GAHCHO KUÉ PROJECT

ENVIRONMENTAL IMPACT STATEMENT
CONFORMITY RESPONSE, ITEM 1

SECTION 10

KEY LINE OF INQUIRY: LONG-TERM BIOPHYSICAL EFFECTS, CLOSURE, AND RECLAMATION

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10.1 INTRODUCTION

10.1.1 Context

The following section of the environmental impact statement (EIS) for the Gahcho Kué Project (Project) consists solely of the Key Line of Inquiry: Long-term Biophysical Effects, Closure, and Reclamation. In the *Terms of Reference for the Gahcho Kué Environmental Impact Statement* (Terms of Reference) issued on October 5, 2007, the Gahcho Kué Panel (2007) defined this topic as a key line of inquiry based on the following concerns:

> *"The environmental assessment revealed considerable concern over the long term effects of this development. In particular, the environmental assessment identified uncertainty about the viability of encapsulating processed kimberlite and mine water in the mined out pits, as well as pessimism about the recovery of the lake ecosystem after mine closure."*

Connections exist between this key line of inquiry and the three other key lines of inquiry that relate to aquatics and caribou, namely:

- Key Line of Inquiry: Water Quality and Fish in Kennady Lake (Section 8);
- Key Line of Inquiry: Downstream Water Effects (Section 9); and
- Key Line of Inquiry: Caribou (Section 7).

In Section 8 of the EIS, the potential for Project activities to affect the aquatic environment in Kennady Lake, including those activities that occur as part of closure and reclamation, was evaluated. The modelling procedures and other assessment tools used to complete the evaluation were also described, and the results of the analysis were discussed. In Section 9 of the EIS, a similar analysis was completed for downstream waterbodies. In Section 7, the effects, including the long-term effects, on caribou are considered.

Connections also exist between the present key line of inquiry, the Project Description (Section 3) and the following subjects of note:

- Subject of Note: Mine Rock and Processed Kimberlite Storage (Section 11.5);
- Subject of Note: Carnivore Mortality (Section 11.10);
- Subject of Note: Other Ungulates (Section 11.11); and
- Subject of Note: Species at Risk and Birds (Section 11.12).

The Project Description contains the Closure and Reclamation Plan that has been developed for the Project. Subject of Note: Mine Rock and Processed Kimberlite Storage (Section 11.5) contains information related to the stability of the Fine Processed Kimberlite Containment (PKC) Facility, mine rock and Coarse Processed Kimberlite (PK) piles. The remaining subjects of note pertain to the effects, including the long-term effects, on wildlife.

To avoid undo repetition and to ensure that the EIS presents the information requested by the Gahcho Kué Panel (2007) in as efficient a manner as possible, the relevant information presented in each of the aforementioned sections has been summarized and is reported herein. The present section has been designed to be stand-alone, with a focus on the key findings of the analyses that are reported elsewhere in the EIS. In keeping with the Terms of Reference, cross-referencing to other sections of the EIS has been kept to a minimum.

10.1.2 Purpose and Scope

The focus of this section is to address the issues outlined by the Gahcho Kué Panel in the Terms of Reference and to present the reader with the following information:

- a conceptual Closure and Reclamation Plan that has been developed for the Project;
- an evaluation of the long-term viability of the Closure and Reclamation Plan, with a particular focus on the physical stability of the reclaimed Fine PKC Facility, mine rock and Coarse PK piles;
- a description of the long-term effects the Project may have on the aquatic ecosystem of Kennady Lake;
- a description of how the changes to the aquatic ecosystem in Kennady Lake may affect, over the long-term, the aquatic ecosystem in downstream waterbodies;
- a summary of the analysis that has been completed to evaluate how long-term changes to Kennady Lake may affect wildlife; and

- a summary of the residual impact classification that has been completed, with a focus on the aquatic ecosystem in Kennady Lake and downstream systems.

The specific scope and purpose of key line of inquiry: Long-term Biophysical Effects, Closure, and Reclamation is to meet the relevant sections of the Terms of Reference issued for the EIS by the Gahcho Kué Panel (2007). The Terms of Reference for this section are summarized in Table 10.1-1. A copy of the complete Terms of Reference is included in the Introduction (Section 1, Appendix 1.I). A table of concordance for the entire Terms of Reference is provided in Section 1, Appendix 1.II.

10.1.3 Study Area

10.1.3.1 General Location

The Project is situated north of the eastern arm of Great Slave Lake in the Northwest Territories (NWT) at Longitude 63° 26' North and Latitude 109° 12' West. The Project site is about 140 kilometres (km) northeast of the nearest Dene community, Łutselk'e, and approximately 280 km northeast of Yellowknife (Figure 10.1-1).

The Project is located in the watershed of Kennady Lake, a small headwater lake within the Lockhart River system. Kennady Lake discharges to the north, via a series of small lakes, into Kirk Lake and then into Aylmer Lake. Aylmer Lake is located on the main stem of the Lockhart River about midway along its length. The Lockhart River system drains into the north-eastern arm of Great Slave Lake.

Table 10.1-1 Terms of Reference Pertaining to Long-term Biophysical Effects, Closure, and Reclamation

Final Terms of Reference Requirements		Addressed in Sub-section
Section	**Description**	
4.1.4 Key Line of Inquiry: Long-term Biophysical Effects, Closure, and Reclamation	General requirements pertaining to long-term biophysical effects, closure and reclamation include:	
	- the EIS must include a conceptual closure and reclamation plan and an analysis of the viability of this plan	10.4.1, 10.4.2
	- the EIS must include a description of follow-up and monitoring programs, contingency plans, or adaptive management programs designed to verify the impact predictions of this environmental impact review	10.10
	- a detailed contingency plan, spelling out monitoring and adaptive management strategies, must be developed to address the possibility that partially backfilled pits will adversely impact water quality in the immediate and surrounding areas	10.10
	- the EIS must address follow-up programs not only in regards to the direct impacts of the proposed development but also in regards to cumulative impacts in combination with other developments	10.10
	- the EIS must include the developer's vision of a coordinated monitoring program for cumulative effects from all diamond mines between the developer, other developers, Aboriginal communities, and government agencies	10.10
	Specific information needs pertaining to long-term biophysical effects, closure, and reclamation include:	
	- provide a demonstration of the long-term physical stability including long-term maintenance of frozen conditions both within and under waste rock and processed kimberlite storage facilities. If long-term waste storage is solely reliant on frozen conditions, stability of frozen conditions in climate change scenarios must be included	10.4.2
	- provide a description of any plans to restock the lake	10.5.3.3
	- provide an evaluation of the long-term physical stability of any works constructed in connection with the development, including reclaimed areas	10.4.2
	- provide an evaluation of the potential for acid generating rock, the resulting impacts, and the management options to deal with acid generating rock and its impacts	10.4.2
	- provide a summary of the use of public consultation, consultation with first nations, and traditional knowledge in determining standards and methods for reclamation	10.4.3
	- provide an evaluation of the possibility of speeding up the re-filling of the lake by utilizing additional water sources	10.4.1.13
	- provide a description of the type of fish and other aquatic habitat that will be created during reclamation, including a comparison to the existing habitat, as well as a description how DFO's No Net Loss requirements will fully mitigate all predicted impacts on fish habitat	10.4.1.12
	- provide an evaluation of the capacity of the ecosystem to fully recover, or a prediction of the type of ecosystem that is expected to be created instead	10.5
	- provide any long-term monitoring plans, need for long-term care and maintenance, assurance of long-term monitoring and maintenance, including long-term structural and environmental stability of waste rock and kimberlite storage facilities	10.10

Source: Terms of Reference for the Gahcho Kué Environmental Impact Statement (Gahcho Kué Panel 2007).

EIS = environmental impact statement.

10.1.3.2 Study Area Boundaries

The study area for this key line of inquiry was identified in the final Terms of Reference as follows (Gahcho Kué Panel 2007):

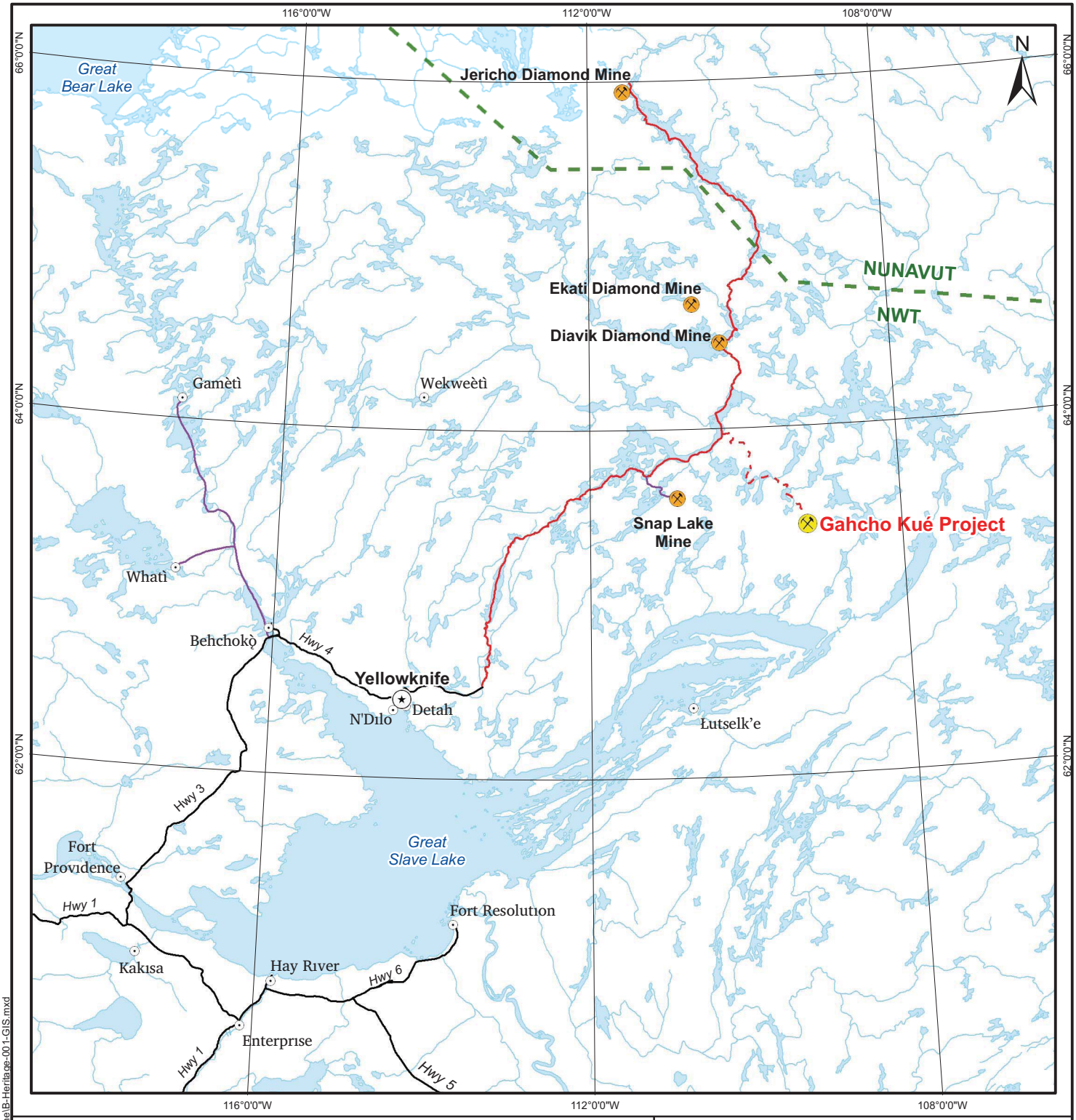
> *"The geographical scope for this Line of Inquiry includes the areas where any valued component may be affected by the development, including the development area, downstream areas for impacts related to aquatics. The geographical scope for the assessment of cumulative effects on wildlife should reflect the biological range characteristics of each species or herd."*

For effects to aquatics, two study areas were defined. They included a regional study area (RSA) and a local study area (LSA).

The aquatics RSA for this key line of inquiry encompasses the entire Lockhart River watershed to its outlet into Great Slave Lake, as shown in Figure 10.1-2. The RSA was defined as such to ensure that potential cumulative effects from the Snap Lake Project were accounted for in the analysis. The RSA boundary, as shown in Figure 10.1-2, is consistent with that used by most aquatic disciplines when discussing baseline or existing conditions in the area, as outlined in Annexes H through J.

The aquatics LSA for this key line of inquiry encompasses a smaller area of the Lockhart River watershed. It is defined by the watersheds of the lakes and streams that may be directly affected by the proposed Project, from the Kennady Lake watershed to the outlet of Kirk Lake (Figure 10.1-3). Consequently, the analysis of potential effects from the Project starts with a focus on waterbodies in the LSA and then expands outwards into the RSA. As with the RSA, the boundary of the LSA for this Key Line of Inquiry is similar to that used by most aquatic disciplines when evaluating baseline or existing conditions in the area.

The wildlife RSA for this key line of inquiry encompasses approximately 5,700 square kilometres (km^2) in size, and was defined to capture the large-scale direct and indirect effects of the Project on wildlife VCs or populations with wide distributions (Figure 10.1-4). Both traditional and scientific knowledge indicate that barren-ground caribou use this area during the northern and post-calving migrations. The study area is also home to a number of other wide-ranging species including grizzly bears, wolverines, raptors, and waterfowl. Consequently, the scale and boundaries of the RSA were selected to capture the diversity of habitats that support the seasonal requirements of these wide-ranging species. Although the distribution of habitat types within the RSA meet seasonal life requirements, not all habitat needs are met because many of these species are migratory.



LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Existing Winter Road
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary

NOTES

Base data source: The Atlas of Canada

GAHCHO KUÉ PROJECT

Location of the Gahcho Kué Project

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83	
Scale: 1:3,500,000 (50 25 0 50 Kilometres)		
FILE No: B-Heritage-001-GIS		DATE: September 20, 2010
JOB NO: 09-1365-1004	REVISION NO: 8	Figure 10.1-1
OFFICE: GOLD-CAL	DRAWN: CW / CHECK: JB	

De Beers Canada

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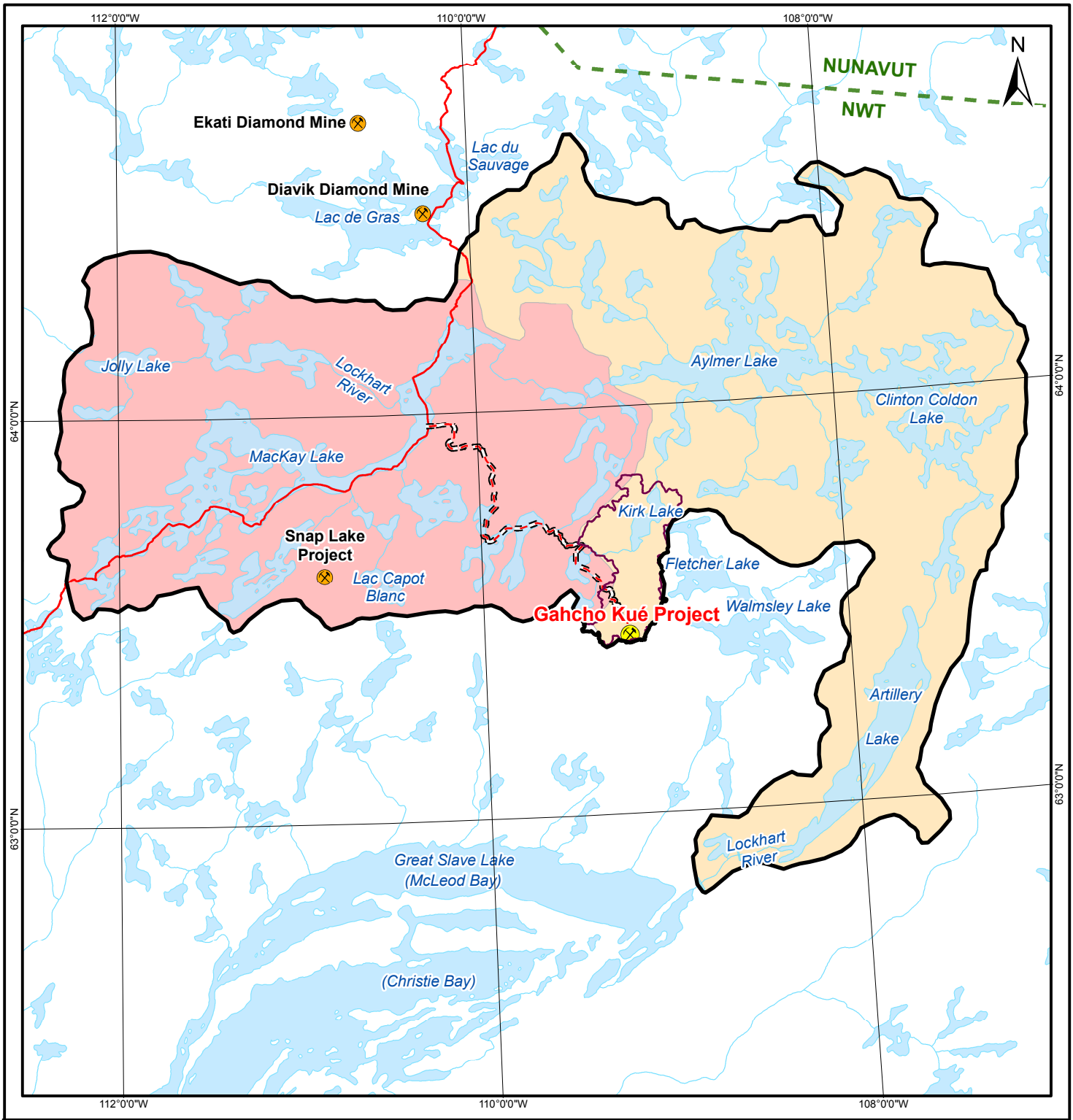

LEGEND

- Gahcho Kué Project
- Existing Mine
- Tibbitt-to-Contwoyto Winter Road
- Baseline Winter Access Road
- Proposed Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Long-term Biophysical Effects Boundary
- Lower Lockhart River Watershed
- Upper Lockhart River Watershed
- Regional Study Area

NOTES

Base data source: The Atlas of Canada

GAHCHO KUÉ PROJECT

Long-term Biophysical Effects Aquatic Regional Study Area

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83	
Scale: 1:1,500,276		
30 15 0 30 Kilometres		
FILE No: KLOI-10-001-GIS		DATE: December 22, 2010
JOB NO: 09-1365-1004	REVISION NO: 2	
OFFICE: GOLD-CAL	DRAWN: SK / CHECK: JF	Figure 10.1-2

De Beers Canada

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580000
600000
7080000
7060000
7040000
N
Back Lake
Q2
Kirk Lake
Kirk Lake Watershed
Murdock Lake
P Watershed
Lake 410
Watershed
410
N Watershed
M Watershed
N16
L Watershed
Kennady Lake Watershed
Gahcho Kué Project

LEGEND

- Gahcho Kué Project
- Baseline Winter Access Road
- Proposed Winter Access Road
- Watercourse
- Waterbody
- Index Contour (100m interval)
- Intermediate Contour (20m interval)
- Local Study Area
- Kennady Lake Watershed
- Long-term Biophysical Effects Boundary
- Watershed Boundary

NOTES
Base data source: National Topographic Base Data (NTDB) 1:250,000 096C

GAHCHO KUÉ PROJECT

Long-term Biophysical Effects Aquatic Local Study Area

PROJECTION: UTM Zone 12	DATUM: NAD83	
Scale: 1:150,000 (2.5 1.25 0 2.5 Kilometres)		DE BEERS CANADA
FILE No: KLOI-10-002-GIS		DATE: December 22, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	Figure 10.1-3
OFFICE: GOLD-CAL	DRAWN: SK / CHECK: JF	

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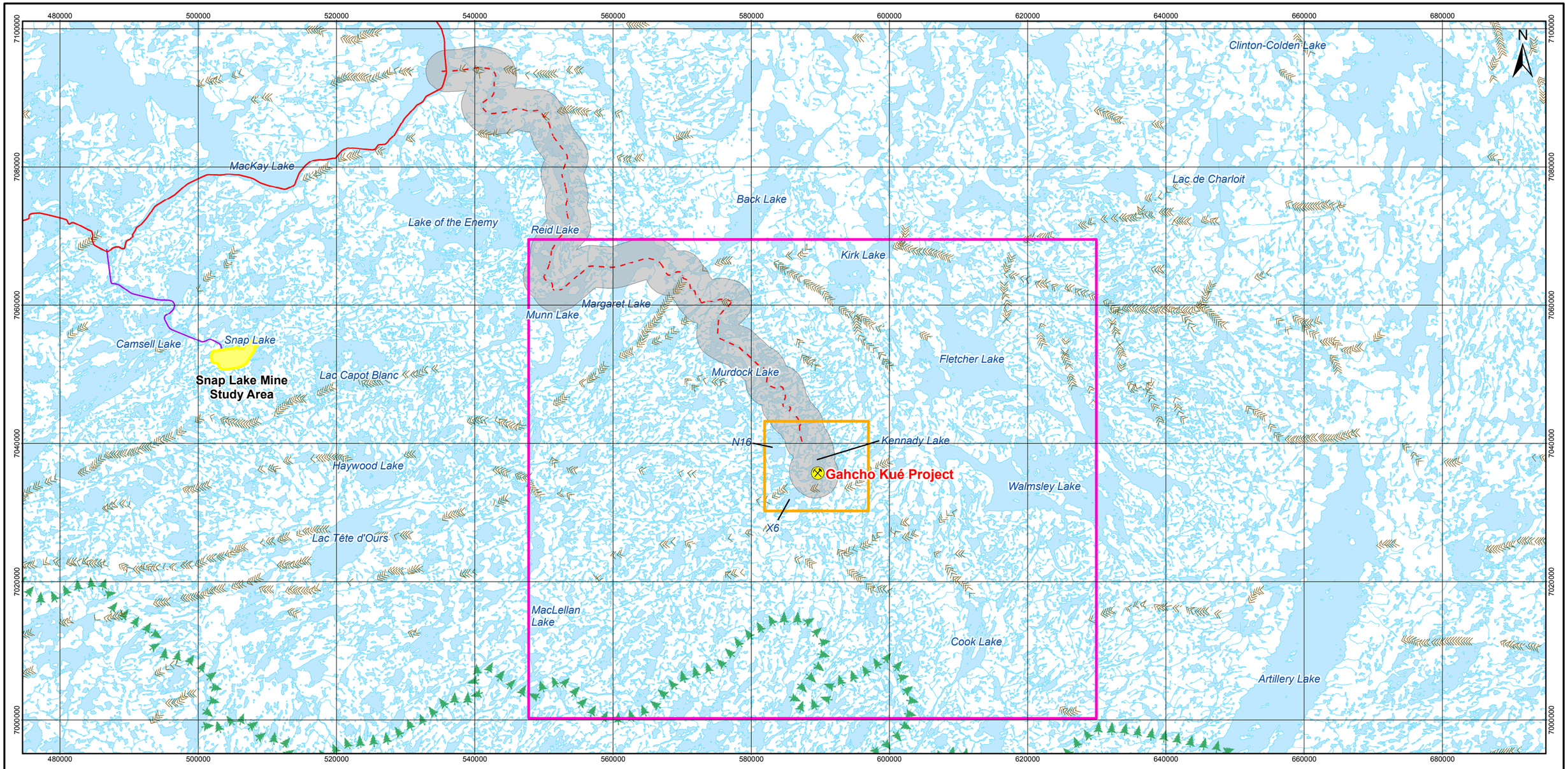

LEGEND

- Gahcho Kué Project
- Existing Winter Road
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Esker
- Treeline
- Snap Lake Project Study Area
- Wildlife Local Study Area (LSA)
- Wildlife Regional Study Area (RSA)
- Winter Access Road Study Area (3 Km)

NOTES
Base data source: National Topographic Base Data (NTDB) 1:250,000

GAHCHO KUÉ PROJECT

Long-term Biophysical Effects Wildlife Study Areas

PROJECTION: UTM Zone 12	DATUM: NAD83	
Scale: 1:550,000 (10 5 0 10 Kilometres)		De Beers Canada
FILE No: KLOI-10-009-GIS		DATE: December 22, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	
OFFICE: GOLD-CAL	DRAWN: SK / CHECK: JF	**Figure 10.1-4**

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The LSA for this key line of inquiry encompasses the Project, which includes the proposed development of the anticipated mine footprint. The LSA is approximately 200 km^2, centred on Kennady Lake. The LSA was designed to assess direct effects from the mine footprint (e.g., habitat loss and fragmentation) and small-scale indirect effects on individuals from Project activities (e.g., changes in habitat quality resulting from dust deposition). For species with small home ranges, such as upland bird species and small carnivores, the LSA could contain habitat that is capable of supporting all requirements necessary for life, including forage, cover, and breeding habitat.

10.1.4 Content

This key line of inquiry consists of a summary (Section 10.2) followed by the more detailed and technical analysis completed in response to the relevant sections of the Terms of Reference. The more detailed and technical analysis that follow the summary consist of eleven sub-sections. The title of each subsection and a general description of its contents are as follows:

- **Existing Environment** provides a brief description of existing conditions in Kennady Lake and places them into context with those of the surrounding environment, including downstream systems in the LSA. The discussion is focused around Kennady Lake, because a key component of this key line of inquiry involves an evaluation of the long-term recovery of this system, and it is described in terms of surface water quantity, surface water quality, physical aquatic habitat, lower trophic levels, and fish, all of which are relevant in addressing the final Terms of Reference (Section 10.3).
- **Closure and Reclamation** contains a summary of the Closure and Reclamation Plan that has been developed for the Project, along with a discussion of the viability of the plan and how stakeholder feedback and traditional knowledge were incorporated into its development (Section 10.4).
- **Effect of Project Activities on the Long-term Recovery of Kennady Lake** describes how Project activities may affect Kennady Lake over the long-term and what type of recovery is expected after the lake is refilled; valued components considered in the analysis include surface water quality, and three principal fish species (i.e., Arctic grayling, lake trout and northern pike) (Section 10.5).
- **Long-term Effects to Downstream Aquatic Ecosystems** outlines how predicted changes in Kennady Lake may affect aquatic biota in downstream waterbodies (Section 10.6).
- **Long-term Related Effects to Wildlife and Human Use** details how the Closure and Reclamation Plan and the predicted performance of

Kennady Lake may affect wildlife and human use of the area (Section 10.7).

- **Residual Impact Classification** describes the methods used to classify the residual effects and presents the results of the classification (Section 10.8).
- **Uncertainty** discusses sources of uncertainty surrounding the Closure and Reclamation Plan and predictions of long-term biophysical effects (Section 10.9).
- **Monitoring and Follow-up** describes recommended monitoring programs, contingency plans, and/or adaptive management strategies related to long-term effects and closure issues (Section 10.10).
- **References** lists all documents and other material used in the preparation of Key Line of Inquiry: Long-term Biophysical Effects, Closure, and Reclamation (Section 10.11).
- **Glossary, Acronyms, and Units** explains the meaning of scientific, technical or other uncommon terms used in Key Line of Inquiry: Long-term Biophysical Effects, Closure, and Reclamation; it also contains a list of definitions for the acronyms and abbreviated units that are included in this section (Section 10.12).

10.2 SUMMARY

Background

The proposed Gahcho Kué Project (Project) is a diamond mine located in the watershed of Kennady Lake, a headwater lake within the Lockhart River system, located about 280 kilometres (km) northeast of Yellowknife, Northwest Territories (NWT). Long-term effects were identified in the *Terms of Reference for the Gahcho Kué Environmental Impact Statement* as a key line of inquiry because of concerns related to the long term effects of this development, including the uncertainty about the viability of encapsulating processed kimberlite and mine water in the mined out pits, and the recovery of the lake ecosystem after mine closure.

Connections exist between this key line of inquiry and the three other key lines of inquiry that relate to aquatics and caribou, namely:

- Key Line of Inquiry: Water Quality and Fish in Kennady Lake (Section 8);
- Key Line of Inquiry: Downstream Water Effects (Section 9); and
- Key Line of Inquiry: Caribou (Section 7).

This sub-section provides a brief summary of the long-term effects of the proposed Project on area wildlife and the aquatic ecosystems of Kennady Lake and downstream waterbodies, as well as a brief description of mitigation included in the Closure and Reclamation Plan intended to address long-term effects. More detailed summaries of long-term effects and proposed mitigation can be found in the remainder of this section.

Existing Environment

Components of the existing environment that are relevant to this key line of inquiry include surface water quantity, surface water quality, lower trophic levels, and fish.

Closure and Reclamation Plan

A Conceptual Closure and Reclamation Plan has been developed for the Project. Two important concepts for the Project are “progressive reclamation” and “design for closure”. Closure and reclamation were considered during the selection of design alternatives. As such, closure and reclamation planning has been considered in all Project phases, including design. Progressive reclamation during operations, and closure and reclamation of the site at the end of mining will be consistent with the objectives outlined by INAC in the *Mine Site Reclamation Guidelines for the NWT* (INAC 2007).

The overall goal of the reclamation plan is to minimize the lasting environmental impacts of operations to the extent practical and allow disturbed areas to return to productive fish and wildlife habitat as quickly as possible.

The general components of the reclamation program are summarized briefly as follows:

- Salvage and stockpile soil, overburden, and lakebed sediments, to the extent practical, from areas of disturbance.
- Create new or expanded fish habitat areas during construction and operations phases.
- Progressively reclaim parts of the Area 1 and Area 2 portions of the Fine PKC Facility.
- Progressively reclaim portions of the South Mine Rock Pile.
- Progressively reclaim portions of the West Mine Rock Pile.
- Progressively backfill the 5034 Pit.
- Partially backfill the Hearne Pit.
- At the end of operations:

- remove all potentially hazardous materials from site;
- dismantle and remove or demolish all buildings and related structures;
- remove all above-grade (i.e., above ground level) concrete footings and foundations;
- construct additional fish compensation habitat near Kennady Lake;
- construct additional fish habitat enhancements structures, although most habitat enhancement structures will be constructed during operations;
- refill Kennady Lake using natural runoff supplemented by water drawn from Lake N11;
- cut channels in Dykes B, K, and N to begin filling the areas around Tuzo Pit and 5034 Pit and allow for lowering of all dykes below final planned lake elevation;
- upon refilling the lake and achieving appropriate water quality, breach and/or partially remove Dyke A to connect the reclaimed portions of Kennady Lake with Area 8;
- monitor conditions over time to evaluate the success of the Closure and Reclamation Plan and, using adaptive management and newer proven methods as available, adjust the plan, if necessary; and
- comply with the legal requirements for closure and reclamation in effect at the end of operations.

The consideration of public feedback and traditional knowledge in developing the Closure and Reclamation Plan was also summarized. Based on the feedback received during the open houses and the traditional knowledge available through secondary sources, De Beers recognized the following community desires for reclamation:

- restore Kennady Lake as quickly as possible;
- restore Kennady Lake so that the refilled lake can support fish;
- completely backfill all three mine pits;
- reclaim the PK facilities in such a way that they do not attract caribou;
- isolate process-affected materials, including PK, so that they are not accessible to wildlife;
- protect water quality in Kennady Lake and downstream systems so that it does not affect the health of caribou and other biota; and

- remove all buildings and materials, so that there is no garbage or waste left on-site that may wash downstream or blow around.

Long-Term Effects to Kennady Lake Watershed

Long-term Effects to Hydrology

Beyond closure, the water balance will change for the Kennady Lake watershed resulting in the increase of mean annual water yield by 8.9 percent (%). The reduction in the surface area of Kennady Lake of 14.1% means that flood peak discharges will increase slightly during post-closure due to less storage in the lake.

Long-term Effects to Water Quality

Water quality was modelled under the assumption that permafrost would not establish in the mine rock piles, Coarse PK Pile, and Fine PK Facility. Therefore, simulated concentrations of water quality parameters downstream of Kennady Lake following closure will remain elevated above background levels for the long-term. However, these projections are conservative as parameter loading to Kennady Lake from the reclaimed mine rock and PK storage facilities is expected to decrease with the establishment of permafrost. With the onset of climate change conditions that reduce or eliminate permafrost conditions at the Project site, water quality constituent concentrations are projected to increase to modelled long-term levels.

In post-closure, concentrations of total dissolved solids (TDS) and major ions are predicted to remain above background conditions, but below levels that would affect aquatic health. Concentrations of TDS and major ions in Area 8 are predicted to increase when Dyke A is removed; concentrations are predicted to peak within five years of Dyke A being removed, as water in Area 8 is replaced with water from the refilled Kennady Lake. Over time, concentrations of TDS and major ions are generally predicted to decline, but for some parameters (e.g., potassium), concentrations are predicted to increase during post-closure and reach a long-term steady state concentration within a few decades.

By the time Dyke A is removed, modelled nitrate and ammonia concentrations are expected to be at, or below, water quality guidelines and decline thereafter to near background levels. In Area 8, all forms of nitrogen are expected to peak in concentration within five years of the removal of Dyke A, then return to near-background concentrations. Concentrations of phosphorus are also predicted to increase during post-closure due to seepage from materials located in the mine rock piles, Coarse PK Pile, and the Fine PKC Facility. The Fine PKC facility is the largest contributing source of phosphorus. Using a combination of mitigation strategies, De Beers is committed to incorporating additional mitigation to achieve a long-term maximum steady state total phosphorus concentration of

0.018 mg/L in Kennady Lake. As a result of the increase in phosphorus levels, changes in lake trophic status from oligotrophic (low productivity) to mesotrophic (moderately productive) are expected in the refilled Kennady Lake, including Area 8.

An increase in productivity (e.g., growth of phytoplankton and algae) will result in increased organic carbon remaining in the lake after senescence in the fall. An increased under-ice oxygen demand in Kennady Lake is anticipated as a result of the increased productivity. The winter oxygen depletion rate for surface (under ice to 6 m), middle (7 to 12 m) and deeper (>12 m) depth zones in Kennady Lake and a dissolved oxygen balance for Kennady Lake at the end of winter was estimated. The results indicate that the surface zone of the water column is expected to remain oxygenated over the winter, but the mid-depth and bottom depth zones will likely be subject to lower dissolved oxygen levels. The deeper epilimnetic zones of the open Tuzo and Hearne pits are not expected to be subject to the same winter oxygen demand as other shallower areas of Kennady Lake and are expected to remain well oxygenated. Under open-water conditions, Kennady Lake is expected to remain well mixed and near, or at, saturation with respect to dissolved oxygen (similar to existing conditions).

Of the 23 trace metals that were modelled for the assessment, three patterns are predicted in modelled concentrations of the main areas of Kennady Lake:

- Chromium, cobalt, iron, lead, manganese, mercury, selenium, silver, thallium, uranium and zinc are predicted to increase in concentration during the operations phase, then steadily decline in concentration as the lake is flushed during post-closure. Chromium and iron are projected to exceed water quality guidelines in the post-closure phase.
- Aluminum, antimony, arsenic, cadmium, copper, nickel and vanadium are predicted to increase in concentration relatively steadily throughout the operations phase, rise or fall during closure, and then remain fairly constant throughout post-closure. Cadmium and copper are projected to exceed water quality guidelines in post-closure.
- Barium, beryllium, boron, molybdenum and strontium are predicted to increase after closure, reach steady state conditions in Kennady Lake within about 40 years. None of these five metals are projected to exceed water quality guidelines in post-closure.

As groundwater and geochemical sources are the primary contributors of these metals**,** dissolved fraction of these metals is predicted to comprise the majority of the total concentrations.

Concentrations of trace metals in Area 8 are predicted to remain similar to background concentrations until Dyke A is removed, after which it will take approximately five years for metals concentrations to peak and then follow the general trends described for Kennady Lake in post-closure. Of the 23 modelled trace metals, cadmium, chromium, and copper are projected to exceed water quality guidelines in post-closure in Area 8.

A long-term analysis evaluated the stability of the stratification (meromictic conditions) in the Tuzo Pit following the refilling of Kennady Lake, and concluded that the saline bottom layer will remain stable and will not overturn. The water quality in Kennady Lake above Tuzo Pit will, therefore, be primarily determined by the upper 20 metres (m) of fresh water, which will be subject to temperature and wind-driven summer seasonal stratification.

Long-term Effects to Aquatic Health

Changes to water quality in Kennady Lake during closure and post-closure are expected. For direct waterborne exposure, predicted maximum concentrations for most substances of potential concern (SOPCs) were lower than the corresponding chronic effects benchmark (CEB), with the exception of total copper, iron, and strontium; however, the potential for these metals to cause adverse effects to aquatic life in Kennady Lake was considered to be low. Follow-up monitoring will be undertaken to confirm this evaluation.

For the indirect exposure pathway, predicted fish tissue concentrations are below toxicological benchmarks for all substances considered in the assessment except silver. Given the modest predicted increase, and that both baseline and predicted tissue concentrations only marginally exceed the available no-effect concentration, the potential for predicted silver concentrations to cause effects to fish is concluded to be low. Based on the above results, changes to concentrations of all substances considered in this assessment are predicted to result in negligible long-term effects to aquatic health in Kennady Lake.

Long-term Effects to Fish and Fish Habitat

In Kennady Lake, flows and water levels will return to near baseline conditions. However, during post-closure, concentrations of nutrients are predicted to be higher than pre-development conditions, with the trophic status of Kennady Lake predicted to be mesotrophic. The predicted change in the trophic status is expected to result in increased primary and secondary productivity in Kennady Lake. Due to the increases in the food base for fish (zooplankton and benthic invertebrates), and likely in the small-bodied forage fish community, there may also be increased growth and production in the large-bodied fish species of Kennady Lake. However, due to the change in trophic status to mesotrophic, overwintering habitat in Kennady Lake at post-closure may become more limited