	Workshop Objective	Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
		aesthetics to capture spiritual and other aspects of being on the land. - More TK input for this objective. - Note that smoothing of islands for aesthetics may cause erosion problems.	*Objective #5 regarding aesthetics and TK.*		
		Progressive reclamation used for flooding pits to use learned information for subsequent flooding.	*Staff comment: This does not appear to be an objective. It can be considered when developing options and identifying research needs.*		
		Revegetate islands for erosion prevention and use by wildlife.	12. Revegetate islands for erosion prevention and use by wildlife.		
	Currents do not cause sediment release or pit wall instability.		*Staff comment: See objective #8.*		

NORTH INLET

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Water quality in the North Inlet that is safe for human/wildlife with no significant adverse effects on water uses in Lac de Gras.	1. The North Inlet should not be a source of contaminants to Lac de Gras 2.water quality is similar or equal to Lac de Gras water quality 3.If water quality in the North Inlet is harmful, then wildlife should be excluded	If water quality and sediment are harmful, then fish should be excluded from the North Inlet. See earlier comments about ``significant``.	1. Water quality in the North Inlet that is safe for humans and wildlife. 2. Water quality in the North Inlet that will not cause significant adverse effects on water uses in Lac de Gras or the Coppermine River. 3. Not a source of contaminants to Lac de Gras. *Staff comment: Diavik`s proposed objective was split into two since two separate criteria may be required. Use of the word deleterious implies the DFO definition of the word which addresses fish. This may be too narrow for WLWB purposes. Presence of contaminants, loading and concentration can be addressed through the criteria. The word `significant` is not problematic since it can be defined by closure criteria.*		

NORTH INLET

Diavik's Proposed Objective	Workshop Objective	Workshop Ideas for Refinement	Board Staff's Proposed Objective	Reviewer`s Recommended Change	Reviewer`s Rationale
Maintenance of water levels equal to Lac de Gras.			*Staff comment: This is unnecessary because of objective #4.*		
No water retaining structures.	reconnect the inlet to Lac de Gras		4. Reconnect with Lac de Gras.		
Evaluate opportunities to fully reconnect the North Inlet with Lac de Gras.	reconnect the inlet to Lac de Gras	Note that if water quality is sufficient, dike could remain to allow water movement, but not movement of fish.	*Staff comment: This is unnecessary because of objective #4.*		
	return North Inlet to productive capacity suitable for fish		5. Productive fish habitat present in North Inlet.		
		There was a comment from the workshop to include objectives for dust for all mine components.	6. Dust levels safe for people, vegetation and wildlife.		
			7. Stable channel banks and breach locations.		

List of Workshop Participants

Name	Organization
Nick Lawson	Jacques Whitford AXYS **now** Stantec (for WLWB)
Chandra Venables	Government Northwest Territories (GNWT)
Todd Slack	Yellowknives Dene First Nation (YKDFN) Land and Environment
Tim Byers	YKDFN consultant
John McCullum	Environmental Monitoring Advisory Board (EMAB)
Eddie Erasmus	EMAB
Floyd Adlem	EMAB
Doug Crossley	EMAB
Lindsey Cymbalisty	Indian and Northern Affairs Canada (INAC - E&C)
Lorraine Sawdon	Department Fisheries and Oceans (DFO)
Lionel Marcinkosky	INAC (E&C)
Lawrence Goulet	EMAB – YKDFN
Sheryl Grieve	North Slave Metis Alliance (NSMA)
Lena Adjun	Kitikmeot Inuit Association
Kevin Tweedle	Kitikmeot Inuit Association
Julian Kanigan	INAC
Marc Casas	INAC – Water Resources
Robert Jenkins	INAC – Water Resources
Florence Catholique	EMAB
Anne Wilson	Environment Canada (EC)
Jane Fitzgerald	EC
Gord MacDonald	Rio Tinto
Kathy Racher	WLWB
Ryan Fequet	WLWB
Patty Ewaschuk	WLWB
Stephen Bourn	Rio Tinto
Colleen English	Rio Tinto
Shannon Hayden	NSMA

Appendix IX-4

DDMI Options and Criteria Workshop – May 12-13, 2009

Rio Tinto

Diavik Diamond Mines Inc.
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memo

From	Gord Macdonald
To	Distribution (email)
Reference	Diavik ICRP Options and Criteria Workshop – May 12&13, 2009
Date	July 9, 2009 – Updated from June 15, 2009

Outcome from Diavik ICRP Workshop – Options & Criteria

Workshop Purpose

- To present and obtain comment on alternative closure options in order to assist DDMI in identifying a preferred option for each option(s) (Part L, Item 1a);
- Identify measurable closure criteria that describe each closure objective.

Workshop Outcome - Options

- Attached is a copy of the workshop options slides that were presented.
- A summary of the positive and negative aspects identified by workshop participants for each of the closure options presented at the workshop are attached.
- If we got something wrong in this summary – please let me know as soon as possible.
- This material will form an Appendix in the 2009 ICRP.

Workshop Outcome – Research Ideas/Opportunities

- As we worked through the closure options participants asked that we make a listing of research ideas/opportunities that came up during the discussions
- Attached is a copy of what was recorded.

Workshop Outcome – Criteria

- The workshop provided a good opportunity for general discussion on closure criteria but very little progress was made in establishing specific criteria.
- Attached is a copy of what was recorded from the session

On behalf of Rio Tinto I would like to thank all workshop participants for their continued time and effort.

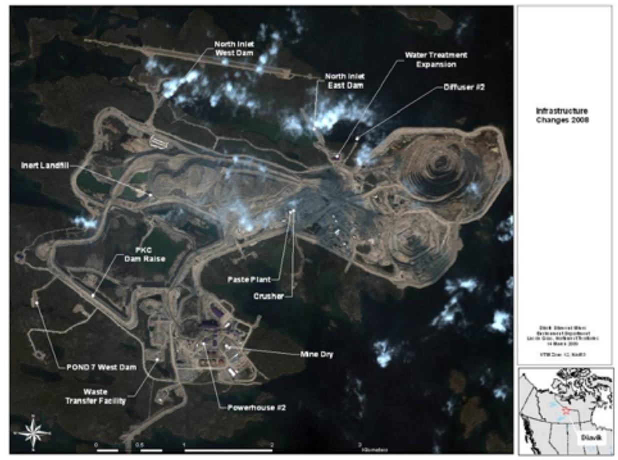
Attachments: Workshop Presentation Material
Results from Closure Options Review (Tables 1-11)
Closure Criteria – Notes from Workshop (Tables 12-23)
Closure Research Ideas/Opportunities (Table 23)

Distribution

1	Lorraine Sawdon	DFO
2	Jennifer Potten	INAC
3	Shannon Hayden	EMAB – NSMA
4	Nathen Richea	INAC
5	Lindsey Cymbalisty	INAC
6	Velma Sterenberg	INAC
7	Steve Wilbur	WLWB (consultant)
8	Patty Ewaschuk	WLWB
9	Ryan Fequet	WLWB
10	Kathy Racher	WLWB
11	Anne Wilson	EC
12	Jane Fitzgerald	EC
13	Stanly Anablak	KIA
14	Kevin Tweedle	KIA
15	Florence Catholique	EMAB- LDFN
16	Lawrence Goulet	EMAB - YKDFN
17	Steve Bourn	DDMI
18	Lydnon Clark	DDMI
19	Calvin Yip	DDMI
20	Gord Macdonald	DDMI
21	Todd Slack	YKDFN
22	Tim Beyers	YKDFN
23	Zabey Nevitt	WLWB
24	Erika Nyyssonen	GNWT
25	John McCullum	EMAB

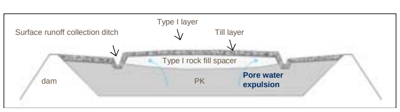
Diavik Closure Planning

Interim Closure and Reclamation Plan – Options and Criteria Workshop
May 12-13, 2009

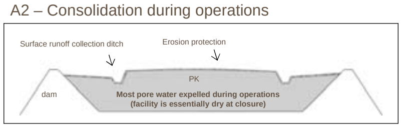


Option A – Processed kimberlite consolidation

A1- Consolidation post closure



A2 – Consolidation during operations



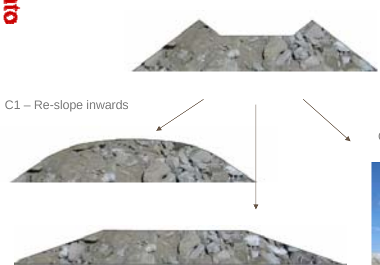
Option B – Surface of Processed Kimberlite Containment Area

B1 – Coarse Kimberlite

B2 – Kimberlite beach

B3 – Country rock

Option C – Height for roads, plantsite, laydown and airstrip

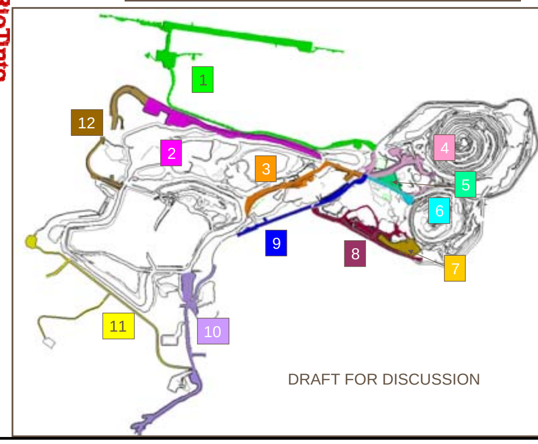


C1 – Re-slope inwards

C2 – Re-slope outwards

C3 – Re-mine for material

Possible Other Type 1 Closure Material



DRAFT FOR DISCUSSION

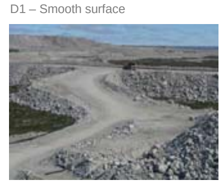
Possible Other Type 1 Closure Material

		cubic metres	tonnes (x 2.04)
1	Runway/apron/airport road	906,330	1,848,910
2	Ring road	1,577,150	3,217,390
3	North haul road	1,771,090	3,613,020
4	Dump 7 area	646,200	1,318,250
5	N3 laydown	223,350	455,630
6	Pit access road	73,060	149,040
7	Pond 14	430,940	879,120
8	UG portal area	326,520	666,100
9	South haul road	213,360	435,250
10	A21 Causeway	1,229,220	2,507,610
11	AN storage/DWE road	185,180	377,770
12	Pond 2 dam	622,630	1,270,170

DRAFT FOR DISCUSSION

Option D – Surface for roads, plantsite, laydown and airstrip

D1 – Smooth surface



D2 – Scarified surface

Option E – Inert landfill location

E1 – Country rock pile
E2 – PKC
E3 – Pit Bottom
E4 – Underground tunnels

Option F – North Inlet

F1 – Hydrologic connection to Lac de Gras

F2 – Open connection to Lac de Gras

F3 – No connection to Lac de Gras

Option G – Side slope on country rock piles

G1 – Flat slopes

G2 – Steep slopes

Option H – Till cap on country rock piles

H1 – Till cap on top and sides

H2 – Till cap on top

H3 – No till cap

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Option I – Alternative infrastructure use

I1 – On-site facility

I2 – Reuse in communities

RioTinto

Option J – Areas for revegetation

J1 – Roads, plantsite, laydown, airstrip
J2 – PKC
J3 – Country rock piles

Results from Closure Options Review

Table 1. Summary of workshop positives and negatives – Option A – Processed Kimberlite Consolidation

A1 – Consolidation Post Closure	A2 – Consolidation During Operations	A3 – Consolidation During Both*
- porewater mystery at closure - metals treatment at closure + no costs until closure - till cracking and porewater getting into the environment + thicker cap is isolation from wildlife and vegetation - slower freezing - active zone greater than 3-5 m	+ learn porewater chemistry and freezing rates - metals treatment during operations + no Lac de Gras raw water use - costs for piping and infrastructure + possibly reduce dam raises + seepage management + option to cover like A1 if necessary - operational dust – wind generated - impact on water quality from not having impermeable cover + faster freezing	+ don't have to make a decision with poor quality information + fully documents this option + includes positives from A2 - some negatives + till less likely to crack

* Option A3 was added during the workshop at the request of a participant. DDMI notes that most options evaluated are not either/or options. Options can be combined over time or even applied to different areas. They are not intended to be mutually exclusive.

Table 2. Summary of workshop positives and negatives – Option B – Surface of Processed Kimberlite Containment Area

B1 – Coarse Kimberlite	B2 – Kimberlite Breach	B3 – Country Rock	B4 – Till
- susceptible to erosion - metal leaching potential - metal uptake in vegetation - salt attractant for wildlife - direct wildlife ingestion + less snow accumulation - probability of kimberlite getting out of containment area	- no erosion protection - metal leaching potential - metal uptake in vegetation - salt attractant for wildlife - direct ingestion by wildlife - wildlife getting physically stuck + can support vegetation if wanted + less snow - highest probability of kimberlite getting out of containment area - erodability of material	+ large rocks provide cover from predators + best dust control + keeps caribou out of kimberlite - increased snow load if rocks are too big	+ wildlife mobility + vegetation + thermal active zone - susceptible to erosion - material availability

Table 3. Summary of workshop positives and negatives – Option C – Height for roads, plantsite, laydown and airstrip

C1 – Re-slope Inwards	C2 – Re-slope Outwards	C3 – Re-mine for Materials
- Runoff water quality + maintain trafficability - wind erosion + safe travel for caribou - predation - safe travel for people + more natural feature - caribou less willing to cross	+ can keep trafficability - broadens footprint - wind erosion + safe travel for caribou - predation + safe travel for people	+ drainage crossings and drainage control + source of closure material + vegetation + can do it early - higher dust during active removal + most natural landscape + closest to the way it was + caribou most willing to cross - water erosion

Table 4. Summary of workshop positives and negatives – Option D – Surface for roads, plantsite, laydown and airstrip

D1 – Smooth Surface	D2 – Scarified Surface
+ trafficable for people, caribou, trucks - will not revegetate + no new disturbance – will not disturb established vegetation + smooth surface for caribou crossings + easy routes for caribou + use to encourage caribou routes - liability to third party traffic	+ micro habitat for vegetation + more natural + runoff erosion control - too rough is a hazard particularly on side slopes

Table 5. Summary of workshop positives and negatives – Added Option for E – Onsite versus Offsite Landfill

Onsite Landfill	Offsite Landfill
+ lower cost + fewer GHG from haulage offsite + progressive closure - larger footprint if surface located - final closure landfill waste volume versus rock volume Comment – if it is burnable then burn	+ increased salvage value by increasing disposal cost + meets global closure objective - Yellowknife landfill space limited + progressive reclamation – back haul + kick start NWT recycle - haul costs - increased and winter road use + everything removed from site

Table 6. Summary of workshop positives and negatives – Option E – Inert Landfill Location

E1 – Country Rock Pile	E2 – PKC	E3 – Pit Bottom	E4 – Underground Tunnels
- takes up rock storage space + already in use + all in one spot + more capacity than PKC + more transparent + reversible - might get bigger	- poor cover – as it freezes materials pushed to surface + in an engineered containment - capacity - increased waste volume	+ takes up space - preparation of materials - impact on water quality + technically a good place - spiritually unacceptable - lack of transparency - not reversible	+ takes up space - preparation of materials - impact on water quality - lack of transparency + progressive reclamation

Table 7. Summary of workshop positives and negatives – Option F – North Inlet

F1 – Hydrologic Connection to LDG	F2 – Open Connection to LDG	F3 – No Connection to LDG
- sediment disturbance from construction - water quality impacts on LDG + filter dam to remove particulates	- sediment disturbance during construction + additional fish habitat + fish in North Inlet can go to Lac de Gras - water quality impacts on Lac de Gras + meets a priority closure objective + no stability issues	+ reduced risk to downstream users - long-term water treatment to maintain water balance - geotechnical inspections long-term - does not meet priority closure objective

Table 8. Summary of workshop positives and negatives – Option G – Side slopes on Country Rock Piles

G1- Flat Slopes	G2- Steep Slopes
+ better stability + safe passage for caribou + could cover adjacent roads - greater water erosion - increased snow accumulation + greater opportunity for revegetation + caribou access to top of pile to get away from bugs	+ enhanced freezing + smaller footprint + prohibits caribou access - snow accumulation on benches + larger buffer from pile edge to Lac de Gras + more opportunities for natural drainage patterns - herd caribou against slopes - sharpness of angles

Table 9. Summary of workshop positives and negatives – Option H – Till Cap on Country Rock Piles

H1 – Till cap on top and sides	H2 – Till cap on top	H3 – No till cap
+ reduces oxygen into piles - reduces freezing + reduces infiltration - shortage of till material - difficulty in sorting useable till + good for revegetation	+ better freezing + good for vegetation - vegetation on surface holds snow increasing infiltration amounts Comment: target type III rock	+ enhanced freezing

Table 10. Summary of workshop positives and negatives – Option I – Alternative Infrastructure Use

I1 – On-site Facility	I2 – Reuse in Communities	I3 – Removal for Sale*
- legal liability/ownership + airstrip for emergencies - maintaining airstrip/facilities + creates long-term facility and use - not consistent with pre-development land use - still requires final closure - removal	+ community use + capacity for communities + viable business opportunity + removes from site - transport/deconstruction may not be net positive environmentally – life cycle basis - unfair to communities with no land	+ opportunities to increase community capacity - requires buyer with money + recycle/reuse + removes from site - cost of removal

* Option I3 was added during the workshop at the request of participants.

Table 11. Summary of workshop positives and negatives – Option J – Areas for Vegetation

J1 – Roads, plantsite, laydown, airstrip	J2 – PKC	J3 – Country Rock piles
+ surface stabilization – erosion protection + snow capture + return to useable + closest to pre-development land use - cost and additional monitoring - drainage from soil amendments - wildlife attractant that would increase predation in particular spots – easy targets	- attractant to wildlife - snow capture + dust control Comment: uncertain if we want vegetation	- attractant to wildlife - snow capture + dust control

Closure Criteria – notes from Workshop Discussion

Table 12. Closure Criteria – Objective #19,29,40,50,68 – Dust levels safe for people, vegetation, aquatic life, and wildlife.

Ideas - Options
• 60*u*g/L and 120*u*g/L • Background levels + ? • Return of caribou to area • Dependent on composition of dust • Level that meets requirements for fish habitat • Level that prevents smothering/degredation of vegetation
Suggestion
• What: develop (over 3 years) a risk based criteria for dust • When: criteria would apply post-closure • Where: criteria would apply to all mine site areas

Table 13. Closure Criteria – Objective #20,30,41,51,69 – Dust levels do not affect palatability of vegetation to wildlife.

Ideas - Options
• Observations of wildlife continuing to eat vegetation • Evidence that caribou are eating vegetation • Presence of scat • Wildlife observations in dust deposition • Wildlife use area but not more than in past
Suggestion
• What: criteria would be wildlife presence though direct observation, browse or scat • When: criteria would apply post-closure • Where: in areas where planned for specific wildlife use post-closure

Table 14. Closure Criteria – Objective #12 – A final landscape *(infrastructure)* guided by pre-development conditions.

Ideas - Options
• Add "infrastructure" to objective definition to differentiate from #14 – (topography and vegetation) • Criteria would be compliance with an approved plan that was based on a final landscape that was guided by pre-development conditions • No unwanted buildings left on site. • No foreign material left on site
Suggestion
• What: surface infrastructure removed or cut to post-closure surface • When: Post-closure • Where: all surface closure areas

Table 15. Closure Criteria – Objective #14 – Landscape features (topography and vegetation) that match aesthetics and natural conditions of surrounding natural areas, where appropriate.

Ideas - Options
• Match ecological land classification (ELC) – pre and post • Match percentage of pre-disturbance ELC • Maintain pre-disturbance ELC distribution of types • Criteria would be compliance with an approved plan that was based on a final landscape that was guided by pre-development conditions
Suggestion
• What: • When: • Where:

Table 16. Closure Criteria – Objective #11 – Opportunities for communities to re-use infrastructure, where appropriate, allowable under regulation and where liability is not a significant concern.

Ideas - Options
• Opportunities are clearly communicated to communities • Communities get something • Communities had opportunities • Process is auditable and fair • Contract are open tender • Adheres to conditions of Socio-economic Monitoring Agreement (SEMA) and Participation Agreements (PA) • Number of on-site and off-site opportunities created for communities • First offer to communities • Don't let economics dictate • On-island liabilities understood
Suggestion
• What: Confirmation via third-party audit that relevant conditions of SEMA/PA were met and PA communities were given priority. • When: • Where:

Table 17. Closure Criteria – Objective #26 – Physically stable slopes to limit risk of failure that would impact the safety of people or wildlife.

Ideas - Options
• No significant subsidence, erosion, slumping
Suggestion
• What: Design by and as-built inspected and signed off by a Professional Engineer • When: Post-closure • Where: Wasterock and Till Storage Area, PKC, Pit Walls, North Inlet, Dike Islands

Table 18. Closure Criteria – Objective #16,31,42 – Ground surface designed, where appropriate, to drain naturally and follow pre-development drainage patterns to protect water quality, limit erosion and enable safe use by wildlife and people.

Ideas - Options
•
Suggestion
• What: Design by and as-built inspected and signed off by a Professional Engineer • When: Post-closure • Where: Mine Infrastructure Area, Wasterock and Till Storage Area, PKC Area

Table 19. Closure Criteria – Objective #48 – Safe small craft navigation through pit area.

Ideas - Options
•
Suggestion
• What: Breaks in dike to be 6m wide X 3m deep as per Transport Canada approval • When: Post-closure • Where: A154 and A418 dikes

Table 20. Closure Criteria – Objective #32 – No increased opportunities for predation of caribou compared to pre-development.

Ideas - Options
• Insert word "natural" before "predation" in objective • Develop criteria with Traditional Knowledge and science • Traditional Knowledge and science sign-off on design • Build to design • DDMI to monitor predation
Suggestion
• What: • When: • Where:

Table 21. Closure Criteria – Objective #22 – Prevent infrastructure from contaminating land or water.

Ideas - Options
• Change option description to "Prevent materials from contaminating land or water"
Suggestion
• What: CCME Soil Quality Criteria or Risk-based Criteria or Site specific Criteria • When: Post-closure • Where: Hydrocarbon Land Farm, Process Plant, Ammonium Nitrate Storage, Water Treatment Plant, Waste Transfer Area, Tank Farms.

Table 22. Closure Criteria – Objective #24 – Surface runoff and seepage quality that will not cause adverse effects on aquatic life or water uses in Lac de Gras or the Coppermine River.

Ideas - Options
• CCME drinking water guidelines • CCME aquatic life guidelines • CCME equivalent guidelines • Traditional Knowledge guidelines • Baseline water quality • No deleterious substances • Water License Effluent Quality Criteria
Suggestion
• What: Aquatic Thresholds – Acute and Chronic • When: Post-closure • Where: Acute threshold applies before mixing with Lac de Gras – Chronic threshold applies some distance into Lac de Gras

Closure Research Ideas / Opportunities generated during Closure Options Review

Table 23. Listing of closure research ideas/opportunities identified during the review of closure options.

Closure Research Ideas - Opportunities
• Processed kimberlite pore water monitoring. • Processed kimberlite freeze monitoring. • Active thaw zone depth in rock pile. • Processed kimberlite consolidation rate. • Metals uptake in vegetation – is there a difference with processed kimberlite. • Will caribou walk safely on coarse processed kimberlite. • Seepage rates and quality from PKC. • Vegetation species mix – technical desirability and desirability for wildlife. • Traditional knowledge on wildlife and caribou travel on roads. • Review of wildlife mitigation used in design of road to Rae. • What is the limnology of the North Inlet. • Dust generation from slopes of rock pile. • Water quality impacts from steep versus flat slopes on rock pile. • Amount of till available for closure.

Appendix IX-5

DDMI Site Workshop – Post-Closure Caribou Movement

August 17-21, 2009

Appendix IX-5
Site Workshop on Caribou Movement

Caribou will occasionally use disturbed areas such as roads, airstrips and tailings ponds to rest (Gunn, 1998), returning to these areas after foraging on nearby tundra. This behaviour has been observed at other mines in the Bathurst range, such as Lupin and Ekati. It has been suggested that this is to take advantage of the view and to make it difficult for predators to conceal themselves, similar to their habit of bedding on frozen lakes in the winter. Further, these areas have fewer mosquitoes and blackflies (Gunn, 1998). Although it is not clear that these disturbed areas are used preferentially to undisturbed areas (Gunn, 1998), it is possible that the waste rock piles and Processed Kimberlite Containment (PKC) area may be used by caribou following closure.

Eventually, it is possible that the waste rock piles and PKC will revegetate, providing forage for caribou and other wildlife. During winter, caribou forage primarily on lichen, which is slow to recover. Studies of caribou behaviour in relation to forest fires indicate that caribou select areas which have remained un-burnt for at least 50 years (Dalerum et al. 2007; Joly et al. 2007). Shrubs and forbs may colonize the waste rock piles in a much shorter period, and these may be used by caribou during the late summer and fall months.

In many respects, the waste rock piles and PKC dams are similar to the boulder associations present in the Lac de Gras area and the larger central Canadian Arctic (described and mapped in Matthews et al. 2001). Both Traditional Knowledge and aerial surveys in the Lac de Gras area have indicated that caribou avoid these areas.

The objective of the 2009 program was to engage five affected Aboriginal communities in discussions regarding post-closure caribou movement with respect to the site.

The camp was held at the Diavik mine site between 17 and 21 August 2009, with 1.5 days allotted to a second program relating to fish palatability. Representatives from the five affected Aboriginal communities participated (Table 1). Camp activities were organized and implemented by Diavik and were supported by a Wildlife Biologist from Golder Associates Ltd. in Yellowknife.

Table 1. Members from the five affected Aboriginal parties that participated in the 2009 fish palatability and caribou movement study.

Aboriginal Party	Participants
Kitikmeot Inuit Association (KIA)	Sadie Hanak and Jimmy Hanak
Lutsel K'e Dene First Nation*	Florence Catholique (translator) and Ernest Boucher
North Slave Metis Alliance (NSMA)	Nora McSwaine and Ron Balsillie§
Tli Cho	Francis Williah and Michel Louis Rabesca
Yellowknives Dene First Nation*	Alfred Baillargeon and Mary Rose Sundberg (translator)

*One participant from Lutsel K'e Dene First Nation and one participant from Yellowknives Dene First Nation cancelled at the last-minute; § participant only present on 17-18 August.

The camp schedule is presented in Table 2.

Table 2. 2009 Community-based Monitoring Program camp schedule.

Monday 17 August	Tuesday 18 August	Wednesday 19 August	Thursday 20 August	Friday 21 August
• Arrival and orientation • Discussion of camp objectives and schedule • Bus tour of the camp, including PKC and waste rock pile	• Tour of East Island and Diavik mine by helicopter • Discussion on caribou movement post-closure (slides & maps)	• Fish activities	• Fish activities (a.m.) • Discussion on closure options relating to caribou • Break-out groups to discuss closure options	• Closing remarks by Diavik and camp participants • Flights home

Prior to discussing closure options, the Camp participants were provided with a bus tour of the Diavik mine, with particular emphasis on the waste rock pile and PKC, a helicopter tour of East Island and the Diavik mine, and graphics showing options for the waste rock pile closure (included in this report).

The bus tour included driving past the PKC, to show its structure and location relative to the waste rock pile. Following this, the Participants were brought to the waste rock pile, ending in a brief walk at the top of the waste rock pile to inspect the structure, edge and height of the pile. The tour also included a visit to the test pile, to illustrate what the waste rock pile may look like following closure.

The view overlooking Lac de Gras from the waste rock pile.

Camp participants overlooking Lac de Gras from the top of the waste rock pile.

The helicopter tour of the East Island and Diavik mine included a survey of caribou trails on the East Island and surrounding areas, and a second tour of the PKC and waste rock pile. The tour by helicopter was intended to provide a view of Diavik in the larger context of the East Island, and Lac de Gras.

Finally, Diavik presented computer-rendered graphics showing the likely final size and area of the PKC and waste rock pile, and possible locations for trails over these piles. Following the site tour, helicopter tour and presentation of graphics illustrating closure options, the participants were engaged in discussions regarding closure options for the Diavik mine in relation to caribou.

The mine site looking across from the CBM camp.

Participants spoke of the value of caribou to all, the long history of the Dene and Inuit of hunting and fishing in the Lac de Gras area, and their concerns about the effects of mining and other activities. Although the overriding concern seemed to be of effects to water quality in the Coppermine River, caribou-related issues were an area of great concern. With regards to caribou, some of the aspects of the mine discussed included:

- concerns regarding caribou crossing very high rock piles
- the possibility of restricting wildlife access on the pile so they don't eat any vegetation growing up there
- smoothing the sides of the pile so that wildlife can go over it if they want to
- the possibility of contouring the waste rock pile so that its similar to natural topography
- need for a fence around PKC
- concerns that caribou will sink down into the PKC area
- the concept of finding traditional paths and plan access/crossing areas around these
- the need to smooth crossing/access areas so caribou feet do not get hurt
- that the East island is now dead due to mine development, caribou may naturally avoid this area in the future for this reason
- ramps have been used along the Misery road to facilitate caribou crossing

Caribou discussions in the onsite meeting room.

During the course of the discussions, three options in particular were developed during the course of discussion by the Participants:

- Leave the rock piles and PKC as they are now. Participants stated that they view the East Island as dead because of the development so caribou will not return. Also, the current rock pile and PKC dams prevent access to most caribou due to the steep sides and large rocks.

- Cover the entire surface of the waste rock pile and PKC with fine, smooth gravel. This would allow access for caribou to pass freely over the waste rock piles and PKC. Further, the waste rock piles should be contoured to mimic the surrounding landscape.

- Design passages or corridors over or around the waste rock pile and PKC area. This would allow movement of caribou around, over and across the structures, but at specific areas. It was recommended that the general layout of these corridors should correspond to historic caribou trails on the island.

Observations of caribou in the Diavik study area and East Island do not support the assumption that the East Island is entirely dead. Although there has been disturbance to the East Island as a result of mine development and activities, caribou do still return to the island and are observed annually, predominantly in the late summer and fall.

With regards covering the waste rock pile and PKC with fine gravel and smoothing the surface, there are a number of feasibility issues which may not make this option viable. First, the waste rock pile contains acid-generating rock, which should be kept frozen to mitigate the potential for acid rock drainage. This permafrost development may (or would likely be) compromised if the waste rock piles were re-contoured to look like surrounding hills. Secondly, there are limited supplies of non-acid generating rock required to completely cover the waste rock pile and PKC area with fine gravel. Finally, the other environmental consequences to such an effort must be considered; in particular, the dust and emissions required to crush, move and contour such a large volume of rock.

The final option presented to Diavik, of creating pathways around and over the PKC and waste rock pile, appears to have several merits and would be feasible. There are currently various ramps and access points to the waste rock pile and PKC area, used by haul trucks to access the pile. The surface of these ramps is smooth and would not present a hazard to caribou. These could be expanded and added to, providing a series of access points over the waste rock piles and PKC area. Further discussion is required to decide if these should be straight passages, if there should be intersections between trails, how they should be bermed, and if they should be straight or tapered corridors or lead to some open areas.

Various Traditional Knowledge studies conducted during the Ekati and Diavik baseline studies will provide insight into the historic movements of caribou on the East Island. Aerial surveys could be conducted with community members to map caribou trails (or confirm trails identified in the Diavik EA). Air photos may also be helpful to identify pre-disturbance trails. In consultation with land users, these trails could be used to guide the layout of caribou passages over the waste rock pile.

Recommendations - Wildlife Movement

- Further community consultations on closure options are required
- Ensure that good interpreters are available who know some technical terminology
- Keep participants for the camp consistent from year to year
- Diavik needs to communicate consistent participant requirements to the communities when requesting participants
- Each group needs to now relay information from this camp to their respective organizations
- Further discussion of the camp should take place during the meetings between Diavik representatives and community Chief & Council being planned for September 2009 in each community
- A summary PowerPoint presentation should be provided to community representatives so they can share with their communities

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Joly, K., Bente, P. and Dau, J. 2007. Response of overwintering caribou to burned habitat in Northwest Alaska. Arctic 60:401-410.

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Wildlife Movement Options

Closure Options for Wildlife Movement

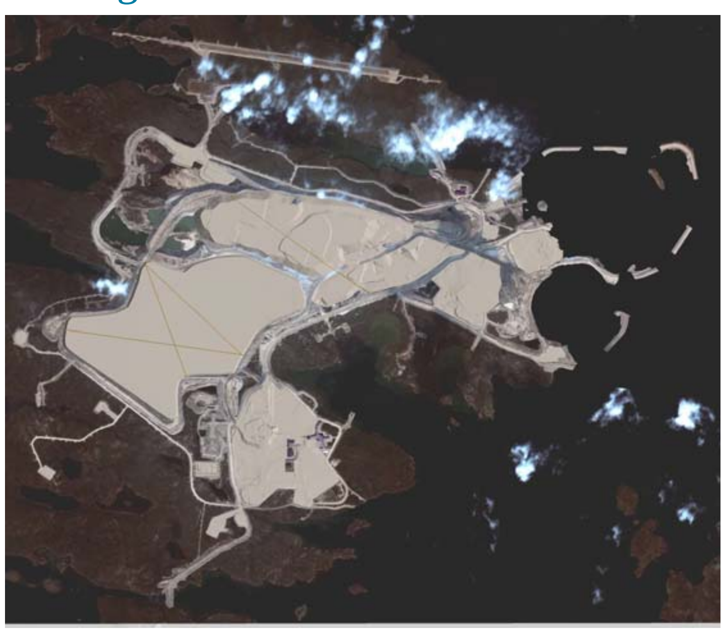
Key Considerations

- How can wildlife safely move around or over the mine site once the site is no longer being used?
- Do participants prefer wildlife to avoid the area of the mine?
- Do we want to create habitat for wildlife in some areas within the mine footprint?
- What should the waste rock piles & PKC look like once they are no longer being used?
  - Left as is?
  - Smooth sides?
  - Smooth on top?
  - Corridors?

The Mine Site – Current (2008 image)

3

Drawings – Possible Closure Views



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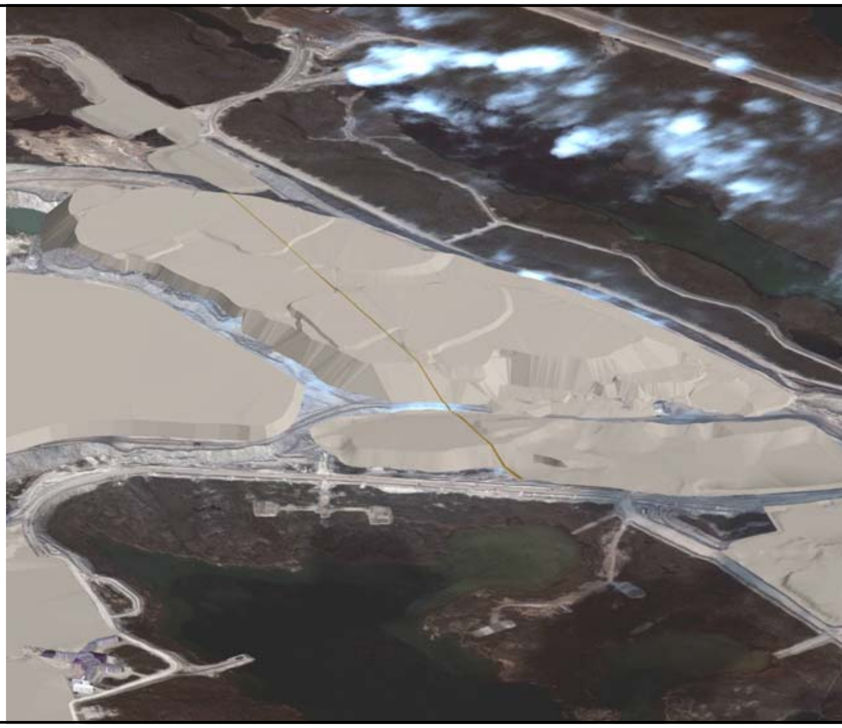

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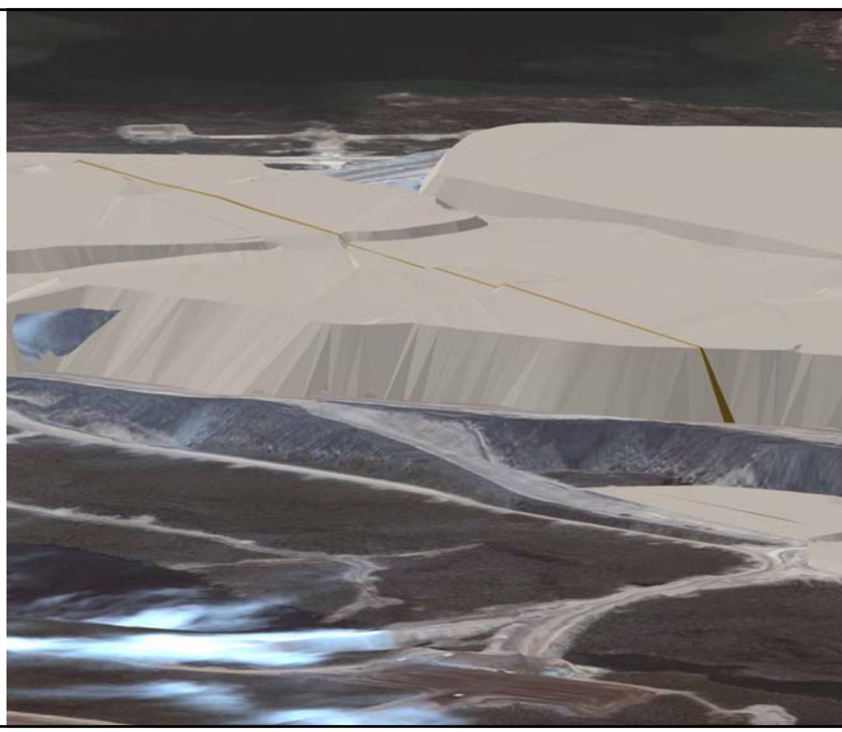

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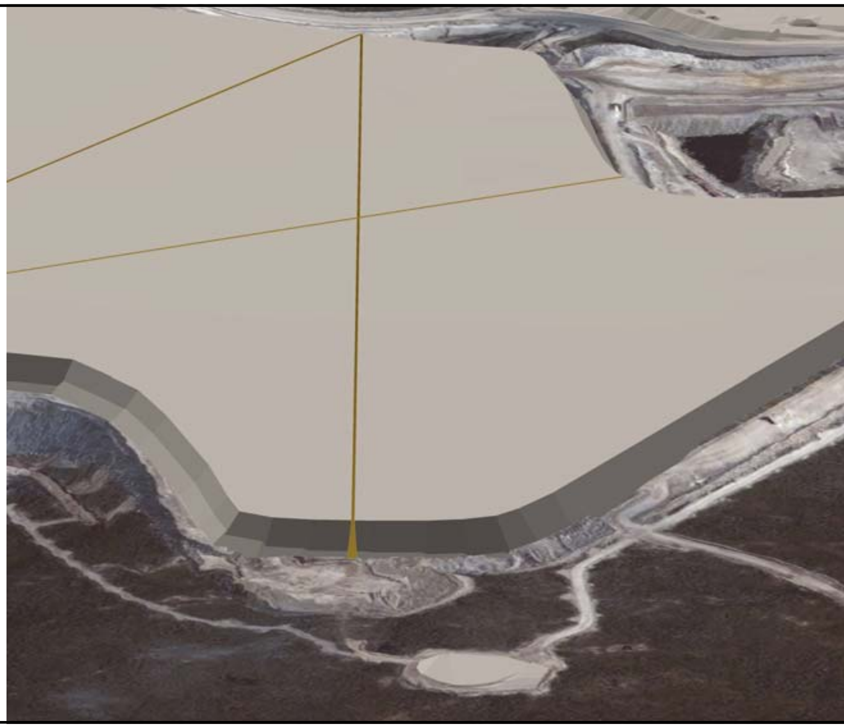

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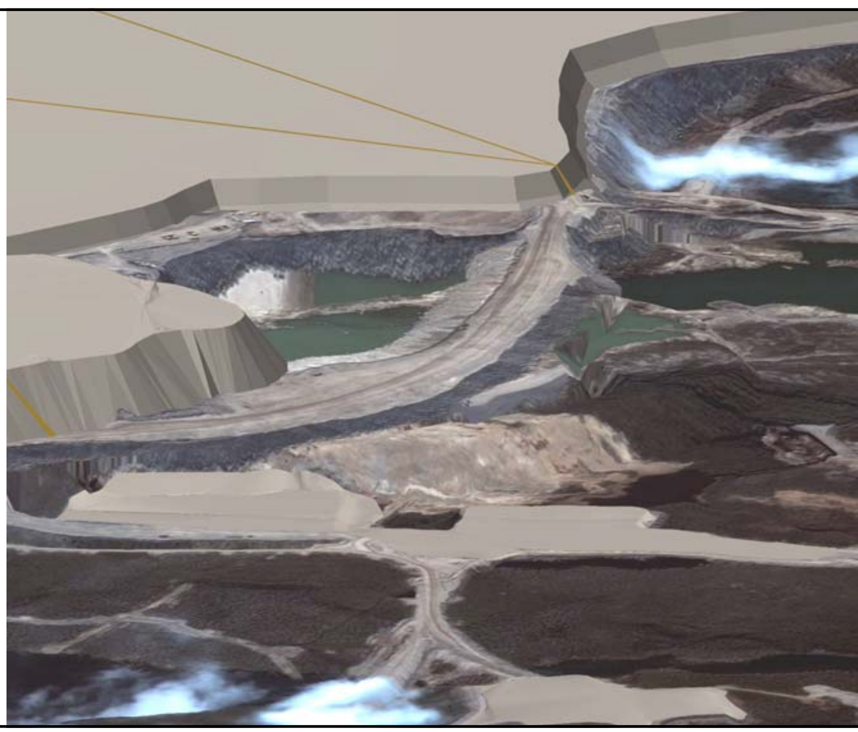

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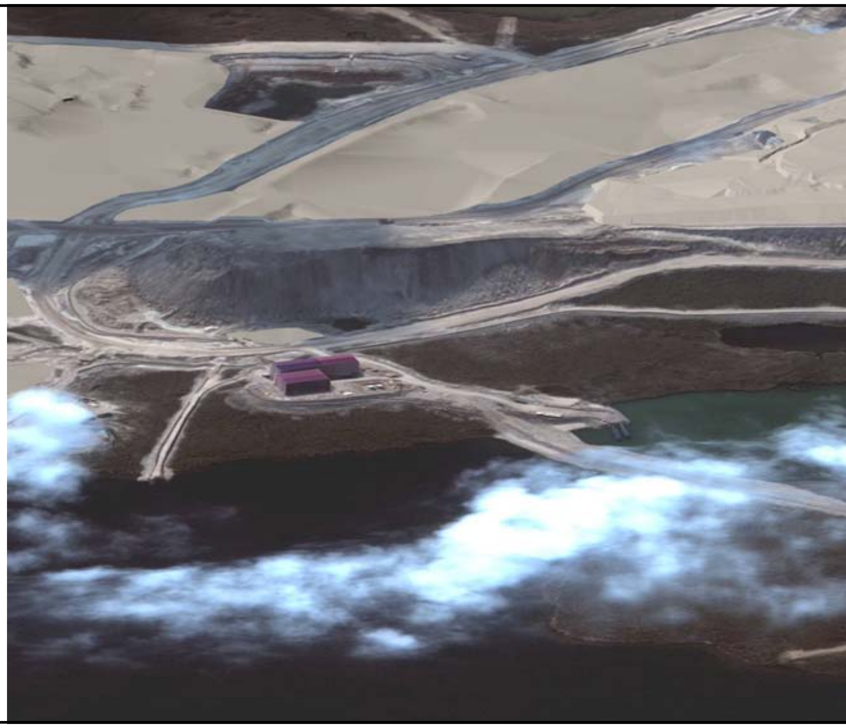

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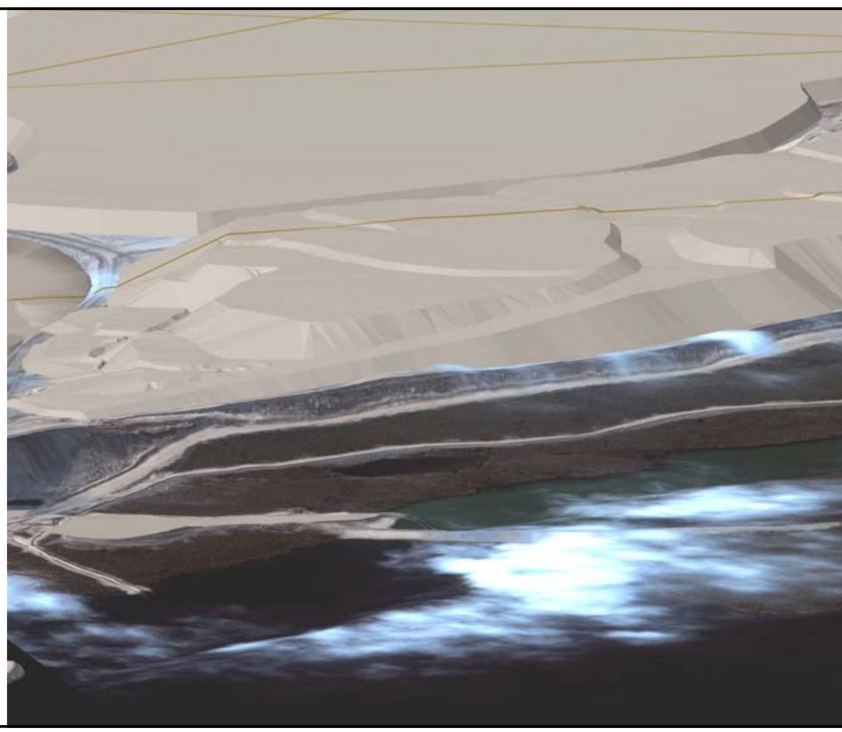

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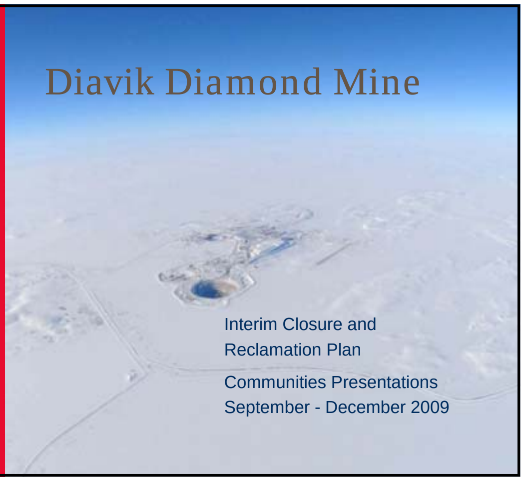
Appendix IX-6

DDMI Presentation to Communities

September to December 2009



Diavik Diamond Mine

Interim Closure and Reclamation Plan

Communities Presentations
September - December 2009

Closure planning history

Closure alternatives – mine design phase

Human resources options

Mining method options

Siting options
- PKC
- Waste rock

Design options
- Water management
- Water treatment
- Processed kimberlite containment

Location alternatives - PKC

- **#1: T-Lake on mainland** – causeway and larger footprint
  - Better closure option than #2 due to location.
- ✓ **#2: East Island valley** – closest to mine
  - Most technically challenging closure
- **#3: Lac de Gras** – preferred geochemical option – unacceptable from communities perspective.
  - Technically most secure closure option.

Location alternatives – waste rock

- ✓ **#1: Near open pits** – most practical
  - More difficult closure option
- **#2: Backfill completed pits** – mining sequence issue, geochemical problems, double handling
  - Better closure option if placed directly into flooded pits
- **#3: Lac de Gras** – widening of dikes – best geochemical control – fish habitat and communities concerns
  - Technically most secure closure option

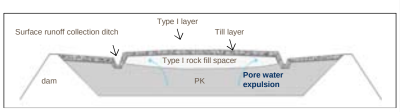
Initial closure and reclamation plan 1999

Interim closure and reclamation plan 2009 update

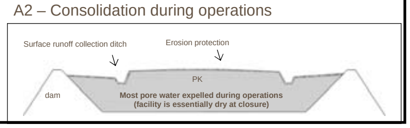
- Identification of options
- Selection of preferred options - landscape level
- Selection of more detailed options in the future
- Recommended closure criteria
- Working towards selection of all options and a Final Closure Design by 2015

A – Processed kimberlite consolidation

A1- Consolidation post closure



A2 – Consolidation during operations



B – Surface of processed kimberlite containment area

B1 – Coarse kimberlite

B2 – Kimberlite beach

B3 – Country rock

C – Height for roads, plant site, laydown and airstrip

C1 – Re-slope inwards

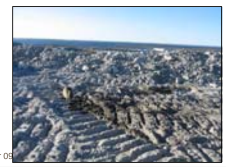
C3 – Re-mine for material

C2 – Re-slope outwards

D – Surface for roads, plant site, laydown and airstrip

D1 – Smooth surface

D2 – Scarified surface



E – Inert landfill location

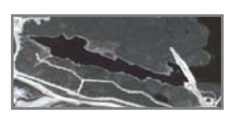
E1 – Country rock pile
E2 – PKC
E3 – Pit Bottom
E4 – Underground tunnels

F – North inlet

F1 – Hydrologic connection to Lac de Gras

F2 – Open connection to Lac de Gras

F3 – No connection to Lac de Gras



G – Side slope on country rock piles

G1 – Flat slopes

G2 – Steep slopes

H – Till cap on country rock piles

H1 – Till cap on top and sides

H2 – Till cap on top

H3 – No till cap

I – Alternative infrastructure use

I1 – On-site facility

I2 – Reuse in communities

J – Areas for re-vegetation

J1 – Roads, plant site, laydown, airstrip
J2 – PKC
J3 – Country rock piles

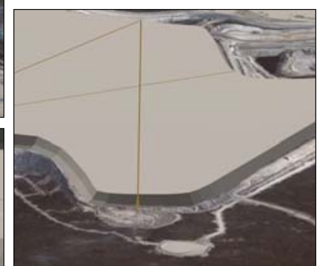
Wildlife movement – post-closure

- Closure design for wildlife movement is current focus
- Communities workshop at site 17-21 August 2009
- Outcome was three main options:

1 Leave rock pile and dam as is – little to no access to PKC or rock piles

Wildlife movement – post-closure

2 Use traditional caribou trails to develop defined paths - controlled access to PKC and rock piles



Wildlife movement – post-closure

3 Contour the pile and dams - full access to PKC and rock piles

Next steps

- The Interim Closure and Reclamation Plan will be submitted to the WLWB by 2 November 2009
- The WLWB will be distributing the Plan for review on 9 November 2009
  - The Plan will discuss the options we have outlined here for you today
- Reviewer comments on the Plan will be due on 18 December 2009
- On-going process to define closure criteria, complete required research, conduct additional consultation and select closure options
  - Goal is final closure plan by 2015
- Continual community participation is beneficial – workshops, meetings, consultations, discussions, letters
- We want to know what is appropriate for how the site should look at closure, and how the animals should move through/around the site

APPENDIX X

CLOSURE DESIGN REPORTS

REPORT ON

FISH HABITAT DESIGN FOR THE PIT SHELF AREAS AT THE DIAVIK DIAMOND MINE

Submitted to:

Diavik Diamond Mines Inc.
1420 6A Street N.W.
Calgary, Alberta T2M 3G7
Attention: Mr. Gord MacDonald

DISTRIBUTION:

1	Copy -	Diavik Diamond Mines Inc., Calgary (Attention Gord MacDonald)
1	PDF -	Diavik Diamond Mines Inc., Calgary (Attention Gord MacDonald)
2	Copies -	Diavik Diamond Mines Inc., Yellowknife
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1	CD -	Diamond Mines Inc., Yellowknife
3	Copies -	Diavik Diamond Mines Inc., Lac de Gras (Attention Jeff Reinson)
1	Copy -	Golder Associates Ltd., Saskatoon
1	Copy -	Golder Associates Ltd., Calgary
1	Copy -	Golder Associates Ltd., Yellowknife

March 2003
012-2331

EXECUTIVE SUMMARY

This report presents the detailed design for the creation of fish habitat on the interior of the water retention dikes (dikes) for the Diavik Diamond Mines Inc. diamond mine located on Lac de Gras in the Northwest Territories, Canada. This design was prepared in accordance with the "No Net Loss" plan prepared by Diavik Diamond Mines Inc.

This design is applicable to the A154, A418, and A21 pits; however, since only the A154 dike has been constructed, the majority of the information is based on A154. This design has been prepared by developing criteria for the end result, thus providing flexibility on the part of Diavik Diamond Mines Inc. as to how the end result is achieved.

The fish habitat creation on the interior of the dikes consists of placing material excavated from the open pits in the area between the pit crest and the toe of the dikes, to create an area generally varying from 3 m to 5 m below the mean normal water level for Lac de Gras. During mining operations, the toe of the fill will be set back from the edge of the pit crest for safety. At the completion of mining, the fill will be extended to the pit crest.

Detailed design drawings have been prepared for A154, and construction guidelines have been presented that can be applied to A418 and A21, once the dike location and pit geometry are determined.

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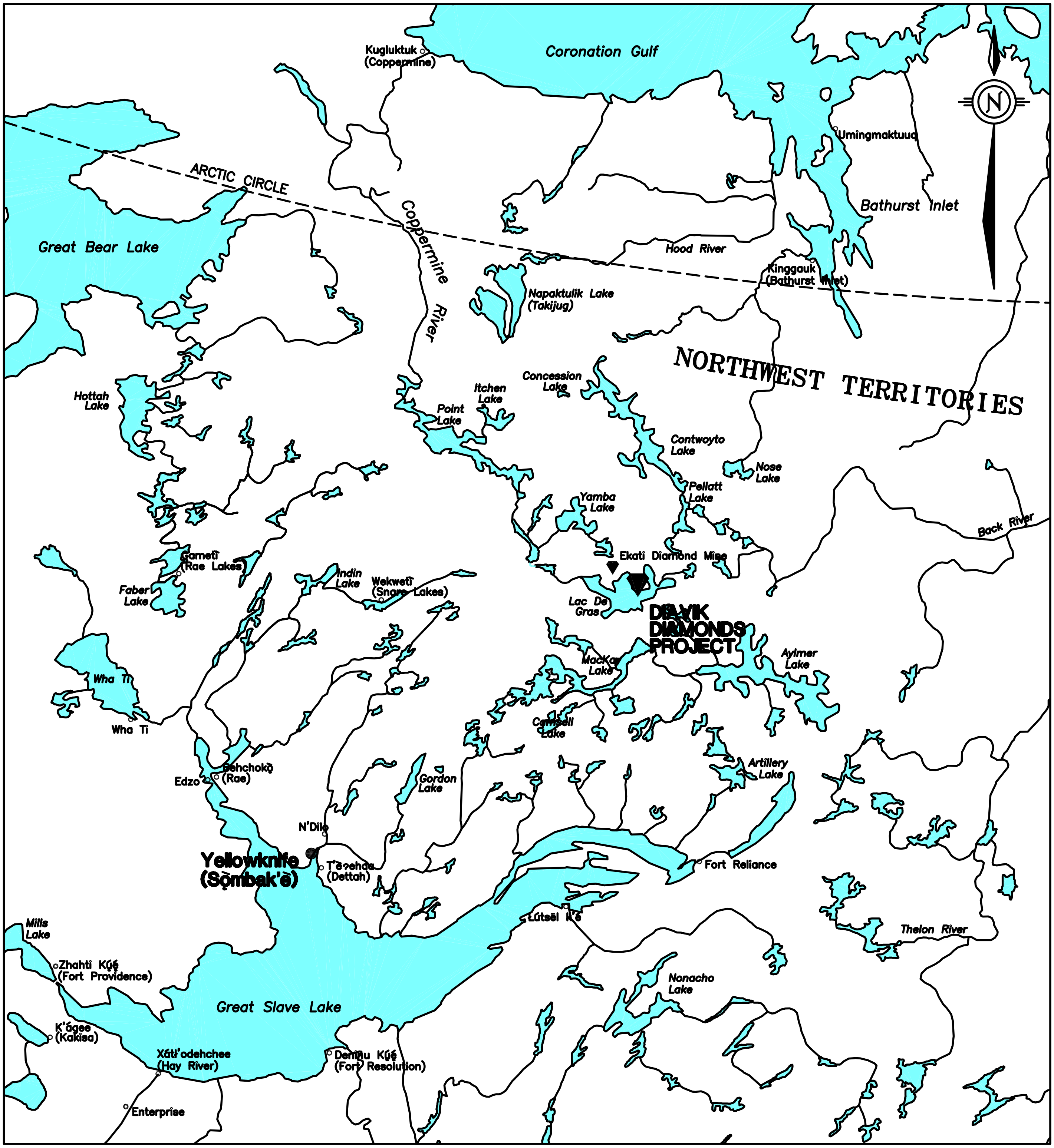
1.0 INTRODUCTION

This report presents the detailed design for the fish habitat compensation plan for the interior of the water retention dikes (*i.e.*, the pit shelf) at the Diavik Diamond Mines Inc. (DDMI) diamond mine in the Northwest Territories. The location of the mine is shown in Figure 1. This detailed design is based on the “No Net Loss” (NNL) Plan (Diavik 1998), and the conceptual fish habitat plan prepared by Golder Associates Ltd. (Golder). The conceptual fish habitat compensation plan for the pit shelf is to construct habitat on the shelf, by filling in the lower elevation (deeper water) areas. The general plan is to fill in the areas on the shelf that are deeper than 5 m of water depth with materials excavated during development of the pits.

As stated, this document provides the detailed design for the fish habitat compensation for the pit shelf; however, it does not provide specifications for construction. Rather, this document provides details for achieving the desired end result, while providing flexibility in how the end result is achieved. The requirement for this flexibility is due to some of the unknowns with respect to material parameters, mine operations (*i.e.*, blasting details, availability of various materials), and construction timing. The habitat design parameters were developed considering fish habitat, surface water runoff, and geotechnical issues. Design details with respect to surface water handling, material selection, construction, and other issues would be addressed by DDMI, to achieve the desired habitat compensation prior to reflooding of the diked areas.

This design applies to the A154, A418, and A21 pits; however, only A154 has been constructed to date. A418 is scheduled for construction in approximately 2007, with A21 currently scheduled for about 2013. Since the water retention dike (dike) locations and pit layouts for A418 and A21 have not been finalized, some of the design details may be modified for these two pits. It is intended that the design details (particularly setback distances and slope angles) be reviewed prior to construction of fish habitat compensation measures for A418 and A21, to incorporate knowledge gained from the construction and performance of A154. Also, it was understood that the pits will be developed in a series of expansion cuts, thus permitting the opportunity to monitor slope stability and pore-pressures in the in-situ materials in each pit well in advance of the excavation of the final pit slopes, and construction of the fish habitat fills.



0 50 100 150 200km

SCALE: 1:4,000,000

LEGEND

- ° COMMUNITY
- ▼ DIAMOND MINE/EXPLORATION

REFERENCE

SELECTED MINERAL DEPOSITS OF THE NORTHWEST TERRITORIES, DEPARTMENT OF ENERGY, MINES AND RESOURCES, MINERAL INITIATIVES 1991 TO 1996 REVISED OCTOBER, 1996

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

PROJECT LOCATION

Golder Associates
Saskatoon, Saskatchewan

PROJECT	012-2331.5310		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	02/17/03	FIGURE: 1	
CHECK				
REVIEW				

N:\Active\2000\012-2331 Diavik Habitat Compensation\cad\LDD\ Drawing file: KeyplanA.dwg Mar 27, 2003 - 5:37pm

2.0 BACKGROUND

The objective of the fish habitat compensation measures on the interior of the water retention dikes is to provide nursery and rearing habitat similar to the pre-mine habitat in the north inlet. The conceptual design for the fish habitat compensation, as outlined in Golder's report entitled "Conceptual Design and Compensation Workplan for the Fish Habitat Compensation Program, Diavik Diamond Mines Inc., Lac de Gras", dated August 2001 consisted of:

- Re-contouring the pit shelf (area between the interior toe of the water retention dike and the crest of the pit slope) to provide habitat with a water depth of approximately 5 m after the dike is breached. New habitat will only be constructed where the water depth exceeded 5 m, the shallower areas of the shelf will not be excavated, as these areas already provide shallow water habitat. If fill is placed in this area during mine operations, setbacks will be required between the pit crest and the toe of the slope, as well as between the interior toe of the dike and the toe of the fill slope. These areas could be filled near the end of mining, or after completion of mining, if required.

- Constructing long, narrow, rocky reefs extending from the interior slope of the dike to the crest of the open pit. The reefs would be built in areas where the water depth is 5 m and would be approximately 2 m to 3 m high. Areas of granular and soft substrates between the reefs would be based on the conditions that existed in the north inlet.

- Modification of disturbed shoreline areas to establish conditions similar to pre-development. This may include placement of boulders in water depths up to about 5 m.

- Flooding the area after completion of habitat construction.

- Breaching the dikes to create shallow (minimum 2-m depth from low water) entrances, to deter the movement of larger fish into the nursery and feeding habitat, similar to the rearing habitat in the north inlet.

3.0 DESIGN PARAMETERS

3.1 Geotechnical Parameters

The information that was available to carry out the design consisted of bathymetric contours, till thickness isopachs, sediment thickness isopachs, till and sediment grain size and strength parameters, and earthquake seismic parameters. Production blasts have only recently begun, and thus some assumptions were made, and will be used in conjunction with the observational method to account for the potential of blast-induced instability. The majority of the information provided was specifically for the A154 dike and pit. However, the material parameters and construction guidelines for the fish habitat compensation on the pit shelves are similar for all three proposed open pits.

The till and sediment shear strength parameters used for slope stability analyses were obtained from the final A154 dike design report prepared by Nishi-Kohn/SNC-Lavalin (NKSL). The till and sediment were also observed and sampled to check that the material appeared consistent with the shear strength parameters used for the dike design. The till was also sampled to determine if the grain size of the material sampled was similar to that presented in the dike design report.

The till was sampled at the till dumps, as the active excavation areas were inaccessible at the time of sampling. Inactive excavation areas could not be sampled, as the till was frozen. The till that was sampled at the till dumps is considered representative of the till that was being excavated on October 14 and 15, 2002. It is not considered representative of the till throughout the A154 pit shelf area, as this is a very large area and the till is likely to vary across the shelf, as reflected in the range of grain sizes presented in the dike design report. The results of the grain size analyses are shown in Table 1. The grain size of the till that was sampled generally fall within the range of samples reported in the design report, but on average the samples obtained on October 14 and 15 contain more silt and less sand than the typical samples from the design report. The grain size information from the design report and the October 2002 samples are compared in Table 2.

Table 1
Grain Size Analysis Results

Location	Moisture Content (%)	Gravel Content (%)	Sand Content (%)	Silt/Clay Content (%)	Clay Content (%)
South Dump	6.2	52	23	25	nm
South Dump	9.5	23	34	43	nm
Upper Quarry	11.0	18	39	43	5
Upper Quarry	19.2	27	37	36	4
Batch Plant	7.6	33	35	32	nm
Batch Plant	31.2	7	46	47	nm
Average	14.1	26.7	35.7	37.7	NA

Notes: nm = not measured.
NA = not applicable, insufficient values measured.

Table 2
Summary of Grain Size Analyses

Material	Gravel Content (%)	Sand Content (%)	Silt/Clay Content (%)	Clay Content (%)
From Dike Design Report				
Till (range)	0 to 45	40 to 90	3 to 50	0 to 6
Till (average)	26	51	23	NA
Sediments (range)	0 to 15	0 to 75	10 to 100	0 to 33
Sediments (average)	2	29	63	6
From samples obtained in October 2002				
Till (range)	7 to 52	23 to 46	25 to 47	4 to 5
Till (average)	27	36	38	NA

Note: values from dike design report are approximate.
NA = not applicable, insufficient values measured.

The shear strength results reported in the design report are listed in Table 3. The samples were tested in a disturbed state and thus are considered appropriate for the placed material and are conservative for the in-situ material. The design parameters are considered reasonable for the till and sediments, considering the variability of the grain size of these materials.

Table 3
Shear Strength Parameters (from Final Dike Design Report)

Material	Measured Friction Angle (°)	Measured Cohesion (kPa)	Design Friction Angle (°)	Design Cohesion (kPa)
Sediments	32 to 38.7 (average = 34)	0	26	0 to 10 (0 used in this study)
Till	36 to 41.5 (average = 39)	0	35	0

Note: Strength parameters are based on effective stresses.
kPa = kilopascal.

The bathymetric measurements carried out by DDMI prior to dewatering A154 indicate that the maximum water depth was 22 m. The deepest water around the pit crest appears to be approximately 17 m, and the deepest water near the toe of the dike is also approximately 17 m. Consequently, the highest expected long-term face of placed fill for A154 is expected to be 12 m to 14 m, depending on surface water drainage requirements.

Based on available information from exploration boreholes, the lakebed sediments range from 0 m to 7 m thick and are typically less than 2 m thick, except for a few localized pockets. The in-situ till, beneath the sediment, ranges up to 13 m thick and is typically 5-m to 10-m thick. The till is significantly thicker above the pit than on the pit shelf area. The till thickness information is relatively scant on the east side of the A154 pit and thus the till thicknesses could vary from the interpreted values.

3.2 Fish Habitat Parameters

3.2.1 Overview of No Net Loss Requirements related to Insides of Dike Areas

The Fisheries Authorization identified the requirements for achieving NNL of habitat for all aspects of the DDMI Diamond Project. Specific requirements for the inside of all three dike areas included:

- the development of shallow rearing habitat and shoreline habitat; and,
- ensuring that the habitat features within the dikes areas are modeled after those features found in other productive areas of Lac de Gras, including depth, substrate type, size, and configuration.

Four key zones of habitat were identified in the NNL Plan (Diavik 1998) for the area found inside the constructed dikes during the post closure phase. These included:

1. Inside edge of the dike. The area of water depths from 0 m to 2 m along constructed sections of the dike representing new shoreline habitat.

2. Reclaimed shorelines. Areas of pre-existing shorelines.
3. The pit shelf. The area between the inside edge of the dike, the shorelines, and the pit crest.
4. Deep water. The pit itself as it will have a depth of approximately 250 m.

The NNL Plan provided habitat unit calculations based on the available design information for the dikes and pits at the time. Some modifications to the design dike and pit dimensions were made subsequent to the submission of the NNL plan, and as-built information is now available for the A154 dike. The habitat units calculated as part of the NNL Plan Addendum (DDMI April 1999), along with re-calculated values based on this updated information are presented in Appendix I.

The following sections outline the general principles and criteria to be used in developing the final layout for all three dike areas. As discussed in the NNL, the primary focus for habitat creation inside of all dikes is based on maximizing rearing habitat value. Target species include lake trout (*Salvelinus namaycush*), arctic grayling (*Thymallus arcticus*), burbot (*Lota Lota*), longnose sucker (*Catostomus catostomus*), round whitefish (*Prosopium cylindraceum*), cisco (*Coregonus artedi*), lake whitefish (*Coregonus clupeaformis*), and slimy sculpin (*Cottus cognatus*).

3.2.2 Overall Criteria

Several overall governing criteria can be applied to the habitat creation activities inside the dikes. First of all, areas inside the dike on the pit shelf that are already at a depth of 4 m or less should not be disturbed if possible. This will allow the maintenance of habitat features not easily re-created. In areas where final depth is between 4 m and 5 m, it would be desirable to maintain existing habitat depending upon grading requirements for drainage, or other construction considerations. Existing shoreline features should also be maintained to the extent feasible. Construction crews should avoid driving on, dumping on, scraping, or otherwise impacting these areas. Leaving these areas intact will decrease the amount of work required to restore the shoreline at closure and will speed the recovery process of the altered areas inside the dike as a variety of organic properties, including the possibility that dormant life stages of some plants or animals will be present in the substrate.

The storage and handling of materials, particularly hydrocarbons or other types of contaminants, should be closely monitored on the shorelines, pit shelf, and inside edges of the dike. Heavy equipment in the area should be maintained and fuelled in a manner that avoids the possibility of spills occurring in areas to be reclaimed as fish habitat.

3.2.3 Inside Edges of Dike

The inside edge of the dike is intended to provide new shoreline features for foraging and rearing habitat for most species as well as other values, including spawning, for slimy sculpin. The dike itself will resemble existing shoreline and reef habitat and is expected to provide a rocky (boulder/cobble), moderate slope area with low to moderate wind and wave action. The NNL plan habitat evaluation completed for the inside edge the dikes treated this area as shoreline habitat.

Suitable materials for this habitat feature are a mix of primarily large boulder with some smaller cobble. Slopes should also ensure a stable profile and range from gentle to moderate. The range of slopes for existing shorelines should be used as a guideline. The area of habitat predicted in the NNL plan for this habitat type, for all three dikes is provided in Table 4. For A154, based on constructed dike configuration and the design criteria presented in this report, 3.41 ha of new shoreline habitat are expected to be created.

Table 4
Inside Edge of the Dike Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	1.37	3.41
A418	0.48	n/a
A21	1.07	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.2.4 Reclaimed Shorelines

The objectives for the pre-existing shoreline along the edge of the diked area, and around any islands within diked areas, are to:

- minimize change to existing substrates or other features; and,
- re-configure disturbed portions to pre-development conditions as much as possible.

This will allow the shoreline areas to be restored to pre-existing conditions once the dikes are breached. Any areas of disturbed shoreline are to be re-configured to provide fish habitat resembling that which was temporarily lost during the project. This may include placement of boulders in water up to 5 m deep to provide a sloping shoreline. The area of habitat predicted in the NNL plan for this habitat type, for all three dikes, is provided in Table 5. For A154, based on constructed dike configuration and the design criteria presented in this report, 2.36 ha of shoreline habitat are expected to be reclaimed and includes shoreline areas around one island on the pit shelf.

Table 5
Reclaimed Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	0.52	2.36
A418	0.61	n/a
A21	0.82	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.2.5 Pit Shelf

The pit shelf area extends from the lower inside edges of the dike to the edges of the pit. The reclaimed pit shelf area is intended to provide shallow foraging and rearing habitat for most species of fish present in Lac de Gras. Material excavated from the pit will be used to fill in deeper portions of the pit shelf area. The area of the pit shelf will be covered by water that ranges from 3 m to 5 m deep. As per the *Navigable Waters Protection Act* Permit for the project, no dike breach or constructed shoal features will be less than 2 m from the expected low water level in Lac de Gras.

As indicated in the NNL plan and the Fisheries Authorization, the objectives for the selection of substrate type are based on reflecting physical characteristics of other areas of good foraging and rearing in Lac de Gras. The pit shelf configuration is also to be based on reflecting the physical characteristics of foraging and rearing habitats within Lac de Gras. In order to address these objectives, substrate information from baseline data collections was used and a basic configuration evaluation of the North Arm and two other nearby inlets identified as rearing areas within Lac de Gras was completed. The configuration evaluation was completed through air photo interpretation. Key features identified by assessing other rearing areas included:

- Rocky Shoal Shape – rocky shoals should be somewhat irregular in size and shape and relatively long and narrow. Some may also be constructed like a series of submerged rocky humps like links in a chain. Longer and narrower reefs have more “edge” habitat. Edges are important to fish that feed in one habitat type and rest or seek refuge in another.

- Isolated Pond-like Areas - In some cases it is beneficial to small fish to have the reefs forming a disjointed “ring” to provide pond-like conditions where circulation is limited.

- Hard to Soft Substrate Ratio - The hard substrate (shoals areas) to soft substrate (depositional areas) ratio in other nearby rearing areas ranged from 25% to 40% hard with the remainder as soft substrate.

- Access to Refuge Habitat – Rocky reefs provide refuge or cover for small fish. It is important for fish to have connectivity between rocky areas and reefs to avoid exposing themselves for extended distances or periods of time to predators. Keeping the distance between rocky reef areas less than 30 m to 40 m will allow fish reasonable access refuge, or hiding places.

Shape Configuration

With regard to water circulation within the diked area, several features should be incorporated to reduce circulation. The shallow nature of the breaches, shallow nature of the pit shelf, and the creation of shoals on the pit shelf will reduce circulation and wind and wave action. The shallow water is expected to warm up quickly in the spring, relative to open areas of the lake, because of the limited water circulation within the enclosed area. As with other rearing habitats in Lac de Gras, warmer water should therefore assist in increasing biological productivity inside the dike by providing a warmer, refuge, and foraging area.

Determining the locations of the reefs should take several factors into consideration. Reefs should have some connectivity to the dikes and other reefs to allow fish to travel throughout the area without being fully exposed to predators for long distances. If the reefs are long, winding, and finger-like, a large amount of "edge" habitat will be created to allow fish to feed in the fine substrate while maintaining close proximity to the cover provided by the rocky reefs. Ideally the reefs will be placed in areas where the final water depth will be 3-m to 5-m deep and the tops of the reefs will remain under at least 2 m of water at all times. This will allow the reef habitat to remain functional even in winter with ice thickness of up to 2 m. Widths of the reefs should vary between 5 m and 30 m, averaging from 10 m to 20 m in width. Distance between the reefs could range from 10 m to 40 m, averaging from 20 m to 30 m apart. Habitat diversity is important and varying the size and shape of the reefs throughout the pit shelf area is expected to improve its value as fish habitat.

Substrate Material

Based on the substrate materials within the North Arm, substrates on the pit shelf should be mostly fine material, primarily sand and silt interspersed with rocky reefs for habitat diversity. The till (existing lake substrate) is primarily sand and silt with some gravel (Tables 1 and 2). The till material will therefore be an appropriate substrate for the expected biological zone of the sediments (*i.e.*, approximately top 10-cm layer represents the biological zone). The fine substrate areas will support a variety of benthic organisms that will provide forage for small fish.

If till is placed over angular rock to provide the soft substrate zone, it should be a layer deep enough to maintain at least 0.5 m depth of soft substrate after settling, accounting for some migration of fines into the voids in the rock fill.

Reefs should be constructed of granular material of a range of sizes. The primary material should be large boulder size rock with some smaller cobble material. The objective is to create refuge habitat, or hiding areas, among the rocks. Angular, unconsolidated material would provide this benefit. Run of mine blast rock is expected to be acceptable for this purpose.

The area of habitat predicted in the NNL plan for this habitat type, for all three dikes, is provided in Table 6. For A154, based on constructed dike configuration and the design criteria presented in this report, 61.35 ha of shallow rearing and foraging habitat are expected to be created.

Table 6
Pit Shelf Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	59.89	61.35
A418	8.68	n/a
A21	54.13	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.2.6 Deep Water (Pit Area)

The deep water habitat created by the project will be located in each of the mine pits near the center of the diked area. The deep water will provide a cooler environment for fishes and was considered a pelagic zone in the NNL plan. This area will likely be used by pelagic feeding fish such as cisco and may provide other benefits. The maximum depth of the pit areas is anticipated to be 250 m. The area of habitat predicted in the NNL plan for this habitat type, for all three dikes is provided in Table 7. For A154, based on constructed dike configuration and the design criteria presented in this report 52.3 ha are actually expected to be created.

Table 7
Deep Water Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area [1] (ha)
A154	55.21	52.3
A418	41.94	n/a
A21	29.29	n/a

[1] Note: Based on final constructed configuration of dikes, where available.
ha = hectare.

3.3 Construction Considerations

There are a number of construction considerations that arise due to the variabilities in the material parameters, pore-pressure conditions, blasting effects and construction timing. The following construction considerations were evaluated with respect to the detailed design of the fish habitat compensation measures for the pit shelf areas:

- It was understood that flowing artesian conditions were present the southeast portion of the A154 pit shelf. Artesian conditions may cause build-up of porewater pressures within the fill on the pit shelf, depending on drainage conditions and the development of frozen layers.

- The fine-grained lake-bottom sediments are expected to provide poor trafficability, particularly where artesian conditions exist, and when the materials are thawing.

- A berm will be required between the pit crest and the toe of the fish habitat fill to provide safety with respect to equipment travelling too close to the pit crest and to reduce the potential for fill materials spilling into the pit during placement. The berm could also be used as a construction access road prior to pit development adjacent to the berm.

- The majority of the fill volume may consist of either till or rock fill, depending on construction timing and material availability. The final surface of the fill will consist of till, or lake-bottom sediments, to support aquatic life. The thickness of the final till/sediment layer will depend on whether a filter is used between the rock and till. DDMI will be responsible for picking the construction methods, and materials handling such that adequate quantities of till are available for the final fill surface.

- Based on gradation information for the till, summarized in Section 3.1, and predicted blast rock gradations from the feasibility study, it is anticipated that at least two, and possibly three graded aggregate filters would be required. The gradations of the till and blast rock, along with tentative filter gradations are shown in Appendix II.

Production of filter material would be relatively expensive, since it would involve crushing, screening, stockpiling, and double handling of the materials. It has been assumed that use of a filter between the rockfill and the till would not be utilized, due to logistical and economic considerations. As an alternative to using a filter, the thickness of the till cover on a rock fill can be varied as a function of the total fill thickness. The premise for this approach is that a certain portion of the till will migrate into the void spaces in the rock fill, so the thickness of the till cover must be such that a minimum of 0.5 m of till remains on top of the rock. For design purposes, it has been assumed that the porosity of the rock fill would be approximately 30 percent, and that with time, till would migrate into the rock such that 50 percent of the available voids would be filled. Thus, the thickness of till required over the rock is equal to 15 percent of the rock fill thickness, plus 0.5 m. Theoretically, where rocky reefs are to be constructed, till would not be required between the rock fill and reef material.

- Rock fill has the advantages of higher shear strength and better potential for drainage/dissipation of pore-water pressures. Rock fill may require a smaller thickness than till to provide a stable trafficking surface for the initial lifts.

- Rock fill would permit faster infiltration than till, which may provide a more stable trafficking surface after precipitation events and during spring thaw.

- Till will be available earlier in the mining cycle for each pit, since it overlies the bedrock. Materials may be transported between pits, if required.

4.0 STABILITY ANALYSES

4.1 Overall Pit Stability

The overall pit stability was assessed in Golder's report entitled "Revised A154 Ultimate Pits Stability Review", dated August 16, 2002. The summary of the ultimate pit stability review, and recommendations were as follows:

The pit slope configurations incorporated into the revised A154 ultimate pit plan are consistent with recommendations previously made by Golder in December 1999, November 2000, and February 2002.

Based on the overall slope stability and deformation analyses of the revised A154 pit design, the pit slopes are anticipated to be stable.

The haulage ramp crosses the northeast wall at the 190 m elevation, and coincides with the contact between the granitic waste rocks and the A154 north kimberlite pipe. The slope above the ramp on the northeast wall is single benched and consist of kimberlite rocks. The kimberlite is highly fractured, with a low rock mass strength, and ravelling of benches excavated within kimberlite is expected to occur. The bench configuration within the kimberlite should provide adequate catchment for ravelled material. However, the kimberlite exposures must be closely monitored for signs of excessive ravelling on to the haulage ramp.

The stability and deformation review of the revised A154 ultimate pit slopes, highlight the following geotechnical considerations:

- *If localized areas of bench scale toppling are encountered, additional operational considerations such as scaling and installation of ground support in problem areas may be necessary.*

- *The orientation and nature of the structures exposed along the exposed pit slopes should be detailed as excavation of these slopes begins. This can be achieved by continuous geotechnical mapping of new exposures, and comparison of these data with those previously collected through drillcore.*

- *The sensitivity of the northwest wall deformation analyses highlights the need for slope and dike movement monitoring program as outlined in Golder's February 2002 report.*

Analyses indicated that the overall pit stability is not significantly impacted by the presence of the fish habitat fills on the pit shelf.

4.2 Stability of Fish Habitat Fills

Slope stability analyses were carried out to determine the stability of the face of the fish habitat fills, and the required setback from the pit crest. The impact of the placed material on the stability of the pit was also checked.

Stability analyses were carried out using the computer programs, XSTABL and SLOPE/W. Factors of safety were calculated on the principle of limit equilibrium against potential sliding along a failure surface for each of the selected cross-sections. Factors of safety were computed using both Spencer's method and the Morgenstern-Price method, which satisfy both force and moment equilibrium. Based on the type of soil and the configuration of the habitat, both circular and wedge failure mechanisms were assessed.

DDMI indicated that flowing artesian conditions have been measured in the southeast portion of the A154 pit shelf. It is expected that these conditions would be affected by the development of the pit, but it is not possible/feasible to quantify these conditions until pit development commences. Thus, the factor of safety was assessed for various phreatic levels within the fill. Surface grading towards the sumps along the toe of the dike will help to drain surface water, reducing infiltration of the water into the fill, particularly if the surface of the fill consists of till or lake-bottom sediments.

The effects of blasting in the pit on the stability of the fill were assessed parametrically by using a pseudo-static limit equilibrium analysis with varying levels of pseudo-static loading. As production blasting data is accumulated, the impact of blasting may be reassessed and the design refined.

The results of the stability analyses are summarized in Appendix III. The stability analyses indicate that the critical slip surface impacting both the fish habitat fill and the in-situ till slope in the pit only impacts a small portion of the fish habitat fill. The factor of safety is sensitive to both the phreatic surface and the pseudo-static loading; therefore, a conservative approach with respect to setback distances and slope angles is proposed, combined with monitoring to assess modifications to the proposed design as mining proceeds. The recommended setback from the pit crest (*i.e.*, top of the in-situ till slope to the toe of the fish habitat fill) is 4 times the height of the fill (taken as the difference between the ultimate top of the fill and the elevation of the pit crest), with a minimum of 15 m. The slope of the faces of the fish habitat fill facing the pit and the interior of the dikes should be 3H:1V or flatter. As mining progresses, it may be possible to modify the setback and slope angle parameters.

5.0 CONSTRUCTION GUIDELINES

The recommended configuration of the fish habitat on the pit shelves is based on the following guidelines:

- Construct fills with face slopes of 3H:1V during mining, and final slopes at the angle of repose adjacent to the pit crest at the completion of mining.

- Setback from the pit crest to the toe of the fill equal to 4 times the elevation difference between the top of fill and the pit crest, with a minimum of 15 m.

- To the extent feasible, areas of existing shallow habitat (*i.e.,* water depth less than 5 m below mean normal water level) should remain untouched.

- Construction of a berm between the toe of the till slope and the crest of the pit. This berm will help retain material that erodes from the slope away from the pit, and will reduce the potential for any material rolling down the slope and into the pit. A minimum setback of 5 m from the crest of the pit to the toe of the berm has been used. As a minimum, the berm would be approximately 2 m high, with a 2-m crest width and 2H:1V sideslopes. The geometry of this berm may be modified on the basis of construction techniques.

- A setback from the interior toe of the water retention dike, to the upstream toe of the fill may also be required. This setback distance should be determined by DDMI, based on operational requirements and surface water handling requirements.

- Construction in one lift is acceptable.

- The materials used to construct the fill may consist of till, rock fill, or a combination of materials. If rock fill is used to construct the lower portion of the fill, the thickness of till to create the final surface should be equal to 0.15 times the height of rock fill, plus 0.5 m. Alternatively, filter zones could be provided between the rock fill and the till. Details of the filter zones would have to be developed further, once construction techniques and material gradations are determined. Processing of the blast rock will be required to produce filter materials, and is likely to be expensive. If the filter zone approach is taken, it is likely that at least two, and possibly, three filters would be required.

- Grading of the surface of the fill at a nominal grade of 1% is recommended, to direct surface water towards the water collection system at the toe of the dike.

- Final contouring of the surface will be required to establish some relief to provide fish habitat (*i.e.*, some hummocks and hollows, rather than an evenly graded surface).

- Rock ridges or reefs are also required for fish habitat. These reefs should be constructed of non-acid generating country rock, and conform to the parameters discussed in Section 3.2.5.

6.0 DETAILED DESIGN DRAWINGS

A set of detailed design drawings is included in Appendix IV for the A154 pit. Detailed design drawings for the A418 and A21 pits have not been prepared, since the dikes have not been constructed, and the pit layout may change prior to construction. The detailed design guidelines presented in this document are considered sufficient to develop drawings for the A418 and A21 pits once the dike and pit details have been finalized.

7.0 MONITORING RECOMMENDATIONS

Monitoring of various parameters is recommended to confirm the design assumptions, and to provide information for refining the design of the fish habitat on the pit shelves. It is recommended that monitoring consist of:

- Monitoring pore-water pressures in the lake-bottom sediments and till that will form the foundation for the fish habitat fills to assess drainage due to pit development, as well as pore-pressures due to fill placement and blasting.

- Monitor pore-pressures within the fish habitat fills, so that the slope stability analyses can be confirmed.

- Monitor production blasting to assess accelerations and peak particle velocities (PPV) for the fish habitat fills.

- Monitor movements of the fish habitat fills using a series of monitoring prisms, and potentially slope inclinometers. Visual inspections should also be conducted to check for signs of instability, such as bulging, slumping or the development of tension cracks.

Monitoring programs have previously been recommended for the water retention dikes and for monitoring the overall pit stability. It is recommended that the monitoring for the fish habitat fills on the interior of the dikes be integrated into the overall monitoring program, to provide consistency, and improve the efficiency of the monitoring efforts.

8.0 CLOSURE

We trust this report presents the information that you require. Please feel free to call at anytime if you have any questions or concerns.

GOLDER ASSOCIATES LTD.

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9.0 REFERENCES

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APPENDIX I

HABITAT UNITS

Appendix I, Table 1. No Net Loss Habitat Summary "Accounting" Showing Habitat Units Only in the Proposed Areas of Disturbance, from No Net Loss Addendum, 1999

Life Stage	Species	North Inlet (2001 - 2023)		A418 (2009 2023)		A154 (2001-2023)		A21 (2012 2018)		**Available (pre-1988)	**Available (post-2024)	Net Change
		loss	gain	loss	gain	loss	gain	loss	gain			
Spawning	LKTR	0.32	0.00	0.10	0.07	0.68	0.15	0.79	0.14	1.88	0.37	-1.51
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CISC	0.31	0.00	0.11	0.06	0.95	0.12	0.80	0.11	2.16	0.29	-1.87
	RNWH	0.05	0.00	0.02	0.05	0.18	0.29	0.14	0.26	0.39	0.60	0.21
	LKWH	0.12	0.00	0.04	0.02	0.24	0.04	0.30	0.04	0.70	0.11	-0.59
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.04	-0.29
	BURB	0.04	0.00	0.02	0.00	0.16	0.01	0.12	0.01	0.33	0.02	-0.31
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.11	0.00	0.03	0.21	0.23	0.78	0.27	0.66	0.65	1.65	1.01
Rearing	LKTR	1.60	0.00	1.00	3.60	5.65	10.53	3.46	8.31	11.71	22.44	10.73
	ARGR	0.17	0.00	0.17	0.26	1.03	0.76	0.44	0.60	1.81	1.62	-0.19
	CISC	1.06	0.00	1.53	3.47	6.37	10.17	3.83	8.02	12.78	21.66	8.87
	RNWH	0.40	0.00	0.26	0.61	1.21	2.06	0.72	1.69	3.90	4.35	0.46
	LKWH	0.52	0.00	0.28	0.62	1.27	2.31	1.00	1.93	3.07	4.85	1.79
	LNSC	0.34	0.00	0.30	0.48	1.40	1.63	0.80	1.34	2.85	3.45	0.60
	BURB	0.27	0.00	0.19	0.27	0.99	0.90	0.65	0.74	2.09	1.91	-0.18
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.36	0.00	0.26	0.43	1.36	1.57	0.87	1.32	2.86	3.32	0.47
Foraging	LKTR	0.70	0.00	0.90	0.96	4.03	2.76	2.44	2.19	8.08	5.91	-2.17
	ARGR	0.11	0.00	0.10	0.13	0.54	0.39	0.27	0.31	1.01	0.83	-0.18
	CISC	0.77	0.00	0.88	1.65	3.90	4.31	2.37	3.31	7.92	9.27	1.35
	RNWH	0.23	0.00	0.17	0.28	0.88	0.80	0.51	0.63	2.37	1.71	-0.66
	LKWH	0.21	0.00	0.15	0.28	0.73	0.94	0.44	0.77	1.54	1.99	0.46
	LNSC	0.18	0.00	0.21	0.24	0.88	0.81	0.55	0.67	1.82	1.72	-0.10
	BURB	0.10	0.00	0.11	0.12	0.51	0.34	0.31	0.27	1.04	0.73	-0.31
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.07	0.00	0.14	0.21	0.61	0.77	0.40	0.64	1.23	1.62	0.39
Nursery	LKTR	0.32	0.00	0.10	0.06	0.68	0.12	0.79	0.12	1.88	0.30	-1.58
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CISC	0.31	0.00	0.11	0.06	0.95	0.12	0.80	0.11	2.16	0.29	-1.87
	RNWH	0.05	0.00	0.02	0.05	0.18	0.29	0.14	0.26	0.39	0.60	0.21
	LKWH	0.12	0.00	0.04	0.02	0.24	0.04	0.30	0.04	0.70	0.11	-0.59
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.04	-0.29
	BURB	0.04	0.00	0.02	0.00	0.16	0.01	0.12	0.01	0.33	0.02	-0.31
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.11	0.00	0.03	0.21	0.23	0.78	0.27	0.66	0.65	1.65	1.01
Total		9.10	0.00	7.33	14.45	36.38	43.84	24.27	35.19	78.95	93.49	14.54

Total by life stage	Spawning	1.01	0.00	0.34	0.43	2.50	1.41	2.59	1.24	6.44	3.09	-3.35
	Rearing	4.71	0.00	4.00	9.73	19.29	29.93	11.78	23.94	41.07	63.61	22.54
	Foraging	2.37	0.00	2.66	3.86	12.09	11.11	7.30	8.80	25.00	23.77	-1.22
	Nursery	1.01	0.00	0.34	0.42	2.50	1.38	2.59	1.22	6.44	3.02	-3.42

Total by species	LKTR	2.93	0.00	2.11	4.69	11.04	13.56	7.48	10.76	23.55	29.02	5.47
	ARGR	0.27	0.00	0.27	0.40	1.57	1.15	0.71	0.91	2.83	2.45	-0.37
	CISC	2.44	0.00	2.62	5.23	12.18	14.72	7.80	11.55	25.03	31.51	6.48
	RNWH	0.72	0.00	0.47	0.99	2.46	3.44	1.52	2.84	7.05	7.26	0.22
	LKWH	0.97	0.00	0.51	0.94	2.48	3.34	2.05	2.79	6.00	7.06	1.06
	LNSC	0.67	0.00	0.55	0.74	2.40	2.48	1.69	2.03	5.31	5.25	-0.07
	BURB	0.45	0.00	0.34	0.40	1.81	1.26	1.21	1.03	3.80	2.68	-1.12
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.65	0.00	0.47	1.06	2.45	3.91	1.82	3.28	5.38	8.25	2.87

Note:
Minor variation in numbers, when compared with 1999 documentation, due to rounding

** - habitat units available the pre-1998 and post-2024 represent the number of habitat units present on shoals, shorelines, and 'in deep/shallow water areas within the proposed boundaries of the three dikes (A154, A418, A21) and the north inlet.
LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

Appendix I, Table 2 No Net Loss Habitat Summary "Accounting" Showing Habitat Units Only in the Proposed Areas of Disturbance, Recalculated with 2002 Dike A154 Constructed Dimensions

Life Stage	Species	North Inlet (2001 - 2023)		A418 (2009 2023)		A154 (2001 2023)		A21 (2012 2018)		**Available (pre-1988)	**Available (post-2024)	Net Change
		loss	gain	loss	gain	loss	gain	loss	gain			
Spawning	LKTR	0.32	0.00	0.10	0.07	0.68	0.24	0.79	0.14	1.88	0.45	-1.43
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	CISC	0.31	0.00	0.11	0.03	0.95	0.27	0.80	0.16	2.16	0.37	-1.79
	RNWH	0.05	0.00	0.02	0.05	0.18	0.31	0.14	0.26	0.39	0.63	0.24
	LKWH	0.12	0.00	0.04	0.02	0.24	0.09	0.30	0.04	0.70	0.15	-0.55
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.05	-0.28
	BURB	0.04	0.00	0.02	0.00	0.16	0.02	0.12	0.01	0.33	0.03	-0.30
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.11	0.00	0.03	0.21	0.23	0.83	0.27	0.66	0.65	1.70	1.05
Rearing	LKTR	1.60	0.00	1.00	3.60	5.65	10.82	3.46	8.31	11.71	22.73	11.01
	ARGR	0.17	0.00	0.17	0.26	1.03	0.79	0.44	0.60	1.81	1.65	-0.16
	CISC	1.06	0.00	1.53	2.48	6.37	3.42	3.83	1.86	12.78	21.89	9.10
	RNWH	0.40	0.00	0.26	0.61	1.21	2.14	0.72	0.31	3.90	3.06	-0.84
	LKWH	0.52	0.00	0.28	0.62	1.27	2.42	1.00	1.93	3.07	4.97	1.90
	LNSC	0.34	0.00	0.30	0.48	1.40	1.69	0.80	1.34	2.85	3.51	0.67
	BURB	0.27	0.00	0.19	0.27	0.99	0.95	0.65	0.74	2.09	1.95	-0.14
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.36	0.00	0.26	0.43	1.36	1.66	0.87	1.32	2.86	3.41	0.56
Foraging	LKTR	0.70	0.00	0.90	0.96	4.03	2.87	2.44	2.19	8.08	6.03	-2.05
	ARGR	0.11	0.00	0.10	0.13	0.54	0.40	0.27	0.31	1.01	0.85	-0.17
	CISC	0.77	0.00	0.88	1.59	3.90	4.27	2.37	3.20	7.92	9.36	1.43
	RNWH	0.23	0.00	0.17	0.28	0.88	0.83	0.51	0.63	2.37	1.74	-0.62
	LKWH	0.21	0.00	0.15	0.28	0.73	0.98	0.44	0.77	1.54	2.03	0.49
	LNSC	0.18	0.00	0.21	0.24	0.88	0.84	0.55	0.67	1.82	1.74	-0.08
	BURB	0.10	0.00	0.11	0.12	0.51	0.36	0.31	0.27	1.04	0.75	-0.29
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.07	0.00	0.14	0.21	0.61	0.81	0.40	0.64	1.23	1.65	0.42
Nursery	LKTR	0.32	0.00	0.10	0.06	0.68	0.21	0.79	0.12	1.88	0.39	-1.49
	ARGR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	CISC	0.31	0.00	0.11	0.05	0.95	0.55	0.80	0.11	2.16	0.37	-1.79
	RNWH	0.05	0.00	0.02	0.05	0.18	0.31	0.14	0.26	0.39	0.62	0.23
	LKWH	0.12	0.00	0.04	0.02	0.24	0.09	0.30	0.04	0.70	0.15	-0.55
	LNSC	0.07	0.00	0.02	0.01	0.06	0.02	0.17	0.02	0.33	0.05	-0.28
	BURB	0.04	0.00	0.02	0.00	0.16	0.02	0.12	0.01	0.33	0.03	-0.30
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
	SLSC	0.11	0.00	0.03	0.21	0.23	0.83	0.27	0.66	0.65	1.70	1.05

Total		9.10	0.00	7.33	13.38	36.38	39.04	24.27	27.59	78.95	94.01	15.06

Total by life stage	Spawning	1.01	0.00	0.34	0.41	2.50	1.78	2.59	1.28	6.44	3.39	-3.05
	Rearing	4.71	0.00	4.00	8.75	19.29	23.88	11.78	16.41	41.07	63.16	22.10
	Foraging	2.37	0.00	2.66	3.81	12.09	11.35	7.30	8.69	25.00	24.14	-0.86
	Nursery	1.01	0.00	0.34	0.41	2.50	2.03	2.59	1.21	6.44	3.31	-3.12

Total by species	LKTR	2.93	0.00	2.11	4.69	11.04	14.13	7.48	10.76	23.55	29.59	6.04
	ARGR	0.27	0.00	0.27	0.40	1.57	1.19	0.71	0.91	2.83	2.49	-0.33
	CISC	2.44	0.00	2.62	4.16	12.18	8.50	7.80	5.32	25.03	31.99	6.96
	RNWH	0.72	0.00	0.47	0.99	2.46	3.60	1.52	1.47	7.05	6.05	-0.99
	LKWH	0.97	0.00	0.51	0.94	2.48	3.57	2.05	2.79	6.00	7.30	1.29
	LNSC	0.67	0.00	0.55	0.74	2.40	2.58	1.69	2.03	5.31	5.35	0.03
	BURB	0.45	0.00	0.34	0.40	1.81	1.34	1.21	1.03	3.80	2.76	-1.04
	NRPK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	SLSC	0.65	0.00	0.47	1.06	2.45	4.13	1.82	3.28	5.38	8.47	3.09

Note:
Minor variation in numbers, when compared with 1999 documentation, due to rounding

** - habitat units available the pre-1998 and post-2024 represent the number of habitat units present on shoals, shorelines, and 'in deep/shallow water areas within the proposed boundaries of the three dikes (A154, A418, A21) and the north inlet.
LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

APPENDIX II

TENTATIVE FILTER GRADATIONS

012-2331: DDMI Fish Habitat Compensation - Interior of Dikes
Tentative Filter Gradations

Specification Bands

Sieve Size mm	SHT Type 31 Percent Passing Coarse Ra	SHT Type 31 Percent Passing Fine Range	SHT Type 33 Percent Passing Coarse Ra	SHT Type 33 Percent Passing Fine Range
31.5	100%			
25				
18	75%	90%	100%	
12.5	65%	83%	75%	100%
5	40%	69%	50%	75%
2	26%	47%	32%	52%
0.9	17%	32%	20%	35%
0.4	12%	22%	15%	25%
0.16	7%	14%	8%	15%
0.071	6%	11%	6%	11%

Manitoba Highways Class A

Sieve Size mm	Percent Passing Coarse Ra	Percent Passing Fine Range
19	100%	
16	80%	100%
4.75	40%	71%
2	25%	55%
0.425	15%	30%
0.075	8%	15%

Mean Till Gradation

Diam	% Passing	
80	100.0%	
50	100.0%	
40	100.0%	
20	97.4%	
10	89.3%	D_{85}
5	80.5%	7.0
2.5	74.0%	
1.25	68.0%	
0.63	62.3%	
0.315	55.9%	
0.16	48.9%	D_{15}
0.08	39.1%	0.08

Filter 1 - Concrete Sand

Sieve Size	Coarse % Passing	Fine % Passing	
10	100%	100%	
5	95%	100%	D_{85}
2.5	80%	100%	1.9
1.25	50%	90%	
0.63	25%	65%	D_{15}
0.315	10%	35%	0.4
0.16	2%	10%	

Filter 2

Diam Fine	Diam Coarse	Fine % Passing	
		100%	
12.5	40	95%	
8	25	85%	D_{85}
3	12.5	60%	21
1.2	5	15%	
0.9	4	10%	D_{15}
			3.3

Filter 3

Diam Fine	Diam Coarse	Fine % Passing
		100%
75	200	95%
50	150	85%
25	75	60%
10	25	15%
9	22	10%

Blast Rock

Diam	% Passing
490	80%
280	50%
130	20%

REPORT NUMBER: ______________

Golder Associates

Grain Size Analysis

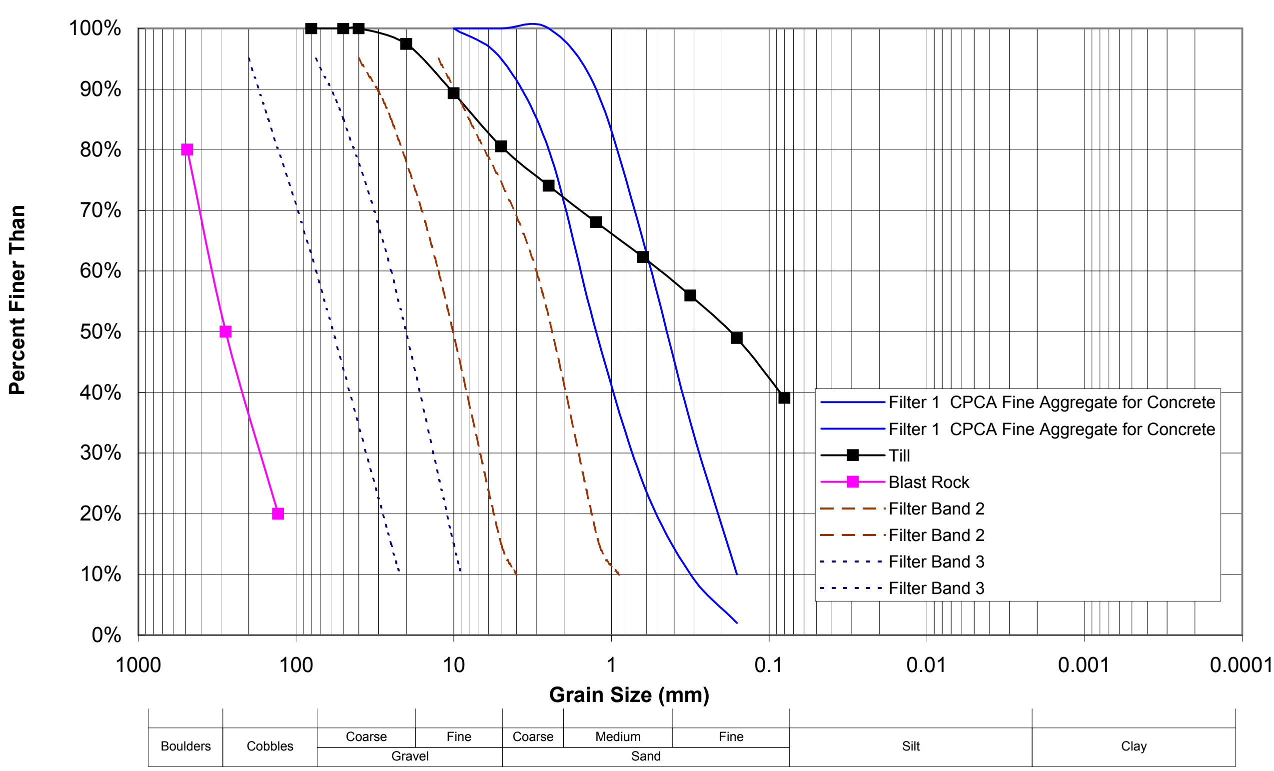
PROJECT No. 012-2331
PROJECT: Diavik - Fish Habitat Compensation - Dikes
LOCATION: Lac de Gras, NWT
SITE:
TESTED BY: N/A
DATE: March 2003

		SIEVE No.	Size of Opening: Inches	Size of Opening: mm	WEIGHT RETAINED (grams): per sieve	WEIGHT RETAINED (grams): cumulative	Total Weight Finer Than (grams)	Percent Finer Than (%)	% Finer Than Original Sample
Tare Weight (grams) =	0						0		
Moist Weight + Tare (grams) =	0						0		
Dry Weight + Tare (grams) =	0						0		
Washed, Dry Wt. + Tare (grams) =	0				0	0	0		
					0	0	0		
Moisture Content (%) =	#DIV/0!				0	0	0		
Total Dry Weight of Sample (grams) =	0				0	0	0		
Passing Total Weight					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		
					0	0	0		

Total Retained on Sieves (grams) = 0

LABORATORY SAMPLE IDENTIFICATION NUMBER:
DESCRIPTION OF SAMPLE:

REMARKS:
This spreadsheet is being used to illustrate tentative grain-size distributions for filters between rock fill and till for the fish habitat compensation plans on the pit shelf.



UNIFIED SOIL CLASSIFICATION SYSTEM

Checked By:________________ Reviewed By:________________

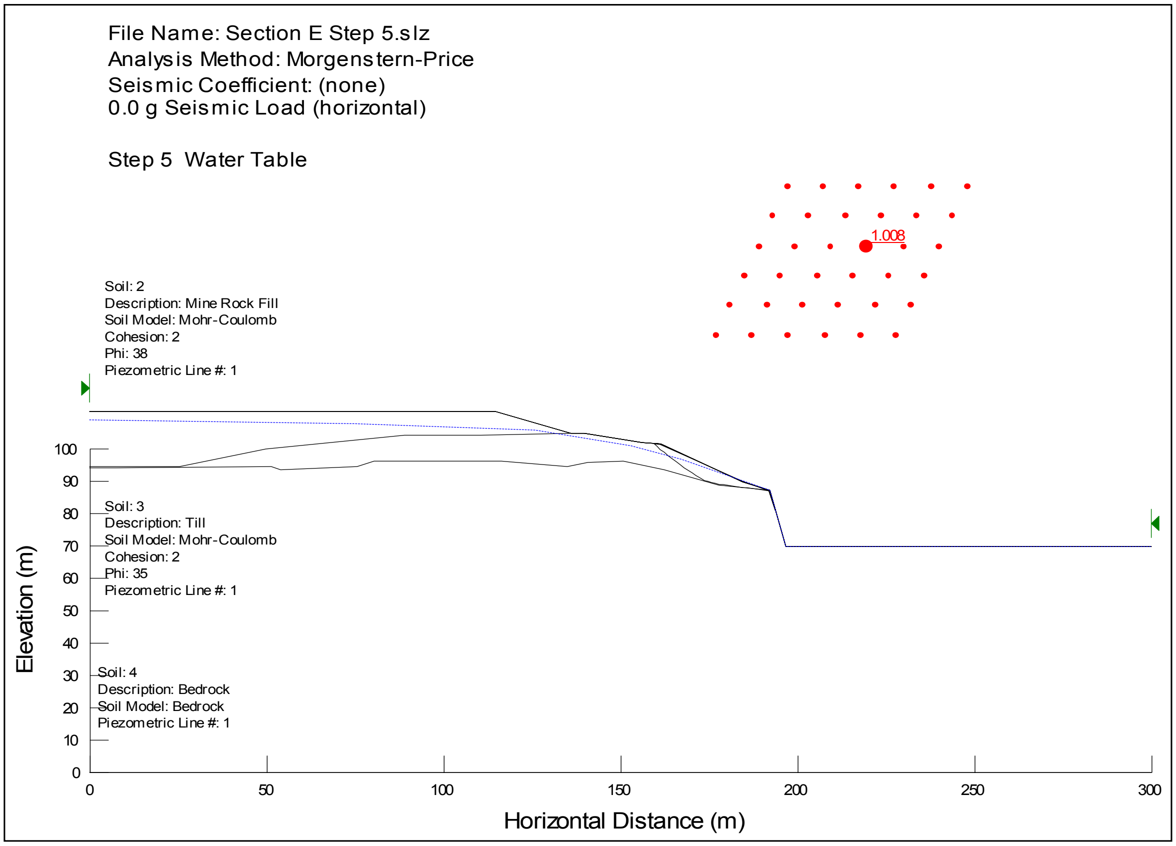
APPENDIX III

SUMMARY OF SLOPE STABILITY ANALYSES

Section E With 25 m Setback			With 35 ϕ Till & 38 Fill			With 35 ϕ Fill & 35 Till	
Water Table Elevation	Seismic Coefficient (horizontal)		F of S (through Till)	F of S (global)		F of S (through Till)	F of S (global)
Base Case	0		1.50	2.66			
Base Case	0.05		1.33	2.24			
Base Case	0.1		1.19	1.94			
Base Case	0.15		1.07	1.71			
Step 1 Water Table	0		1.34	2.43			
Step 1 Water Table	0.05						
Step 1 Water Table	0.1						
Step 1 Water Table	0.15						
Step 2 Water Table	0		1.19	2.22			
Step 2 Water Table	0.05						
Step 2 Water Table	0.1						
Step 2 Water Table	0.15						
Step 3 Water Table	0		1.18	2.05		1.18	2.04
Step 3 Water Table	0.05		1.04	1.76		1.04	1.74
Step 3 Water Table	0.1		0.92	1.53		0.92	1.52
Step 3 Water Table	0.15		0.82	1.35		0.82	1.34
Step 4 Water Table	0		1.01	1.82		1.01	1.81
Step 4 Water Table	0.05						
Step 4 Water Table	0.1						
Step 4 Water Table	0.15						
Step 5 Water Table	0		1.01	1.67		1.01	1.66
Step 5 Water Table	0.05		0.88	1.43		0.88	1.42
Step 5 Water Table	0.1		0.78	1.25		0.78	1.24
Step 5 Water Table	0.15		0.69	1.11		0.69	1.10
Step 5 Water Table							
Step 5 Water Table							

Project Number: 012-2331
Project: DDMI - Diavik
Fish Habitat Comp.

SUMMARY OF SLOPE STABILITY ANALYSIS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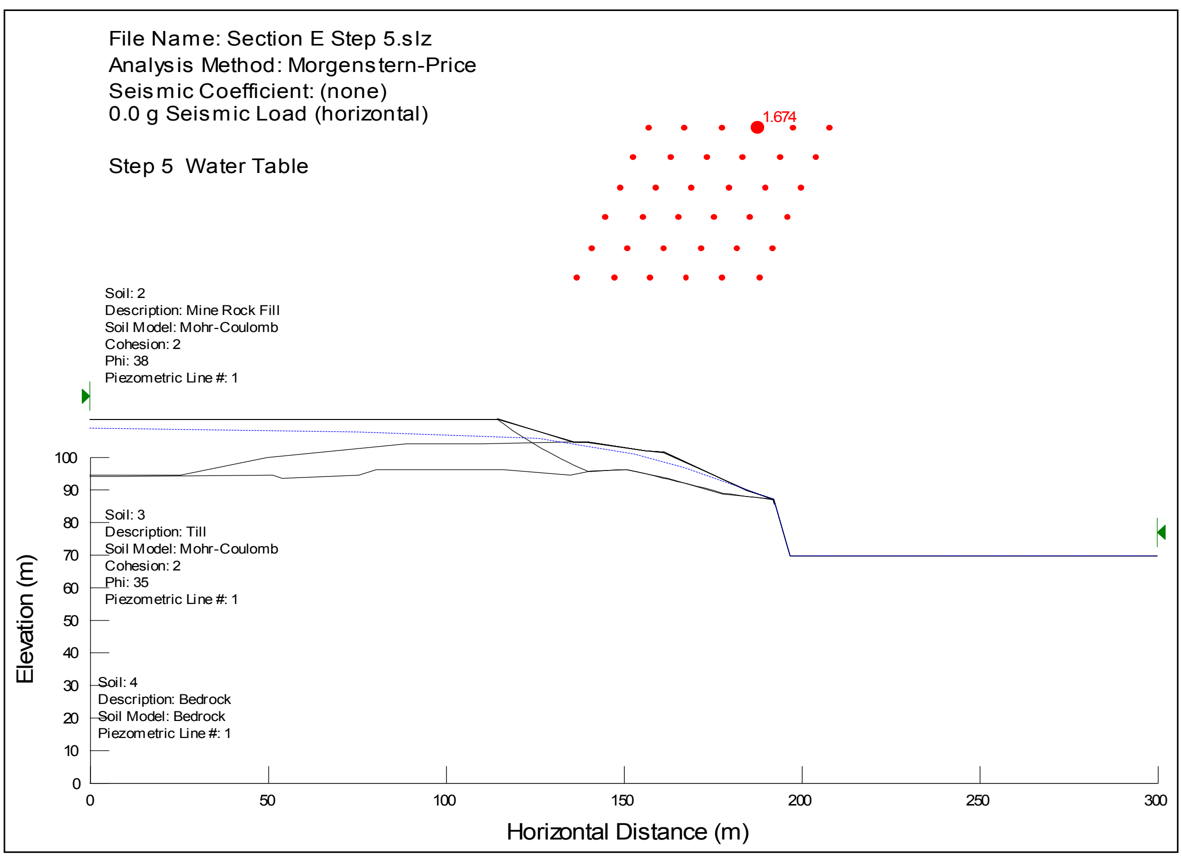
Analysis Method: Morgenstern-Price
Seismic Coefficient: (none)
0.0 g Seismic Load (horizontal)
Step 5 Water Table
1.008
Soil: 2
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)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0.0 g Seismic Load (horizontal)
Step 5 Water Table
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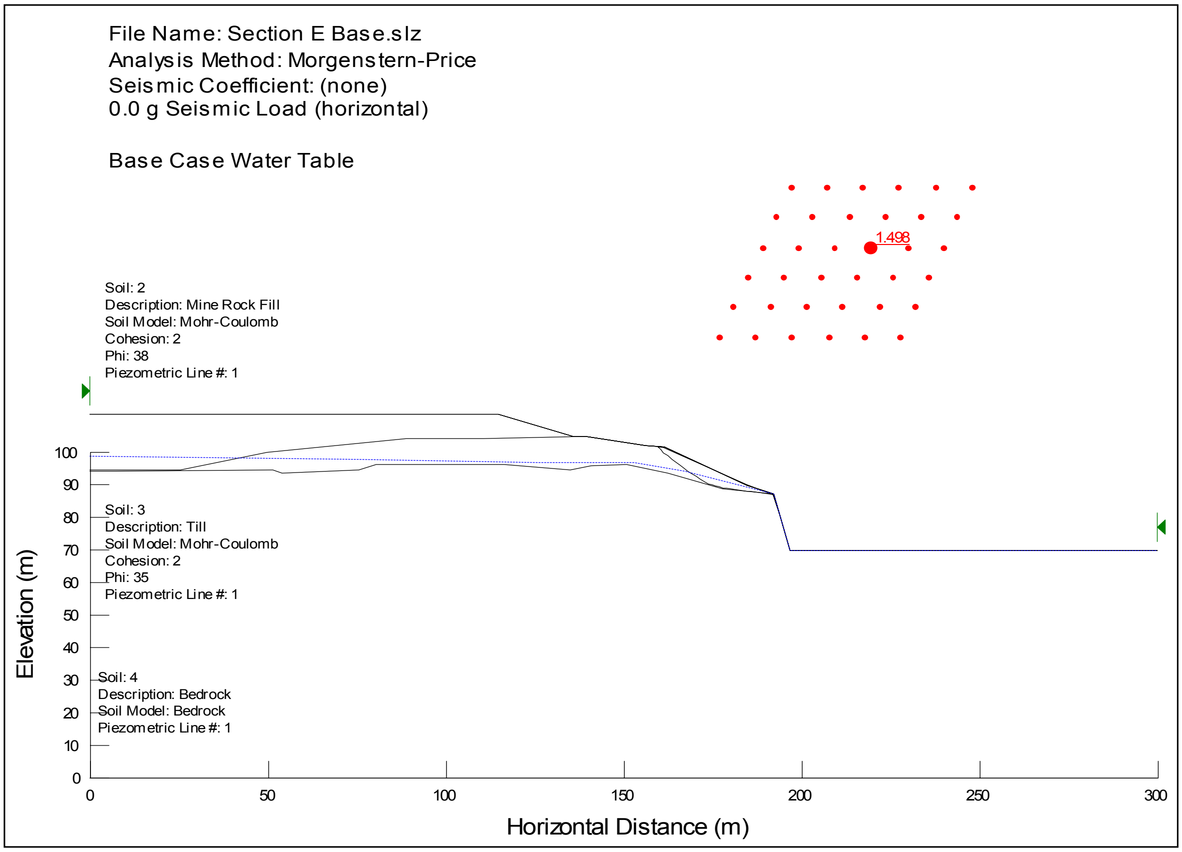
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)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Base Case Water Table
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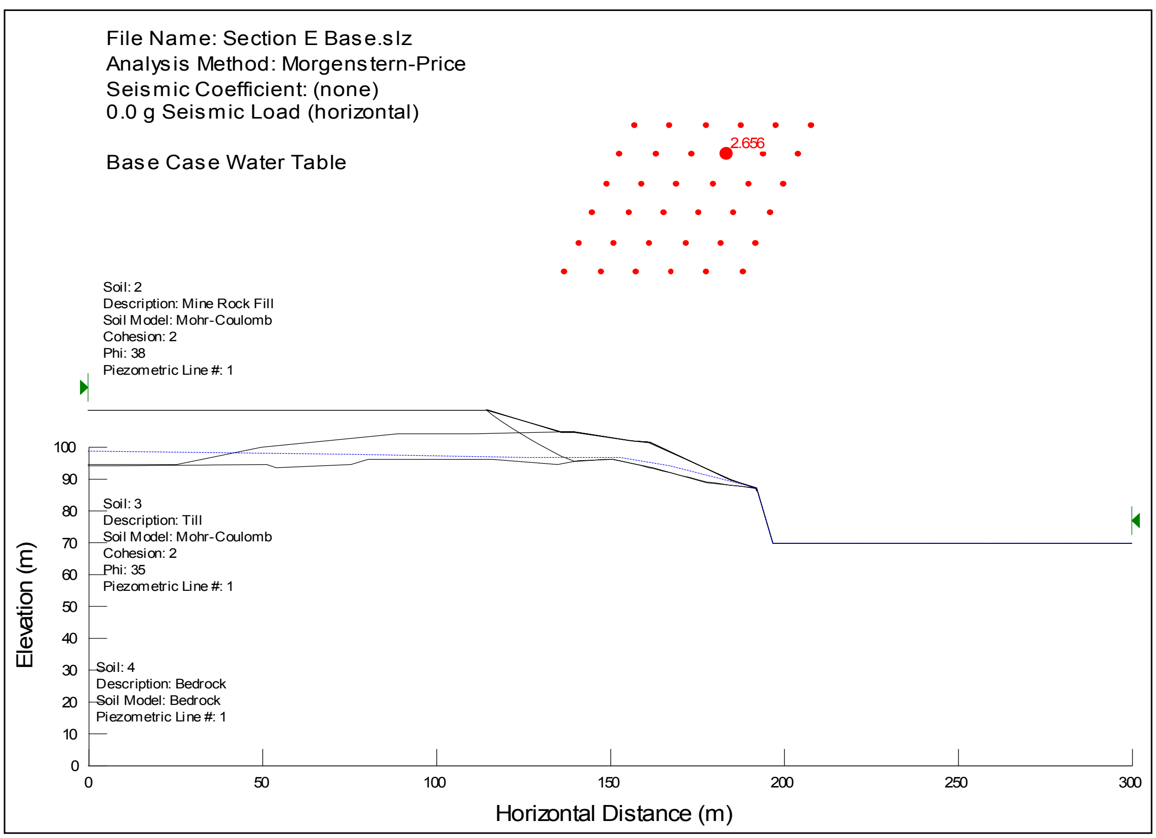
Description: Mine Rock Fill
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)
0
10
20
30
40
50
60
70
80
90
100
0
50
100
150
200
250
300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0.0 g Seismic Load (horizontal)
Base Case Water Table
2.656
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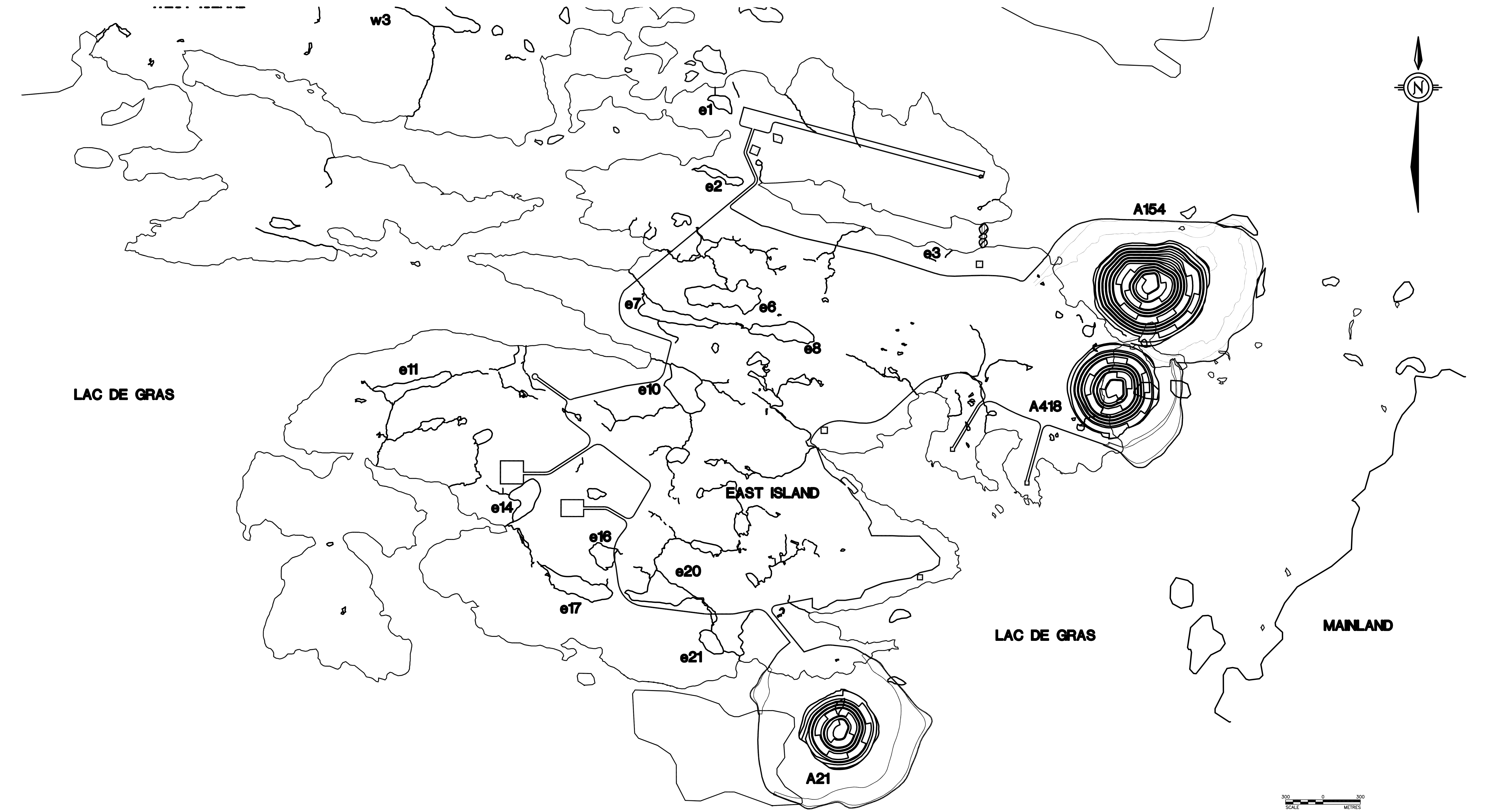
Cohesion: 2
Phi: 38
Piezometric Line #: 1
Soil: 3
Description: Till
Soil Model: Mohr-Coulomb
Cohesion: 2
Phi: 35
Piezometric Line #: 1
Soil: 4
Description: Bedrock
Soil Model: Bedrock
Piezometric Line #: 1
Elevation (m)
Horizontal Distance (m)
0
10
20
30
40
50
60
70
80
90
100
0
50
100
150
200
250
300

APPENDIX IV

DETAILED DESIGN DRAWINGS



PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORHTWEST TERRITORIES

TITLE
PROJECT LAYOUT

Golder Associates
Saskatoon, Saskatchewan

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REVIEW				

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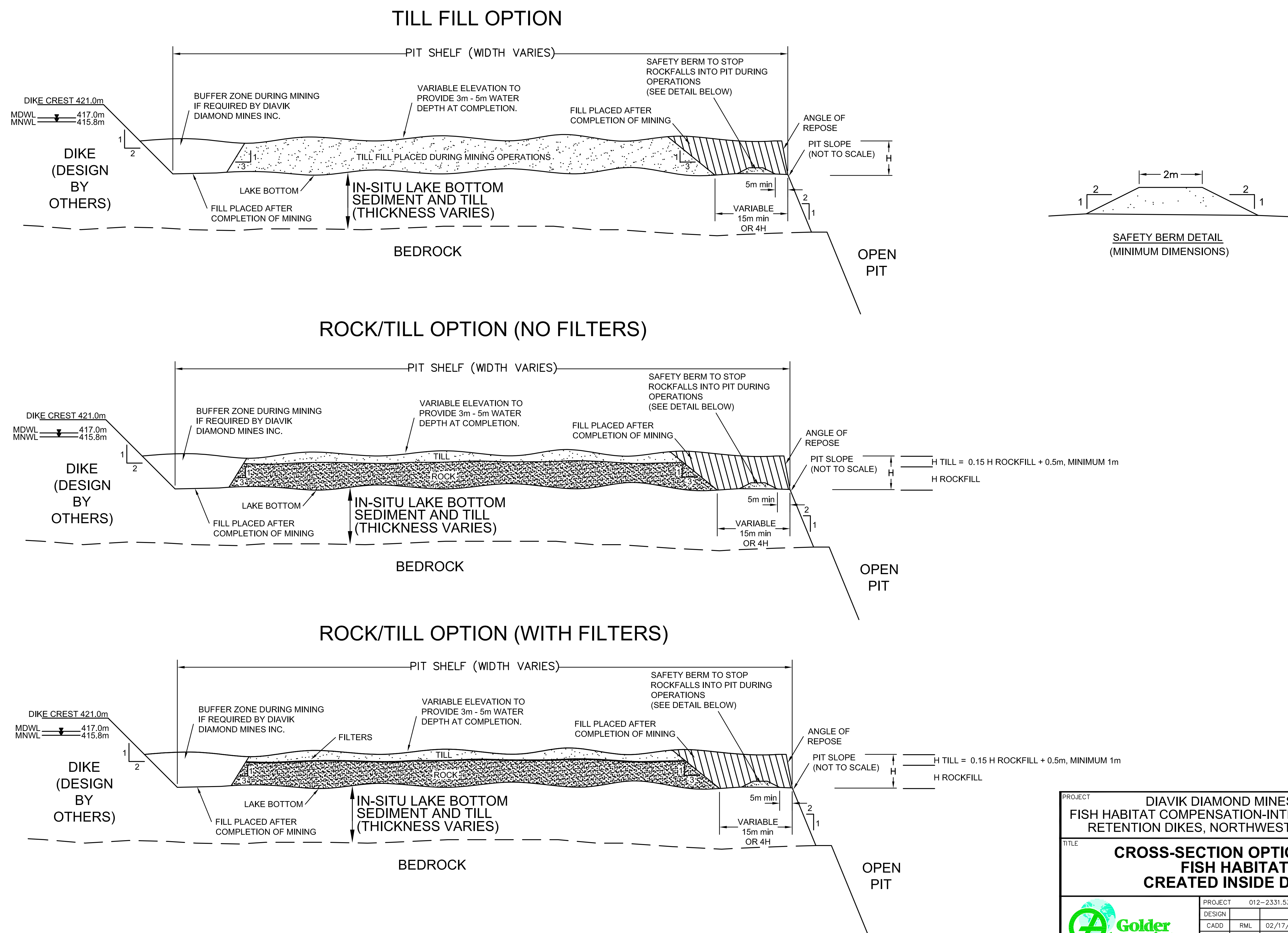

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
CROSS-SECTION OPTIONS FOR FISH HABITAT CREATED INSIDE DIKES

Golder Associates
Saskatoon, Saskatchewan

PROJECT	012-2331.5310		FILE No.
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REVIEW			

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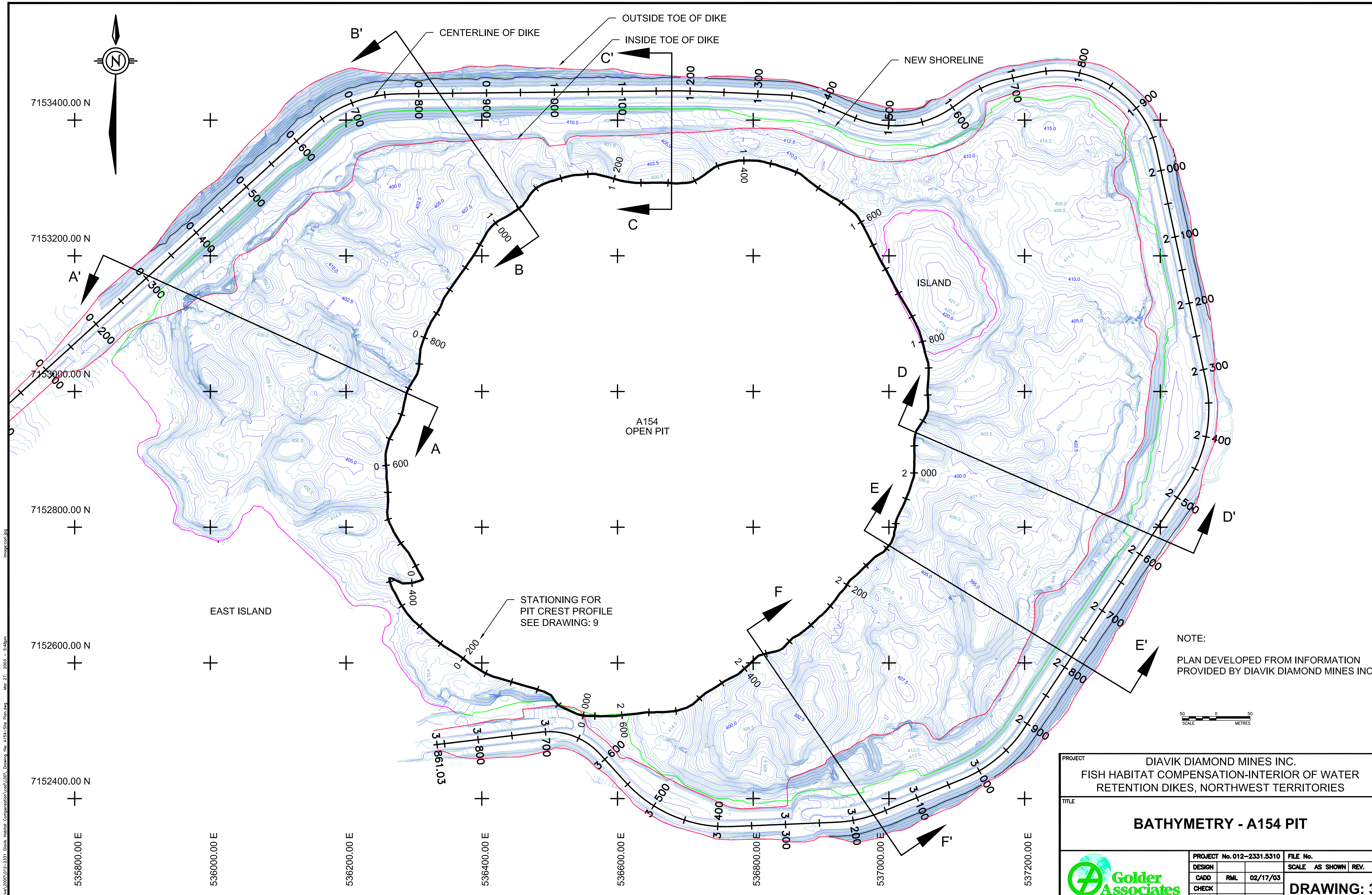

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
BATHYMETRY - A154 PIT

Golder Associates, Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.		
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REVIEW					

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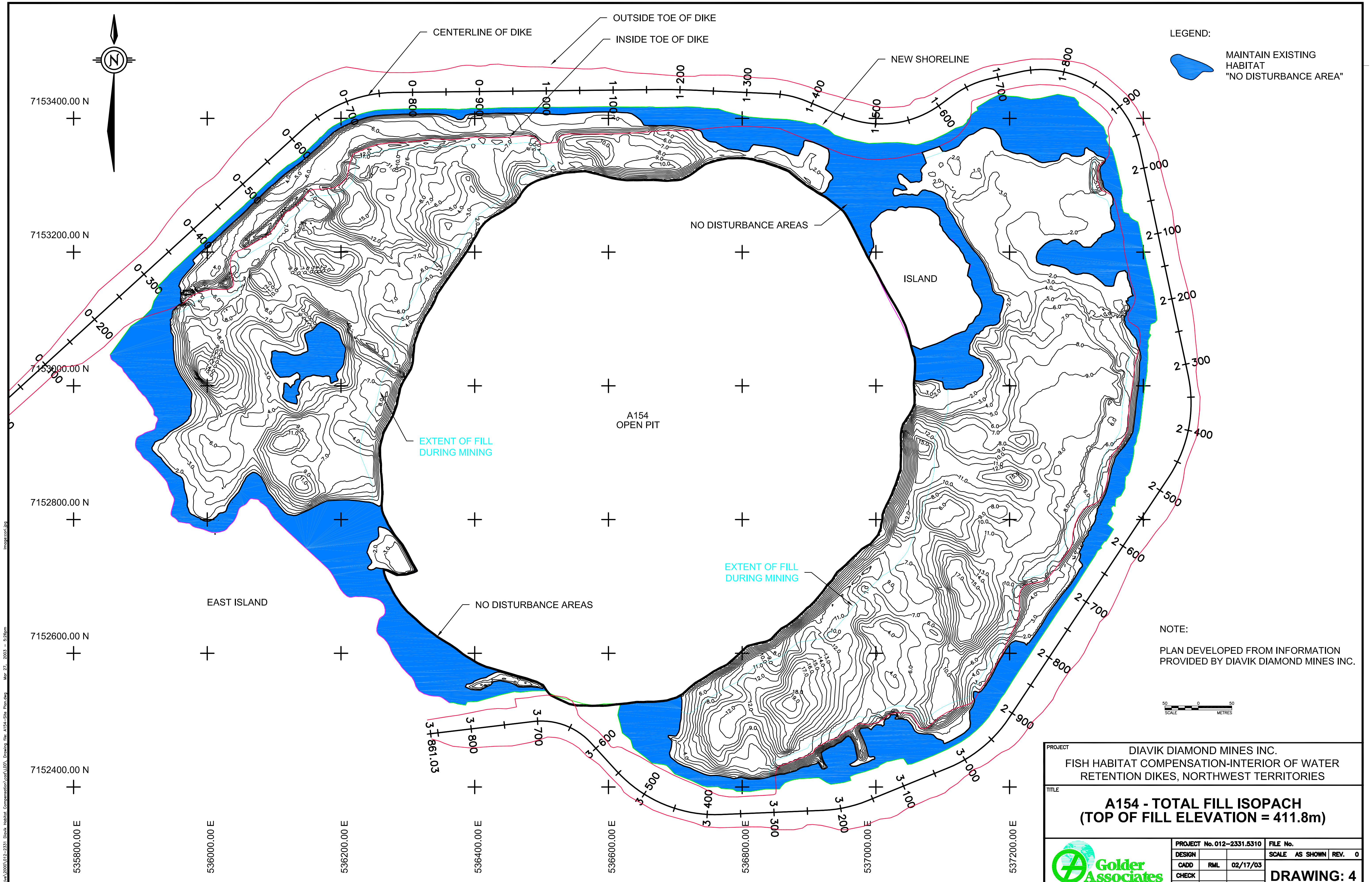

NOTE:

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A154 - TOTAL FILL ISOPACH (TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310		FILE No.	
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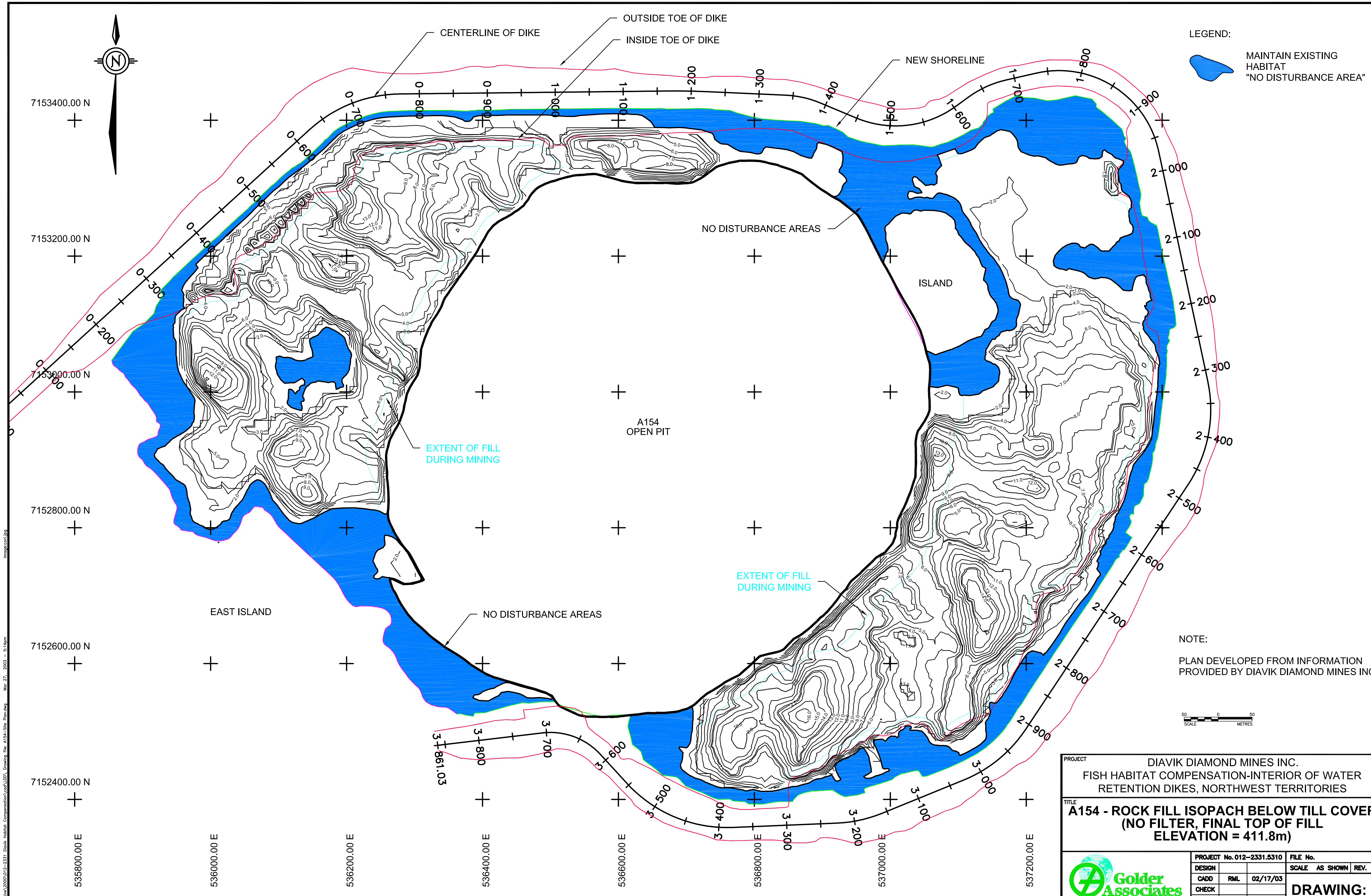
REVIEW			



PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 - ROCK FILL ISOPACH BELOW TILL COVER (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Saskatoon, Saskatchewan

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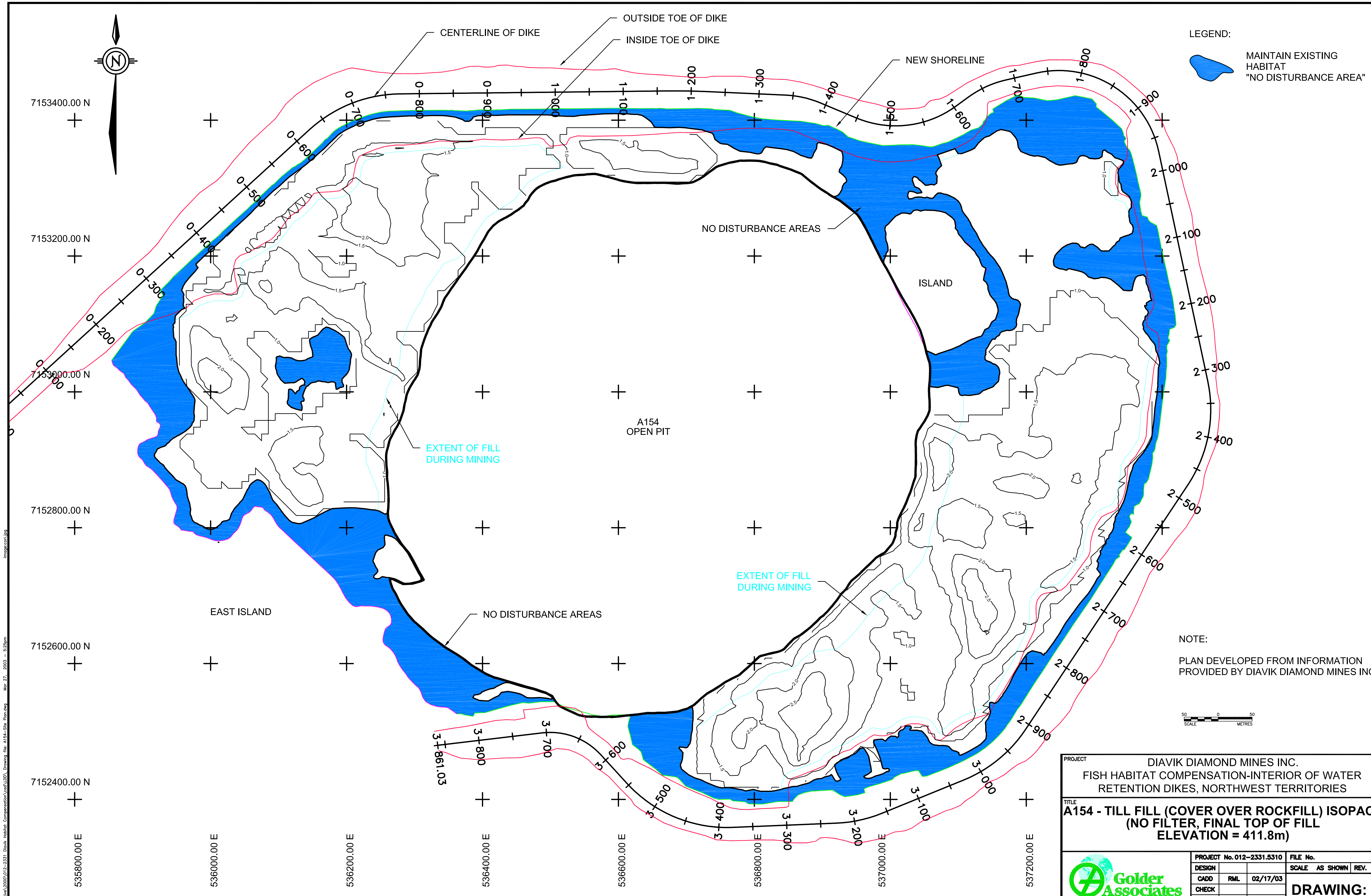

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A154 - TILL FILL (COVER OVER ROCKFILL) ISOPACH (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Saskatoon, Saskatchewan

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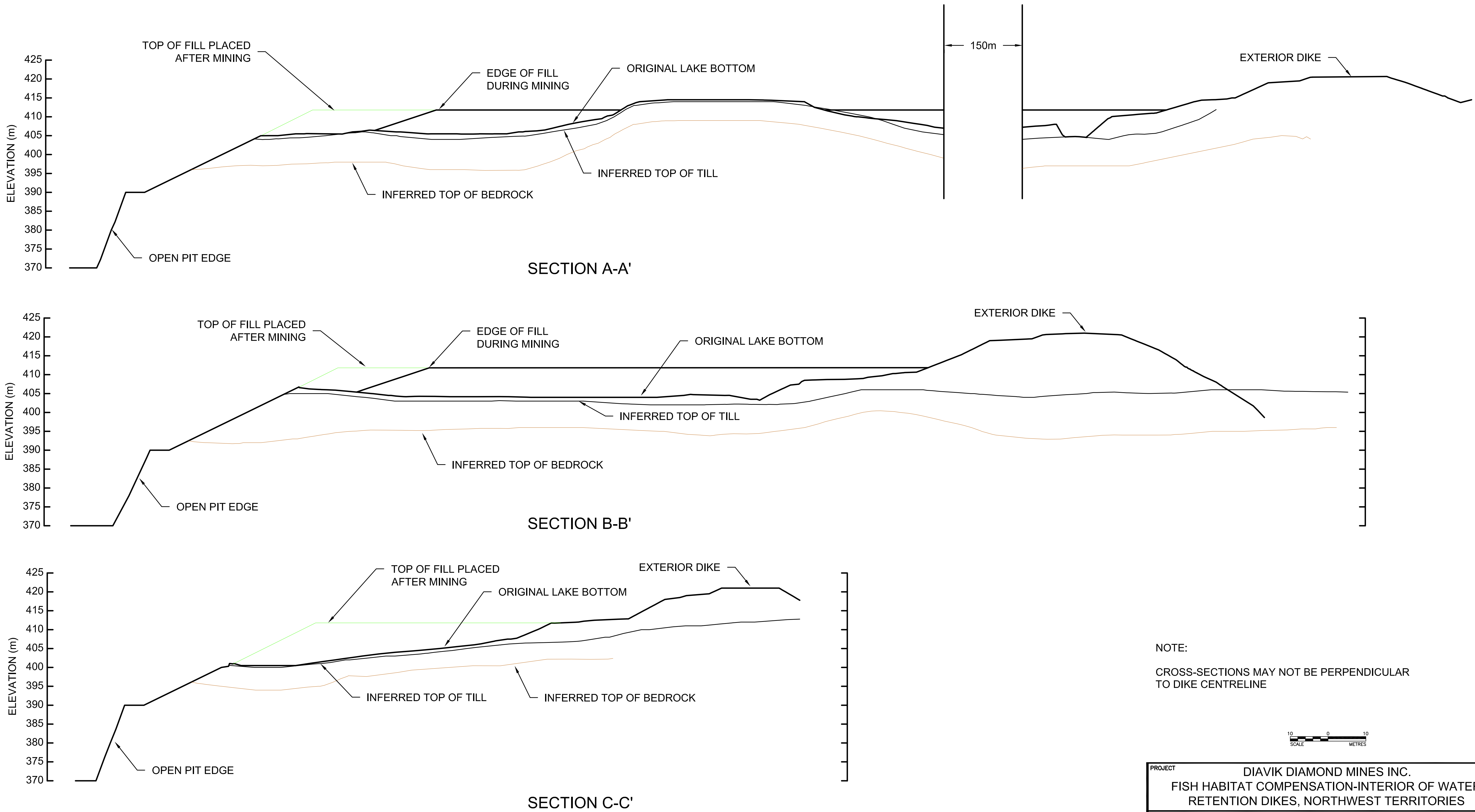

NOTE:

CROSS-SECTIONS MAY NOT BE PERPENDICULAR TO DIKE CENTRELINE

PROJECT	DIAVIK DIAMOND MINES INC. FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES
TITLE	**A154 PIT - CROSS SECTIONS OF FISH HABITAT FILL ON EXTERIOR DIKES**

Golder Associates
Saskatoon, Saskatchewan

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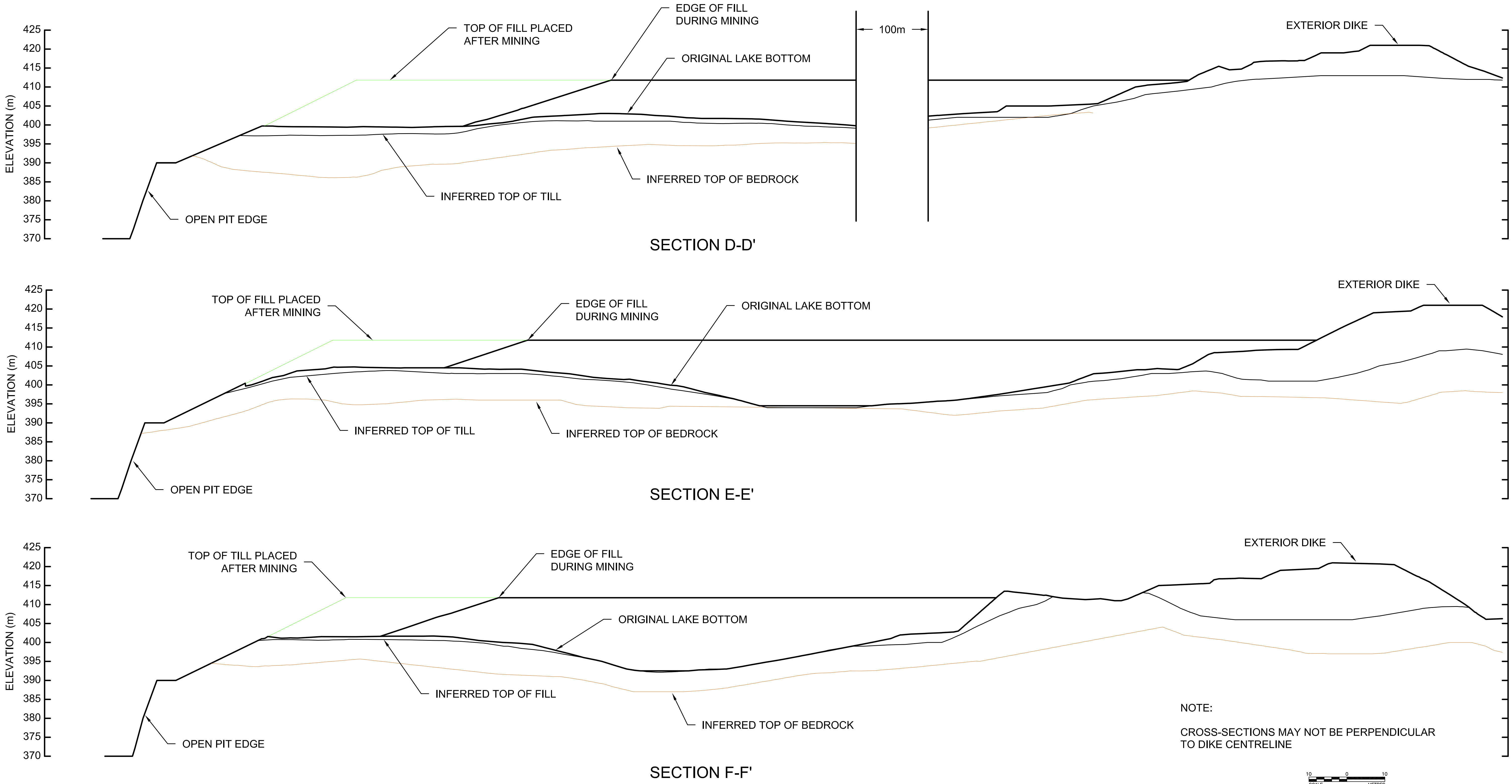

NOTE:

CROSS-SECTIONS MAY NOT BE PERPENDICULAR TO DIKE CENTRELINE

PROJECT	DIAVIK DIAMOND MINES INC. FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES
TITLE	**A154 PIT - CROSS SECTIONS OF FISH HABITAT FILL ON EXTERIOR DIKES**

Golder Associates
Saskatoon, Saskatchewan

PROJECT	No. 012-2331.5310		FILE No.	
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REVIEW				

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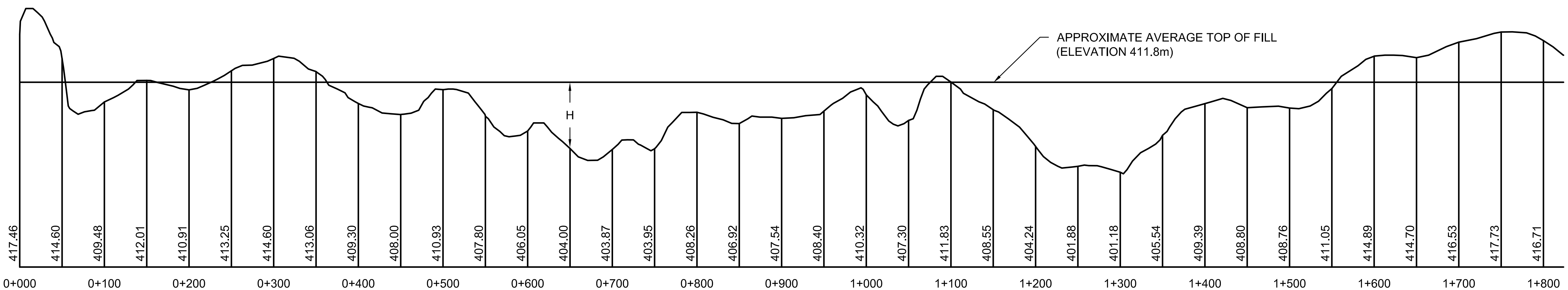

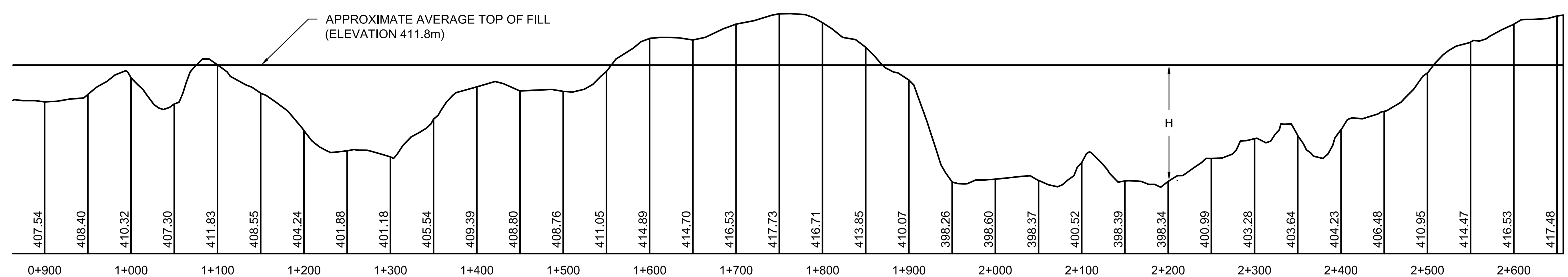

10x VERTICAL EXAGGERATION

NOTES:

1. SEE DRAWING : 3 FOR STATIONING

2. SETBACK FROM PIT CREST TO TOE OF FISH HABITAT FILL (DURING MINING) EQUAL TO 4H WITH A MINIMUM OF 15m.

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A154 PIT - PIT CREST PROFILE

Golder Associates
Saskatoon, Saskatchewan

PROJECT No. 012-2331.5310			FILE No.	
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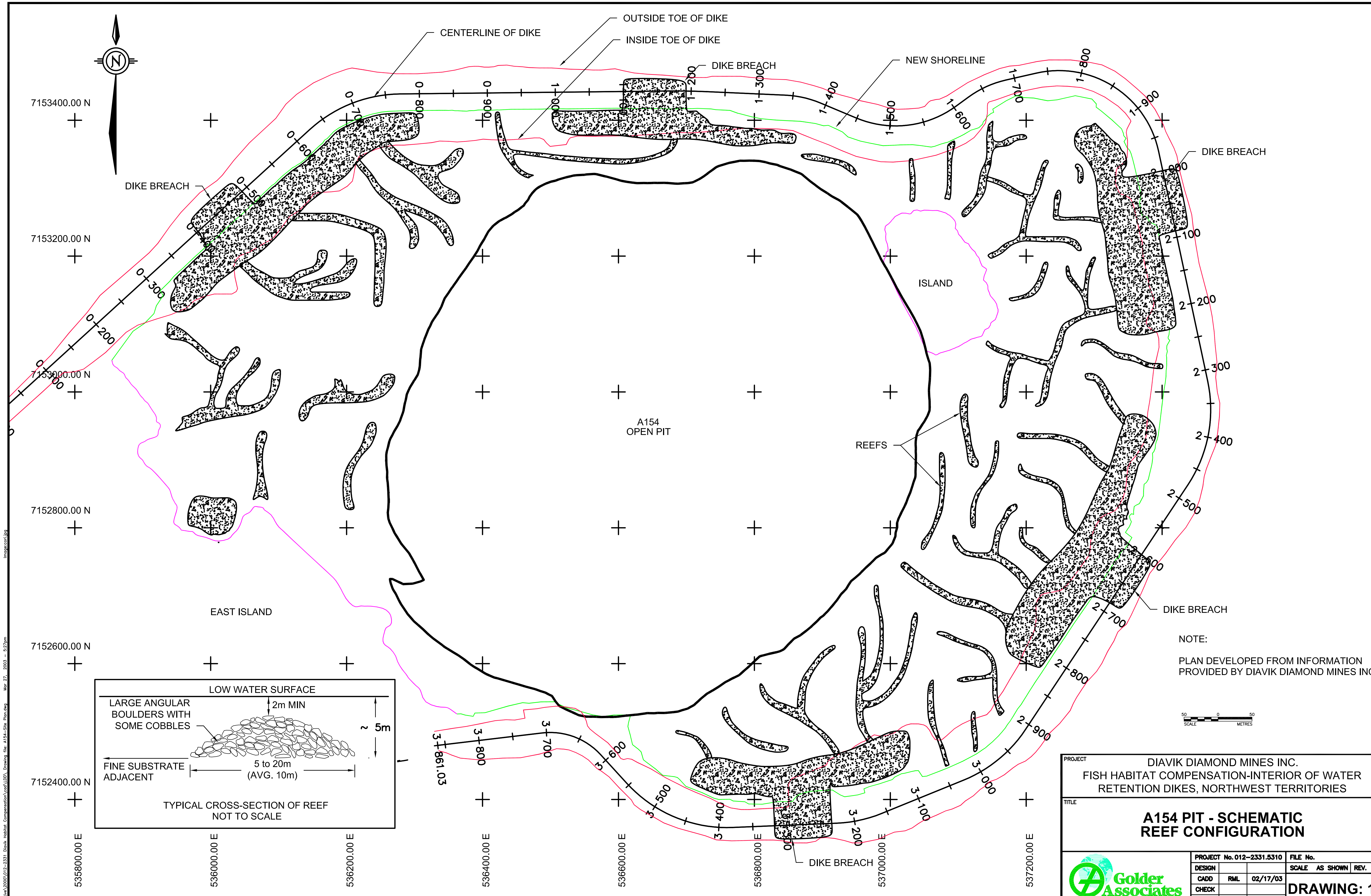
REVIEW				



PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A154 PIT - SCHEMATIC REEF CONFIGURATION

Golder Associates
Saskatoon, Saskatchewan

PROJECT	No. 012-2331.5310		FILE No.			
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CHECK						
REVIEW						

DRAWING: 10

N:\Active\2000\012-2331 Diavik Habitat Compensation\cad\LDD\ Drawing file: A154-Site Plan.dwg Mar 27, 2003 - 5:27pm Image:cori.jpg

REPORT ON

FISH HABITAT DESIGN FOR THE A418 PIT SHELF AREA AT THE DIAVIK DIAMOND MINE

Submitted to:

Diavik Diamond Mines Inc.
P.O. Box 2498
5007 – 50th Avenue
Yellowknife, Northwest Territories
1XA 2P8

Attention: Mr. Gord MacDonald

DISTRIBUTION:

1 Copy - Diavik Diamond Mines Inc., Yellowknife (+1 CD)
1 Copy - Golder Associates Ltd., Saskatoon
1 Copy - Golder Associates Ltd., Vancouver

December 2008
07-1328-0001

Doc No. RPT-788 Ver.0 Rev.1

EXECUTIVE SUMMARY

This report presents the detailed design for the creation of fish habitat on the interior of the A418 water retention dike for the Diavik Diamond Mines Inc. diamond mine located on Lac de Gras in the Northwest Territories, Canada. This design was prepared in accordance with the "No Net Loss" plan prepared by Diavik Diamond Mines Inc.

This design is applicable to the A418 pit and has been prepared by developing criteria for the end result. This approach provides flexibility on the part of Diavik Diamond Mines Inc. as to how the end result is achieved.

The fish habitat creation on the interior of the dikes consists of placing material excavated from the open pits in the area between the pit crest and the toe of the dikes, to create an area generally varying from 3 to 5 m below the mean normal water level for Lac de Gras. During mining operations, the toe of the fill will be set back from the edge of the pit crest for safety. At the completion of mining, the fill will be extended to the pit crest.

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LIST OF FIGURES

TABLE OF CONTENTS (Continued)

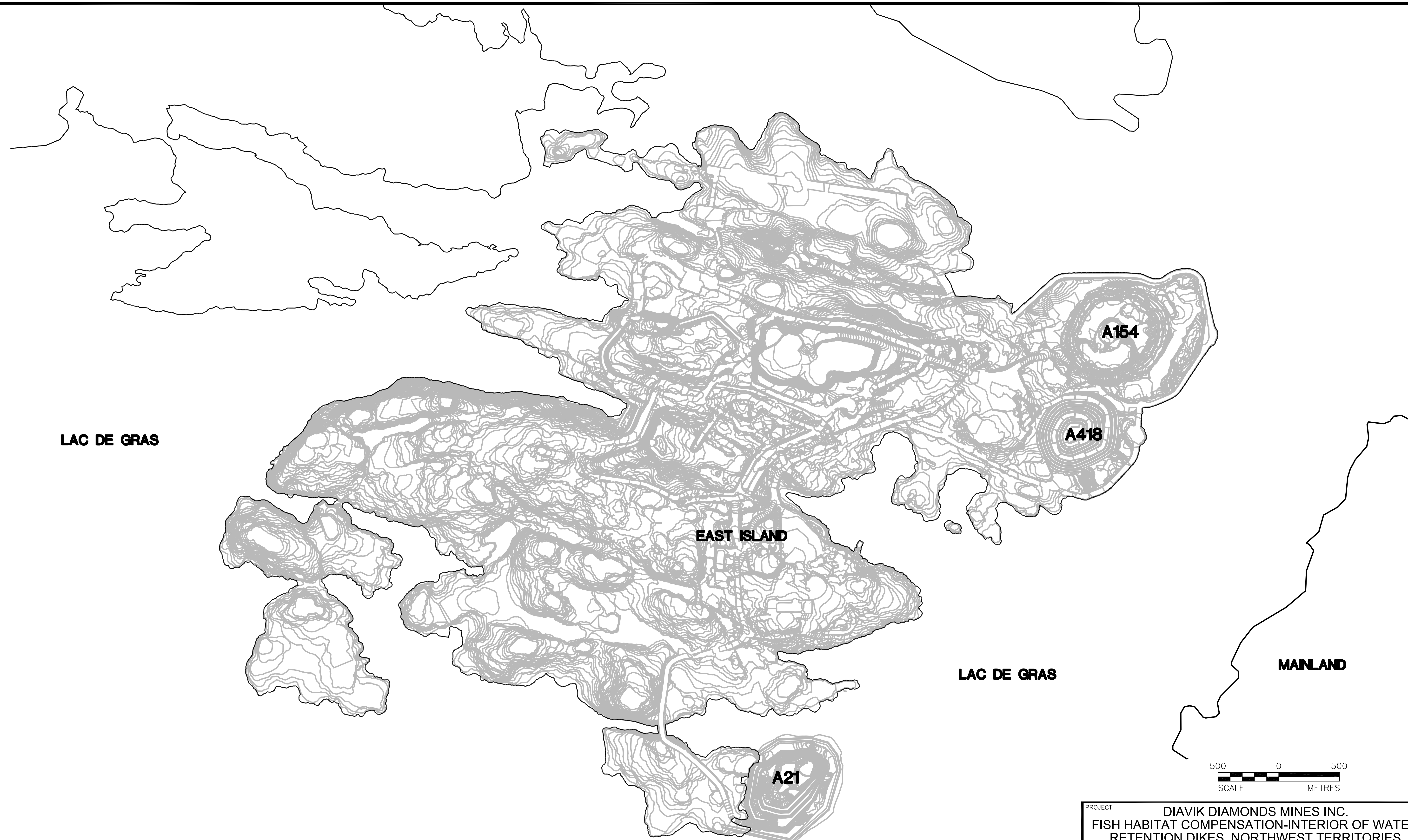
LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the detailed design for the fish habitat compensation plan for the interior of the water retention dikes (i.e., the pit shelf) at the Diavik Diamond Mines Inc. (DDMI) diamond mine in the Northwest Territories. The location of the mine is shown in Figure 1. This detailed design is based on the “No Net Loss” (NNL) Plan (Diavik 1998), and the conceptual fish habitat plan prepared by Golder Associates Ltd. (Golder 2001). The conceptual fish habitat compensation plan for the pit shelf is to construct habitat on the shelf, by filling in the lower elevation (deeper water) areas. The general plan is to fill in the areas on the shelf that are deeper than 5 metres (m) of water depth with materials excavated during development of the pits.

As stated, this document provides the detailed design for the fish habitat compensation for the pit shelf; however, it does not provide specifications for construction. Rather, this document provides details for achieving the desired end result, while providing flexibility in how the end result is achieved. The requirement for this flexibility is due to some of the unknowns with respect to material parameters, mine operations (i.e., blasting details, availability of various materials), and construction timing. The habitat design parameters were developed considering fish habitat, surface water runoff, and geotechnical issues. Design details with respect to surface water handling, material selection, construction, and other issues would be addressed by DDMI, to achieve the desired habitat compensation prior to reflooding of the diked areas.

This design applies specifically to the A418 pit; however, it is similar in concept to plans developed for the A154 and A21 pits. Both A154 and A418 have been constructed with the A418 construction completed in 2006. A21 is currently under financial review and has no scheduled construction timeline. The water retention dike (dike) locations and pit layouts for A418 were modified slightly during construction, and have resulted in minor changes in habitat areas when compared with the original NNL Plan predictions. It is intended that the design details (particularly setback distances and slope angles) be reviewed prior to construction of fish habitat compensation measures to incorporate knowledge gained from the construction and performance of A154, as well as any additional studies, investigations and analyses conducted after the preparation of this report. It will also be important to consider mine operations, seepage control measures for the dikes, overall pit stability and instrumentation/monitoring requirements. It was understood that the pits will be developed in a series of expansion cuts, thus permitting the opportunity to monitor slope stability and pore-pressures in the in situ materials in each pit well in advance of the excavation of the final pit slopes, and construction of the fish habitat fills.



PROJECT

DIAVIK DIAMONDS MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

PROJECT LAYOUT

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
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CHECK	AL	18/12/08	FIGURE: 1	
REVIEW	PGB	18/12/08		

G:\2007\1328\07-1328-0001 Diavik Phase 2000\cad\07-1328-0001 Figure 1.dwg Dec 18, 2008 - 4:43pm

2.0 BACKGROUND

The objective of the fish habitat compensation measures on the interior of the water retention dikes is to provide spawning, nursery, rearing and foraging habitat for lake trout (*Salvelinus namaycush*), cisco (*Coregonus artedi*), round whitefish (*Prosopium cylindraceum*), lake whitefish (*Coregonus clupeaformis*), longnose sucker (*Catostomus catostomus*), burbot (*Lota lota*), northern pike (*Esox lucius*), and slimy sculpin (*Cottus cognatus*), in addition to rearing and foraging habitat for Arctic grayling (*Thymallus arcticus*). The primary gains in habitat are expected to relate to rearing habitat for lake trout, cisco, and slimy sculpin. The habitat on the insides of the dikes was to be designed to be similar to the pre-mine habitat in the north inlet which was considered a shallow, productive area of the lake. The objectives and conceptual design for the fish habitat compensation, were outlined in Golder's report entitled "*Conceptual Design and Compensation Workplan for the Fish Habitat Compensation Program, Diavik Diamond Mines Inc., Lac de Gras*", dated August 2001. The conceptual design consisted of:

- Re-contouring the pit shelf (area between the interior toe of the water retention dike and the crest of the pit slope) to provide habitat with a water depth of approximately 5 m after the dike is breached. New habitat will only be constructed where the pre-mining water depth exceeded 5 m; the shallower areas of the shelf will not be excavated, as these areas already provide shallow water habitat. If fill is placed in this area during mine operations, setbacks will be required between the pit crest and the toe of the slope, as well as between the interior toe of the dike and the toe of the fill slope. These areas could be filled near the end of mining, or after completion of mining, if required.
- Constructing long, narrow, rocky reefs extending from the interior slope of the dike to the crest of the open pit. The reefs would be built in areas where the water depth is 5 m and would be approximately 2 to 3 m high. Areas of granular and soft substrates between the reefs would be based on the conditions that existed in the north inlet.
- Modification of disturbed shoreline areas to establish conditions similar to pre-development. This may include placement of boulders in water depths up to about 5 m.
- Flooding the area after completion of habitat construction.
- Breaching the dikes to create shallow (minimum 2 m depth from low water) entrances, to deter the movement of larger fish into the nursery and feeding habitat, similar to the rearing habitat in the north inlet.

3.0 DESIGN PARAMETERS

3.1 Geotechnical Parameters

Geotechnical parameters used were similar to those used in the fish habitat design for pit A154, as the material composition and construction guidelines for the fish habitat compensation on the pit shelves are similar. Bathymetric contours, till thickness isopachs, and sediment thickness isopachs for the A418 pit area were updated in the analysis, as were till strength properties and seismic parameters. During the final design and construction stage, these input parameters can be re-evaluated as necessary if new information becomes available.

Till and sediment samples were characterized as part of the fish habitat design for A154, as described in the Golder report number 012-2331, "*Fish Habitat Design for the Pit Shelf Areas at the Diavik Diamond Mine*", dated March 2003 (Golder 2003). Since then, additional testing has been conducted on the till; therefore, updated material properties for the till material on site were incorporated into the fish habitat design for the A418 pit. Due to the thickness of the lake sediments and its similarity to the till material, the sediments were modelled as till in the analysis. Material properties used in the stability analysis are summarized in Table 1.

Table 1
Material Strength Properties Used for Stability Analysis

Material	Unit Weight (kN/m^3)	Effective Angle of Internal Friction (°)	Effective Cohesion (kPa)
Till	22	34	0
Sediment	22	34	0

Notes: kN/m^3 = kiloNewtons per cubic metre; ° = degrees; kPa = kilopascal.

The bathymetric information in the A418 area indicated that the maximum water depth was about 22 m. The deepest water around the pit crest appears to be approximately 17 m, and the deepest water near the toe of the dike is also approximately 17 m. The highest expected face of placed aquatic habitat fill over the long-term for A418 is expected to be approximately 11 m.

Based on available information from exploration boreholes, the lakebed sediments range from about 0 to 5 m thick and are typically less than 2 m thick, except for a few localized pockets. The in situ till, beneath the sediment, ranges up to approximately 10 m thick and is typically 5 to 9 m thick.

3.2 Fish Habitat Parameters

3.2.1 Overview of No Net Loss Requirements related to Insides of Dike Areas

The Fisheries Authorization identified the requirements for achieving NNL of habitat for all aspects of the DDMI Diamond Project. Specific requirements for the inside of the A418 dike include:

- the development of shallow rearing habitat, spawning shoals, and shoreline habitat within the dikes areas around the open pits in Lac de Gras upon completion of mining in each open pit; and
- ensuring that the habitat features within the dikes areas are modelled after those features found in other productive areas of Lac de Gras, including depth, substrate type, size, and configuration.

Four key zones of habitat were identified in the NNL Plan (Diavik 1998) for the area found inside the constructed dike during the post closure phase. These included:

1. Inside edge of the dike. The area of water depths from 0 to 2 m along constructed sections of the dike representing new shoreline habitat.
2. Reclaimed shorelines. Areas of pre-existing shorelines.
3. The pit shelf. The area between the inside edge of the dike, the shorelines, and the pit crest.
4. Deep water. The pit itself as it will have a depth of approximately 210 m.

The NNL Plan provided Habitat Unit (HU) calculations based on the available design information for the dikes and pits at the time. Some modifications to the dike design and pit dimensions were made subsequent to the submission of the NNL plan, and the new HU calculations reflect these changes. The HUs calculated as part of the NNL Plan Addendum (DDMI April 1999), along with re-calculated values based on this updated information are presented in Appendix I.

The following sections outline the general principles and criteria to be used in developing the final layout for the A418 dike area. As discussed in the NNL, the primary focus for habitat creation inside of all dikes is based on providing spawning, nursery, rearing and foraging habitat. Target species include lake trout, arctic grayling, burbot, longnose sucker, round whitefish, cisco, lake whitefish, northern pike, and slimy sculpin.

3.2.2 Overall Criteria

Several overall governing criteria can be applied to the habitat creation activities inside the dike. First of all, areas inside the dike on the pit shelf that are already at a depth of 4 m or less should not be disturbed if possible. This will allow the maintenance of habitat features not easily re-created. In areas where final depth is between 4 and 5 m, it would be desirable to maintain existing habitat depending upon grading requirements for drainage, or other construction/operational considerations. Existing shoreline features should also be maintained to the extent feasible. Construction crews should avoid driving on, dumping on, scraping, or otherwise impacting these areas. Leaving these areas intact will decrease the amount of work required to restore the shoreline at closure and will speed the recovery process of the altered areas inside the dike as a variety of organic properties, including the possibility that dormant life stages of some plants or animals will be present in the substrate.

The storage and handling of materials, particularly hydrocarbons or other types of contaminants should be closely monitored on the shorelines, pit shelf, and inside edges of the dike. Heavy equipment in the area should be maintained and fuelled in a manner that avoids the possibility of spills occurring in areas to be reclaimed as fish habitat.

3.2.3 Inside Edges of Dike

The inside edge of the dike is intended to provide new shoreline features for foraging and rearing habitat for most species as well as other values, including spawning, for slimy sculpin. The dike itself will resemble existing shoreline and reef habitat and is expected to provide a rocky (boulder/cobble), moderate slope area with low to moderate wind and wave action. The NNL plan habitat evaluation completed for the inside edge the dike treated this area as shoreline habitat.

Suitable materials for this habitat feature are a mix of primarily large boulder with some smaller cobble. Slopes should also ensure a stable profile and range from gentle to moderate. The range of slopes for existing shorelines should be used as a guideline. The area of habitat gain predicted in the NNL plan as well as the area based on the constructed dike alignment for this habitat type is provided in Table 2. For A418, based on constructed dike configuration and the design criteria presented in this report, 0.34 hectares (ha) of new shoreline habitat are expected to be created.

Table 2
Inside Edge of the Dike Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	0.48	0.34

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.2.4 Reclaimed Shorelines

The objectives for the pre-existing shoreline along the edge of the diked area, and around any islands within diked areas, are to:

- minimize change to existing substrates or other features; and
- re-configure disturbed portions to pre-development conditions as much as possible.

This will allow the shoreline areas to be restored to pre-existing conditions once the dike is breached. Any areas of disturbed shoreline are to be re-configured to provide fish habitat resembling that which was temporarily lost during the project. This may include placement of boulders in water up to 5 m deep to provide a sloping shoreline. The area of habitat predicted in the NNL plan for this habitat type is provided in Table 3. For A418, based on the dike configuration and design criteria presented in this report, 1.2 ha of shoreline habitat are expected to be reclaimed and includes shoreline areas around one island on the pit shelf.

Table 3
Reclaimed Shoreline Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	0.61	1.2

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.2.5 Pit Shelf

The pit shelf area extends from the lower inside edges of the dike to the edges of the pit. The reclaimed pit shelf area is intended to provide shallow foraging and rearing habitat for most species of fish present in Lac de Gras. Material excavated from the pit will be used to fill in deeper portions of the pit shelf area. The area of the pit shelf will be covered by water that ranges from 3 to 5 m deep. As per the *Navigable Waters*

Protection Act Permit for the project, no dike breach or constructed shoal features will be less than 2 m below the expected low water level in Lac de Gras.

As indicated in the NNL plan and the Fisheries Authorization, the objectives for the selection of substrate type are based on reflecting physical characteristics of other areas of good foraging and rearing in Lac de Gras. The pit shelf configuration is also to be based on reflecting the physical characteristics of other productive habitats within Lac de Gras. In order to address these objectives, substrate information from baseline data collections was used and a basic configuration evaluation of the North Arm and two other nearby inlets identified as rearing areas within Lac de Gras was completed. The configuration evaluation was completed through air photo interpretation. Key features identified by assessing other rearing areas included:

- Rocky Shoal Shape – Rocky shoals should be somewhat irregular in size and shape and relatively long and narrow. Some may also be constructed like a series of submerged rocky humps like links in a chain. Longer and narrower reefs have more "edge" habitat. Edges are important to fish that feed in one habitat type and rest or seek refuge in another.
- Isolated Pond-like Areas - In some cases it is beneficial to small fish to have the reefs forming a disjointed "ring" to provide pond-like conditions where circulation is limited.
- Hard to Soft Substrate Ratio - The hard substrate (shoals areas) to soft substrate (depositional areas) ratio in other nearby rearing areas ranged from 25 to 40% hard with the remainder as soft substrate.
- Access to Refuge Habitat – Rocky reefs provide refuge or cover for small fish. It is important for fish to have connectivity between rocky areas and reefs to avoid exposing themselves for extended distances or periods of time to predators. Keeping the distance between rocky reef areas less than 30 to 40 m will allow fish reasonable access refuge, or hiding places.

Shape Configuration

With regard to water circulation within the diked area, several features should be incorporated to reduce circulation. The shallow nature of the breaches, shallow nature of the pit shelf, and the creation of shoals on the pit shelf will reduce circulation and wind and wave action. The shallow water is expected to warm up quickly in the spring, relative to open areas of the lake, because of the limited water circulation within the enclosed area. As with other rearing habitats in Lac de Gras, warmer water should, therefore, assist in increasing biological productivity inside the dike by providing a warmer refuge, and foraging area.

Determining the locations of the reefs should take several factors into consideration. Reefs should have some connectivity to the dikes and other reefs to allow fish to travel throughout the area without being fully exposed to predators for long distances. If the reefs are long, winding, and finger-like, a large amount of “edge” habitat will be created to allow fish to feed in the fine substrate while maintaining close proximity to the cover provided by the rocky reefs. Ideally, the reefs will be placed in areas where the final water depth will be 3 to 5 m deep and the tops of the reefs will remain under at least 2 m of water at all times. This will allow the reef habitat to remain functional even in winter with ice thickness of up to 2 m. Widths of the reefs should vary between 5 and 30 m, averaging from 10 to 20 m in width. The distance between the reefs could range from 10 to 40 m, averaging from 20 to 30 m apart. Habitat diversity is important and varying the size and shape of the reefs throughout the pit shelf area is expected to improve its value as fish habitat.

Substrate Material

Based on the substrate materials within the North inlet substrates on the pit shelf should be mostly fine material, primarily sand and silt interspersed with rocky reefs for habitat diversity. The till (existing lake substrate) is primarily sand and silt with some gravel. The till material will therefore be an appropriate substrate for the expected biological zone of the sediments (i.e., approximately top 10 centimetre (cm) layer represents the biological zone). The fine substrate areas are expected to support a variety of benthic organisms that will provide forage for small fish.

If till is placed over angular rock to provide the soft substrate zone, it should be a layer deep enough to maintain at least 0.5 m depth of soft substrate after settling, accounting for some migration of fines into the voids in the rock fill.

Reefs should be constructed of granular material of a range of sizes. The primary material should be large boulder size rock with some smaller cobble material. The objective is to create refuge habitat, or hiding areas, among the rocks. Angular, unconsolidated material would provide this benefit. Run of mine blast rock is expected to be acceptable for this purpose.

The area of habitat predicted in the NNL plan for this habitat type is provided in Table 4. For A418, based on constructed dike configuration and the design criteria presented in this report, 9.4 ha of shallow rearing and foraging habitat are expected to be created.

Table 4
Pit Shelf Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	8.68	9.4

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.2.6 Deep Water (Pit Area)

The deep water habitat created by the project will be located in the mine pit, near the center of the diked area. The deep water will provide a cooler environment for fish and was considered a pelagic zone in the NNL plan. This area will likely be used by pelagic feeding fish such as cisco and may provide other benefits (e.g., over wintering habitat). The maximum depth of the pit areas is anticipated to be 210 m. The area of habitat predicted in the NNL plan for this habitat type is provided in Table 5. For A418, based on constructed dike configuration and the design criteria presented in this report, 34.13 ha are actually expected to be created.

Table 5
Deep Water Habitat Areas

Dike	No Net Loss Predicted Area (ha)	Current Predicted Area[(a)] (ha)
A418	41.94	34.13

Notes: ha = hectare.
(a) = Based on final constructed configuration of the A418 dike.

3.3 Construction Considerations

There are a number of construction considerations that arise due to the variability in the material parameters, pore-pressure conditions, blasting effects, and construction timing. The following construction considerations were evaluated with respect to the detailed design of the fish habitat compensation measures for the pit shelf areas:

- It was understood that flowing artesian conditions were present in the southeast portion of the A154 pit shelf. Artesian conditions may cause build-up of porewater pressures within the fill on the pit shelf, depending on drainage conditions and the development of frozen layers. It is unknown if similar conditions exist on the A418 pit shelf.

- The fine-grained lake-bottom sediments are expected to provide poor trafficability, particularly where artesian conditions exist, and when the materials are thawing. Portions of the A418 dike are expected to encounter permafrost, which would also present poor trafficability conditions if it thaws.
- A berm will be required between the pit crest and the toe of the fish habitat fill to provide safety with respect to equipment travelling too close to the pit crest and to reduce the potential for fill materials spilling into the pit during placement. The berm could also be used as a construction access road prior to pit development adjacent to the berm.
- The majority of the fill volume may consist of either till or rock fill, depending on construction timing and material availability. The final surface of the fill will consist of till, or lake-bottom sediments, to support aquatic life. The thickness of the final till/sediment layer will depend on whether a filter is used between the rock and till. DDMI will be responsible for picking the construction methods, and materials handling such that adequate quantities of till are available for the final fill surface.
- Based on gradation information for the till from the A154 pit shelf, it is anticipated that at least two, and possibly three graded aggregate filters would be required to prevent the till from migrating into the voids within the rock fill. Production of filter material would likely be relatively expensive, since it would involve crushing, screening, stockpiling, and double handling of the materials. It has been assumed that a filter between the rockfill and the till would not be utilized, due to logistical and economic considerations. As an alternative to using a filter, the thickness of the till cover on a rock fill can be varied as a function of the total fill thickness. The premise for this approach is that a certain portion of the till will migrate into the void spaces in the rock fill, so the thickness of the till cover must be such that a minimum of 0.5 m of till remains on top of the rock. For design purposes, it has been assumed that the porosity of the rock fill would be approximately 30 percent, and that with time, till would migrate into the rock such that 50 percent of the available voids would be filled. Thus, using this approach, the minimum thickness of till required over the rock is equal to 15 percent of the rock fill thickness, plus 0.5 m. If this approach is adopted, some overbuilding of the till layer should be considered to maintain the desired water depths after the till migrates into the rock fill, especially where the till thicknesses are greater. Theoretically, where rocky reefs are to be constructed, till would not be required between the rock fill and reef material.
- Rock fill has the advantages of higher shear strength and better potential for drainage/dissipation of pore-water pressures. Rock fill may require a smaller thickness than till to provide a stable trafficking surface for the initial lifts.
- Rock fill would permit faster infiltration than till, which may provide a more stable trafficking surface after precipitation events and during spring thaw.

- Till will be available earlier in the mining cycle for each pit, since it overlies the bedrock. Materials may be transported between pits, if required.

4.0 STABILITY ANALYSES

4.1 Overall Pit Stability

Golder prepared various reports regarding the stability of the A154 pit (Golder 1999, 2000, 2002, 2002a). The overall pit stability for A418 was assessed in Golder's report entitled, "*A418 Feasibility Pit Slope Design*" (Document No. Rpt-138, dated January 11, 2007). Pertinent items from this report related to the fish habitat compensation fills are as follows:

- Fractured rock zones similar to Dewey's Fault in the vicinity of the A154N/S pipes have not been encountered in the A418 area; however, a bathymetric low, trending a north-south direction, occurs in the south through southeast area of the planned pit. This feature is not fully understood, although while it has been speculated that it could potentially be a zone of high hydraulic conductivity, there is currently no evidence to support this.
- Modelling showed that depressurization will be necessary for Section 130 in order to achieve the required safety factor for the overall slope. Recommendations were provided for piezometer installations to monitor the depressurization of the pit wall.

Construction of the fish habitat compensation fill will require a setback from the crest of the pit to the toe of the fill, such that the overall pit stability is not significantly impacted by the presence of the fish habitat fills on the pit shelf during operations.

4.2 Stability of Fish Habitat Fills

Slope stability analyses were carried out to determine the stability of the fish habitat fills, and the required setback from the pit crest. The impact of the placed material on the stability of the pit was also checked.

Stability analyses were carried out using the computer program, SLOPE/W. Factors of safety were calculated using the principle of limit equilibrium, for potential sliding along assumed failure surfaces for each of the selected cross-sections. Factors of safety were computed using both Spencer's method and the Morgenstern-Price method, which satisfy both force and moment equilibrium. Based on the type of soil and the configuration of the habitat, both circular and wedge failure mechanisms were assessed. The factor of safety was assessed for a phreatic level which was situated at the top of the till/lake sediment surface, simulating saturated conditions in the pit shelf. This is considered conservative due to cut-off measures to be implemented during the dyke construction.

The effects of blasting in the pit on the stability of the fill were assessed by using a pseudo-static limit equilibrium analysis using a 1:2500 year return earthquake value of 0.06 g in the horizontal direction. As production blasting data is accumulated, the impact of blasting may be reassessed and the design refined.

The results of the stability analyses are summarized in Appendix II. The stability analyses indicate that computed factors of safety for the fills are in excess of 1.4 for the conditions during mining. A conservative approach with respect to setback distances and slope angles is proposed, combined with monitoring to assess modifications to the proposed design as mining proceeds, due to the critical importance of maintaining stability during operations. The recommended setback from the pit crest (i.e., top of the in-situ till slope to the toe of the fish habitat fill) is four times the height of the fill (taken as the difference between the ultimate top of the fill and the elevation of the pit crest), with a minimum of 15 m. The slope of the faces of the fish habitat fill facing the pit and the interior of the dikes should be 3H:1V or flatter. As mining progresses, it may be possible to modify the setback and slope angle parameters.

5.0 CONSTRUCTION GUIDELINES

The recommended configuration of the fish habitat on the A418 pit shelf is based on the following guidelines:

- Construct fills with face slopes of 3H:1V during mining, and final slopes at the angle of repose adjacent to the pit crest at the completion of mining.
- Setback from the pit crest to the toe of the fill equal to four times the elevation difference between the top of fill and the pit crest, with a minimum distance of 15 m.
- To the extent feasible, areas of existing shallow habitat (i.e., water depth less than 5 m below mean normal water level) should remain untouched.
- A berm should be constructed between the toe of the till slope and the crest of the pit. This berm will help retain material that erodes from the slope of the fish habitat fill and keep it away from the pit, and will also reduce the potential for any material rolling down the slope and into the pit during fill placement. A minimum setback of 5 m from the crest of the pit to the toe of the berm has been used. As a minimum, the berm would be approximately 2 m high, with a 2 m crest width and 2H:1V sideslopes. The geometry of this berm may be modified on the basis of construction techniques.
- A setback from the interior toe of the water retention dike, to the upstream toe of the fill may also be required. This setback distance should be determined by DDMI, based on operational requirements and surface water handling requirements. Construction must also accommodate instrumentation for monitoring seepage through the dike, and overall pit slope stability.
- Construction in one lift is acceptable.
- The materials used to construct the fill may consist of till, rock fill, or a combination of materials. If rock fill is used to construct the lower portion of the fill, the thickness of till to create the final surface should be a minimum of 0.15 times the height of rock fill, plus 0.5 m. Alternatively, filter zones could be provided between the rock fill and the till. Details of the filter zones would have to be developed further, once construction techniques and material gradations are determined. Processing of the blast rock will be required to produce filter materials, and is likely to be expensive. If the filter zone approach is taken, it is likely that at least two, and possibly, three filters would be required.
- Grading of the surface of the fill at a nominal grade of 1% is recommended, to direct surface water towards the water collection system at the toe of the dike.
- Final contouring of the surface will be required to establish some relief to provide fish habitat (i.e., some hummocks and hollows, rather than an evenly graded surface).
- Rock ridges or reefs are also required for fish habitat. These reefs should be constructed of non-acid generating country rock.

6.0 DETAILED DESIGN DRAWINGS

A set of detailed design drawings is included in Appendix III for the A418 pit. The design drawings indicate the desired end results, and provide DDMI with flexibility in regards to construction materials, methods, and timing. Operational considerations and the results of monitoring programs to assess seepage through/below the dike, and overall pit slope stability should be taken into account when planning the construction of the fish habitat fills. At the end of mining, construction of angle of repose slopes adjacent to the pit crest will be required. The exact extent of the fill, placement procedures, and safety protocols should be developed prior to construction.

7.0 MONITORING RECOMMENDATIONS

Monitoring of various parameters is recommended to confirm the design assumptions, and to provide information for refining the design of the fish habitat on the pit shelves. It is recommended that monitoring consist of:

- Monitoring pore-water pressures in the lake-bottom sediments and till that will form the foundation for the fish habitat fills to assess drainage due to pit development, as well as pore-pressures due to fill placement and blasting.
- Monitor pore-pressures within the fish habitat fills, so that the slope stability analyses can be confirmed.
- Monitor movements of the fish habitat fills using a series of monitoring prisms, slope inclinometers or other technologies, consistent with monitoring of the overall pit slopes. Visual inspections should also be conducted to check for signs of instability, such as bulging, slumping, or the development of tension cracks.

Monitoring programs have previously been recommended for the water retention dikes and for monitoring the overall pit stability. It is recommended that the monitoring for the fish habitat fills on the interior of the dikes be integrated into the overall monitoring program, to provide consistency, and improve the efficiency of the monitoring efforts.

8.0 CLOSURE

We trust this report presents the information that you require. Please feel free to call at anytime if you have any questions or concerns.

GOLDER ASSOCIATES LTD.

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APPENDIX I

SUMMARY OF HABITAT UNIT ACCOUNTING FOR A418

Table I-1
No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, from No Net Loss Addendum, 1999

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Spawning	LKTR	0.10	0.07	-0.03
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.06	-0.05
	RNWH	0.02	0.05	0.03
	LKWH	0.04	0.02	-0.02
	LNSC	0.02	0.01	-0.01
	BURB	0.02	0.00	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.18
Rearing	LKTR	1.00	3.60	2.60
	ARGR	0.17	0.26	0.09
	CISC	1.53	3.47	1.94
	RNWH	0.26	0.61	0.34
	LKWH	0.28	0.62	0.34
	LNSC	0.30	0.48	0.19
	BURB	0.19	0.27	0.08
	NRPK	0.00	0.00	0.00
	SLSC	0.26	0.43	0.17
Foraging	LKTR	0.90	0.96	0.06
	ARGR	0.10	0.13	0.04
	CISC	0.88	1.65	0.77
	RNWH	0.17	0.28	0.11
	LKWH	0.15	0.28	0.13
	LNSC	0.21	0.24	0.03
	BURB	0.11	0.12	0.00
	NRPK	0.00	0.00	0.00
	SLSC	0.14	0.21	0.06
Nursery	LKTR	0.10	0.06	-0.04
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.06	-0.05
	RNWH	0.02	0.05	0.03
	LKWH	0.04	0.02	-0.02
	LNSC	0.02	0.01	-0.01
	BURB	0.02	0.00	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.18
Total		7.33	14.45	7.12

Table I-1

No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, from No Net Loss Addendum, 1999 (continued)

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Total by life stage	Spawning	0.34	0.43	0.10
	Rearing	4.00	9.73	5.74
	Foraging	2.66	3.86	1.20
	Nursery	0.34	0.42	0.08
Total by species	LKTR	2.11	4.69	2.59
	ARGR	0.27	0.40	0.13
	CISC	2.62	5.23	2.61
	RNWH	0.47	0.99	0.51
	LKWH	0.51	0.94	0.43
	LNSC	0.55	0.74	0.19
	BURB	0.34	0.40	0.06
	NRPK	0.00	0.00	0.00
	SLSC	0.47	1.06	0.60

Notes: LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

Table I-2

No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, Recalculated with Constructed Dimensions for A418 Dike

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Spawning	LKTR	0.10	0.09	-0.01
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.07	-0.03
	RNWH	0.02	0.06	0.04
	LKWH	0.04	0.03	-0.01
	LNSC	0.02	0.01	-0.02
	BURB	0.02	0.01	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.17
Rearing	LKTR	1.00	3.25	2.24
	ARGR	0.17	0.24	0.06
	CISC	1.53	3.11	1.58
	RNWH	0.26	0.56	0.30
	LKWH	0.28	0.59	0.31
	LNSC	0.30	0.45	0.15

Table I-2

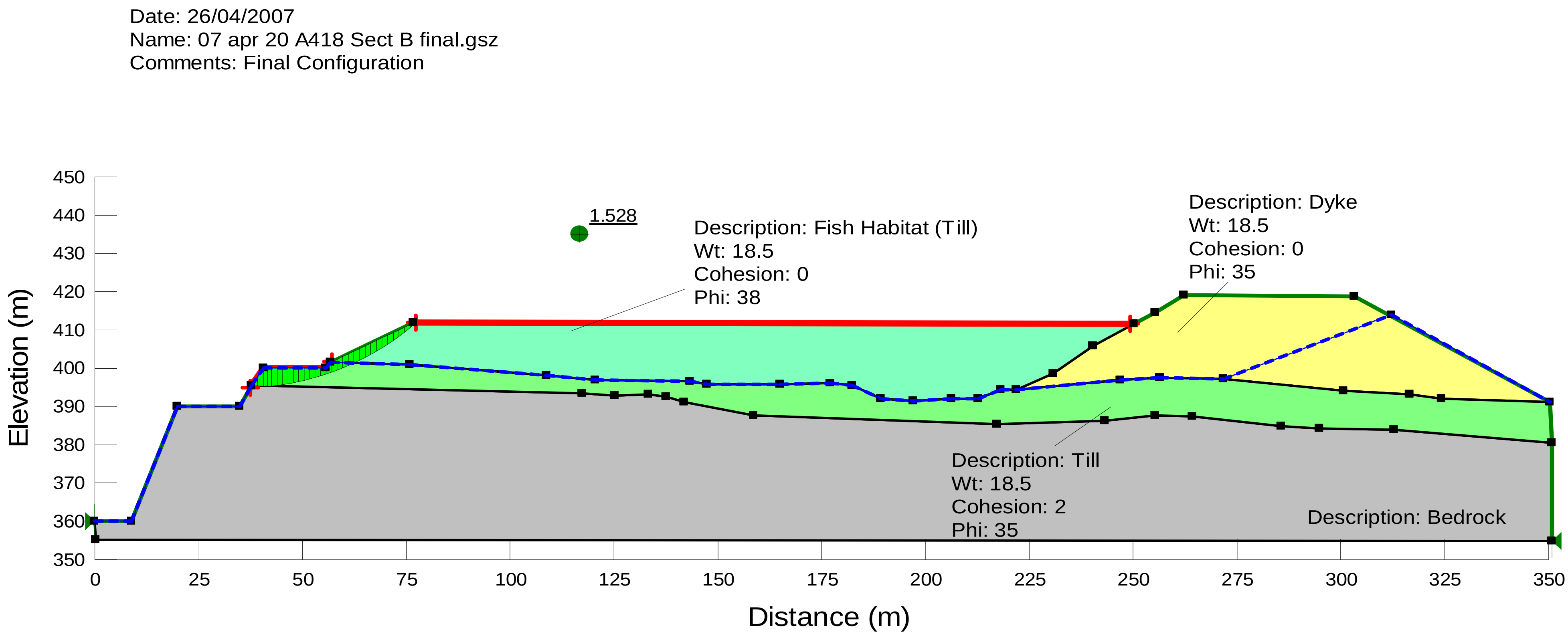
No Net Loss Habitat Summary "Accounting" Showing Habitat Units for A418, Recalculated with Constructed Dimensions for A418 Dike (continued)

Life Stage	Species	A418 (2009-2023)		Net Change
		loss	gain	
Rearing (continued)	BURB	0.19	0.25	0.06
	NRPK	0.00	0.00	0.00
	SLSC	0.26	0.41	0.16
Foraging	LKTR	0.90	0.88	-0.03
	ARGR	0.10	0.12	0.03
	CISC	0.88	1.47	0.59
	RNWH	0.17	0.25	0.09
	LKWH	0.15	0.26	0.11
	LNSC	0.21	0.22	0.02
	BURB	0.11	0.11	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.14	0.19	0.05
Nursery	LKTR	0.10	0.08	-0.02
	ARGR	0.00	0.00	0.00
	CISC	0.11	0.07	-0.03
	RNWH	0.02	0.06	0.04
	LKWH	0.04	0.03	-0.01
	LNSC	0.02	0.01	-0.02
	BURB	0.02	0.01	-0.01
	NRPK	0.00	0.00	0.00
	SLSC	0.03	0.21	0.18
Total		**7.33**	**13.28**	**5.95**
Total by life stage	Spawning	0.34	0.46	0.13
	Rearing	4.00	8.85	4.86
	Foraging	2.66	3.51	0.85
	Nursery	0.34	0.45	0.12
Total by species	LKTR	2.11	4.29	2.18
	ARGR	0.27	0.36	0.09
	CISC	2.62	4.72	2.10
	RNWH	0.47	0.93	0.45
	LKWH	0.51	0.90	0.40
	LNSC	0.55	0.69	0.14
	BURB	0.34	0.38	0.04
	NRPK	0.00	0.00	0.00
	SLSC	0.47	1.02	0.56

Notes: LKTR = lake trout; ARGR = Arctic grayling; CISC = cisco; RNWH = round whitefish; LKWH = lake whitefish; LNSC = longnose sucker; BURB = burbot; NRPK = northern pike; SLSC = slimy sculpin.

APPENDIX II

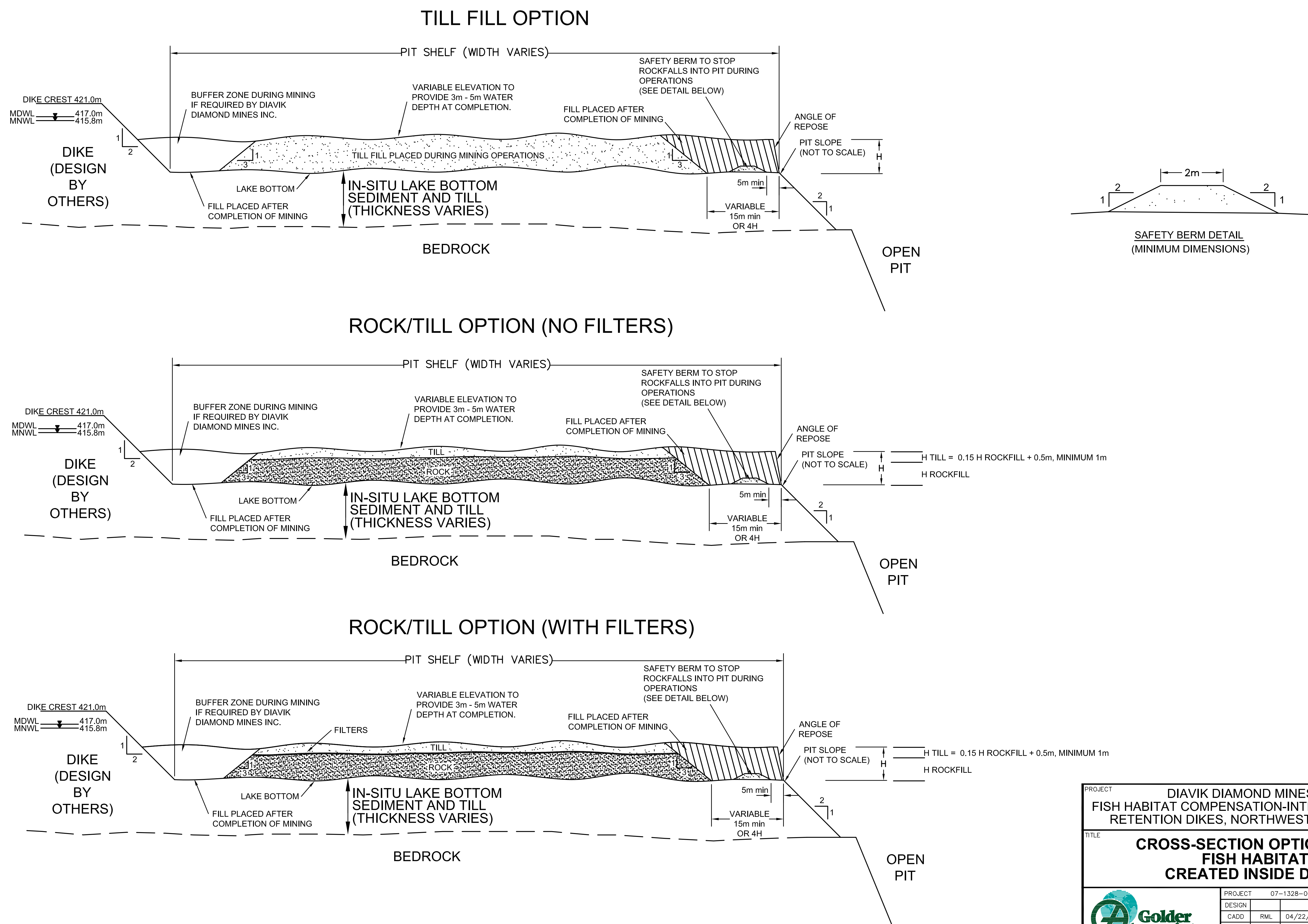
SUMMARY OF SLOPE STABILITY ANALYSES



PROJECT	DIAVIK DIAMONDS MINES INC. FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES				
TITLE	A418 STABILITY ANALYSIS RESULTS				
Golder Associates Saskatoon, Saskatchewan	PROJECT	07-1328-0001		FILE No.	
	DESIGN	EAM	23/09/08	SCALE N/A	REV.
	CADD			FIGURE:II-1	
	CHECK	RML	18/12/08		
	REVIEW	PGB	18/12/08		

APPENDIX III

DETAILED DESIGN DRAWINGS



PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
CROSS-SECTION OPTIONS FOR FISH HABITAT CREATED INSIDE DIKES

Golder Associates
Saskatoon, Saskatchewan

PROJECT	07-1328-0001		FILE No.
DESIGN			SCALE NTS REV. 0
CADD	RML	04/22/07	
CHECK	AL	18/12/08	FIGURE: III-1
REVIEW	PGB	18/12/08	

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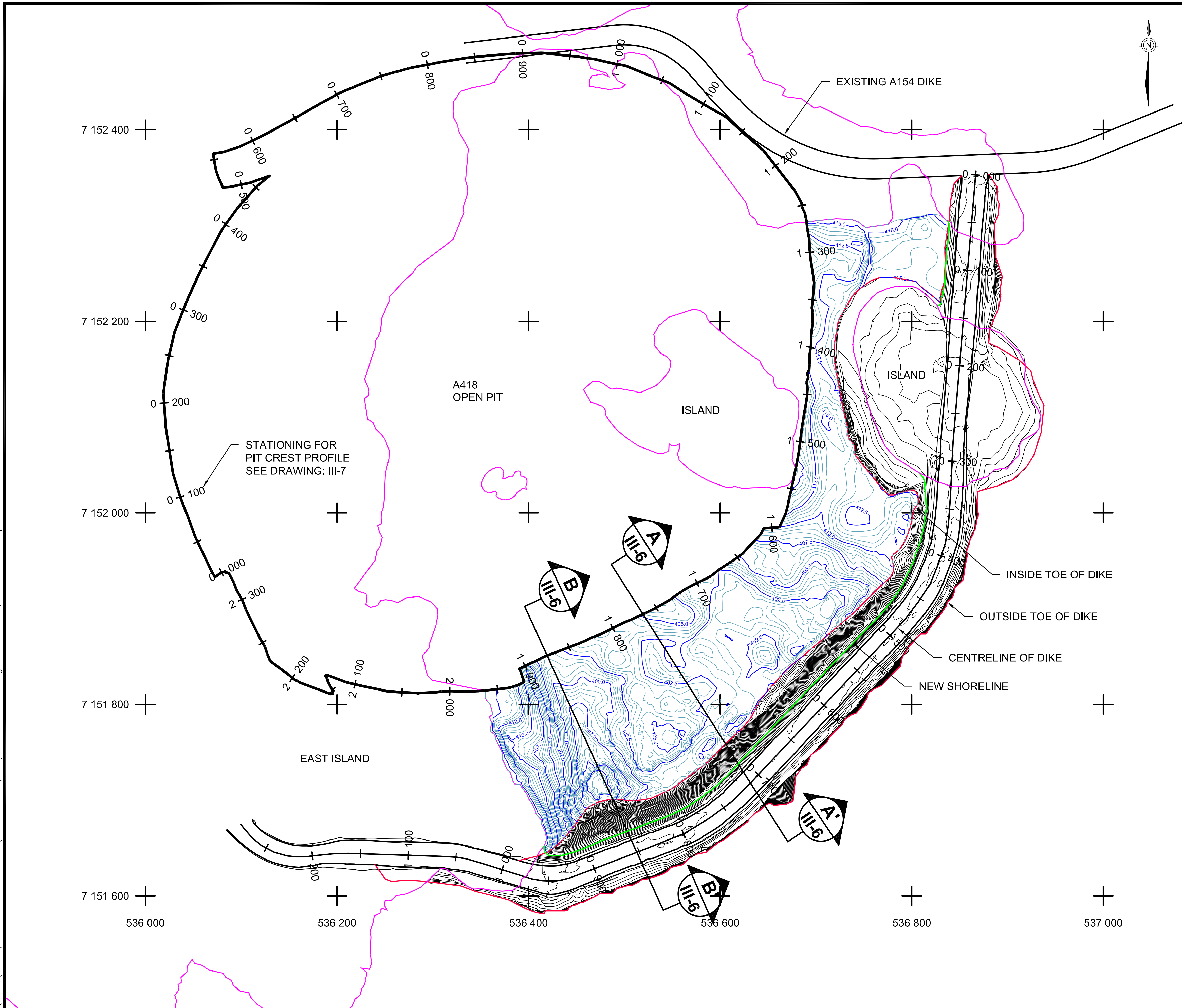

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100

SCALE METRES

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

BATHYMETRY - A418 PIT

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07		
CHECK	AL	18/12/08	**FIGURE: III-2**	
REVIEW	PGB	18/12/08		

Golder Associates
Calgary, Alberta

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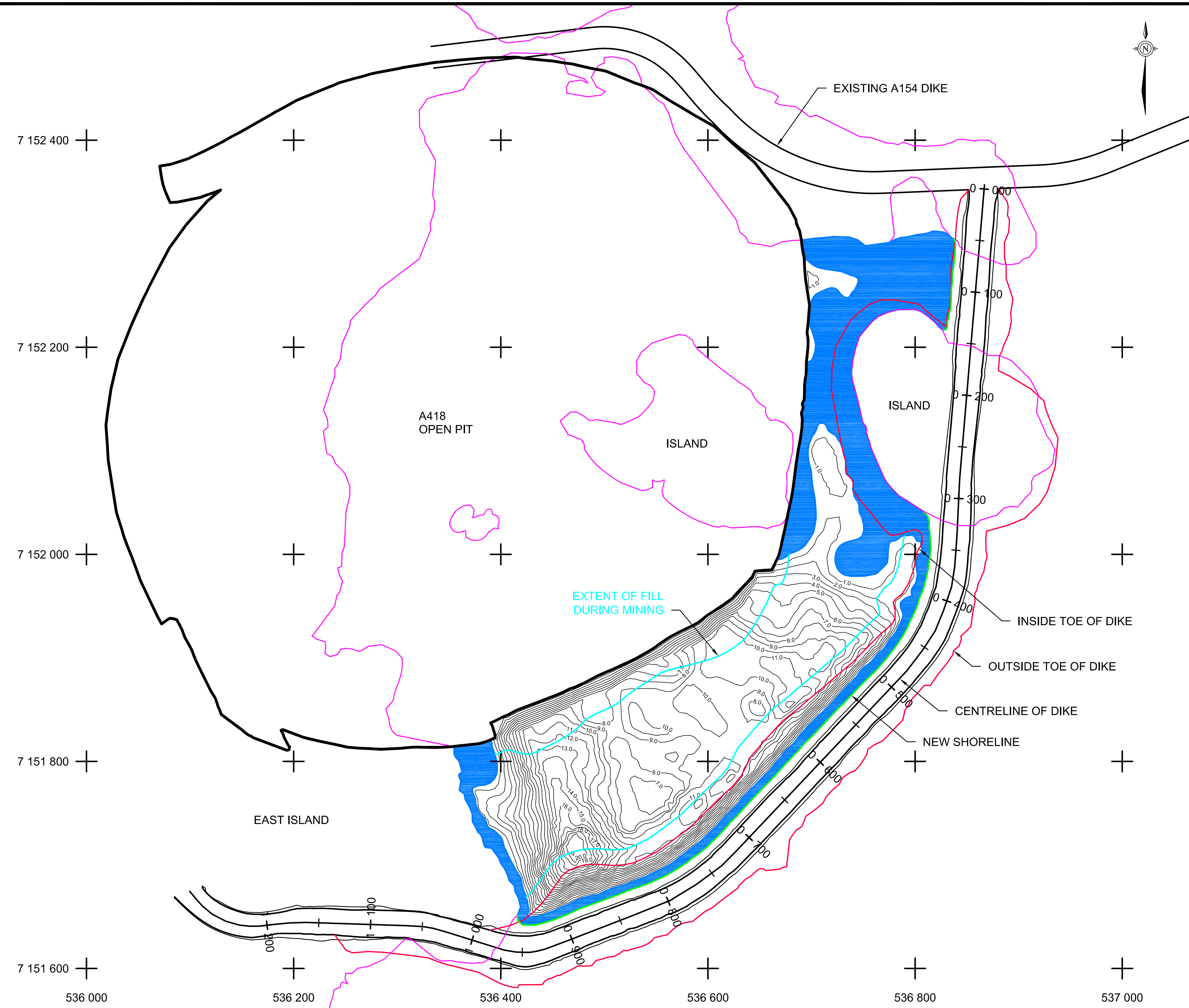

LEGEND:

MAINTAIN EXISTING HABITAT "NO DISTURBANCE AREA"

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100

SCALE METRES

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A418 - TOTAL FILL ISOPACH (TOP OF FILL ELEVATION = 411.8m)

PROJECT	07-1328-0001		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	RML	04/18/07	
CHECK	AL	18/12/08	FIGURE: III-3
REVIEW	PGB	18/12/08	

Golder Associates
Calgary, Alberta

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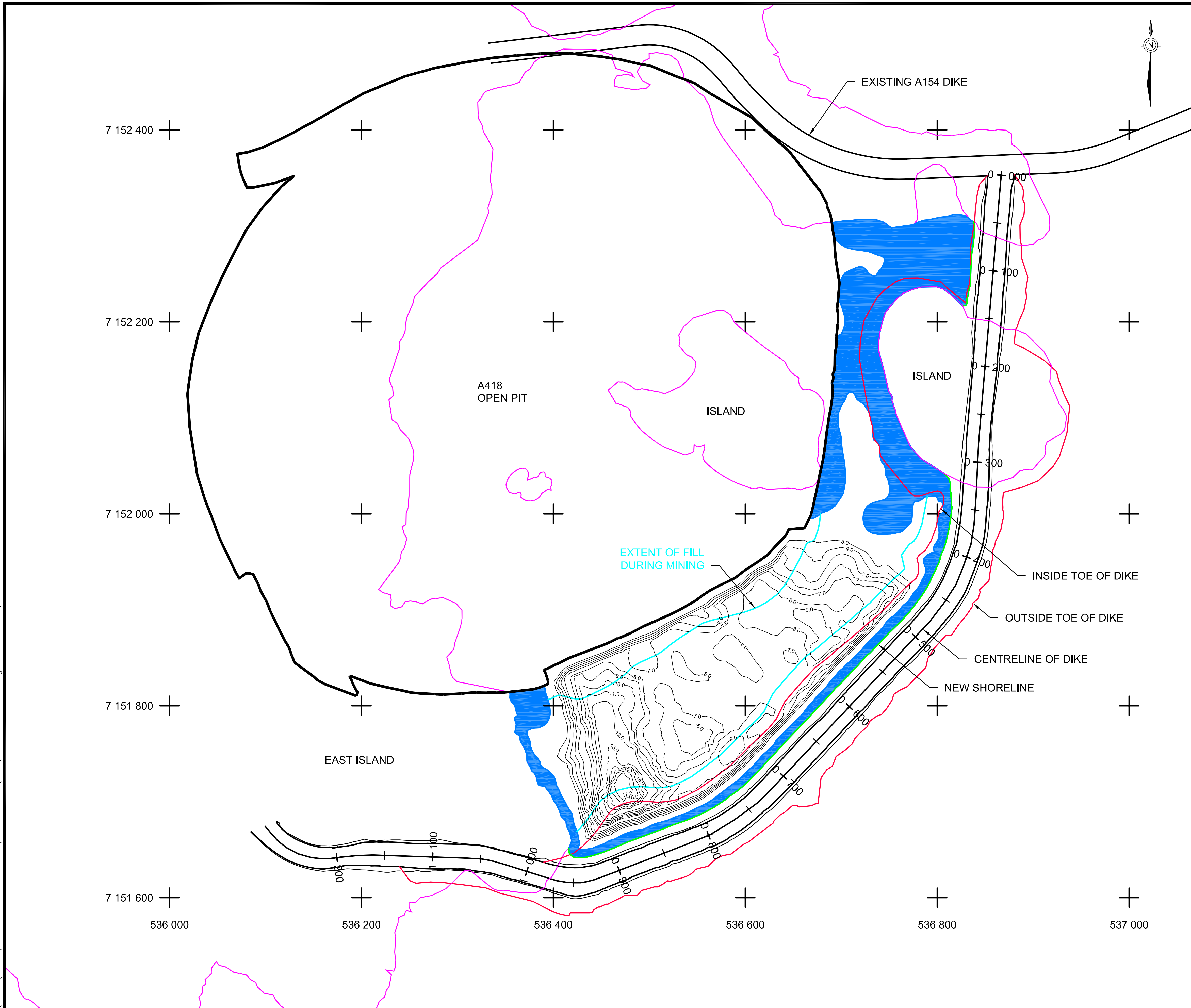

LEGEND:

MAINTAIN EXISTING HABITAT "NO DISTURBANCE AREA"

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100

SCALE METRES

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A418 - ROCK FILL ISOPACH BELOW TILL COVER (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07	**FIGURE: III-4**	
CHECK	AL	18/12/08		
REVIEW	PGB	18/12/08		

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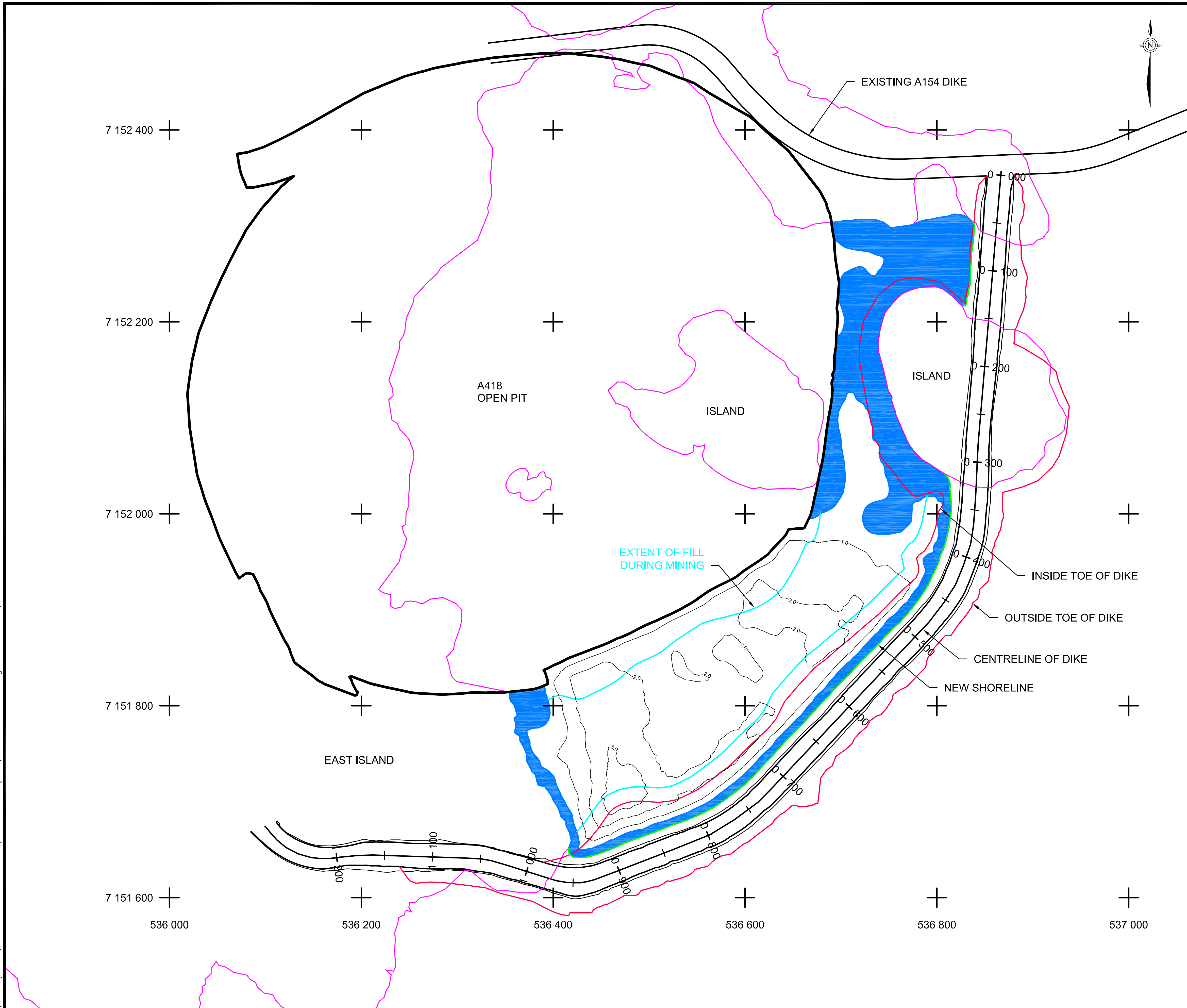

LEGEND:

MAINTAIN EXISTING HABITAT "NO DISTURBANCE AREA"

REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100

SCALE METRES

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A418 - TILL FILL (COVER OVER ROCKFILL) ISOPACH (NO FILTER, FINAL TOP OF FILL ELEVATION = 411.8m)

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07	**FIGURE: III-5**	
CHECK	AL	18/12/08		
REVIEW	PGB	18/12/08		

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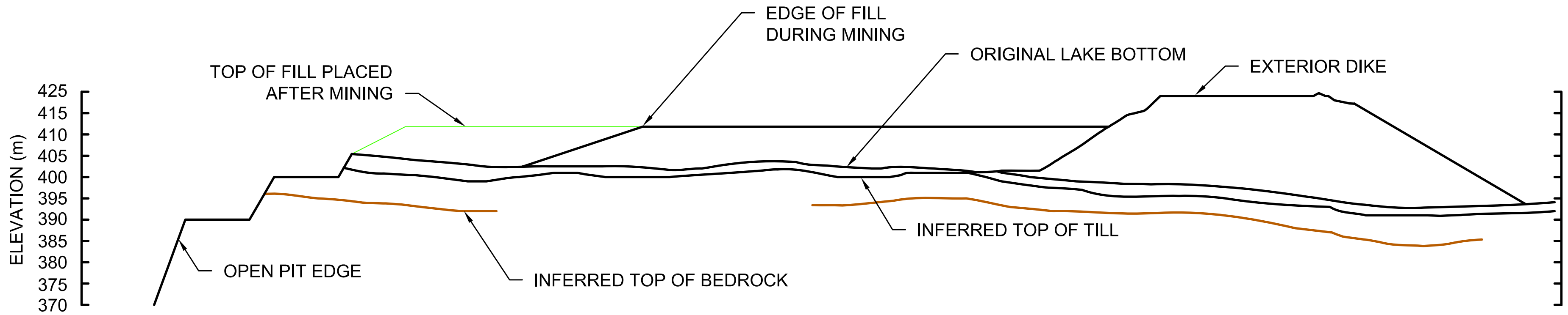
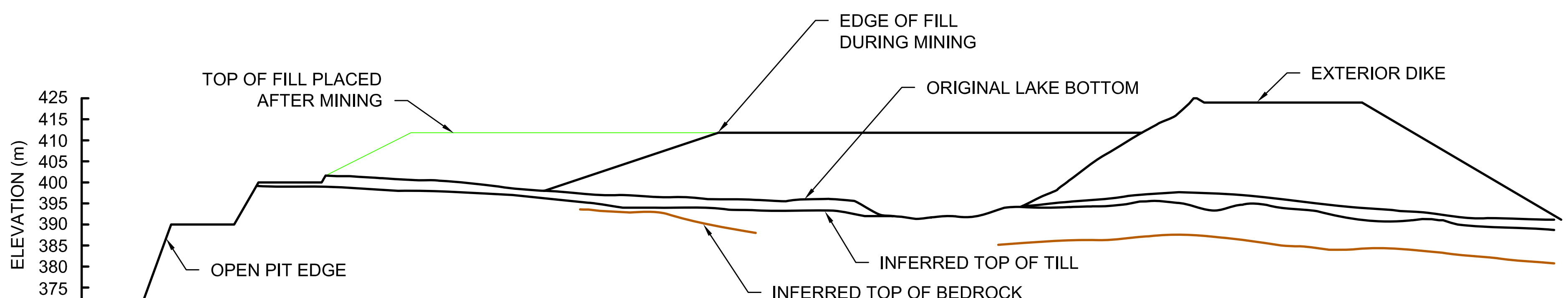


A / III-2 **CROSS SECTION A-A'**



B / III-2 **CROSS SECTION B-B'**

NOTE:

CROSS-SECTIONS MAY NOT BE PERPENDICULAR TO DIKE CENTRELINE.

30 0 30
SCALE METRES

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - CROSS SECTIONS OF FISH HABITAT FILL ON EXTERIOR DIKES

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.
DESIGN			SCALE AS SHOWN REV. 0
CADD	RML	04/18/07	
CHECK	AL	18/12/08	**FIGURE: III-6**
REVIEW	PGB	18/12/08	

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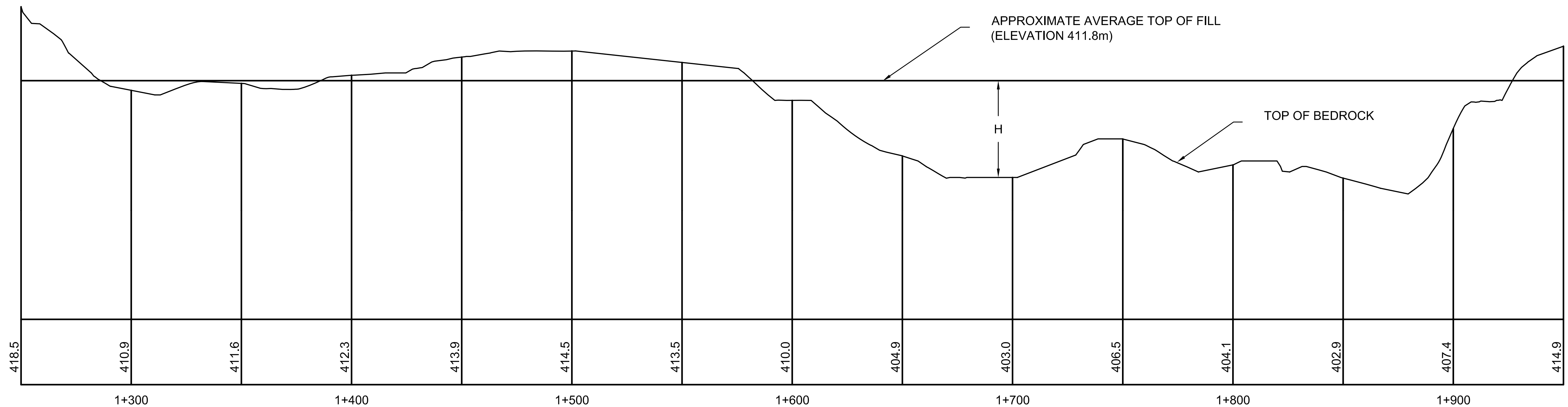


PIT CREST PROFILE

40 0 40
SCALE METRES

5x VERTICAL EXAGGERATION

NOTES:

1. SEE FIGURE : III-2 FOR STATIONING

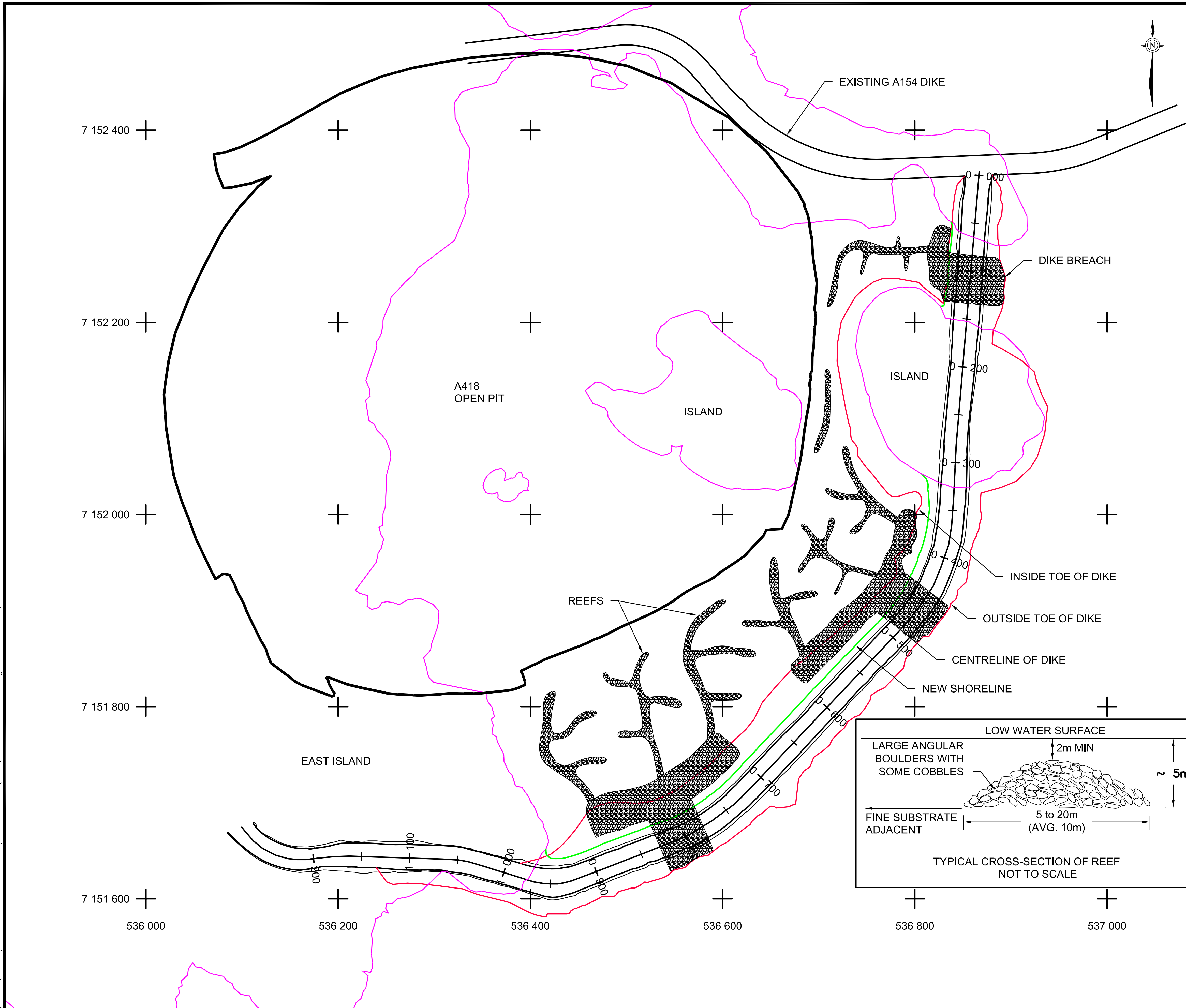
2. SETBACK FROM PIT CREST TO TOE OF FISH HABITAT FILL (DURING MINING) EQUAL TO 4H WITH A MINIMUM OF 15m.

PROJECT
DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE
A418 - PIT CREST PROFILE

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07		
CHECK	AL	18/12/08	**FIGURE: III-7**	
REVIEW	PGB	18/12/08		



REFERENCE

PLAN DEVELOPED FROM INFORMATION PROVIDED BY DIAVIK DIAMOND MINES INC.

100 0 100

SCALE METRES

PROJECT

DIAVIK DIAMOND MINES INC.
FISH HABITAT COMPENSATION-INTERIOR OF WATER RETENTION DIKES, NORTHWEST TERRITORIES

TITLE

A418 PIT - SCHEMATIC REEF CONFIGURATION

Golder Associates
Calgary, Alberta

PROJECT	07-1328-0001		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
CADD	RML	04/18/07	**FIGURE: III-8**	
CHECK	AL	18/12/08		
REVIEW	PGB	18/12/08		

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APPENDIX XI

DEVIATIONS FROM WLWB TEMPLATE

Appendix XI – Deviations from WLWB Report Outline

As directed by the WLWB, this ICRP was developed to conform with a new *Annotated Outline for Interim and Final Closure and Reclamation Plans*. This reporting template was developed by the Mackenzie Valley Land and Water Board (MVLWB) Standard Procedures and Consistency Working Group. Although it has not been approved by the MVLWB it has been reviewed by the WLWB and meets their expectations for this Interim Closure and Reclamation Plan (WLWB 2009).

In some areas this ICRP has deviated from the outline to improve readability. The deviations of note are:

1. The template uses "reclamation" and "closure" interchangeably. To avoid any confusion we will identify in the introduction that we will use "closure" to mean closure, reclamation or closure and reclamation.

2. *5.2.3 Alternative Closure Options, Identified Risks and Contingencies* – was changed to *Preferred and Alternative Closure Options* it is important to let the reader know where to find the preferred closure option.

3. *Risks* have been moved from 5.2.3 to 5.2.6 and renamed 5.2.6 *Uncertainties, Risks and Research Plans*. While risks are discussed in 5.2.3 they are in relation to advantages/disadvantages of closure options. Whereas 5.2.6 is specific to risks associated with the preferred closure option.

4. *Contingencies* have been moved from 5.2.3 to 5.2.9 which is already titled *Contingencies*. In 5.2.3 the contingencies are effectively the options. In 5.2.9 specific contingencies are identified that could be applied if the preferred option is not successful.

5. In section 5.2.5 *Residual Effects* the expected environmental effects that would remain post-closure for that specific closure area are listed. In Section 9 we provide an overall assessment of the combined environmental effects from all mine components.

APPENDIX XII

CONFORMANCE TABLES

Table XII-1 Conformance Table with Class "A" Water Licence W2007L2-0003 Requirements. Part L, Conditions Applying to Closure and Reclamation

Water License Item #	Requirement(s) of the Interim Closure and Reclamation Plan	December 2009 ICRP Update
1 a)	Specific closure and restoration objectives and criteria and an evaluation of alternatives for the closure of each mine component, including, but not limited to: i) open pits, water retention dikes, and related structures; ii) underground workings; iii) Processed Kimberlite Containment Facility, including the placement of coarse kimberlite material over PKC slimes, and water handling during placement; iv) Waste Rock Storage Facilities and the Drainage Control and Collection System; v) water management structures (dams, intake and delivery systems, treatment plants); vi) Dredged Sediment Containment Facility; vii) North Inlet Facility including, sediment containment, and water management; viii) borrow pits, ore storage stockpiles, and other disturbed areas; ix) surface infrastructure (Process Plant, camp, roads, and airstrip); x) all petroleum and chemical storage areas; xi) any other areas potentially contaminated with hazardous materials; xii) any facilities or areas, which may have been affected by development such that a potential pollution problem exists; xiii) contingencies for pit water treatment during closure; xiv) dike breach locations and sizes; and xv) restoration of aquatic habitat in all areas.	S. 2, S. 5 and Appendix V
1 b)	A description of the detailed plans for reclamation, measures required, or actions to be taken, to achieve the objectives stated in the Board's Guidelines and Part L, Item 1 for each mine component.	S. 5,
1 c)	A detailed description, including maps and other visual representation, of the pre-disturbance conditions for each site, accompanied by a detailed description of the proposed final landscape, with emphasis on the restoration of surface drainage over the restored units.	S. 5
1 d)	A comprehensive assessment of materials suitability, including geochemical and physical characterization, and schedule of availability for restoration needs, with attention to top-dressing materials, including maps where appropriate, showing sources and stockpile locations of all reclamation construction materials.	S. 4, S. 5
1 e)	A description of the procedure to be employed for progressive reclamation, including details of restoration scheduling and procedures for coordinating restoration activities within the overall mining sequence and materials balance.	S. 6
1 f)	A description of any post-closure treatment that may be required for drainage water that is not acceptable for discharge from any of the reclaimed mine components including a description for handling and disposing of post-closure treatment facility sludges.	S. 5.2, S. 5.2.4.3
1 g)	A description of the plan to assess and monitor any ground water contamination during post-closure.	S.5 and S 9
1 h)	An evaluation of the potential to re-vegetate disturbed sites that includes the identification of criteria to be used to determine technical feasibility and alternative restoration options.	S 5.2.5 and Appendix VIII-10

Water License Item #	Requirement(s) of the Interim Closure and Reclamation Plan	December 2009 ICRP Update
1 i)	An identification of the research needs for restoration.	S. 5 and Appendix VIII
1 j)	A description of how progressive reclamation will be monitored throughout the life of the mine, including an evaluation of the effectiveness of any reclaimed areas.	S.5 and S.6
1 k)	Details of closure measures proposed in the event of a premature or temporary shutdown at any time throughout mine life.	Ch. 7
1 l)	A description of proposed means to provide long term maintenance of collection system and treatment plant.	S. 5
6	A restoration monitoring program to evaluate the effectiveness of all progressive reclamation and to identify any modifications required to facilitate landscape restoration.	S.5 and Appendix VIII

Table XII-2 Conformance table: Water Licence Requirements Not Met in the 2006 Version of the ICRP (according to WL N7L2-1645)

#	Deficiencies in 2006 ICRP	Location Addressed in 2009 ICRP Update
1	There are no criteria presented that would indicate and/or measure the success or failure of closure for each mine component.	Appendix V
2	DDMI has not provided evidence of ongoing community engagement with respect to the development of the ICRP	S.2.4
3	Include contingency plan for re-sloping of country rock and till storage	S. 5.2.2.9
4	Address North Inlet rehabilitation potential for fish habitat and how backwash sediments from NIWTP may impact on NI use of fish habitat	S. 5.2.4.3 and Appendix VIII-9
5	Address how much backwash sediments from NIWTP might impact the quality of discharges from NI to Lac de Gras	S. 5.2.4.3 and Appendix VIII-9
6	Include alternatives for storage for NI backwash sediments	S. 5.2.4.3
7	In chapter 8 of DDMI's 2006 ICRP, each mine component has "closure strategies" which touch on the goals for closure for that component but lacks a clear and explicit objective	S. 5.2 and Appendix V
8	There are no evaluations of alternatives discussed for the closure of each mine component, only a "Closure Strategy" and the "Proposed Closure Method" in chapters 7 and 8 of the 2006 ICRP	S. 5.2
9	There are no detailed reclamation plans presented. DDMI has produced "Closure Factors" and "Closure Strategies" within the 2006 ICRP but they lack a focused objective which may attribute to the lack of a clear link between what action will be taken to fulfill which objective.	S 5.2 and Appendix V
10	A map which illustrates the pre and post operational condition at a general level (Figure 2-1 and 9-1) is present in the 2006 ICRP, but does not show surface drainage throughout the site or the final landscape for each altered site.	S 5.2
11	A schedule of major operational activities has been included in Table 11-2, and some general reclamation events are listed in Figures 2-2 and 2-3, however there is no detailed schedule or description which outlines the dates for the commencement, completion and evaluation of all progressive reclamation studies and activities	S 5.2 and S.8
12	A description of the processes that will be used during closure to treat unsafe water for each mine component has been provided. However, no contingency has been provided in the event that the remaining water does not meet discharge criteria post-closure. These details should be included in the ICRP. Also, additional detail is needed regarding the process for specific handling and disposal of facility sludges during closure and post-closure	S.5.2
13	How will contaminated groundwater be assessed after closure? Plan not found.	S. 9

#	Deficiencies in 2006 ICRP	Location Addressed in 2009 ICRP Update
14	Objectives of revegetation have been listed in 10.3-3 and alternative strategies for revegetation are listed in 3.2.1, however, no indication of the criteria that will be used to evaluate the success of the studies have been discussed. Much more investigation and detail is needed in section 3.2.	Appendix V and Appendix VIII-10
15	Some areas of necessary research have been identified but it is not clear if it was with the participation of outside parties. DDMI has not provided evidence that parties have given input into the development of research gaps and requirements that will be investigated	S. 2.4 and Appendix IX-4
16	In section 10.3, DDMI explains the current monitoring that is taking place within each mine component. However, no description of how reclamation activities will be monitored or evaluated during or after mine operations has been discussed	S.5.2, S.9 and Appendix VI
17	DFO are concerned that no specific habitat thresholds and criteria have been identified within the plan so how can reviewers be confident that the proposed restored aquatic habitat will support fish populations and components of the aquatic ecosystem.	Appendix V
18	LKDFN are concerned that Aboriginal Parties were not consulted on either version of the reclamation plan and the development of closure criteria. They also believe that EKATI and Diavik should collaborate on closure programs and develop consistent closure criteria to address the cumulative effects on the Lac de Gras ecosystem.	S.2.4
19	The NSMA strongly encourage a public review process so interveners are given the opportunity to participate, whereas some of their compensation claim allows for funding to specifically be part of such a process.	S.2.4
20	The Tlicho observed that the 'PKC Monitoring Plan' has never been carried out and submitted and thus relevant monitoring activities might not fulfil requirements set out in Schedule 2 of the Licence. Additional research needs and monitoring details have not been addressed and include areas such as: PKC Cover (technical feasibility of this strategy has not been assessed), Water Quality in the flooded pits (the impact of soluble metals on the pits walls has not been studied for this issue) and the breaching of dikes to meet water quality objectives	S.5.2, Appendix VIII-1, and VIII-5
21	EMAB identified several uncertainties within the 2006 ICRP, most of which were not adequately addressed throughout the plan. This observation of remaining uncertainties is consistent with other reviewers conclusions.	S.5.2