4.2.2.1 Habitat Destruction

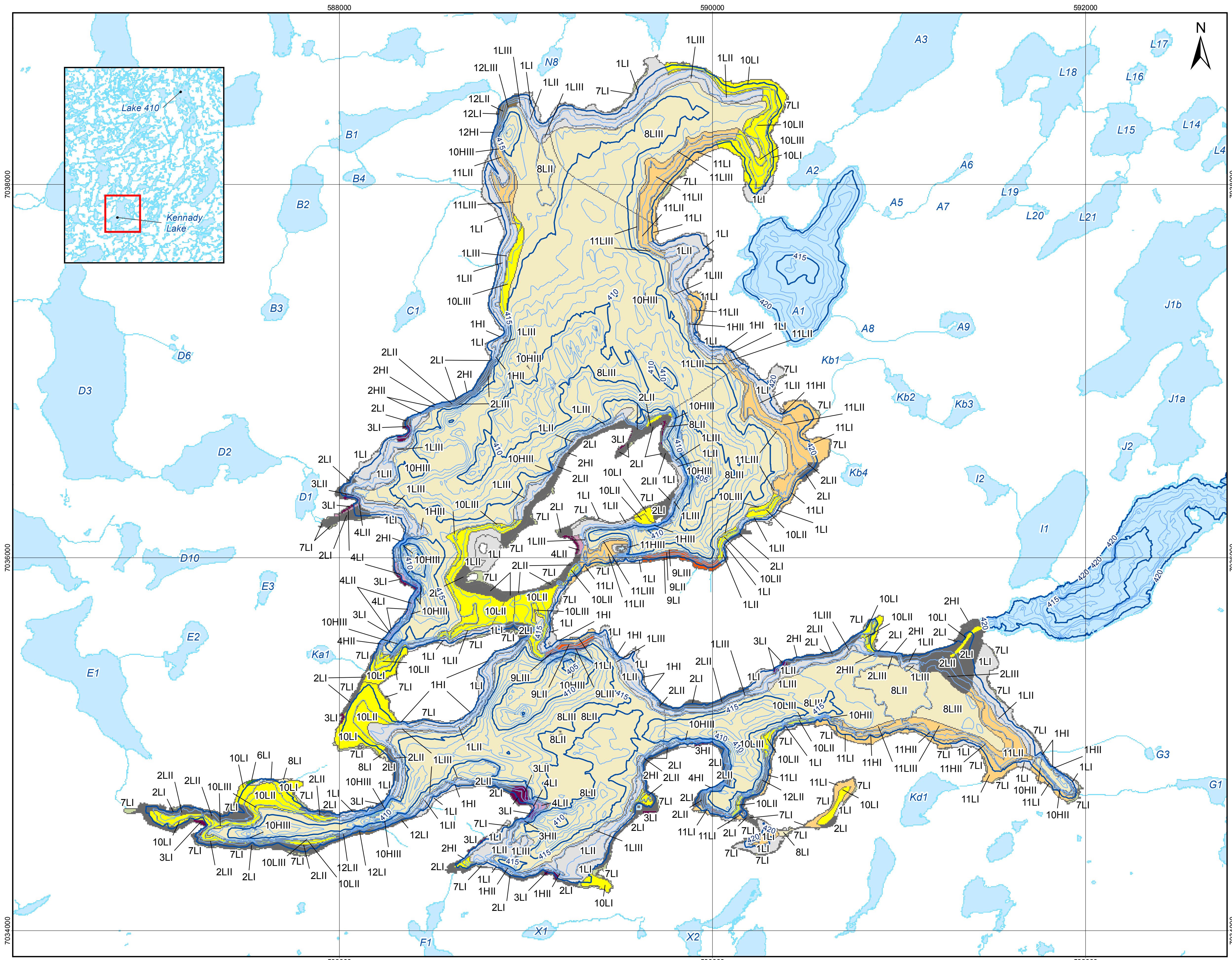
The Project will result in the permanent loss of approximately 158.9 ha of lake area (Figure 4). Most of the losses will occur in Kennady Lake (156.9 ha), representing about 19% of the total pre-development Kennady Lake area of 813.6 ha. The remainder of the permanently lost areas in adjacent waterbodies includes the complete loss of Lakes Ka1, and Kb4 associated with mine rock piles; however, both of these lakes are considered to be non fish-bearing (De Beers 2010, Annex J) and would not contribute to the final habitat offset requirements. It has been assumed that in final design that habitat losses of small portions of Lakes N7 and E1 associated with roads and dykes will be avoided (Figure 4).

4.2.2.2 Habitat Alteration

The Project will affect an additional 84.1 ha of lake area that will be dewatered and physically altered, but will be re-submerged at closure. These habitat alterations occur within Kennady Lake through the development of mine pits, roads, dykes, and water containment ponds on the lake bed (Figure 4), representing about 10% of the total pre-development Kennady Lake area of 813.6 ha. At closure, these areas will become re-submerged to provide fish habitat, although the physical attributes of the habitat at these locations will have been altered.

4.2.2.3 Habitat Disruption

The Project will result in disruption to approximately 429.4 ha of lake area being dewatered and unavailable as habitat during the operational and refilling periods, but will be re-submerged at closure and will remain otherwise unaltered by direct Project activities. This area includes 427.5 ha in Kennady Lake, which represents about 53% of the total pre-development Kennady Lake area, as well as 1.9 ha in Lake D1. At closure, these areas will become re-submerged to provide fish habitat, with physical attributes and suitability of the habitat being effectively the same as pre-development conditions. Portions of the dewatered areas of Kennady Lake will likely be targeted as areas for habitat enhancement to form part of the in-lake habitat compensation options as described in Section 5.3.1, but would not be altered due to Project activities and, therefore, are not included in the habitat alteration category.



LEGEND

- Watercourse
- Waterbody
- *Area 1* Kennady Lake Area Identifier
- *B1* Lake Identifier
- Bathymetry Contour (1m interval)
- Bathymetry Contour (5m interval)

Substrate Category

1. Boulder/Cobble
2. Boulder
3. Bedrock
4. Bedrock/Boulder
5. Bedrock/Cobble
6. Vegetation/Organics
7. Vegetation/Boulder
8. Fines/Organics
9. Cobble/Gravel
10. Boulder/Fines
11. Cobble/Fines
12. Boulder/Gravel

Gradient Category

- H High
- L Low
- \- Unknown

Depth Category

- I 0 - 2 m
- II 2 -4 m
- III > 4 m
- \- Unknown

Aquatic Habitat Label

8LI
- Depth Category
- Gradient Category
- Substrate Category

NOTES

Base data source: National Topographic Base Data (NTDB) 1:250,000 and Eagle Mapping Ltd.

GAHCHO KUÉ PROJECT

Baseline Aquatic Habitat in Kennady Lake Areas 2-7

PROJECTION: UTM Zone 12	DATUM: NAD83
Scale: 1:20,000 (200 100 0 200 Metres)	DE BEERS CANADA
FILE No: B2011-Fish-027-GIS	DATE: October 15, 2012
JOB NO: 11-1365-0001	REVISION NO: 1
OFFICE: GOLD-CAL	DRAWN: DC / CHECK: KC

Figure 5

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4.2.3 Calculation of Habitat Units

For the purpose of calculating habitat losses in terms of habitat units, the areal quantity of fish habitat permanently lost, physically altered, or dewatered as a result of the Project was determined using a Geographic Information System (GIS) to overlay the Project footprint over habitat classification maps of the affected waterbodies. Habitat was classified into categories of substrate type (e.g., boulder/cobble) and depth (i.e., less than 2 m, between 2 and 4 m, greater than 4 m). The area (A_k) of each habitat category, *k*, within the Project footprint was digitized using GIS for each waterbody and quantified in hectares. Habitat categories within Kennady Lake under baseline conditions are shown in Figure 5.

A number of different approaches have been discussed with DFO for integrating habitat unit calculations per unit area for each affected waterbody based on differences in species composition and habitat complexity, whereby habitats that can support a complex fish assemblage or support a fishery would have increased weighting relative to habitats that do not support such fish communities. This is a critical step, as this determines how different categories of habitats lost and gained will be assessed to determine if no net loss has been achieved, and can focus habitat compensation efforts on projects that will support target fisheries identified through consultation with DFO and communities. Several meetings have occurred between DFO and De Beers (e.g., 9 May 2012, 27 June 2012, and 7 September 2012) to discuss this topic. However in the absence of a final approach to summarize or weight habitat units affected by the Project, the un-weighted calculations of habitat units by species and life-history stages are provided in Appendix C.

4.3 Quantification of Habitat Loss in Watercourse Segments

The length of watercourse segments affected by the Project was determined using GIS. Kennady Lake tributary streams are generally small and less than 3 m wide (De Beers 2010, Annex J). For the purposes of estimating the quantity of watercourse habitat lost, the area of the watercourse affected was determined by multiplying the length of each watercourse segment by an assumed width of 3 m. The affected watercourse habitat areas include the following:

- Permanent losses – segments of watercourses that will be permanently lost by the placement of permanent dykes or mine rock piles;
- Temporary losses – segments of watercourses that will be physically altered by the placement of infrastructure (i.e., temporary dykes and culverts associated with site roads and the airstrip) that will be removed at closure and the stream channel restored to equivalent habitat characteristics; and
- Flooded areas – segments of watercourses that will be affected by flooding associated with the Project.

There are also a number of drainage paths that show up on the GIS map layer that were investigated and found during field assessment to not have fish habitat. As a result, these drainage paths were not included in the quantification of losses associated with stream segments but are presented here for completeness.

4.3.1 Habitat Suitability of Watercourse Segments

The watercourse areas lost are small compared to the lake areas, and as such, watercourse losses will form a minor component of the overall compensation requirements. Therefore, HSI models will not be used for watercourse segments; instead the habitat data collected in the field, along with fish use information from field sampling, will be directly used to determine the habitat quality rating. The habitat quantity (surface area) and habitat quality will be integrated for each watercourse.

The approach for watercourse segments is based on methods used for other northern projects, and has been discussed favourably with DFO (27 June 2012). Additional field surveys were conducted in the spring and summer of 2012 to validate the assessment of stream habitat quantity and quality affected by the Project to support the development of the plan.

For stream habitats, the Project will result in permanent losses due to project infrastructure, alterations due to flooding or realignment, and disruptions due to dewatering that will be restored at closure but are otherwise unaltered (Figure 6). As described in Section 3.12.7.6 of the Project Description in the 2012 EIS Supplement (De Beers 2012a), site roads and the airstrip will be decommissioned and reclaimed at the end of the closure phase, or at the end of post-closure monitoring period. Culverts or stream-crossing structures will be removed, and natural drainage re-established.

4.3.2 Watercourse Habitat Area Affected

4.3.2.1 Permanent Losses

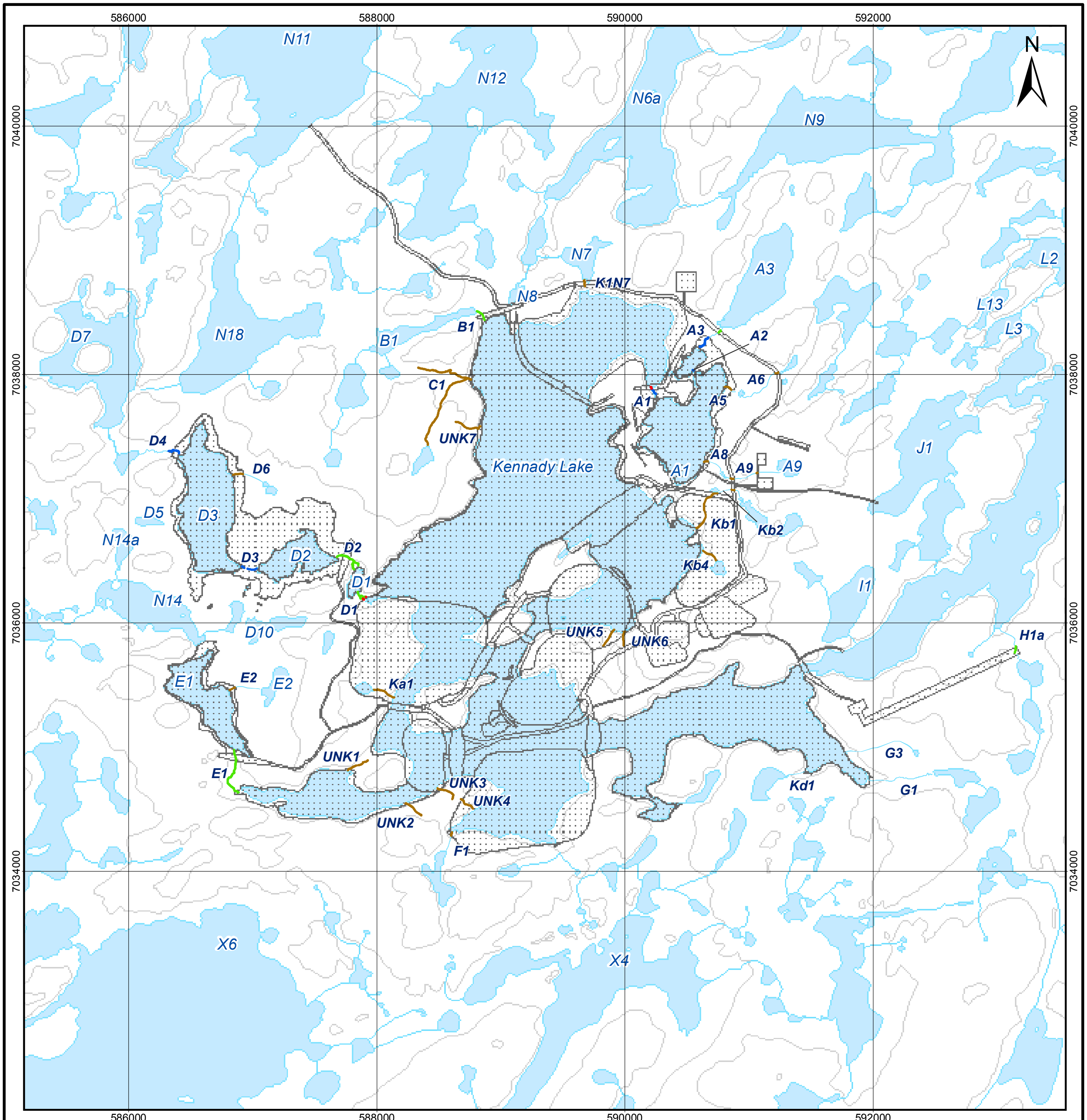
The Project will result in the permanent loss of approximately 0.01 ha of watercourse area (Table 6, Figure 6). These losses are associated with the placement of permanent Dyke A1 on Stream A1 and the placement of the West Mine Rock Pile on Stream D1.

Table 6: Watercourse Areas Permanently Lost as a Result of the Project

Stream[(a)]	Disturbance	Area [m^2]
A1	Dyke A1	67.5
D1	West Mine Rock Pile	19.4
Total Area [m^2]		**86.9**
Total Area [ha]		**0.01**

m = metres; m^2 = square metres; ha = hectares.

[(a)] Stream widths based on field measurements as reported in Section 3.2.



LEGEND

Contour (10m interval)
Watercourse
Waterbody
Project Footprint - Operations
B1 Lake Identifier
B1 Stream Identifier

Affected Stream Category

Flooded Habitat
No Fish Habitat
Permanent Habitat Loss
Temporary Habitat Loss

NOTES
Base data source: National Topographic Base Data (NTDB) 1:50,000

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GAHCHO KUÉ PROJECT

Stream Disturbance During Operations

PROJECTION: UTM Zone 12		DATUM: NAD83	DE BEERS CANADA
Scale: 1:45,000 — 800 400 0 800 Metres			
FILE No: E2011-Fish-019-GIS			DATE: October 11, 2012
JOB NO: 11-1365-0001	REVISION NO: 1		Figure 6
OFFICE: GOLD-CAL	DRAWN: DC	CHECK: KC	

4.3.2.2 Temporary Losses

The Project will affect an additional 0.18 ha of watercourse area that will be physically altered, but will be reclaimed at closure (Table 7, Figure 6). These habitat alterations will occur within the bed of small streams through the placement of temporary dykes and culverts associated with the site road or airstrip. The following mitigation will be implemented where practicable to minimize effects of the watercourse crossings during construction:

- following best practices for the design and construction of watercourse crossings, including minimizing the removal of riparian vegetation, and operating machinery in a manner that minimizes disturbance to the watercourse bed and banks;
- minimizing the amount and duration of instream work, completing the work at low or no flow conditions, and separating the work site from flowing water;
- having machinery arriving on site in a clean condition, maintaining to be free of fluid leaks, washing refuelling and servicing machinery and storing fuel and other materials away from the water, and keeping an emergency spill kit on site;
- installing, inspecting, and maintaining erosion and sediment control measures, e.g., placing silt fencing around disturbed areas, re-establishing a vegetative cover as soon as practical, and directing local road runoff away from the crossing location into the adjacent vegetation; and
- designing and regularly maintaining culverts to ensure fish passage where appropriate.

At closure, the dykes will be notched and the site road and airstrip will be reclaimed, with the physical attributes and suitability of the habitat being effectively the same as pre-development conditions.

Table 7: Watercourse Areas Temporarily Lost as a Result of the Project

Stream[(a)]	Disturbance	Area (m^2)
A3	Site Road	64.8
B1	Dyke E	301.0
D2	Dyke F	816.8
E1	Dyke G	617.1
H1a	Airstrip	34.4
Total Area (m^2)		**1834.1**
Total Area (ha)		**0.18**

m = metres; m^2 = square metres; ha = hectares.

[(a)] Stream widths based on field measurements as reported in Section 3.2.

4.3.2.3 Flooded Areas

The Project will result in a change in habitat conditions in approximately 0.10 ha of watercourse area being flooded (Table 8, Figure 6). These areas will change from watercourse habitat to lake habitat, but overall will remain suitable for fish species within the area.

Table 8: Watercourse Areas Flooded as a Result of the Project

Stream[a]	Disturbance	Area [m^2]
A1	Flooded-Area 1	236.6
A2	Flooded-Area 1	58.4
A3	Flooded-Area 1	303.1
D3	Flooded-Lake D2	238.4
D4	Flooded-Lake D4	133.6
Total Area [m^2]		**970.0**
Total Area [ha]		**0.10**

m = metres; m^2 = square metres; ha = hectares.

[a] Stream widths based on field measurements as reported in Section 3.2.

4.3.2.4 Drainage Paths with No Fish Habitat

Based on field reconnaissance, the following drainages that show up on the map layer were found to have no fish habitat (Table 9, Figure 6). In many cases, these drainage paths lacked defined banks, and were dry or consisted of disconnected, shallow wetted sections in spring or fall. Fish migration or rearing habitat was not considered to be present. As a result, fish habitat offsets would not be required for these project disturbances.

Table 9: Drainage Paths Determined to Have No Fish Habitat

Stream	Disturbance
A5	Flooded-Area 1
A6	Site Road
A8	Flooded-Area 1
A9	Building D
A9	Site Road
C1	Flooded-Area 3
D6	Flooded-Lake D6
E2	Flooding during operations
F1	South Mine Rock Pile
K1N7	Dyke D
K1N7	Fine PK Containment Facility
Ka1	West Mine Rock Pile
Kb1	Coarse PK Pile
Kb1	Site Road
Kb2	Site Road
Kb4	Coarse PK Pile
UNK1	Dewatered-Area 6
UNK2	Flooded-Area 6
UNK3	Hearne Pit
UNK3	Dewatered-Area 6
UNK4	South Mine Rock Pile
UNK5	Tuzo Pit
UNK6	Tuzo Pit, Dewatered Area 4
UNK7	Flooded Area-Area 3

5.0 HABITAT COMPENSATION OPTIONS

5.1 Regulatory Approach

The selection of the habitat compensation approach included consideration of the hierarchy of compensation preferences as outlined in the DFO Policy for Management of Fish Habitat (DFO 1986) and the Practitioner's Guide to Habitat Compensation (DFO 2006).

As per the Practitioner's Guide to Habitat Compensation (DFO 2006), these preferences for habitat compensation are summarized in the following points, in declining order of priority:

1) Create or increase the productive capacity of **like-for-like** habitat in the same ecological unit;

2) Create or increase the productive capacity of **unlike** habitat in the same ecological unit;

3) Create or increase the productive capacity of habitat in a **different** ecological unit;

4) As a last resort, use artificial production techniques to maintain a stock of fish, deferred compensation or restoration of chemically contaminated sites.

It is recognized that physical habitat offset projects will be required for the permanent habitat losses resulting from the Project to satisfy the requirements of DFO's guiding principal of No Net Loss as set out in the Policy for the Management of Fish Habitat (DFO 1986). It is also recognized that the areas of habitat alterations within Kennady Lake will change the characteristics of the fish habitat at closure and may also require physical habitat offsets to account for those changes. De Beers also acknowledges that consideration will be required within the no net loss plan for the areas that will be dewatered and re-submerged at closure, but otherwise unaltered, as these areas will be unavailable for fish for the life of the mine.

De Beers has been in consultation with DFO and communities on the approach for physical habitat offsets, as well as other options that could be considered to form part of the no net loss plan. Currently, permanent losses to fish habitat will be offset through enhancement or creation of physical habitat. For temporal losses of fish habitat during mine operations, research programs will be put in place. The goals of the research programs are to expand the scientific knowledge in the North and reduce the uncertainty around habitat compensation and the recovery of Kennady Lake.

However, during the current environmental review phase of the Project, a range of potential habitat compensation options continue to be evaluated, and input through ongoing consultation is being collected. Identifying a single habitat offset project is not required at this stage in the review process, but viable options must be presented that could provide sufficient habitat compensation to conclude that sufficient habitat compensation can be achieved (based on the September 7, 2012 meeting between DFO and De Beers). The final habitat offset option selected will be refined through ongoing consultation and will be finalized with DFO during the regulatory permitting phase of the Project prior to De Beers obtaining a *Fisheries Act* Authorization for the Project.

5.1.1 Initial Compensation Options Considered

A Conceptual Compensation Plan (CCP) was submitted as Appendix 3.II of the EIS (De Beers 2010). The purpose of the CCP was to provide preliminary concepts for projects that will offset the loss of fish habitat to demonstrate that suitable habitat compensation for the Project could be achieved and to form the basis for future consultation. For the purpose of evaluating the feasibility of compensation options, achieving more than approximately 300 ha of habitat compensation area was used as a preliminary target to offset the HADD of fish habitat associated with the Project. Opportunities to develop habitat enhancement features in the refilled Kennady Lake are present and will be pursued, but were determined as not being sufficient alone to achieve the required compensation. As a result, a large-scale habitat compensation option had to be developed.

As the proposed project activities will result in permanent loss or alteration of primarily lake habitats, the initially proposed compensation options involved creating additional lake habitat and habitat enhancement features in existing lake habitats. The options were also located at site, which allowed for the effective use of equipment and personnel for the construction of the compensation habitats, as well as for monitoring (i.e., evaluating the physical and biological characteristics of the habitats, as well as fish use of the habitats).

A number of options were identified in the CCP for consideration as compensation, either in whole or in part (De Beers 2010). A number of preliminary decision criteria were used to screen the potential suitability of each option, including environmental viability (e.g., ecological effectiveness, fish access and colonization) and engineering and cost viability, as well as long-term sustainability. Each option and the key factors considered in evaluating the suitability of each option presented in the CCP are provided in Appendix D.

Based on the ranking developed in the CCP, the preferred options for the proposed compensation plan included Options 1b and 1c (raising the water level in lakes to the west of Kennady Lake), Option 2 (raising the level of Lake A3), and Option 10 (widening the top bench of mine pits where they extend onto land). Also included in the proposed compensation plan were Options 3 and 4 (construction of habitat enhancement features in Areas 6, 7 and 8) and Option 8 (the Dyke B habitat structure). With the supplemental mitigation associated with the Fine PKC Facility (De Beers 2012a), Option 2 was no longer considered viable as described in the CCP.

5.1.1.1 Compensation Lake in the D-E-N Watershed

Through consultation with DFO since the submission of the CCP, the compensation lake in the D-E-N watershed (i.e., Options 1b and 1C in the CCP) was the option carried forward and presented in the June 29 Compensation Plan - Update memo. The following provides a brief description of this option for creating a compensation lake to the west of Kennady Lake. This option was initially pursued as it met DFO's hierarchy (lake habitat gain for lake habitat losses, and located close to site) and due to its potential to create a large compensation gain to offset the losses associated with the Project.

During operations, this option involved raising the water level of some lakes west of Kennady Lake (in D, E, N watersheds) to a level greater than required only for the Project. This involved the construction of impounding dykes to raise Lakes D2, D3, E1, and N14 during operations, which would increase the maximum depths of these lakes, i.e., Lake D2 by 3.8 m (from 1.0 to 4.8 m), Lake D3 by 2.6 m (2.5 to 5.1 m), Lake E1 by 2.8 m (3.4 to 6.2 m), and Lake N14 by 2.7 m (2.8 to 5.5 m). The increased depths were expected to improve overwintering habitat and provide conditions for a more diverse fish community. The total compensation habitat provided by this option was 149.7 ha of newly created habitat and connection of three non-fish-bearing lakes, which would become useable fish habitat. Specific habitat enhancement features, including the creation of rocky shoal habitat and vegetated bays and shorelines, were to be developed within the newly created habitat.

At closure, additional raising of the water level above the operational compensation lake would create additional new habitat area. This would involve a further increase in water level in Lakes D2, D3, E1, N14, and surrounding area at closure, which would additionally create new and enhanced habitat and further improve overwintering conditions in the compensation lake. The newly developed habitat area (D-E-N lakes) would be reconnected to the refilled Kennady Lake through Lake D1 at closure. It was expected that this component of the plan would provide spawning and rearing habitat for the re-established fish populations in Kennedy Lake at closure, as well as additional overwintering habitat outside of Kennady Lake through connection to the compensation lake. The total compensation habitat provided by this component of the plan was 184.4 ha, which included newly developed habitat area and connection of four non-fish-bearing lakes to fish-bearing waters. Habitat enhancement features installed during the operational phase would be expanded, such that approximately 37.5 ha of the newly created habitat would be enhanced at closure, representing approximately 20% of the newly created habitat area.

The option for creating habitat in the D-E-N watershed is viable and technically feasible, and would provide adequate physical habitat offsets for the Project. Furthermore, this option was consistent with increasing the productive capacity as referred to in the Policy for the Management of Fish Habitat (DFO 1986), as it increases the area of habitat available. However, through ongoing consultation with DFO and Aboriginal groups, De Beers understands that this is no longer a preferred option and will not be pursued further.

5.2 Community and Regulatory Engagement

Fish habitat compensation options were discussed with Aboriginal communities during several meetings and workshops (e.g., February 2012 community visits, 22-25 May 2012 Technical Sessions, August 2012 site workshops, and 20 September 2012 habitat compensation workshop). During these meetings, both on- and off-site options were presented, with the emphasis of the discussion being to get additional options that De Beers could consider as part of the overall NNLP (see Appendix E and Section 7.4). In addition, compensation options were discussed with local and regional DFO at several meetings over the past two years (e.g., 16 June 2010, 26 May 2011, 16 September 2011, 24 November 2011, 21 February 2012, 9 May 2012, 27 June 2012, and September 7, 2012). The outcome from the meetings with communities and DFO was that the option of permanently raising lake levels in the D-E-N watersheds (to the west of Kennady Lake) was not preferred. As a result, the on-site habitat compensation lake option is no longer being pursued.

5.3 Proposed On-Site Compensation Options

5.3.1 Habitat Enhancement Structures in Kennady Lake

Habitat enhancement structures will be constructed in Kennady Lake to improve fish habitat conditions at closure. Reef areas are currently limited within Kennady Lake; as well, some shoreline reef areas will be lost due to the placement of Project facilities (e.g., mine rock piles, pits, etc.). The habitat enhancement structures will be designed to provide spawning, rearing, and/or foraging habitat for the fish community that will re-establish in Kennady Lake after closure, and may in fact help with the re-establishment of species, such as lake trout and round whitefish. These structures will be designed and constructed to maximize high quality habitat in the 2 m to 4 m depth range, which will be kept clean of silt and fine organic debris by wave-generated currents. These habitat enhancement structures also will help offset losses/alterations of shoreline habitat associated with the Project. The structures will be built in dewatered areas prior to re-filling, allowing for more effective implementation of design and placement of material.

The first component of the compensation plan for habitat enhancement includes the construction of finger reefs in Areas 6 and 7 during the dewatered period. This involves the placement of appropriately-sized mine rock to create finger reefs. The reefs would extend to within 2 m of normal refilled lake level, be aligned to maximize exposure to wind-generated waves, and be designed to provide rocky reef habitats suitable for fish species expected to inhabit refilled Kennady Lake (i.e., spawning, rearing habitat for fish species, such as lake trout and round whitefish). The finger reefs would be available for use by fish immediately after refilling is complete. For the purpose of preliminary habitat design, it has been assumed that approximately 8 ha of habitat enhancement features will be created.

An additional habitat enhancement feature of the compensation plan is the development of a Dyke B habitat structure within Kennady Lake during closure. After operations, Dyke B will be lowered to below the expected restored lake level and enhanced. This involves the placement of boulder and cobble sized mine rock to maximize suitability as rocky reef habitat for fish species expected to inhabit refilled Kennady Lake (e.g., lake trout and round whitefish). The habitat created by this feature will be included as part of the calculation of HUs in Kennady Lake at closure.

5.3.2 Development of Fish Habitat near the Pits

This option involves the development of habitat in Kennady Lake near the pits. This involves the widening of the top bench of the Tuzo and 5034 pits to create shelf areas where they extend onto land, i.e., alterations to the southeast edge of Tuzo/5034 joined pit edge, north end of Tuzo Pit, and northwest edge of 5034 Pit. At closure, this will create additional aquatic habitat within Kennady Lake on areas that are currently land, which would create additional littoral area (rearing/foraging habitat), and therefore, be expected to increase fish production. At each of these new habitat areas, specific habitat enhancements will be provided. The new habitat areas and specific habitat enhancements will be identified at the detailed design stage.

5.3.3 Development of Habitat in the A Watershed

Based on the revised footprint of the Project associated with supplemental mitigation of the Fine PKC Facility, additional habitat area will be created within the A watershed due to the raising of the water level in Lakes A1 and A2, with specific habitat enhancements targeted within the newly created lake area to enhance littoral zone productivity and habitat complexity. The specific habitat enhancements will be identified at the detailed design stage. Habitat gains will be calculated as the net gain in HUs relative to the pre-development conditions.

5.4 Off-Site Compensation Options

From discussions with DFO and communities, the option of a compensation lake (i.e., raised lake) at the site is no longer being pursued. As a result, De Beers has been amendable to pursue potential off-site options. At this point in time, potential offsite options are preliminary, and other options may subsequently be identified through ongoing consultation.

5.4.1 Culvert Rehabilitation Options

From discussions with DFO, rehabilitating a large culvert crossing in the Northwest Territories that has created a barrier to migratory fish movement was identified as an option for fish habitat compensation for the Project. Three tributaries to the Mackenzie River (Redknife River, Bouvier River, Axe Handle Creek) were identified as potential crossings that could be rehabilitated. The culvert crossings of the Mackenzie Highway (NWT Highway 1) at these watercourses are considered to be barriers for upstream movement of migratory fish, particularly Arctic grayling from the Mackenzie River. Arctic grayling are currently unable to access the upper watersheds and the associated spawning and rearing habitat upstream of the crossing, and providing access to these habitat areas would be considered by DFO as physical habitat offsets.

A desktop review was carried out on these three tributaries to identify the potential to provide habitat offsets at a scale similar to the area of habitat losses due to the Project. The intent was to identify, and quantify at a very cursory level, opportunities for reclaiming fish habitat upstream of currently impassable culvert crossings on selected tributaries. Although restoring connectivity between downstream and upstream stream reaches would benefit a wide range of fish species, this review was focused largely on the potential benefits to Arctic grayling. Following the review and based on further discussions with DFO, the Redknife River crossing was prioritized as it was considered to provide the greatest benefit in terms of upstream area. The preferred rehabilitation approach to achieve credit for habitat offsets would be replacement of the existing crossing with a clear-span bridge. Additional information on reach lengths and representative channel slopes for the Redknife River is provided in Appendix F.

5.4.1.1 Redknife River

Stewart and Low (2000) summarized the results of fisheries surveys conducted during the 1970s. Previous investigators documented the presence of an Arctic grayling spawning run into the Redknife River from the Mackenzie River during May. High culvert velocities at the road crossing during the movement period prevented farther upstream penetration in the system by Arctic grayling spawners. Stewart and Low (2000) noted that anglers took advantage of this blockage by targeting Arctic grayling in the section downstream of the crossing. Spawning was documented downstream of the crossing and young-of-the-year (y-o-y) Arctic grayling were observed in the area during late spring. Following spawning, adult Arctic grayling returned to the Mackenzie River for summer feeding (and presumably overwintering) purposes. It was noted that when river flows and culvert velocities subsided in summer and early fall, immature and y-o-y Arctic grayling, northern pike, and longnose sucker were able to migrate upstream through the culverts. This led to a recommendation by DFO that weirs be installed downstream of the culvert outlet to facilitate upstream passage during the spawning migration period. During the 1970s investigations on the Redknife River, the presence of a small tributary ("Devil Creek") with year-round flows was noted (i.e., entered from the East just upstream from the crossing). This tributary corresponds to Redknife-1 described below. The current status as to whether the highway culver presents a barrier to upstream fish movements at lower summer flows is currently not known.

The Redknife River has a drainage area of approximately 1525 km², and a stream length (mainstem) of 198 km between its confluence with the Mackenzie River and the headwaters. The crossing is located 14.3 km upstream from the confluence. The 14.3 km downstream section (below the crossing) is largely comprised of "moderate" gradient habitat situated within Reach-1 (13 km; gradient of 3.1 m/km). The remainder is a short "steep gradient" section within Reach-2 (1.3 km section; gradient of 16.8 m/km). There is approximately 184 km of channel located upstream of the crossing. This total includes the remaining portion (1.7 km) of steep gradient

Reach-2, an extensive (159 km) "low" gradient Reach-3 (0.9 m/km), and "moderate-to-high" gradient Reach-4 (7.7 m/km), which is 23 km in length.

In addition, there are three tributaries of note situated upstream of the crossing, with a combined stream length of 94 km. Redknife-1 ("Devil Creek') enters from the east 20 km upstream from the crossing. The total stream length for Redknife-1 is 21 km, all of which is contained within Reach-1. Reach-1 is characterized by a "low" gradient (1.4 m/km). As indicated above, this tributary is characterized by year-round flows.

Redknife-2 enters from the west 53 km upstream from the crossing. The total stream length of Redknife-2 is 39 km, of which the majority (33 km) is contained within Reach-1. Reach-1 is characterized by a "moderate" gradient (2.4 m/km). Reach-2, which is 6 km in length, features a "steep", precipitous gradient (53.2 m/km).

Redknife-3 enters from the west 71 km upstream from the crossing. The total stream length of Redknife-3 is 34 km. The lowermost reach (Reach 1), which is 12 km in length, has a "low" gradient (1.1 m/km). The middle reach (Reach-2), is 14 km in length and features a "high" gradient (7.2 m/km). Reach-3, the uppermost reach has a length of 8 km and is characterized by a "steep" gradient (30.2 m/km).

5.4.2 Other Options under Consideration

Based on discussions with local communities, there may be some potential options for fish habitat enhancement located closer to the communities. A workshop was held by De Beers and DFO on 20 September 2012 with community representatives in Yellowknife. The objective of the workshop was to discuss with communities the process for fish habitat compensation planning and achieving No Net Loss, and to identify potential options for fish habitat compensation, either at the workshop or subsequently in community meetings. A summary of the September 2012 workshop is provided in Appendix E. De Beers will continue to engage the local communities in discussions regarding options for fish habitat compensation.

One such option that was identified during October meetings with the Lutsel K'e Dene First Nation was that De Beers could contribute to the removal of their diesel power generation facility in favour of a hydro system. According to the community members, every year during freshet, diesel leaks from the generator into a nearby creek. The removal of the generating facility and remediation of the receiving watercourse may meet Section 5.7.3 of DFO's *Practitioners Guide To Habitat Compensation* (DFO 2006). This is one example of an option that De Beers is considering and the NNLP will continue to evolve as additional community input is received.

6.0 ASSESSMENT OF HABITAT GAINS

Estimates of the amount of compensation habitat, in terms of surface area, provided by the proposed compensation options are summarized below. However, it should be noted that these are estimates only and additional work would be required to further quantify gains. Once compensation options are finalized, quantification of habitat gains in terms of HUs, and determination of compensation ratios based on HUs, will be completed as part of the development of the final NNLP to be completed in 2013.

6.1 In-Lake Compensation Options

6.1.1 Kennady Lake Habitat Gain Areas

Habitat gains in Kennady Lake at closure are achieved through four mechanisms: the development of new habitat, enhancement of existing habitat, alteration of existing habitat such that the characteristics of the habitat may have changed, and the recovery of unaltered habitats through refilling of dewatered areas (Figure 7). The gain areas in Kennady Lake categorized by the type of habitat developed are provided in Table 10 and summarized below.

Table 10: Areas of Habitat Gains in Kennady Lake by Gain Category

Gain Category	Area in Kennady Lake [ha]
Newly Developed Habitat	56.6
Enhanced Habitat	61.6
Altered Habitat	68.1
Unaltered Habitat	419.5
Total	**605.8**

Note: the area of unaltered habitat has been reduced by 8 ha from the loss category due to the installation of habitat enhancement features within Areas 6 and 7 of Kennady Lake, which are accounted for in the enhanced habitat category

Newly Developed Habitat

This category of habitat gain is through the development of new fish habitat from areas that were previously not fish habitat in the pre-development landscape. This results from lake areas at closure extending onto what was previously land, either through flooding in Area 1 or extension of the mine pit onto land that will be filled with water at closure. This category also includes additional habitat enhancements, such as the widening and enhancement of the top bench of the mine pits, and installation of habitat enhancements features (e.g., rocky shoals or vegetated shoreline) within flooded areas.

Enhanced Habitat

This category of habitat gain includes areas that provided fish habitat under pre-development conditions, but have been enhanced at closure to provide specific habitat features to benefit the fish species in the lake. Examples of this category include the enhancement of Dyke B at closure, and the installation of finger reefs in Areas 6 and 7.

Altered Habitat

This category of habitat gain includes areas that provided fish habitat under pre-development conditions, but have been altered due to Project developments, and as such, provide a different quality of habitat at closure. These areas include reclaimed habitat areas associated with road and dykes that are decommissioned. It is assumed that these areas will largely provide similar substrate conditions as the surrounding habitats over time and will provide useable fish habitat.

Unaltered Habitat

This category of habitat gain includes areas that were dewatered during the operations phase but are refilled at closure, and otherwise remain unaltered from pre-development conditions in terms of substrate and depth characteristics. This also includes the reconnection of Lake D1 via outlet channels to Kennady Lake at closure. This category does not include the areas targeted for habitat enhancements identified above.

6.2 Culvert Rehabilitation Option

Based on the desktop analysis, the potential gains in terms of surface area for the culvert option is summarized below.

Redknife River

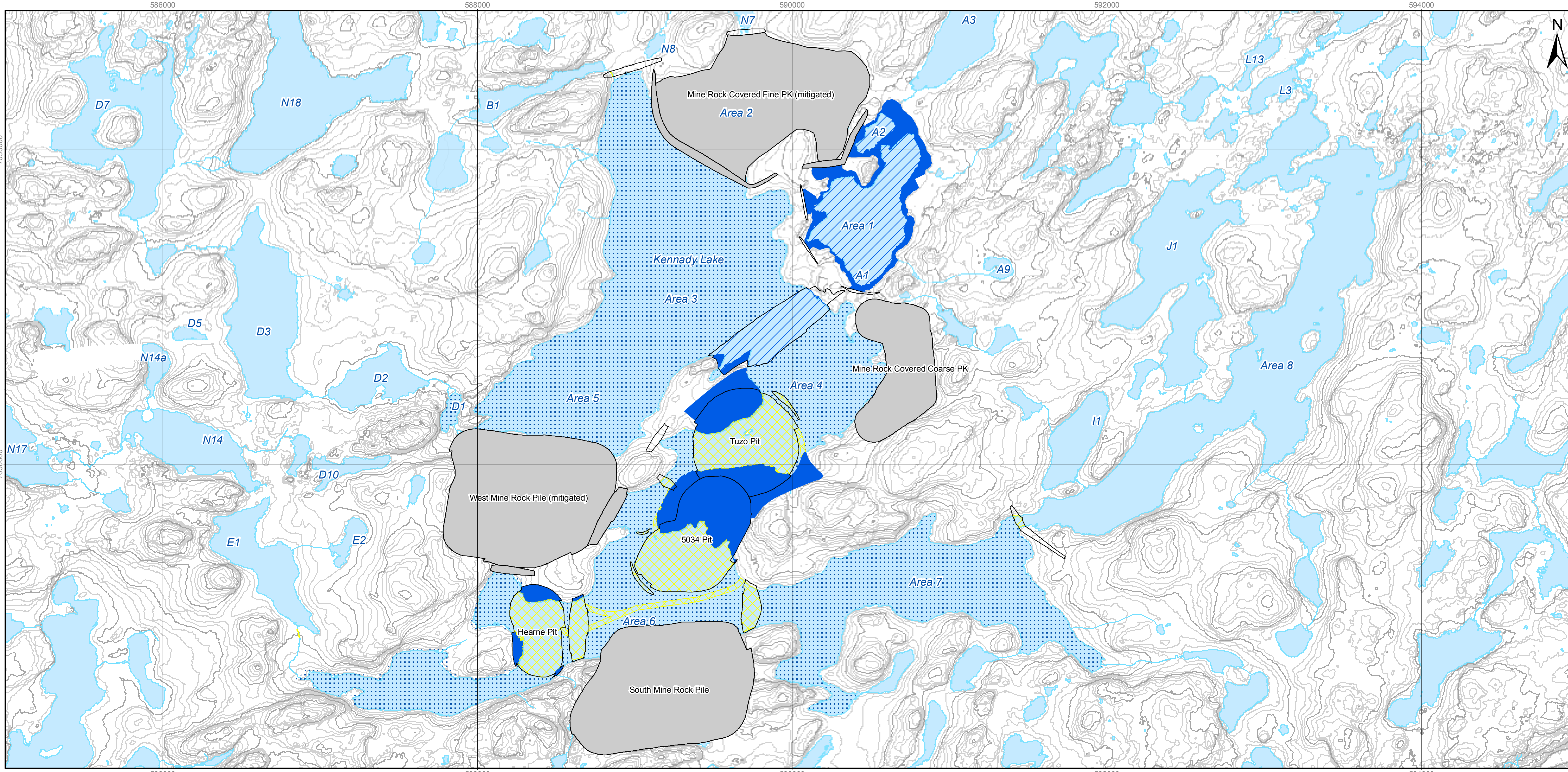
Following are preliminary findings regarding potential habitat gains for Arctic grayling in the Redknife River upstream of the crossing:

- Based on the total length of mainstem upstream of the crossing (184 km) and an assumed average width of 20 m, there is a potential gain of 368 ha by removing the barrier to upstream fish passage. This total includes a portion of Reach-2, and the entirety of Reaches 3 and 4. This is likely an upper bound to the potential habitat gains and has not been adjusted based on likely upstream extent of habitat use or habitat quality within the different reaches of the Redknife River.
- Additional critical habitat could be provided by upstream-situated tributaries. It is likely that the lower reaches of these systems could be used on a seasonal basis for spawning and rearing. If suitable flow conditions prevail over the summer and winter, there may be some potential for longer term rearing of young-of-the-year and yearling Arctic grayling. Because tributary Redknife-1 (“Devil Creek”) is located close to the road crossing, and it apparently features year-round flows, it would be reasonable to expect a further upstream gain of 10 ha.

The potential habitat gains for the Redknife River could be in excess of 350 ha pending field confirmation of habitat conditions and physical stream characteristics. The Redknife River culvert rehabilitation has the potential to provide habitat gains at a scale appropriate to offset habitat losses associated with the Project. However, field reconnaissance would be required to more accurately determine upstream gains in mainstem and tributaries based on actual width measurements, as well as the potential for Arctic grayling upstream migration, and identification of critical habitat for spawning and rearing. An appropriate method for quantifying habitat gains associated with a culvert rehabilitation project will have to be developed to allow for a comparison with Project habitat losses to determine if an appropriate level of habitat offset has been achieved.

6.3 Habitat Offset Ratio

At this point in time, the ratio for habit losses to habitat gains cannot be presented to determine if an appropriate level of habitat offset has been achieved. Once options are selected, De Beers will continue to work with DFO on the appropriate quantification of losses and gains in terms of area and habitat units.



I:\CLIENTS\DE_BEERS\11-1365-0001\Mapping\MXD\Fish\E2011-Fish-010-GIS.mxd

LEGEND

- Watercourse
- Index Contour (5m interval)
- Intermediate Contour (1m interval)
- Waterbody
- *A1* Lake Identifier

- Project Footprint
- Project Footprint - Permanently Lost Fish Habitat

Fish Habitat

- Altered Fish Habitat
- Enhanced Fish Habitat
- Newly Developed Fish Habitat
- Temporary Disruption

NOTES

Base Data Source: Eagle Mapping Ltd.

GAHCHO KUÉ PROJECT

Kennady Lake and Compensation Fish Habitat at Closure

PROJECTION: UTM Zone 12	DATUM: NAD83	DE BEERS CANADA
Scale: 1:25,000 (250 125 0 250 500 Meters)		
FILE No: E2011-Fish-010-GIS		DATE: October 15, 2012
JOB NO: 11-1365-0012	REVISION NO: 1	Figure 7
OFFICE: GOLD-CAL	DRAWN: DC	CHECK: KC

7.0 RESEARCH PROGRAMS

7.1 Background

The dewatering associated with the Project will result in the temporary disruption of fish habitat in Kennady Lake and a few small adjacent waterbodies. At closure, these areas will be refilled and will once again provide functional habitat with equivalent area and habitat suitability as pre-development conditions. To address the temporal lag of when unaltered and compensation habitat would be available, and reduce potential uncertainty of the compensation plan, De Beers has committed to carry out or fund research projects to provide compensation for these temporal losses. Rather than developing additional physical habitat to offset temporal losses, the research projects will contribute to the body of knowledge of northern fish species, their habitat requirements and the suitability and efficacy of measures to offset habitat losses associated with mining and other industrial developments. The extent of the research requirements for the compensation plan will, in part, be dependent on the compensation that can be achieved from the physical habitat compensation and how the research programs will contribute to reducing uncertainty and temporal lag such that the objectives of the compensation plan will be achieved.

The criteria for initially identifying research options included the following:

- The research option was considered likely to have sufficient scope, either alone or in combination, to fully compensate for the temporal habitat losses;
- The research option was achievable, both in terms of logistics and cost, with clear deliverable(s) as an end point and manageable budgets;
- The research option could fulfill DFO’s preference that the end product be publishable (primary literature or thesis);
- The work required for the research option could be clearly differentiated from work already required for monitoring;
- The research option would reduce uncertainty surrounding compensation feasibility or uncertainty around the effects of the current project on fish populations in Kennady Lake and surroundings; and
- The research option would increase overall understanding of basic biology of fish populations in northern ecosystems, which would improve DFO’s ability to manage similar projects in the future.

A discussion regarding potential research options presented by De Beers was held during the meeting with DFO on 27 June 2012. DFO provided some initial feedback and prioritization of options in the meeting held on 7 September 2012. The list of potential options has been provided to DFO Science for their advice and comment; however, this feedback has not been received at the time of writing.

Based on these criteria, the following research options were identified as summarized below. More details and the prioritization of DFO, are presented in the subsequent sections.

- **Patterns in fish movement and habitat use**. This option would increase understanding of migration and movement of fish in northern regions, as well as reduce uncertainty around assumptions of specific movement patterns within the Kennady Lake watershed.

- **Accuracy of population size estimates (compare mark-recapture and hydroacoustic methods)**. This option would provide information on the accuracy and increase certainty in population estimates, and give insight into the accuracy of the tested methods of estimating population size.
- **Potential for overwintering by fish in shallow lakes**. Assumptions of suitability of overwintering habitat are often made based on lake area or maximum open water depth. This option would explore the biotic and abiotic variables that would allow or prevent successful overwintering in shallow lakes in northern regions.
- **Development of regional HSI models for common fish species in the north**. This option would assemble a panel of experts to develop HSI curves for use on future projects in northern regions similar to the existing document for the Alberta oil sands region (Golder 2008), allowing for consistency between projects.

7.2 Higher Priority Options

Patterns in Fish Movement and Habitat Use

Fish movement and habitat usage by different species in northern environments are not well understood. To help address this, a research study could be conducted to investigate the ranges and patterns in fish movement in this region. The study would likely involve radio telemetry to track individual fish movement, but may involve other methods to determine fish movement.

Possible study directions include questions about basic biology, such as spawning behaviour, seasonal habitat use, as well as potentially addressing questions regarding movement of fish during the operational phase of the project, and the movement back into the refilled Kennady Lake.

The prioritization is based on the premise that this work directly relates to basic biology of fish in this region, has good potential for graduate student work, and for reporting in the primary literature. Based on DFO's feedback, key species to investigate are Arctic grayling (including movement patterns in lakes), as well as small-bodied fish species (i.e., slimy sculpin and lake chub). Small-bodied fish are used for fish health monitoring programs as they are assumed to be non-migratory (i.e., small and localized home ranges); it would be useful to determine if this is the case within this region.

Accuracy of Population Estimates

There are various methods used to determine estimates of fish population in lakes (e.g., mark-recapture and hydroacoustic surveys); however, there is generally a certain level of uncertainty associated with each of the techniques. Establishing the accuracy of population size estimates would increase certainty in population estimates, and give insight into the accuracy of the tested methods of estimating population size. The study would likely use mark-recapture and hydroacoustic methods prior to and during the fish-out, potentially combined with standard gill netting protocols, such as the Nordic netting protocol, or Broad-scale monitoring protocol.

The prioritization is based on the premise that this work would help reduce uncertainty for future projects, as well as for fisheries science (i.e., how well do the estimates compare with fish-out results). As a result, it has good potential for graduate research and reporting in the primary literature.

7.3 Medium Priority Options

Potential for Overwintering by Fish in Shallow Lakes

Ice coverage on boreal lakes can range from 1 to 2 m in thickness effectively eliminating any opportunity for oxygenation by the atmosphere during the ice-covered period, which may last for up to nine months in the North. If oxygen levels become limiting during the winter, this can potentially result in effects ranging from reductions in habitat use to winterkill. Such effects appear to occur more often in shallow than deep lakes, suggesting a reduced capacity of shallow lakes to store oxygen. Ice coverage limits re-oxygenation to the ice free period and this will be dependent on local climatic condition, rate of warming, and depth and area of lakes. Winds after ice-out will determine the downward extent of resulting physical disturbance in a lake and are largely responsible for re-oxygenation post ice out. Small lakes may experience a high rate of warming post ice out. The rapid increase in temperature, but decreasing density of surface water relative to subsurface water, may result in early but relatively shallow stratification. Once stratification is set up, it effectively limits any additional re-oxygenation of bottom waters making the bottom waters increasing susceptible to oxygen consumption caused by decaying algal and plant material. During the winter, since there is no opportunity for re-oxygenation, the organic content of the sediments, which is in part dependent on the amount of algal production the preceding ice-free season, may result in a high oxygen demand. Once oxygen levels fall below critical thresholds (e.g., ~6 mg/L for lake trout), it may result in a succession of negative biological effects, potentially terminating in death for sensitive fish species.

Currently, there is a lack of predictive relationships for boreal lakes as to lake area and depth, summer Chl *a* (as a measure of algal productivity), sediment organic content, winter ice cover (duration, thickness) and the ability to maintain adequate oxygen for a variety of species. Due to limited information on the relationship between these variables and dissolved oxygen levels, determining whether small lakes can support fish populations is often made based on untested assumptions (e.g., shallow lakes are often assumed to not support fish over winter). Testing these assumptions would allow for better understanding of fish presence and community structure in small lakes over winter.

The study would likely involve sampling a number (e.g., 50 to 60) small lakes (i.e., less than 5 ha) to determine relationships between key variables (size, depth, dissolved oxygen, temperature, organic content, Chl *a*, ice duration, ice thickness) followed by additional sampling of a subset of lakes to test assumptions on whether these lakes can support fish.

The prioritization is based on the premise that this would help with clarifying assumptions about winter habitat suitability in the North and what characteristics make a lake capable of supporting fish, and useful for DFO's decision-making abilities. This also has good potential for graduate student work, and for reporting in the primary literature.

Development of Regional HSI Models for Common Species in Northern Regions

HSI models are used to assess habitat losses/gains and compensation options in northern developments; however, these models are applied on a case by case basis, and there is no overarching model or model framework. Although life history and habitat information has been summarized for northern species, (e.g., Evans et al. 2002; Richardson et al. 2001), and can help with the assessment of the suitability of habitat, the models themselves still need to be developed for each project. Consequently, habitat suitability indices lack consistency among projects.

Consistent models have been developed for use in the Oil Sands region, but not for northern projects. Northern fish populations have unique life history and habitat needs resulting in different habitat requirements, and hence, require different HSI models than southern populations. Developing HSI models through expert consensus would increase consistency in compensation planning among projects in the north and help to increase certainty in proposed compensation plans.

A component of this work would be to assemble a group of experts to reach a consensus on HSI curves for species in northern regions; for example, the expertise could include fisheries scientists (academia, government and consulting), industry, and potentially incorporate traditional knowledge. In addition to the expert workshop, a component of this study could potentially be ongoing work to refine the models based on further baseline and monitoring data collected for this and other projects in the region (i.e., using field data to validate or update models over time).

The prioritization is based on the premise that this work directly relates to basic biology of fish in this region, and has relevance for DFO decision-making in the North. Coordination of industry proponents would also likely be beneficial from DFO's perspective.

7.4 Research Options from Site Workshops and Fish Habitat Compensation Workshop

During August workshops at Gahcho Kué and again in a workshop with Aboriginal representatives in Yellowknife on 20 September 2012, potential options for research were discussed. Included among these were the following:

- Additional research on inconnu, including determining potential reasons for why inconnu are no longer present in the Yellowknife River and why inconnu numbers have been declining in the Slave River. Studies have been conducted in the past few years on inconnu in Yellowknife Bay and Great Slave Lake by the Yellowknives Dene First Nation with support from DFO;
- Additional research on Stark Lake. There is a former uranium exploration site on the lake, and concerns were present regarding contamination of the lake from the site. Aboriginal Affairs and Northern Development Canada (AANDC) has conducted an environmental site assessment to inventory materials and characterize the environmental conditions at the site, and has plans for additional work, potentially in 2013;
- Determine ways to enhance Prelude and Prosperous lakes fisheries given the harvesting pressure on these systems; and
- Determine to what extent Slave River water quality is altering habitat usage for fish.

The Lutsel K'e Dene First Nation are preparing additional options for consideration in the NNLP.

8.0 COMPENSATION MONITORING

Habitat created or enhanced to compensate for the loss of fish habitat will be monitored, as required, to assess effectiveness of compensation by evaluating the physical and biological characteristics of the habitats, as well as fish use of the habitats. Habitat improvements will be implemented, as part of an adaptive management approach in consultation with regulators, if new or enhanced habitats are not providing the required habitat components for the target fish species.

Monitoring results would be used, if necessary, to adjust mitigation and habitat compensation measures and make design improvements as required. Habitat monitoring will be key to confirming the no net loss objective has been achieved.

Details of the compensation monitoring will be developed as compensation options are finalized. The detailed monitoring plan will be designed to meet all fish and fish habitat monitoring requirements included as conditions attached to any regulatory authorizations, approvals or permits that may be issued for development of the Project. Should, for some reason, the existing proposed habitat compensation not be sufficient to achieve no net loss, additional habitat compensation would be developed in consultation with the appropriate regulators. A conceptual monitoring plan will be developed as part of the Aquatic Effects Monitoring Program (AEMP), as appropriate, which will be undertaken during the permitting phase of the Project.

9.0 CONCLUSION

The purpose of the draft No Net Loss Plan is to show that compensation is achievable and DFO's No Net Loss Guiding Principle can be met. Based on the options presented in the draft No Net Loss Plan and the discussions with DFO, De Beers will be able to compensate for the HADD associated with the Project. The option presented in the June 29 Compensation Plan Update memo, which included the development of a compensation lake in the D-E-N watershed in combination with additional in-lake habitat enhancements could provide sufficient habitat units to compensate for the habitat destruction (i.e., permanent losses) and habitat alteration (i.e., portions of Kennady Lake that will be physically altered after dewatering and later submerged in the refilled lake) associated with the Project. The final size and location of habitat features and enhancements would be determined at the detailed design phase and factors like construction material availability, geotechnical characteristics, terrain, actual compensation requirements versus terrestrial impacts of construction would factor into decision-making. The compensation habitat units will be recalculated based on the specifics of the detailed design.

However, it is recognized that other off-site options are still under consideration (e.g., culvert rehabilitation or habitat enhancements near communities) based on feedback of the D-E-N compensation lake not being a preferred option of DFO or the communities. If these options are pursued, it is anticipated that sufficient habitat gains will be achieved such that no net loss is achieved. Further discussions will occur with DFO on the accounting of habitat losses/gains based on the finalized compensation options chosen. Consultation on habitat offset options is ongoing and will be finalized during the regulatory permitting phase in advance of applying for a *Fisheries Act* Authorization for the Project.

To offset the habitat disruption (i.e., the portions of Kennady Lake that will be dewatered but not otherwise physically altered before being submerged in the refilled Kennady Lake), De Beers is planning on supporting research programs. A number of research opportunities that De Beers would support are being explored, which would address temporal lag of when compensation habitat would be available, as well as reduce potential uncertainty of the compensation plan. Additional community-based options that support local fish or fish habitat initiatives may also be considered within this aspect of the no net loss plan.

De Beers will also develop a detailed monitoring program designed to address all of its fish and fish habitat monitoring that will track the progress of the compensation habitat, identify any intervention that is required, and evaluate the success of the habitat. If the compensation habitat does not fully meet De Beers' regulatory obligations, additional compensation will be developed to meet DFO requirements. This monitoring program and adaptive management response will further ensure that De Beers meets its fish habitat compensation regulatory requirements. A detailed monitoring plan will be developed as part of the Aquatic Effects Monitoring Program (AEMP), as appropriate, which will be finalized during the permitting phase of the Project.

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10.0 REFERENCES

ASTER GDEM Worldwide Elevation Data. 2011. Available online at: http://asterweb.jpl.nasa.gov/gdem.asp

BC MELP (BC Ministry of Environment, Lands and Parks). 1998. British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials. Province of British Columbia.

Canvec, Canada. 2012. Natural Resources Canada. Available online at: http://geogratis.cgdi.gc.ca/geogratis/en/product/search.do?id=5460AA9D-54CD-8349-C95E-1A4D03172FDF

Cumberland Resources Ltd. 2005. Aquatic Ecosystem/Fish Habitat Impact Assessment. Prepared for the Meadowbank Gold Project.

De Beers (De Beers Canada Mining Inc.). 2002. Snap Lake Diamond Project Environmental Assessment Report. Prepared for De Beers Canada Mining Inc. by Golder Associates Ltd. Yellowknife, N.W.T. February 2002.

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

De Beers. 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011.

De Beers. 2012a. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board. April 2012.

De Beers. 2012b. Gahcho Kué Draft Fish-Out Plan. De Beers Technical Memorandum. Submitted to the to the Mackenzie Valley Environmental Impact Review Board. October 2012. File No: S110-01-04

Diavik (Diavik Diamond Mines Inc.). 1998. Environmental Assessment Report. Diavik Diamond Mines Inc. Yellowknife, NT.

DFO (Fisheries and Oceans Canada). 1986. The Department of Fisheries and Oceans Policy for the Management of Fish Habitat. Presented to Parliament by the Minister of Fisheries and Oceans. October 7, 1986.

DFO. 2006. Practitioners Guide to Habitat Compensation, Developed from the Policy for the Management of Fish Habitat (Habitat Policy) (1986).

Evans, C.L., J.D. Reist, and C.K. Minns. 2002. Life History Characteristics of Freshwater Fishes Occurring in the Northwest Territories and Nunavut, with Major Emphasis on Riverine Habitat Requirements. *Canadian Manuscript Report of Fisheries and Aquatic Sciences* 2614: xiii + 169 p.

Golder Associates Ltd. (Golder). 2005. Doris North Project "No Net Loss" Plan, Revision 4. A report prepared for Miramar Hope Bay Ltd by Golder Associates Ltd, Edmonton, AB. 66 pp. + appendices

Golder. 2008. Fish Species Habitat Suitability Index Models for the Alberta Oil Sands Region. Version 2.0. October 2008.

Golder. 2012a. 2011 Fish and Aquatic Resources Supplemental Monitoring Report. Submitted to the Mackenzie Valley Environmental Impact Review Board, March 2012.

Golder. 2012b. 2012 Fish and Aquatic Resources Supplemental Monitoring Report. In progress.

Golder. 2012c. Gahcho Kué Fish Habitat Compensation Plan – Update. Technical Memorandum from Kasey Clipperton, Golder Associates Ltd., to Andrew Williams, De Beers Canada Inc. Submitted to the Mackenzie Valley Environmental Impact Review Board, June 2012. DCN-070.

Golder. 2012d. Gahcho Kué Flow Mitigation Plan (June 2012). Technical Memorandum from Kasey Clipperton, Golder Associates Ltd., to Andrew Williams, De Beers Canada Inc. Submitted to the Mackenzie Valley Environmental Impact Review Board, June 2012. DCN-069.

Mainstream Aquatics (Mainstream Aquatics Ltd.) 2004. Revised fish habitat no net loss plan for the Jericho Diamond Project. Prepared for Tahera Diamond Corporation. Report No. 04006BF: 63 pp. + appendices.

Richardson, E.S., J.D. Reist, and C.K. Minns. 2001. Life History Characteristics of Freshwater Fishes Occurring in the Northwest Territories and Nunavut, with Major Emphasis on Lake Habitat Requirements. *Canadian Manuscript Report of Fisheries and Aquatic Sciences* 2569.

Stewart, D.B., and G. Low. 2000. A review of information on fish stocks and harvests in the Deh Cho area, Northwest Territories. Can. Manuscr. Rep. Fish. Aquat. Sci. 2549: iv + 73 p.

Stewart, D.B., N.J. Mochnacz, J.D. Reist, T.J. Carmichael, and C.D. Sawatzky. 2007a. Fish Life History and Habitat Use in the Northwest Territories: Arctic Grayling (*Thymallus arcticus*). *Canadian Manuscript Report of Fisheries and Aquatic Sciences* 2797: vi + 55 p.

Stewart, D.B., Carmichael, T.J., Sawatzky, C.D., Mochnacz, N.J., and Reist, J.D. 2007b. Fish Life History and Habitat Use in the Northwest Territories: Round Whitefish (*Prosopium cylindraceum*). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2795: vi + 37 p.

Toporama Web Mapping Service. 2012. Natural Resources Canada. Located online at: http://geogratis.cgdi.gc.ca/geogratis/en/service/toporama.html;jsessionid=C5E6176A092C53E19F4FD3CB230F22DB.

USFWS (United States Fish and Wildlife Service). 1980. Habitat Evaluation Procedures (HEP). USDI Fish and Wildlife Service. Division of Ecological Services. ESM 102.

11.0 ABBREVIATIONS

AEMP	Aquatics Effects Monitoring Program
De Beers	De Beers Canada Inc.
CCP	Conceptual Compensation Plan
DFO	Fisheries and Oceans Canada
EIS	Environmental Impact Statement
GIS	Geographic Information System
HADD	harmful alteration or disruption, or destruction
HEP	Habitat Evaluation Procedure
HSI	Habitat Suitability Index
HU	Habitat Unit
NWT	Northwest Territories
PK	Processed Kimberlite
PKC	Processed Kimberlite Containment
USFWS	US Fish and Wildlife Service
y-o-y	Young-of-the-year

11.1 Units of Measure

%	percent
ha	hectares
km	kilometres
m	metre
m^2	square metres
masl	metres above sea level
mg/L	milligrams per litre
m/km	metres per kilometre

12.0 GLOSSARY

Boulder	A large rounded mass of rock lying on the surface of the ground or embedded in the soil.
Coarse kimberlite	Coarse kimberlite particles range in size from 1.0 mm to 6 mm.
Downstream	Away from the source of a river or stream.
Dyke	A levee, a natural or artificial slope, or wall to regulate water levels.
Fine processed kimberlite	Fine processed kimberlite material with a particle size that smaller than 0.25 mm.
Fines	Silt and clay particles.
Finger reef	A reef constructed for the purpose of creating high value fish habitat. These reefs are configured to be somewhat irregular in size and shape and relatively long and narrow. 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.
Habitat	The place or environment where a plant or animal naturally or normally lives or occurs.
Infrastructure	Basic facilities, such as transportation, communications, power supplies and buildings, which enable an organization, project, or community to function.
Littoral	The shallow, shoreline area of a lake.
Mine rock	Excavated bed rock surrounding the kimberlite deposits. Mine rock consists primarily of granitic rock material.
Open-pit mine	A mine where rock or mineral extraction from the earth is done using a pit or borrow open to the surface, rather than using a tunnel into the earth.
Processed kimberlite	The material that remains after all economically and technically recoverable diamonds have been removed from the kimberlite during processing.
Processed kimberlite containment	On-site storage facility for storing processed kimberlite.
Rearing	Raising of offspring, particular at the early stages of development.
Riparian	Refers to terrain, vegetation or simply a position next to or associated with a stream, floodplain or standing waterbody.
Runoff	The portion of water from rain and snow that flows over land to streams, ponds or other surface waterbodies. It is the portion of water from precipitation that does not infiltrate into the ground, or evaporate.
Sediment	Solid material that is transported by, suspended in, or deposited from water. It originates mostly from disintegrated rocks; it also includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope soil characteristics, land usage, and quantity and intensity of precipitation.
Spawning	The process of aquatic animals releasing eggs and sperm.
Tundra	Treeless terrain, with a continuous cover of vegetation, found at both high latitudes and high altitudes. Tundra vegetation comprises lichens, mosses, sedges, grasses, forbs and low shrubs, including heaths, and dwarf willows and birches. The term is used to refer to both the region and the vegetation growing in the region.
Young-of-the-year (fish)	Fish at age 0, within the first year after hatching.
Watershed	The entire catchment area of runoff containing a single outlet.

Report Signature Page

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APPENDIX A

Site Photographs

Waterbodies

Lake D1

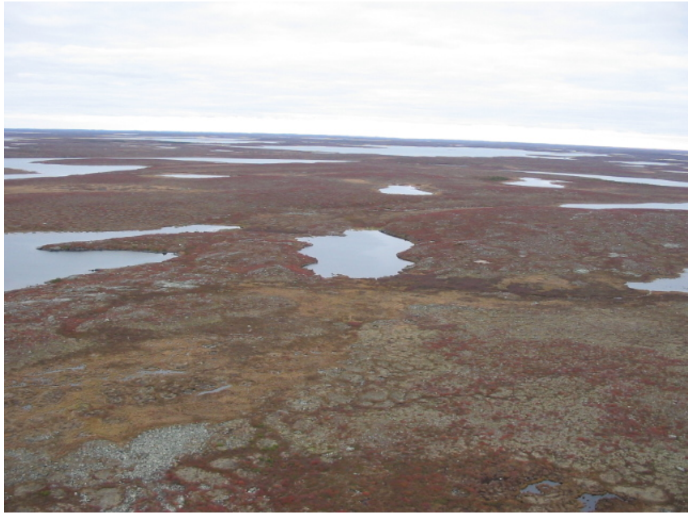


Photo 1 Aerial view of Lake D1. Fall 2005.

Lake D2

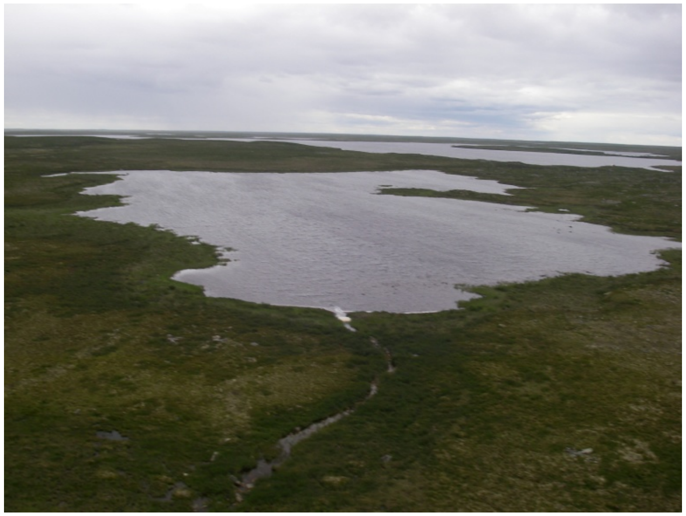


Photo 2 Aerial view of Lake D2. Summer 2012.

Lake D3

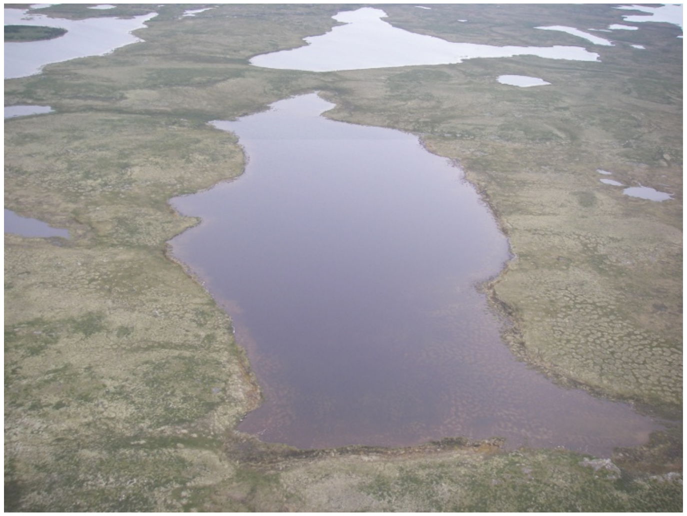


Photo 3 Aerial view of Lake D3. Summer 2012.

Lake D4

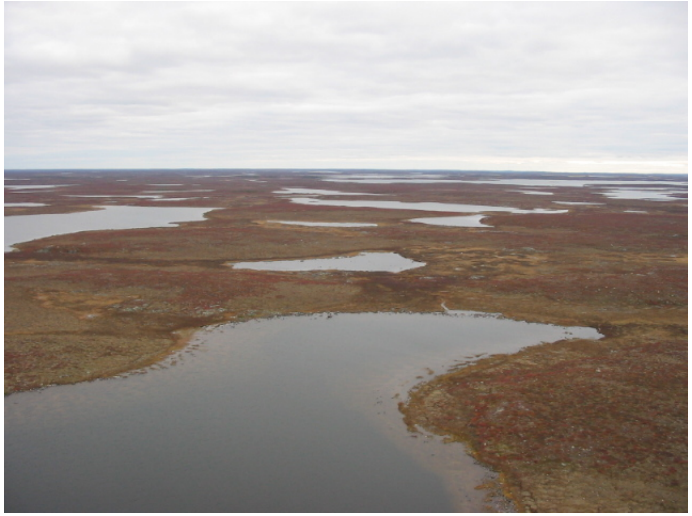


Photo 4 Aerial view of Lake D4. Fall 2005.

Lake D10

Photo 5 Aerial view of Lake D10. Fall 2005.

Lake E1

Photo 6 Aerial view of Lake E1. Summer 2012.

Lake E2

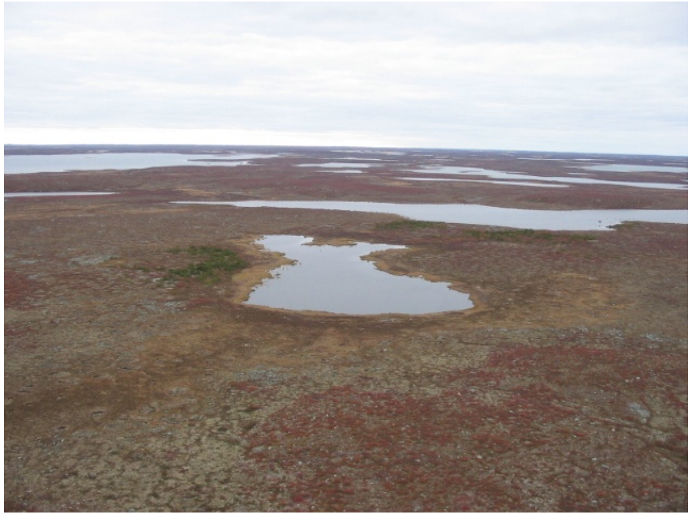


Photo 7 Aerial view of Lake E2. Fall 2005.

Lake Ka1

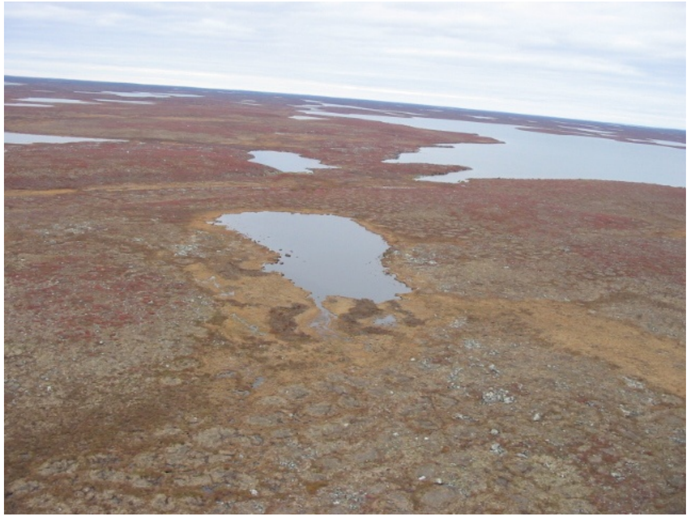


Photo 8 Aerial view of Lake Ka1 showing no inlet or outlet. Fall 2005.

Lake Kb1

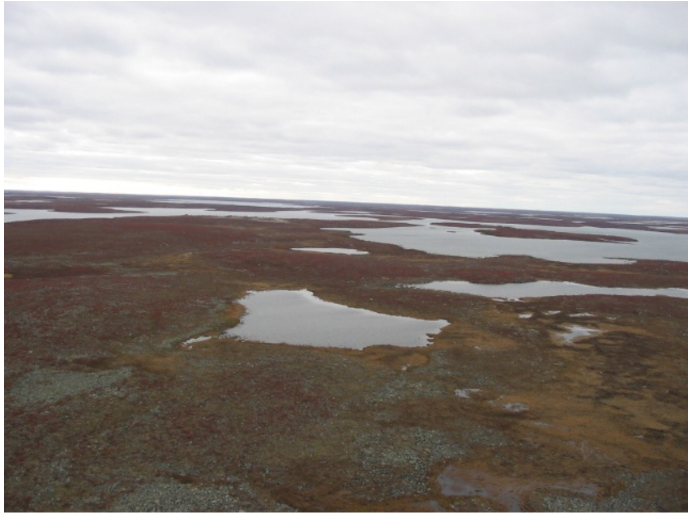


Photo 9 Aerial view of Lake Kb1 showing no inlet or outlet. Fall 2005.

Lake Kb4

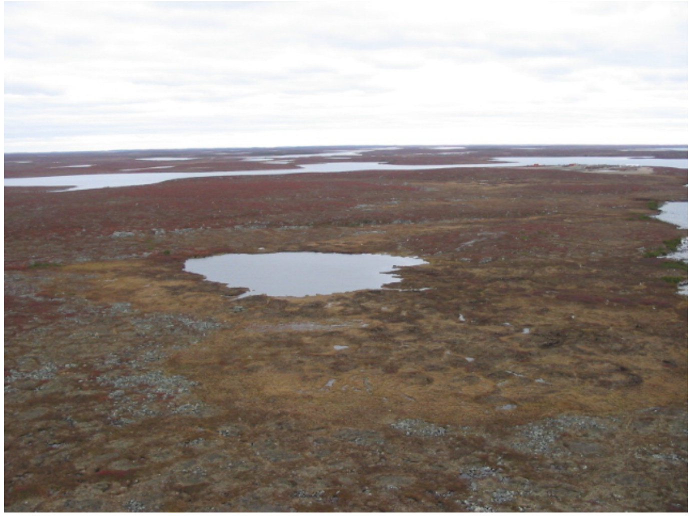


Photo 10 Aerial view of Lake Kb4 showing no inlet or outlet. Fall 2005.

Lake N7

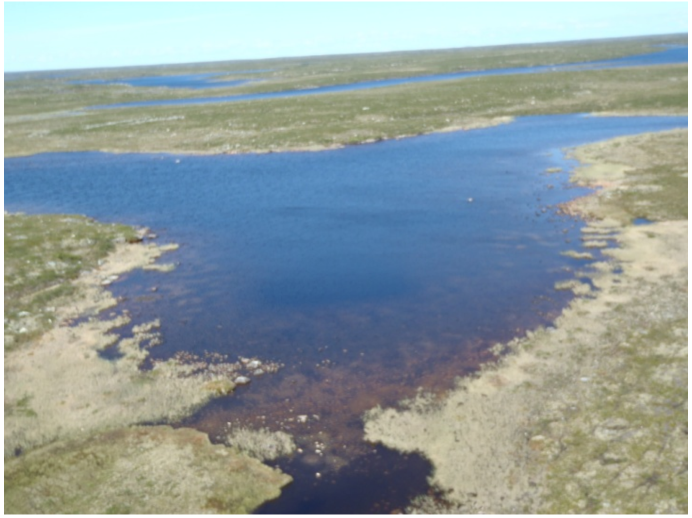


Photo 11 Aerial view of Lake N7. Summer 2011.

Watercourses

A1

Photo 12 Aerial view of Stream A1. Spring 2004.

A2

Photo 13 Aerial view of Stream A2. Spring 2004.

A3

Photo 14 Aerial view of Stream A3. Summer 2011.

A5

Photo 15 View of Stream A5. Summer 2011.

A6

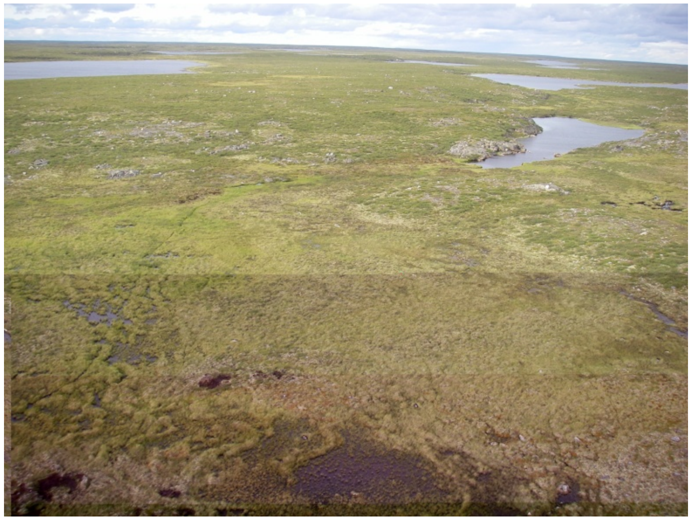


Photo 16 Aerial view of Stream A6. Summer 2012.

A8

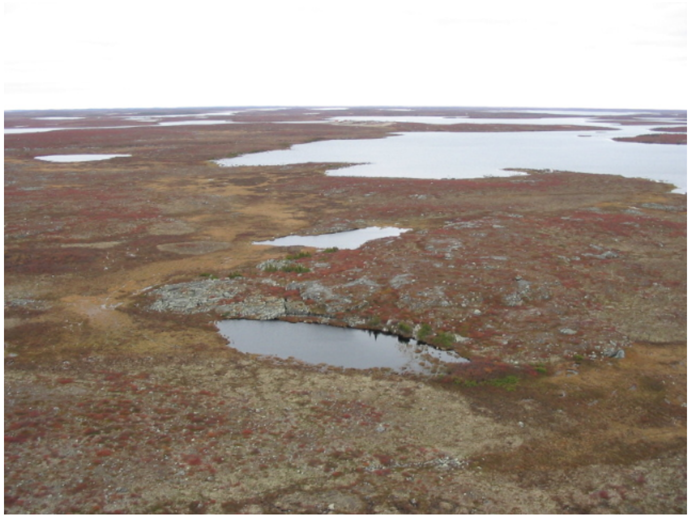


Photo 17 Aerial view of Lake A8 showing no inlet or outlet. Fall 2005.

B1

Photo 18 View of Stream B1. Spring 2004.

C1

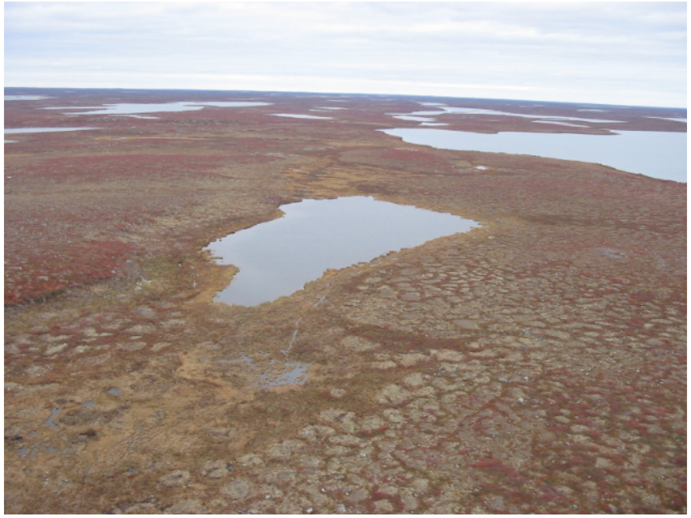


Photo 19 Aerial view of Lake C1 showing no inlet or outlet. Fall 2005.

D1

Photo 20 View of Stream D1. Spring 2004.

D2

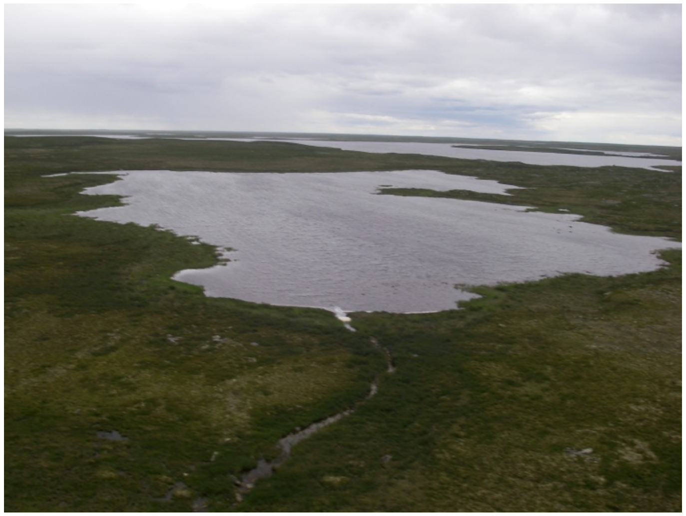


Photo 21 Aerial view of Stream D2. Summer 2012.

D3

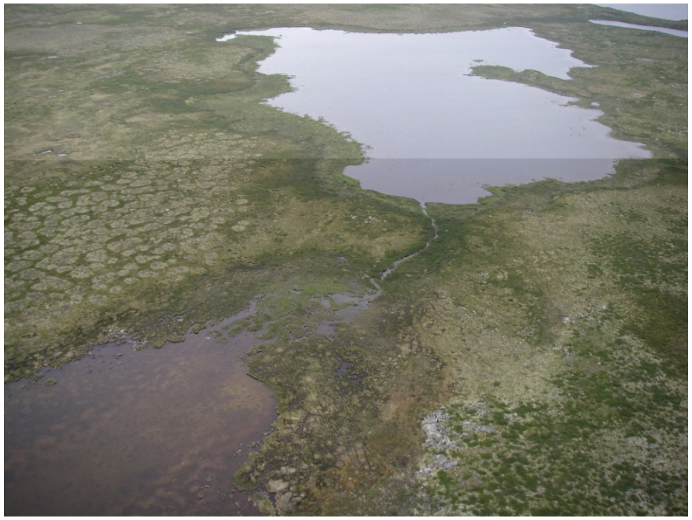


Photo 22 Aerial view of Stream D3. Summer 2012.

D4

Photo 23 Aerial view of Stream D4. Summer 2004.

D5

Photo 24 Aerial view of Lake D5. Summer 2011.

D6

Photo 25 View of Stream D6. Summer 2004.

E1

Photo 26 View of Stream E1. Summer 2004.

E2

Photo 27 Aerial view of Stream E2. Summer 2004.

F1

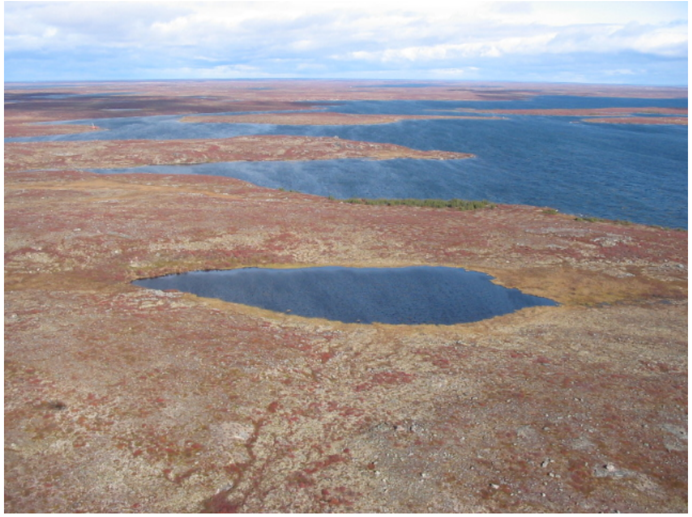


Photo 28 Aerial view of Lake F1 showing no inlet or outlet. Fall 2005.

H1a

Photo 29 View of Stream H1a. Summer 2004.

K1N1

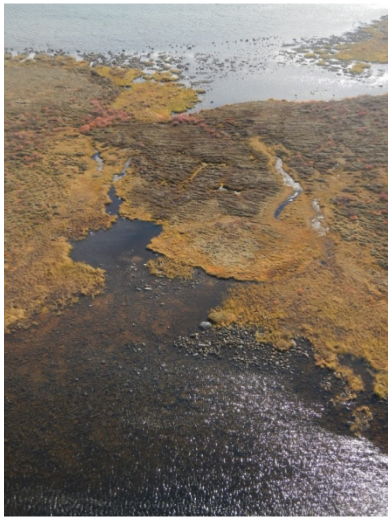


Photo 30 Aerial view of Stream K1N1. Summer 2012.

Kb2

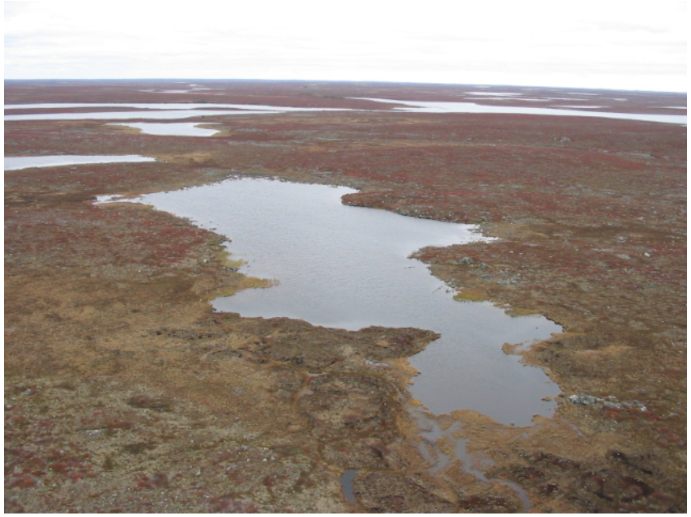


Photo 31 Aerial view of Lake Kb4 and Stream Kb4. Fall 2005.

UNK1

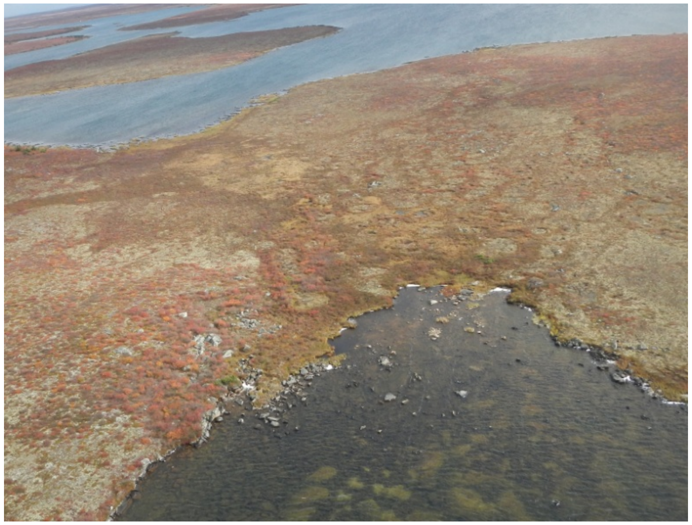


Photo 32 Aerial view of Stream UNK1. Summer 2012.

UNK2

Photo 33 Aerial view of Stream UNK2. Summer 2012.

UNK3

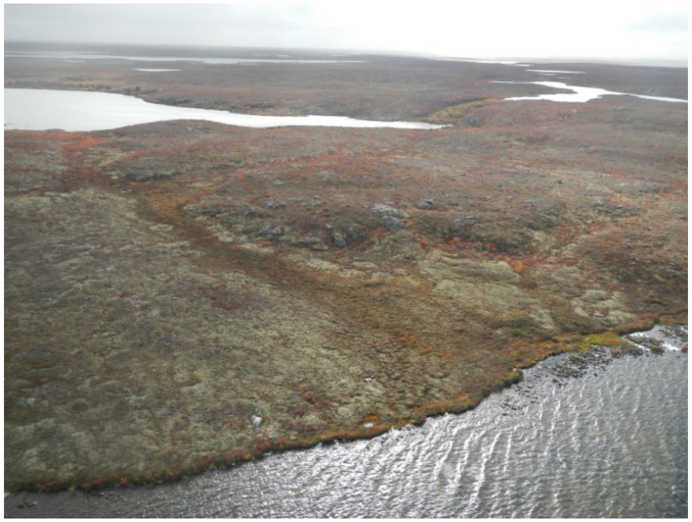


Photo 34 Aerial view of Stream UNK3. Summer 2012.

UNK4

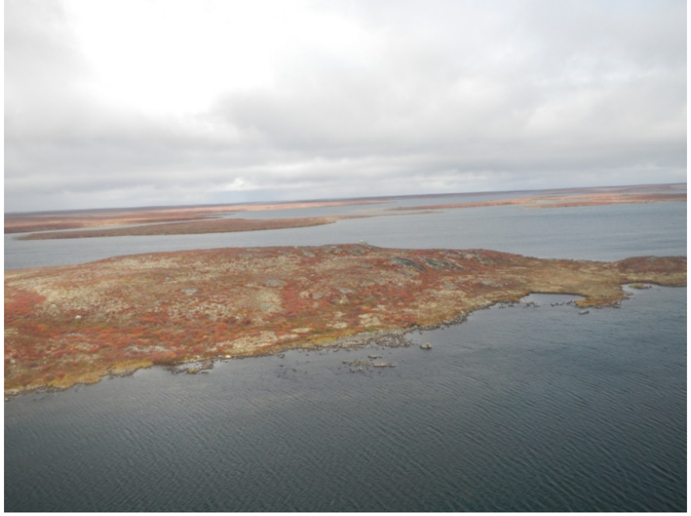


Photo 35 Aerial view of Stream UNK4. Summer 2012.

UNK5

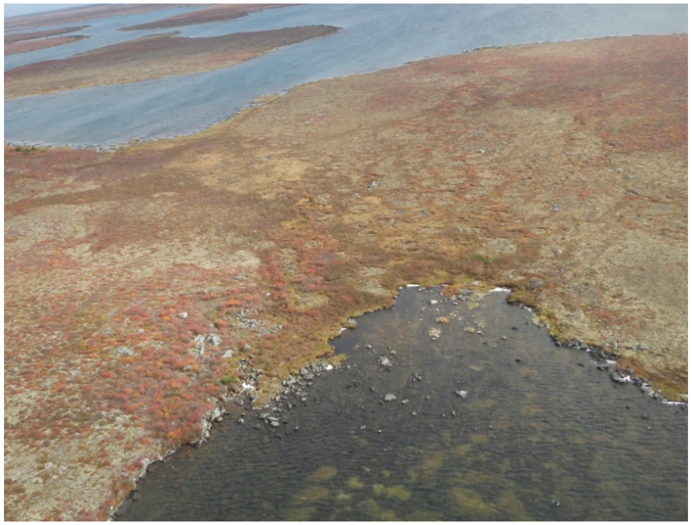


Photo 36 Aerial view of Stream UNK5. Summer 2012.

UNK6

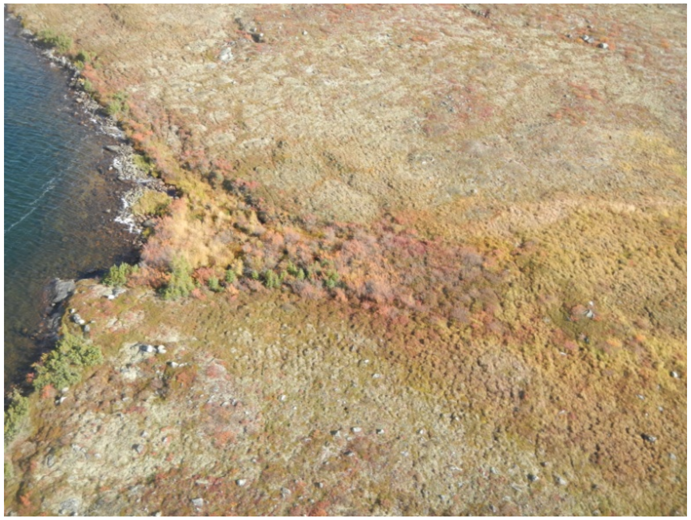


Photo 37 Aerial view of Stream UNK6. Summer 2012.

UNK7

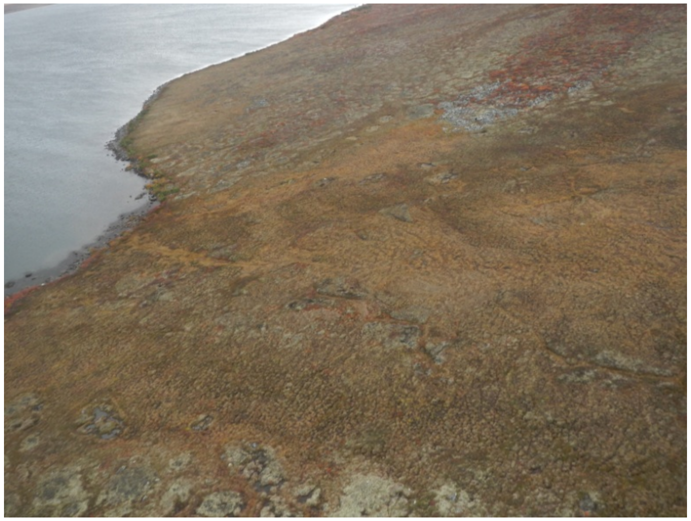


Photo 38 Aerial view of Stream UNK7. Summer 2012.

APPENDIX B

Habitat Suitability Index (HSI) Models

Table B-1: Draft Habitat Suitability Index Model for Arctic Grayling in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	0.75	1	0	0
	Boulder	0.75	1	0	0
	Bedrock	0.25	0.25	0	0
	Bedrock/Boulder	0.25	0.5	0	0
	Bedrock/Cobble	0.25	0.5	0	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.5	0	0
	Fines/Organics	0.25	0.25	0	0
	Cobble/Gravel	0.75	0.75	0	0
	Boulder/Fines	0.5	0.5	0	0
	Cobble/Fines	0.5	0.5	0	0
	Boulder/Gravel	0.75	0.75	0	0
2 - 4 m	Boulder/Cobble	1	0.75	0	0.75
	Boulder	1	0.75	0	0.75
	Bedrock	0.25	0	0	0.25
	Bedrock/Boulder	0.25	0.25	0	0.75
	Bedrock/Cobble	0.25	0.25	0	0.5
	Vegetation/Organics	0.25	0	0	0.75
	Vegetation/Boulder	0.5	0.25	0	0.75
	Fines/Organics	0.25	0	0	0.25
	Cobble/Gravel	0.75	0.5	0	0.5
	Boulder/Fines	0.5	0.25	0	0.75
	Cobble/Fines	0.5	0.25	0	0.5
	Boulder/Gravel	1	0.5	0	0.75
> 4 m	Boulder/Cobble	0.5	0.25	0	1
	Boulder	0.5	0.25	0	1
	Bedrock	0.25	0	0	0.5
	Bedrock/Boulder	0.25	0	0	1
	Fines/Organics	0.25	0	0	0.5
	Cobble/Gravel	0.5	0	0	0.75
	Boulder/Fines	0.25	0	0	1
	Cobble/Fines	0.25	0	0	0.75
	Boulder/Gravel	0.5	0	0	1

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-2: Draft Habitat Suitability Index Model for Burbot in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	0.75	1	0	0
	Boulder	0.75	1	0	0
	Bedrock	0	0	0	0
	Bedrock/Boulder	0	0	0	0
	Bedrock/Cobble	0	0	0	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.5	0	0
	Fines/Organics	0.25	0.25	0	0
	Cobble/Gravel	0.5	0.75	0	0
	Boulder/Fines	0.25	0.75	0	0
	Cobble/Fines	0.25	0.75	0	0
	Boulder/Gravel	0.75	1	0	0
2 - 4 m	Boulder/Cobble	0.75	0.75	1	0.75
	Boulder	0.75	0.75	0.75	0.75
	Bedrock	0	0	0	0.25
	Bedrock/Boulder	0	0	0	0.75
	Bedrock/Cobble	0	0	0	0.5
	Vegetation/Organics	0.25	0	0	0.75
	Vegetation/Boulder	0.25	0.25	0	0.75
	Fines/Organics	0.25	0	0	0.25
	Cobble/Gravel	0.5	0.5	1	0.5
	Boulder/Fines	0.25	0.5	0.25	0.75
	Cobble/Fines	0.25	0.5	0.5	0.5
	Boulder/Gravel	0.75	0.75	1	0.75
> 4 m	Boulder/Cobble	1	0.5	0.75	1
	Boulder	1	0.5	0.5	1
	Bedrock	0	0	0	0.5
	Bedrock/Boulder	0	0	0	1
	Fines/Organics	0.25	0	0	0.5
	Cobble/Gravel	0.75	0.25	0.75	0.75
	Boulder/Fines	1	0.25	0	1
	Cobble/Fines	0.5	0.25	0.25	0.75
	Boulder/Gravel	1	0.5	0.75	1

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-3: Draft Habitat Suitability Index Model for Lake Chub in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	1	1	1	0
	Boulder	1	1	0.5	0
	Bedrock	0	0	0	0
	Bedrock/Boulder	1	1	0.25	0
	Bedrock/Cobble	1	1	0.25	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.25	0.5	0
	Fines/Organics	0	0	0	0
	Cobble/Gravel	1	1	1	0
	Boulder/Fines	0.5	0.5	0.5	0
	Cobble/Fines	0.5	0.5	0.75	0
	Boulder/Gravel	0.5	0.5	1	0
2 - 4 m	Boulder/Cobble	1	1	0.5	1
	Boulder	1	1	0.25	1
	Bedrock	0	0	0	0.5
	Bedrock/Boulder	0.25	0.25	0	0.5
	Bedrock/Cobble	0.25	0.25	0	0.5
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.5	0.5	0.25	0
	Fines/Organics	0	0	0	0.5
	Cobble/Gravel	1	1	0.5	1
	Boulder/Fines	0.5	0.5	0.25	0.5
	Cobble/Fines	0.5	0.5	0.5	0.5
	Boulder/Gravel	0.5	0.5	0.5	0.5
> 4 m	Boulder/Cobble	0.5	0.5	0.25	0.75
	Boulder	0.5	0.5	0.25	0.75
	Bedrock	0	0	0	0.25
	Bedrock/Boulder	0.25	0.25	0	0.25
	Fines/Organics	0	0	0	0.25
	Cobble/Gravel	1	1	0.25	0.75
	Boulder/Fines	0.5	0.5	0	0.25
	Cobble/Fines	0.5	0.5	0.25	0.25
	Boulder/Gravel	0.5	0.5	0.25	0.25

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-4: Draft Habitat Suitability Index Model for Lake Trout in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	0.75	0.75	0	0
	Boulder	0.75	0.75	0	0
	Bedrock	0.25	0	0	0
	Bedrock/Boulder	0.25	0.25	0	0
	Bedrock/Cobble	0.25	0.25	0	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.25	0	0
	Fines/Organics	0.25	0.25	0	0
	Cobble/Gravel	0.5	0.5	0	0
	Boulder/Fines	0.25	0.25	0	0
	Cobble/Fines	0.25	0.25	0	0
	Boulder/Gravel	0.25	0.5	0	0
2 - 4 m	Boulder/Cobble	1	1	0.75	0.75
	Boulder	1	1	0.5	0.75
	Bedrock	0.25	0.25	0	0.25
	Bedrock/Boulder	0.25	0.25	0	0.75
	Bedrock/Cobble	0.25	0.25	0	0.5
	Vegetation/Organics	0.25	0.25	0	0.75
	Vegetation/Boulder	0.25	0.25	0	0.75
	Fines/Organics	0.25	0.25	0	0.25
	Cobble/Gravel	0.5	0.75	0.25	0.5
	Boulder/Fines	0.25	0.25	0	0.75
	Cobble/Fines	0.25	0.25	0	0.5
	Boulder/Gravel	0.5	0.75	0.5	0.75
> 4 m	Boulder/Cobble	1	0.75	1	1
	Boulder	1	0.75	0.75	1
	Bedrock	0.25	0.25	0	0.5
	Bedrock/Boulder	0.25	0.25	0	1
	Fines/Organics	0.25	0.25	0	0.5
	Cobble/Gravel	0.5	0.5	0.5	0.75
	Boulder/Fines	0.25	0.25	0	1
	Cobble/Fines	0.25	0.25	0	0.75
	Boulder/Gravel	0.5	0.5	0.75	1

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-5: Draft Habitat Suitability Index Models for Northern Pike in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	0.25	0	0	0
	Boulder	0.25	0	0	0
	Bedrock	0	0	0	0
	Bedrock/Boulder	0	0	0	0
	Bedrock/Cobble	0	0	0	0
	Vegetation/Organics	1	1	1	0
	Vegetation/Boulder	1	0.75	0.75	0
	Fines/Organics	1	0.5	0	0
	Cobble/Gravel	0.5	0	0	0
	Boulder/Fines	0.25	0	0	0
	Cobble/Fines	0.5	0	0	0
	Boulder/Gravel	0.25	0	0	0
2 - 4 m	Boulder/Cobble	0.25	0	0	1
	Boulder	0.25	0	0	1
	Bedrock	0	0	0	0.5
	Bedrock/Boulder	0	0	0	0.5
	Bedrock/Cobble	0	0	0	0.5
	Vegetation/Organics	1	0.75	0.5	1
	Vegetation/Boulder	1	0.5	0.25	1
	Fines/Organics	1	0.25	0	0.5
	Cobble/Gravel	0.5	0	0	0.5
	Boulder/Fines	0.25	0	0	1
	Cobble/Fines	0.5	0	0	0.5
	Boulder/Gravel	0.25	0	0	1
> 4 m	Boulder/Cobble	0	0	0	0.75
	Boulder	0	0	0	0.75
	Bedrock	0	0	0	0.25
	Bedrock/Boulder	0	0	0	0.25
	Fines/Organics	0.25	0	0	0.25
	Cobble/Gravel	0	0	0	0.5
	Boulder/Fines	0.25	0	0	0.75
	Cobble/Fines	0	0	0	0.5
	Boulder/Gravel	0	0	0	0.75

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-6: Draft Habitat Suitability Index for Ninespine Stickleback in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	0.5	0.25	0	0
	Boulder	0.5	0.25	0	0
	Bedrock	0	0	0	0
	Bedrock/Boulder	0	0	0	0
	Bedrock/Cobble	0	0	0	0
	Vegetation/Organics	1	1	1	0
	Vegetation/Boulder	1	0.75	0.75	0
	Fines/Organics	1	0.75	0.5	0
	Cobble/Gravel	0.5	0.25	0	0
	Boulder/Fines	0.5	0.25	0	0
	Cobble/Fines	0.5	0.25	0	0
	Boulder/Gravel	0.5	0.25	0	0
2 - 4 m	Boulder/Cobble	0.25	0	0	0.5
	Boulder	0.25	0	0	0.5
	Bedrock	0	0	0	0
	Bedrock/Boulder	0	0	0	0
	Bedrock/Cobble	0	0	0	0
	Vegetation/Organics	0.75	0.75	0.5	0.5
	Vegetation/Boulder	0.75	0.5	0.25	0.5
	Fines/Organics	0.75	0.5	0	0.5
	Cobble/Gravel	0.25	0	0	0.5
	Boulder/Fines	0.25	0	0	0.5
	Cobble/Fines	0.25	0	0	0.5
	Boulder/Gravel	0.25	0	0	0.5
> 4 m	Boulder/Cobble	0	0	0	1
	Boulder	0	0	0	1
	Bedrock	0	0	0	0
	Bedrock/Boulder	0	0	0	0
	Fines/Organics	0	0	0	1
	Cobble/Gravel	0	0	0	1
	Boulder/Fines	0	0	0	1
	Cobble/Fines	0	0	0	1
	Boulder/Gravel	0	0	0	1

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-7: Draft Habitat Suitability Index Model for Round Whitefish in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	0.75	0.75	0	0
	Boulder	0.75	0.5	0	0
	Bedrock	0.25	0	0	0
	Bedrock/Boulder	0.25	0.25	0	0
	Bedrock/Cobble	0.25	0.25	0	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.25	0	0
	Fines/Organics	0.25	0.25	0	0
	Cobble/Gravel	0.75	0.75	0	0
	Boulder/Fines	0.25	0.25	0	0
	Cobble/Fines	0.25	0.25	0	0
	Boulder/Gravel	0.75	0.75	0	0
2 - 4 m	Boulder/Cobble	1	1	0.75	0.75
	Boulder	1	0.75	0.25	0.75
	Bedrock	0.25	0	0	0.25
	Bedrock/Boulder	0.25	0.25	0	0.75
	Bedrock/Cobble	0.25	0.25	0	0.5
	Vegetation/Organics	0.25	0.25	0	0.75
	Vegetation/Boulder	0.25	0.25	0	0.75
	Fines/Organics	0.25	0.25	0	0.25
	Cobble/Gravel	1	1	0.75	0.5
	Boulder/Fines	0.25	0.5	0.25	0.75
	Cobble/Fines	0.25	0.5	0.25	0.5
	Boulder/Gravel	1	1	0.75	0.75
> 4 m	Boulder/Cobble	0.5	0.5	1	1
	Boulder	0.5	0.25	0.5	1
	Bedrock	0.25	0	0	0.5
	Bedrock/Boulder	0.25	0.25	0	1
	Fines/Organics	0.25	0.25	0	0.5
	Cobble/Gravel	0.5	0.5	1	0.75
	Boulder/Fines	0.25	0.25	0.25	1
	Cobble/Fines	0.25	0.25	0.25	0.75
	Boulder/Gravel	0.5	0.5	1	1

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

Table B-8: Draft Habitat Suitability Index Model for Slimy Sculpin in Project Lakes

Depth	Substrate	Foraging	Rearing	Spawning	Wintering
0-2 m	Boulder/Cobble	1	1	1	0
	Boulder	1	1	1	0
	Bedrock	0.25	0	0	0
	Bedrock/Boulder	0.5	0.25	0.5	0
	Bedrock/Cobble	0.5	0.25	0.5	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.25	0	0
	Fines/Organics	0.25	0.25	0	0
	Cobble/Gravel	0.75	1	1	0
	Boulder/Fines	0.5	0.5	0.5	0
	Cobble/Fines	0.5	0.5	0.5	0
	Boulder/Gravel	1	0.5	1	0
2 - 4 m	Boulder/Cobble	1	0.75	0.5	0.5
	Boulder	1	0.75	0.5	0.5
	Bedrock	0.25	0	0	0
	Bedrock/Boulder	0.5	0.25	0.25	0
	Bedrock/Cobble	0.5	0.25	0.25	0
	Vegetation/Organics	0.25	0.25	0	0
	Vegetation/Boulder	0.25	0.25	0	0
	Fines/Organics	0.25	0.25	0	0
	Cobble/Gravel	0.75	0.75	0.5	0.5
	Boulder/Fines	0.5	0.25	0.25	0.25
	Cobble/Fines	0.5	0.25	0.25	0.25
	Boulder/Gravel	1	0.25	0.5	0.5
> 4 m	Boulder/Cobble	1	0.5	0	1
	Boulder	1	0.5	0	1
	Bedrock	0.25	0	0	0
	Bedrock/Boulder	0.5	0.25	0	0
	Fines/Organics	0.5	0.25	0	0
	Cobble/Gravel	0.75	0.5	0	1
	Boulder/Fines	0.5	0.25	0	0.5
	Cobble/Fines	0.5	0.25	0	0.5
	Boulder/Gravel	1	0.25	0	1

Note: HSI = Habitat Suitability Index m; = metre; > = greater than

APPENDIX C

Un-weighted Habitat Unit Calculations

Table C-1: Un-weighted habitat unit calculations by affected area

Waterbody	Disturbance Type	Area (ha)	Habitat Units								
			Lifestage	ARGR	BURB	LKCH	LKTR	NRPK	NSST	RNWH	SLSC
Kennady Lake Area 1	Permanent Loss	0.02	Spawning	0	0	0.02	0	0	0	0	0.02
			Rearing	0.02	0.02	0.02	0.02	0	0	0.02	0.02
			Foraging	0.02	0.02	0.02	0.02	0	0.01	0.02	0.02
			Wintering	0	0	0	0	0	0	0	0
Kennady Lake Area 2	Permanent Loss	64.20	Spawning	0	10.88	16.6	6.6	0.5	0.5	9.36	13.79
			Rearing	16.14	21.48	21.46	23.93	0.5	3.72	25.41	25.14
			Foraging	27.43	24.33	21.46	24.49	17.04	10.61	23.37	38.36
			Wintering	73.6	86.72	79.7	85.05	41.48	58.49	88.17	85.92
Kennady Lake Area 3&5	Permanent Loss	36.46	Spawning	0	5.71	8.14	3.27	0.7	0.7	4.92	8.18
			Rearing	9.94	12.19	13.78	14.14	0.71	1.98	14.98	14.19
			Foraging	16.03	14.78	13.78	14.39	9.36	6.05	14.1	21.93
			Wintering	18.86	18.86	12.45	18.86	16.61	23.86	18.86	5.39
	Temporary Disturbance	205.74	Spawning	0	21.48	25.39	16.11	0.22	0.22	17.27	25.14
			Rearing	30.5	33.66	38.13	73.44	0.74	5.26	72.17	71.83
			Foraging	74.11	72.39	38.13	74.32	52.87	15.17	72.81	120.17
			Wintering	101.83	101.83	63.43	101.83	65.64	176.85	101.83	15.31
	Altered Habitat	7.85	Spawning	0	4.46	5.35	2.43	0.22	0.22	3.52	5.08
			Rearing	5.8	6.92	8.3	11.17	0.28	1.17	11.46	11.42
			Foraging	11.92	11.21	8.3	11.18	8.34	3.41	11.43	17.82
			Wintering	14.71	14.71	9.94	14.71	10.29	23.67	14.71	3.44
Kennady Lake Area 4	Permanent Loss	1.00	Spawning	0	0	0.73	0	0.09	0.09	0	0.52
			Rearing	0.58	0.78	0.55	0.32	0.09	0.32	0.29	0.55
			Foraging	0.52	0.32	0.55	0.32	0.56	0.58	0.32	0.55
			Wintering	0	0	0	0	0	0	0	0
	Temporary Disturbance	45.89	Spawning	0	6.3	11.44	2.09	0.18	0.18	4.38	9.15
			Rearing	10.01	13.32	13.84	15.63	0.18	2.15	16.92	16.88
			Foraging	18.29	16.16	13.84	15.7	13.43	6.58	15.66	26.33
			Wintering	20.91	20.91	13.37	20.91	14.93	32.49	20.91	4.72
	Altered Habitat	30.26	Spawning	0	7	7.85	5.51	0.11	0.17	6.17	7.51
			Rearing	9.22	10.2	11.86	18.05	0.21	1.56	17.68	17.73
			Foraging	18.02	17.57	11.86	18.31	11.21	4.42	17.79	27.72
			Wintering	21.96	21.96	14.99	21.96	15.05	36.06	21.96	5.08

Table C-1: Un-weighted habitat unit calculations by affected area (continued)

Waterbody	Disturbance Type	Area (ha)	Habitat Units								
			Lifestage	ARGR	BURB	LKCH	LKTR	NRPK	NSST	RNWH	SLSC
Kennady Lake Area 6	Permanent Loss	54.00	Spawning	0	10.38	10.58	8.39	0.5	0.5	8.57	11.4
			Rearing	14.66	15.47	17.37	23.79	0.5	2.34	22.56	22.77
			Foraging	24.2	21.94	17.37	24.54	13.03	6.82	23.55	34.8
			Wintering	26.01	26.01	19.31	26.01	19.97	39.1	26.01	6.72
	Temporary Disturbance	77.12	Spawning	0	8.8	17.12	4.66	1.42	1.6	7.6	19.86
			Rearing	22.32	27.87	27.09	29.07	1.62	6.16	29.7	31.52
			Foraging	33.77	29.88	27.09	29.06	20.66	15.33	29.25	46.59
			Wintering	34.21	34.21	21.53	34.21	28.47	48.33	34.21	7.75
	Altered Habitat	44.5	Spawning	0	7	7.85	5.51	0.11	0.17	6.17	7.51
			Rearing	9.22	10.2	11.86	18.05	0.21	1.56	17.68	17.73
			Foraging	18.02	17.57	11.86	18.31	11.21	4.42	17.79	27.72
			Wintering	21.96	21.96	14.99	21.96	15.05	36.06	21.96	5.08
Kennady Lake Area 7	Temporary Disturbance	90.5	Spawning	0	13.9	26.79	7.83	1.06	1.18	9.66	25.9
			Rearing	29.48	34.9	35.48	38.16	1.18	7.07	36.72	41.07
			Foraging	41.66	37.91	35.84	38.65	25.67	17.52	37.8	58.12
			Wintering	37.6	37.6	26.13	37.6	28.21	56.57	37.6	10.77
	Altered Habitat	9.42	Spawning	0	0.28	0.28	0.22	0	0	0.21	0.42
			Rearing	0.49	0.52	0.58	2.7	1.99	4.05	2.61	2.7
			Foraging	2.7	2.66	0.58	2.71	8.3	6.19	2.68	3
			Wintering	2.66	2.66	4.48	2.66	4.5	5	2.66	0.19
Kennady Lake Area 8	Altered Habitat	0.17	Spawning	0	0.04	0.06	0.02	0	0	0.02	0.12
			Rearing	0.12	0.14	0.15	0.11	0	0.02	0.09	0.12
			Foraging	0.12	0.1	0.15	0.11	0.04	0.06	0.11	0.15
			Wintering	0.06	0.06	0.06	0.06	0.08	0.04	0.06	0.03
Lake D1	Temporary Disturbance	1.88	Spawning	0	0.11	1.03	0	0.24	0.32	0	0.44
			Rearing	0.82	0.74	1.12	0.76	0.24	0.32	0.84	0.44
			Foraging	0.69	0.69	1.12	0.76	0.61	0.32	0.8	0.8
			Wintering	0.13	0.13	0.13	0.13	0.24	0.24	0.13	0.11

APPENDIX D

Initial Compensation Options Considered

Table D-1: Potential Compensation Options Evaluated in the Conceptual Compensation Plan (De Beers 2010)

Option Number	Compensation Option	Estimated Habitat Area Gained (ha)	Factors Affecting Environmental Viability	Factors Affecting Engineering and Cost Viability	General Comments	Environmental Rank [(a)]	Engineering and Cost Rank [(a)]
1a	Raising Lakes D2 and D3 to 428 masl	96.2	▪ Value of habitats dependent upon nature of habitat in newly flooded areas. ▪ Ecological effectiveness dependent upon nature of new habitats and effect on existing habitats. ▪ Potential effect of dykes on fish access (Lake D2 and Lake E1 connections to Kennady Lake lost, and downstream connectivity to the N watershed established by outflow to Lake N18). ▪ Three non-fish-bearing lakes (Lakes D5, D6 and D10) totaling 6.2 ha in area would become connected to fish-bearing waters.	▪ Relatively low cost as the access and source of construction materials is already established. ▪ Improving and enlarging structures that were built as a part of the mine development which would then remain permanent. ▪ Structures are still relatively low and stable.	▪ Could be constructed early in the Project development. ▪ Potential for developing habitat enhancement features in newly flooded areas.	2	1.5
1b	Raising Lakes D2, D3, E1 and N14 to 428 masl	149.7	▪ Value of habitats dependent upon nature of habitat in newly flooded areas. ▪ Ecological effectiveness dependent upon nature of new habitats and effect on existing habitats. ▪ Potential effect of dykes on fish access (Lakes D2 and E1 connections to Kennady Lake lost, and downstream connectivity to the N watershed established by outflow to N18). ▪ Three non-fish-bearing lakes (Lakes D5, D6 and D10) totaling 6.2 ha in area would become connected to fish-bearing waters.	▪ Additional cost compared to Option 1a in that additional dykes and access roads would have to be constructed. ▪ Relatively low cost because of the proximity of construction material and locations of structures close to existing mine development.	▪ Could be constructed early in the Project development. ▪ Potential for developing habitat enhancement features in newly flooded areas.	2	2

Table D-1: Potential Compensation Options Evaluated in the Conceptual Compensation Plan (De Beers 2010) (continued)

Option Number	Compensation Option	Estimated Habitat Area Gained (ha)	Factors Affecting Environmental Viability	Factors Affecting Engineering and Cost Viability	General Comments	Environmental Rank [(a)]	Engineering and Cost Rank [(a)]
1c	Raising Lakes D2, D3, E1 and N14, and surrounding area, to 429 masl and reconnect to Kennady Lake after closure	195.9	▪ Value of habitats dependent upon nature of habitat in newly flooded areas. ▪ Ecological effectiveness dependent upon nature of new habitats and effect on existing habitats. ▪ Connectivity to Kennady Lake would be re-established after closure. ▪ Four non-fish-bearing lakes (Lakes D5, D6, D10 and E2) totaling 9.2 ha in area would become connected to fish-bearing waters.	▪ Very low incremental cost following from Option 1b, for a relatively large gain of 45 ha. ▪ Addition to existing structures and the construction of a spillway to reestablish flow into Kennady Lake. ▪ The source of construction materials is nearby and access is already established.	▪ Would not be constructed until after closure. ▪ Potential for developing habitat enhancement features in newly flooded areas. ▪ Option 1b would operate for 15 years before Option 1c would be developed.	1	2
2	Raising Lakes D2 and D3 to 427.5 masl	31.1	▪ Value of habitats dependent upon nature of habitat in newly flooded areas. ▪ Ecological effectiveness dependent upon nature of new habitats and effect on existing habitats. ▪ Potential for adverse water quality effects. ▪ Potential effect of dyke (and Fine PKC Facility) on fish access (Lake A3 connection to Kennady Lake lost and downstream connectivity established to the L watershed (by outflow to Lake L18). ▪ Outflow to the L watershed would partially mitigate the flow reductions downstream of Area 8.	▪ Relatively low cost of construction due to short road access and proximity to construction materials. ▪ Construction cost of Dyke C is part of the mine plan.	▪ Would be constructed early in the Project development. ▪ Potential for developing habitat enhancement features in newly flooded areas.	2	1.5
3	Finger Reefs in Areas 6 and 7	Not Determined	▪ Ecological effectiveness of finger reefs dependent upon the extent to which reef habitats are presently limiting to fish production (or would be in the altered and refilled Kennady Lake).	▪ Material will be readily available and the construction would be very low cost with little disturbance considering that the work will be done when the lakes are dry.	▪ To be constructed during the dry period. ▪ Would not be functional until after closure. ▪ Determination of potential habitat area provided by finger reefs requires further design work.	2	1

Table D-1: Potential Compensation Options Evaluated in the Conceptual Compensation Plan (De Beers 2010) (continued)

Option Number	Compensation Option	Estimated Habitat Area Gained (ha)	Factors Affecting Environmental Viability	Factors Affecting Engineering and Cost Viability	General Comments	Environmental Rank [(a)]	Engineering and Cost Rank [(a)]
4	Habitat Enhancement Structures in Area 8	Not Determined	▪ Ecological effectiveness dependent upon nature of habitat enhancement structures and effect on existing habitats. ▪ Ecological effectiveness dependent upon the extent to which the types of habitats that would be provided by enhancement structures are presently limiting to fish production.	▪ Higher cost relative to Option 3, because of longer haul distance and the need to build access roads (Ice roads or gravel).	▪ Could be constructed early in the Project development. ▪ Determination of types of habitat structures and potential habitat area requires further design work.	2	3 (or 2 if using an ice road)
5	Hearne Pit Habitat Structure	16.0	▪ Habitat would include deep-water areas, with shallow areas limited to portions along the edges of the pit. ▪ Ecological effectiveness is uncertain; dependent upon the extent to which similar habitats are presently limiting to fish production (or would be in the altered and refilled Kennady Lake).	▪ Low relative cost and can likely be accommodated within existing mine production schedule.	▪ Would not be constructed until after closure.	2	1
6	5034 Pit Habitat Structure	35.0	▪ Habitat would include deep-water areas, with shallow areas limited to portions along the edges of the pit. ▪ Ecological effectiveness is uncertain; dependent upon the extent to which similar habitats are presently limiting to fish production (or would be in the altered and refilled Kennady Lake).	▪ Low relative cost and can likely be accommodated within existing mine production schedule.	▪ Would not be constructed until after closure.	2	1
7	Tuzo Pit Habitat Structure	35.2	▪ Habitat would include deep-water areas, with shallow areas limited to portions along the edges of the pit. ▪ Ecological effectiveness is uncertain; dependent upon the extent to which similar habitats are presently limiting to fish production (or would be in the altered and refilled Kennady Lake).	▪ Low relative cost and can likely be accommodated within existing mine production schedule.	▪ Would not be constructed until after closure.	2	1
8	Dyke B Habitat Structure	16.0	▪ Ecological effectiveness dependent upon the extent to which similar habitats are presently limiting to fish production (or would be in the altered and refilled Kennady Lake).	▪ Low relative cost and can likely be accommodated within existing mine production schedule.	▪ Would not be constructed until after closure.	2	2

Table D-1: Potential Compensation Options Evaluated in the Conceptual Compensation Plan (De Beers 2010) (continued)

Option Number	Compensation Option	Estimated Habitat Area Gained (ha)	Factors Affecting Environmental Viability	Factors Affecting Engineering and Cost Viability	General Comments	Environmental Rank [(a)]	Engineering and Cost Rank [(a)]
9	Raising Area 8 and Lakes L2, L3 and L13 to 422 m	69.3 in Area 8 and Lakes L2, L3, and L13 55.1 in Kennady Lake Areas 2 to 7 Total: 124.4	▪ Value of habitats dependent upon nature of habitat in newly flooded areas. ▪ Ecological effectiveness dependent upon nature of new habitats and effect on existing habitats. ▪ Outflow from Lake L2 redirected through a natural drainage path to Lake L9 (north of Lake L2) so downstream connectivity to the L watershed would be maintained. ▪ Some Arctic grayling spawning habitat would be lost immediately downstream from Area 8. ▪ Connections between Area 8 and Lakes I1 and J1a (which both have deep water habitat) would be improved and maintained on a more continuous basis. ▪ Increasing the area of Area 8 and improving overwintering capability increases the chances of maintaining viable populations in Area 8 and facilitate re-colonization of Kennady Lake after closure. ▪ During operations, there will be reduced inflows to Area 8 and reduced outflows from Area 8, which may limit the value of the compensation habitat in the operational period.	▪ Higher cost due to the distance of structures from the mine area and the location of fill materials. ▪ The construction of these structures on untouched stream channels is not a part of the mine plan and would be a separate task. ▪ Would enlarge the area of disturbance and the area of monitoring.	▪ Could be constructed early in the Project development. ▪ Will have reduced flows through Area 8 until after closure. ▪ Potential for developing habitat enhancement features in newly flooded areas.	2	3
10	Widening the top benches of Tuzo and 5034 mine pits where they extend onto land	13.7	▪ Ecological effectiveness of shelf areas dependent upon the extent to which reef habitats are presently limiting to fish production (or would be in the altered and refilled Kennady Lake).	▪ Additional material would have to be drilled and blasted which is not a trivial cost; however, the location within the influence of the mine area makes the cost relatively low. ▪ Relatively easy way to make more lake and control the bathymetry of the shoreline.	▪ Would not be constructed until after closure, but before refilling of Kennady Lake.	1	2

APPENDIX E

Summary of September 20, 2012 Fish Habitat Compensation Community Workshop

10/4/2012

Workshop Summary

Fish Habitat Compensation Community Workshop – De Beers Gahcho Kué Project, September 20, 2012

Summary of break out group discussions

Fish Habitat Compensation Community Workshop – De Beers Gahcho Kué Project, September 20, 2012

De Beers Canada hosted a Workshop at the Explorer Hotel in Yellowknife, NT with the intention to share information on how fish habitat compensation achieves no net loss and to discuss fish habitat compensation options for the Gahcho Kué Project with a key consideration of incorporating traditional knowledge.

Attendees included aboriginal community representatives from the Deninu Kué First Nation, Lutsel K'e First Nation, NWT Métis Nation and North Slave Métis Alliance, Tlicho Government, and Yellowknives Dene First Nation as well as representatives from Fisheries and Oceans Canada (DFO) and Golder Associates Ltd.

Following fish habitat informational presentations shared from DFO and De Beers, Workshop participants were encouraged to form smaller, break out groups to discuss options to work towards achieving a no net loss fish plan for the Gahcho Kué Project.

Agenda

The Agenda addressed the following items:

1. Sharing participant expectations for the workshop
2. Presentation by a DFO representative (Pete Cott) on their policy of how fish habitat compensation can achieve no net loss and examples from previous projects
3. Presentation by a DeBeers representative (Craig Blackie) describing the Gahcho Kué Project and the proposed fish compensation plan
4. Opportunity for all participants to offer their input and feedback within small groups and then sharing their findings with all participants

Participant Expectations

Following the opening prayer and review of the agenda, all participants were given the opportunity to introduce themselves and state their overall expectations for the workshop.

Responses varied although the underlying themes included requiring greater clarity in the role of DFO with Gahcho Kué development, an awareness of the specific fisheries considerations surrounding the area in question, clarity around what 'no net loss' means, critical importance for collaboration and cooperation, communication to be brought back to respective communities for further follow-up, establish some options for community-based projects and a better understanding of fisheries habitat compensation concepts.

DFO Presentation

Pete Cott from DFO presented to all participants. The described role of DFO for the purposes of this project were twofold; first, to provide environmental assessment services and second, to provide regulatory services. The presentation included further clarity that no-net-loss can be defined as off-setting any fish habitat damage. The presentation went further to describe specific ratios to be considered when calculating no-net-loss.

One issue that was raised by the participants was the concern and confusion with the impending Fisheries Act changes and how those changes may affect current policies as well as potential future agreements. The response from the DFO representative was an acknowledgement of uncertainty regarding these changes as regulation and policies are still being defined. It was noted however, that there may be a strong consideration to grandfather any key agreements or existing policies that were agreed upon prior to the Fisheries Acts revisions.

A request was made by the participants to DFO to visit the communities throughout the development process of Gahcho Kué.

DeBeers Presentation

Craig Blackie from DeBeers presented to all participants on the specific details of the development of the Gahcho Kué Project including map illustrations and proposed development areas.

Key terms such as fish compensation were defined to include "the replacement of natural habitat, increase in the productivity of existing habitat, or maintenance of fish production by artificial means in circumstances dictated by social and economic conditions, where mitigation techniques and other measures are not adequate to maintain habitats for Canada's fisheries resources."

The presenter went on to describe the Fish Habitat Compensation Approach as establishing how much habitat will be permanently lost and/or altered and how much will be temporarily disturbed during mine operation. Specific considerations as to the fish species in Kennady Lake were discussed.

The presenter outlined Kennady Lake compensation strategies presented to date including the "raised lake option" as well as Redknife River fish passage off-site habitat compensation option . Past community consultation was addressed at site workshops from August to September, 2012 where further suggestions were put forth.

The presenter concluded with an emphasis that DeBeers is currently in the information-collecting stage from all proponents and that the Fish Habitat Compensation Plan will not be finalized until the regulatory phase of the project Nevertheless, the raised lake on-site compensation option was no longer being pursued given community concerns.

Discussion Groups

Two 'break out' groups were formed. Each group included DFO, De Beers, Golder Associates, and Aboriginal Community representatives. Each group discussed no-net-loss strategies as well as other topics of relevance to fish compensation with the Gahcho Kué development. Not all invited participants chose to engage in the "break-out" group discussions and stated that they needed to consult with leadership and their communities prior to sharing any additional information.

Following about an hour of discussion, each group presented their main discussion points to be considered by all workshop participants. These topics included the following underlying themes such as allowing for more time to research and generate ideas, involving community people in monitoring on site and consulting local fishermen, and informing community groups regularly., The break-out groups also noted that past industry experience makes many participants uneasy and distrustful of this process, important to allow for community representatives to report back and share with their elders and community before making decisions and suggesting ideas – more time and community consultation is required and finally, what lessons can be learned from other industry-based models and past experiences?

Conclusion

At the conclusion of the Workshop, participants were asked to “check out” by stating if and how their expectations of the workshop were met.

Participant responses varied, however some of the key themes included, happy to have neighbours all together, a better understanding of no-net-loss and DFO’s role, opportunity to raise community concerns, further consultation & engagement is needed but this is a step in the right direction and that it is best when everyone is at the table, working together.

Next Steps

De Beers will be submitting an updated NNL plan to the MVEIRB in October. Additional community visits will be undertaken to further discuss fish habitat compensation options. The final NNL plan will be submitted after the environmental impact review as part of the permitting phase of the Project.

Break Out Group Discussion

Two break out groups were formed. Each group included DFO, De Beers, Golder Associates, and Aboriginal Community representatives. Below is a summary of what was discussed in the groups:

General Themes

The following are general themes that were repeatedly addressed by several participants:

- Allow for more time to research and generate ideas
- Involve community people through monitoring on site and consulting local fishermen
- Community groups would like to be informed regularly
- Past industry experience makes many participants uneasy and distrustful of this process
- Important to allow for community representatives to report back and share with their elders and community before making decisions and suggesting ideas – more time and community consultation is required
- What lessons can be learned from other industry-based models and past experiences?

Specific Break Out Group Notes

- Work with local, community fishermen to come up with a plan

10/4/2012

Summary of break out group discussions

Fish Habitat Compensation Community Workshop – De Beers Gahcho Kué Project, September 20, 2012

- Give people time, concerns may come forward (trying to work with DFO for a long time)
- Time for research & ideas
- People may need to come to site to see what fish are in the streams
- NNLP conceptual for EA phase
- Authorization phase for details – can be phases of implementation and as new information comes to light, continued consultation should occur (rather than black holes in authorization)
- Continue to hold Workshops in Yellowknife with DFO throughout this process
- Spending $ on research?
- Genetic testing on past remains from old fishing camp
- Research – scientific study, primary literature
- Truck in Dry Bones Bay
- Reduce uncertainty
- Saskatchewan Uranium mines, water clean?
- Aylmer Lake, clean water, fish to eat
- Level of ground & sloping/ Great Slave Lake flows
- Oppose project because it will affect the whole watershed
- Lakes to the west, no longer diverted?
- Water to Area 8, up in lake level, compensation?
- Kennady Lake – DFO & others go there and fly around in chopper, look at flow direction
- Look at Oil Sands, work together
- Holistic approach, trade-offs
- Community concerns with DFO (Regina Bay, Stark Lake)
- Bring in models to help with understanding (land & water, before and after, topographic)
- Engineers to work with aboriginal groups to come up with a plan
- Challenges with trade-offs, prefer to do something at the exact site or to do something within the watershed to maintain integrity
- Concern about permanently lost areas (size of lakes/streams, do they dry up?)
- Kennady Lake is 160 ha, what is a ha?
- Should be informed of changes rather than just being on a public registry/meetings
- List of options, example of last resort (more open to options)
- Compensation ratio for these options
- What options selected for ratio
- Elders hunting & trapping, hear from elders (rep has things in mind but has to discuss with elders first)
- Up north there is water everywhere. This is different to south.
- Lockhart Watershed is a special area
- Inconnu – small size in Slave River

- Building teams to do studies
- Consideration of culverts versus bridges
- Slave Delta – very important
- Concerns re: sewage lagoon & water treatment plant in Ft. Resolution Bay
- Cheese Creek – loche, sewage treatment affected it, ducks, fish and hunting – sewage lagoon killed
- Slave River – still get chum salmon, more showing up, lake trout being caught below rapids at Ft. Smith
- Fort Resolution – concerns regarding Pine Point Mine & reclamation with tailings ponds that are still there, studies going on but needs to be fixed, garbage went into pits, affects fish & water in Fort Resolution Bay
- Toxicity testing at Res re: d/s of Oil Sands
- Fort Resolution Creek (sewage) – beaver dams prevent fish from moving up
- Fish health concerns – lesions, tumors, due to habitat problems of effects of oils sands & pulp mills
- Cabin approach to monitoring
- GSL – stressed due to all upstream developments
- Trade off – bad term, prefer to use “balance”
- Industry bad examples (Pine Point) – makes everyone feel uneasy about industry
- Jobs – feeling not enough jobs for communities but both communities and industry need to do more (e.g. training)
- Stark Lake – studies
- Fish out – healthy enough to survive?
- Mine contaminants land, safe for drinking water? How to use the land?
- Need for direction from chief, take back and discuss with chief & community
- If de-fishing lake, give to community
- For areas not close to Kennady Lake, they should also receive the fish
- Support communities on the edge of the water with their fish & water concerns
- Encourage more community discussion

Conclusion

At the conclusion of the Workshop, participants were asked to “check out” by stating if and how their expectations of the Workshop were met. Here are the participants’ responses:

- Happy to have neighbours all together
- Good facility
- Better understanding off NNL and DFO’s role
- Open & honest – sharing concerns
- Community concerns raised
- Furthering relationship between the Communities, DFO & De Beers
- Further consultation & engagement is needed but this is a step in the right direction
- # of notes, handouts and coffee consumed indicates that this was a productive Workshop
- Best when everyone is at the table, working together
- Concerns about past and toxic material on land, treatment of animals in the past
- The only way to move forward is to work together
- Great to learn about all community concerns
- Makes changes based on feedback – working together

APPENDIX F

Preliminary Redknife River Culvert Rehabilitation Assessment

Table F-1 provides reach lengths and representative slopes for the Redknife River. These data were obtained from Canvec watercourse shapefiles (Natural Resources Canada - Canvec, 2012), ASTER GDEM Worldwide Elevation Data, and Canadian National Topographic Series sheets (Natural Resources Canada – Toporama, 2012).

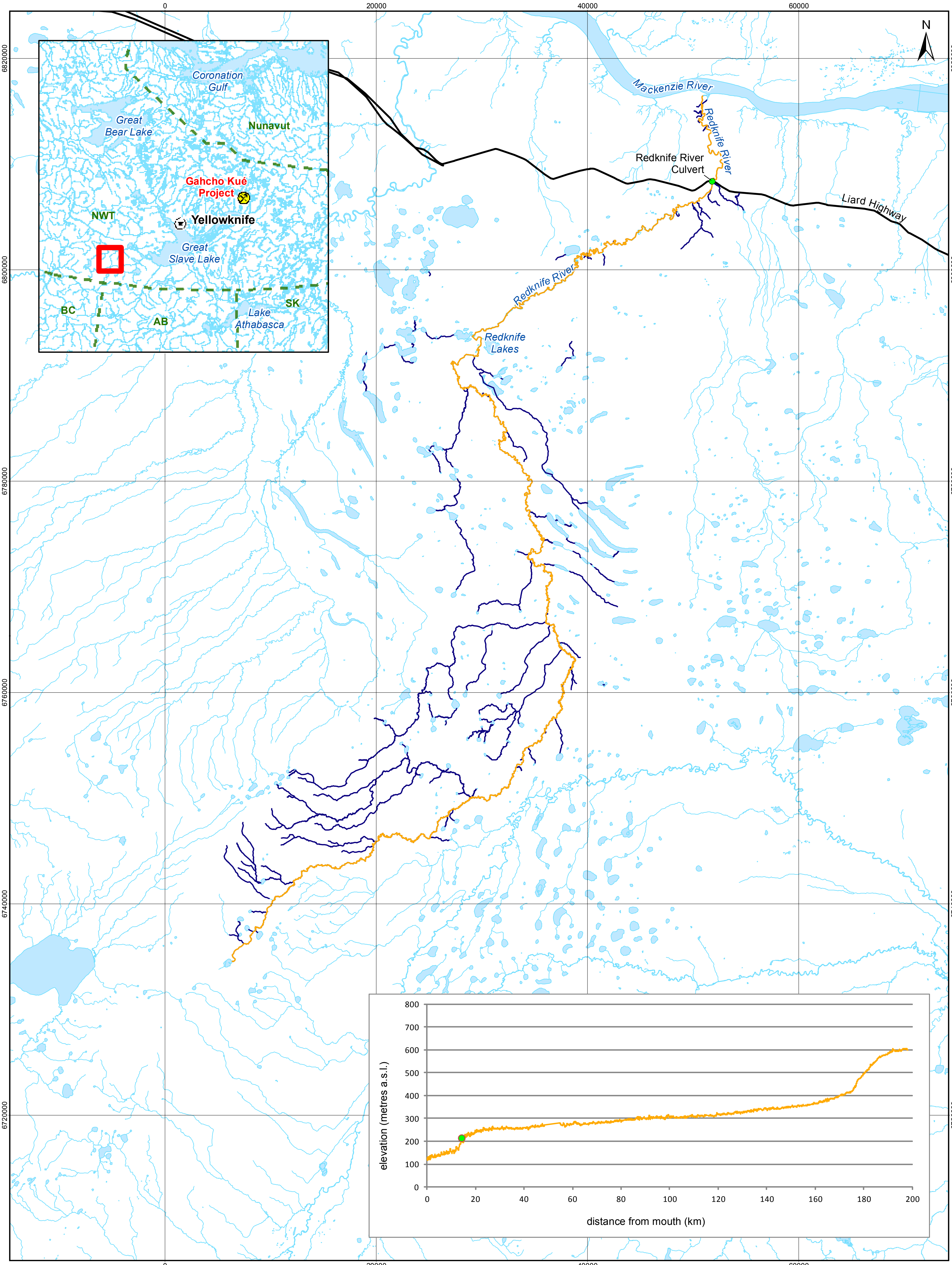
On the basis of digital imagery in Google Earth, it is estimated, that the upstream end of the mainstem (Main) portion of the river has a width in excess of 10 m. This imagery also suggests an approximate width near the culvert, for the Main reach of the Redknife River of approximately 50 m. If it is assumed that this waterway has a linear change in width, the mean width of the Main reach of the Redknife River is, therefore, approximately 20 m. Given the reach lengths provided below, wetted area for the Main Redknife River reaches may be estimated as approximately 10 km^2. Mean individual reach lengths are provided in the following table; however, it must be noted that these are approximate and based on visual interpretations from coarse-resolution imagery.

Table F-1: Redknife River Reach Properties

River	Distance of Tributary Mouth Upstream of Culvert (km)	Reach	Position from Mouth (km)	Position Relative to Crossing (DS/US)	Length (km)	Characteristic Slope (m/km)	% Network Length
Redknife Main	n/a	1	0-13	DS	13	3.1	4.5
		2	13-16	DS&US	3	16.8	1.0
		3	16-175	US	159	0.9	54.5
		4	175-198	US	23	7.7	7.9
Redknife-1	20	1	0-21	US	21	1.4	7.2
Redknife-2	53	1	0-33	US	33	2.4	11.3
		2	33-39	US	6	53.2	2.0
Redknife-3	71	1	0-12	US	12	1.1	4.1
		2	12-26	US	14	7.2	4.8
		3	26-34	US	8	30.2	2.7

Note: Existing culvert is located 14.3 km upstream of the mouth of Redknife Main.

The following figures show the identified river reaches in plan and profile. The sub-reaches can be distinguished based on their slope, and by using the position (km) from their respective mouths. The highway crossing is represented by the red point. While watercourse slope is relatively uniform at scales greater than, or equal to, 10 km, some variability in elevation is suggested at scales less than, or equal to, 2 km. Inspection of elevation contours on NTS sheets, at sites where highly variable elevations are suggested, reveals gradual topography in each instance. Topographic irregularities suggested in elevation profiles are likely an artefact of the 30-m DEM that was used here without a smoothing pre-process.



LEGEND

- Gahcho Kué Project
- Territorial Capital
- Highway
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Redknife River Culvert
- Redknife Main
- Redknife River Network

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

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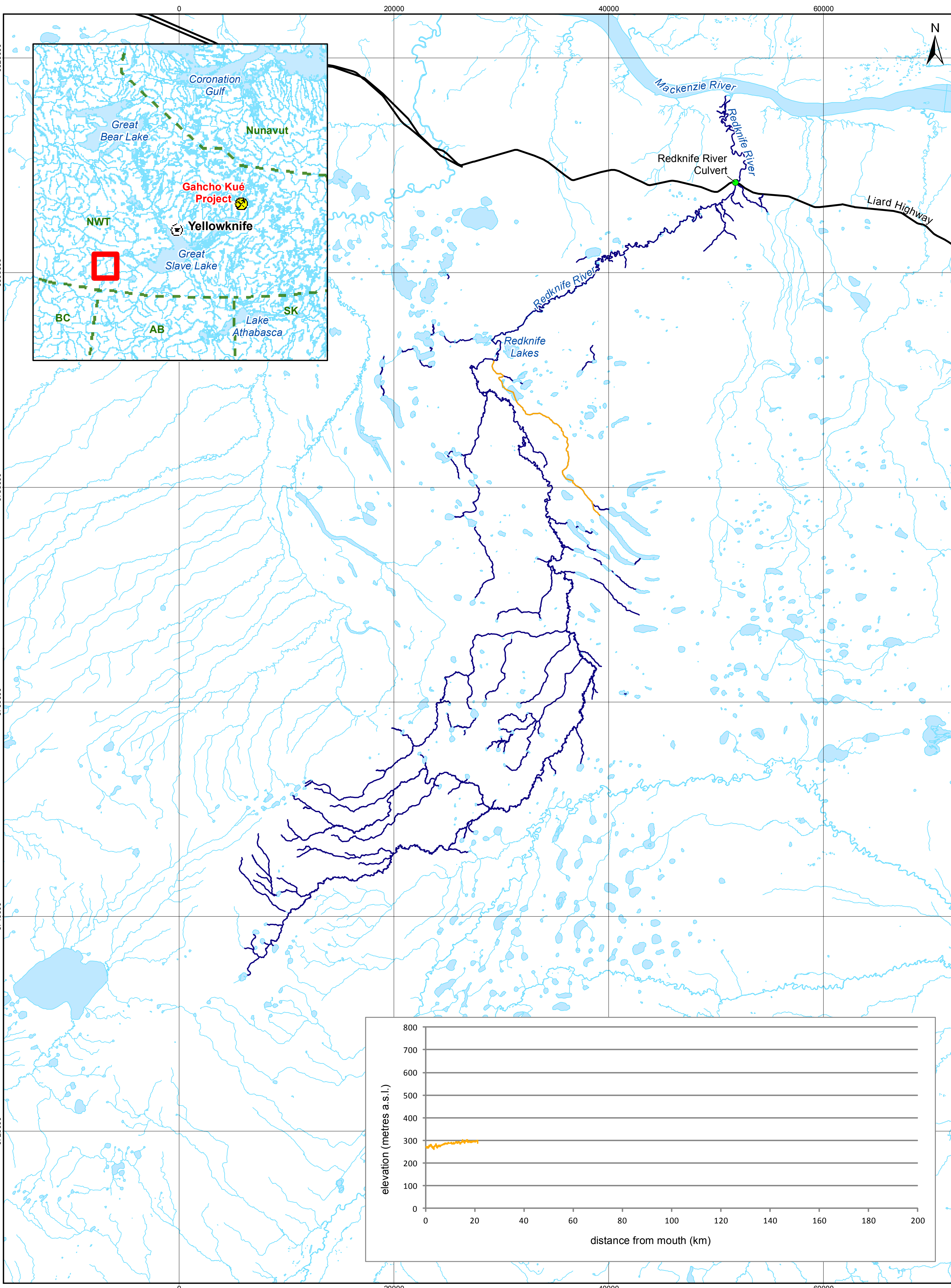
GAHCHO KUÉ PROJECT

Reach Break Analysis for Redknife Main

PROJECTION: UTM Zone 12	DATUM: NAD83
Scale: 1:350,000 (5 2.5 0 5 Kilometres)	DE BEERS CANADA
FILE No: E2011-Fish-022-GIS	DATE: October 17, 2012
JOB NO: 11-1365-0001	REVISION NO: 1
OFFICE: GOLD-CAL	DRAWN: DR
CHECK: KM	

Figure F-1



LEGEND

- Gahcho Kué Project
- Territorial Capital
- Highway
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Redknife River Culvert
- Redknife 1
- Redknife River Network

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

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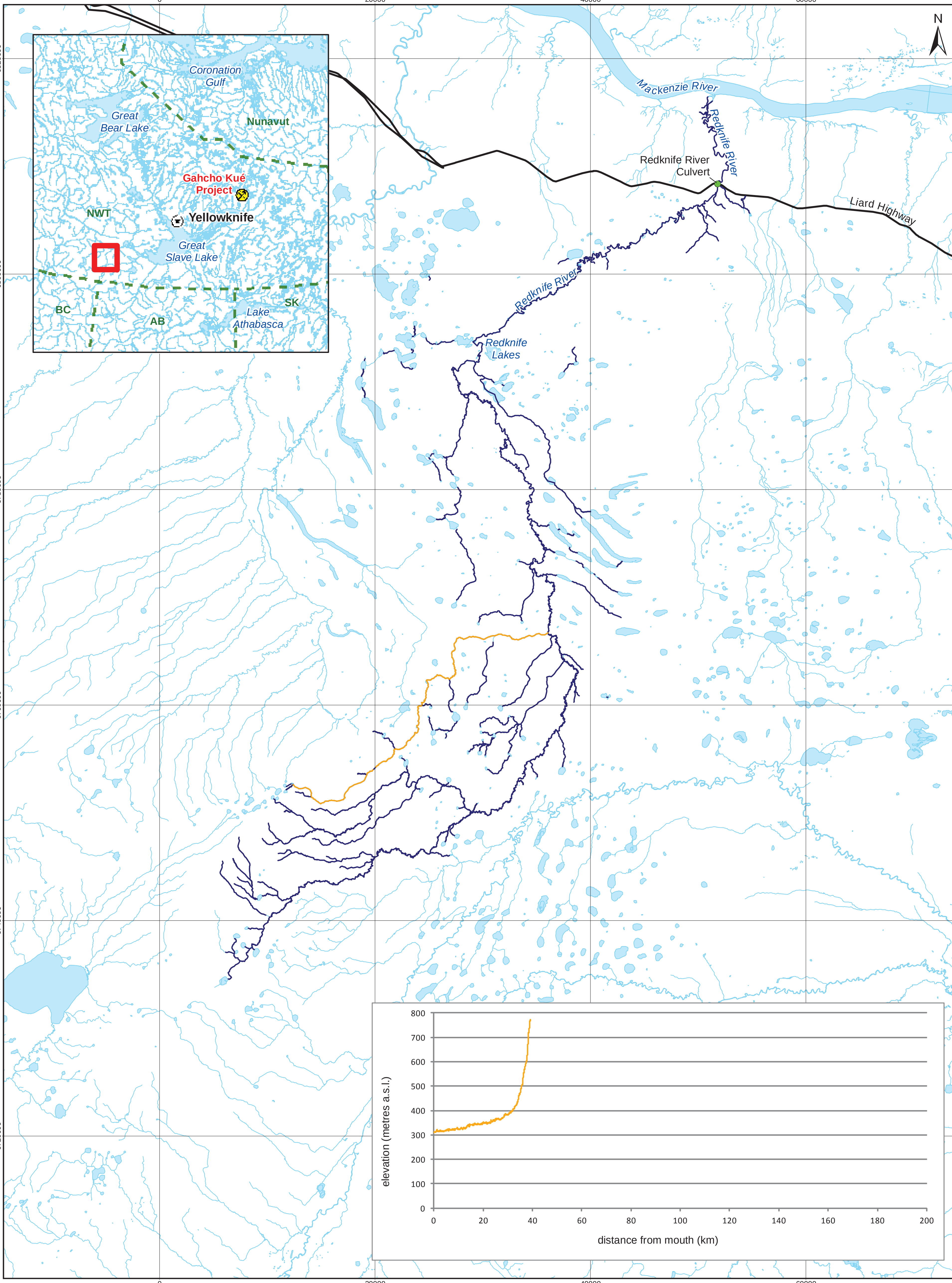
GAHCHO KUÉ PROJECT

Reach Break Analysis for Redknife 1

PROJECTION: UTM Zone 12	DATUM: NAD83
Scale: 1:350,000 (5 2.5 0 5 Kilometres)	
FILE No: E2011-Fish-023-GIS	DATE: October 17, 2012
JOB NO: 11-1365-0001	REVISION NO: 1
OFFICE: GOLD-CAL	DRAWN: DR
CHECK: KM	

DE BEERS CANADA

Figure F-2



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LEGEND

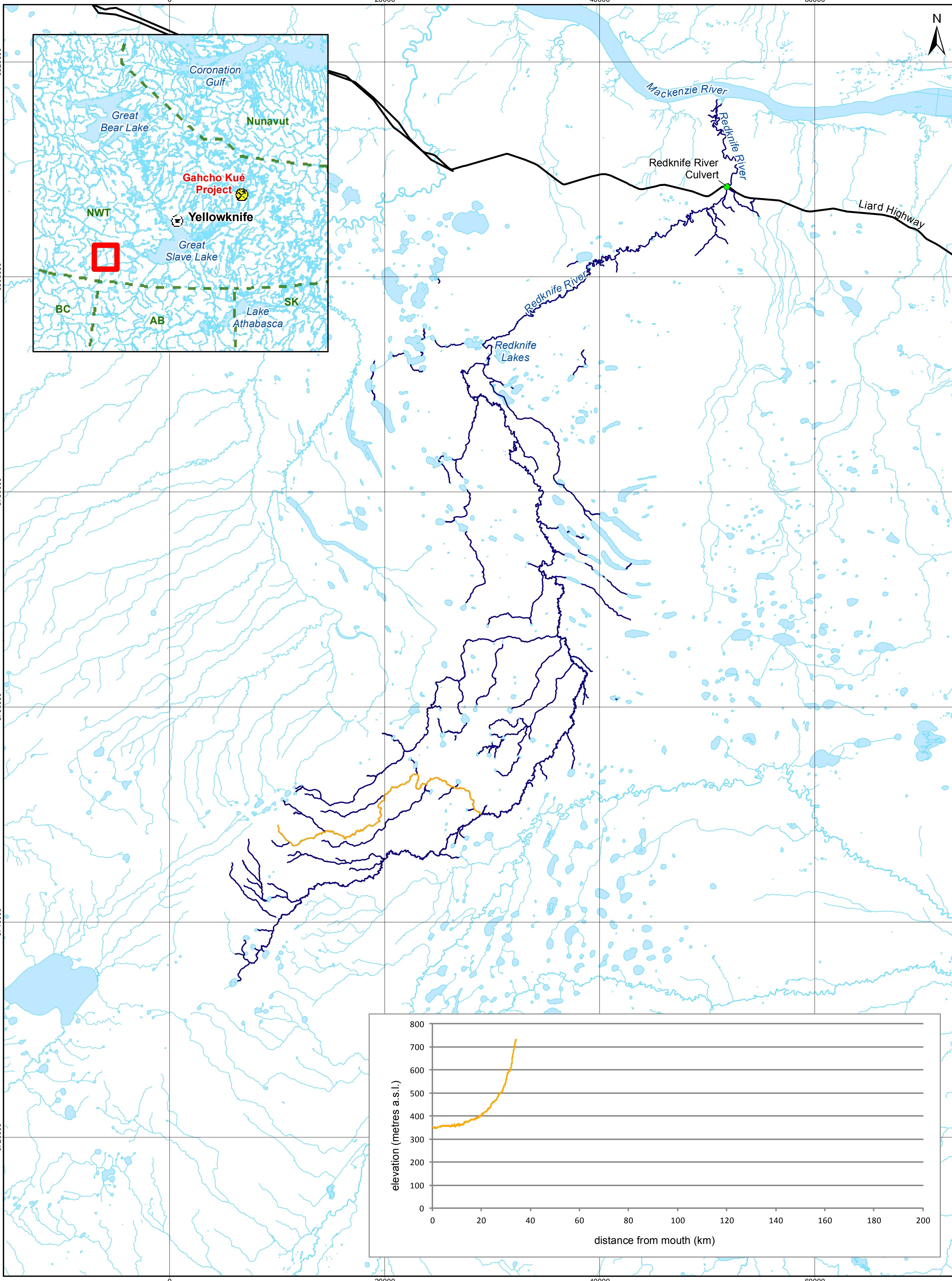
- Gahcho Kué Project
- Territorial Capital
- Highway
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Redknife River Culvert
- Redknife 2
- Redknife River Network

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

GAHCHO KUÉ PROJECT

Reach Break Analysis for Redknife 2

PROJECTION: UTM Zone 12		DATUM: NAD83	DE BEERS CANADA
Scale: 1:350,000 5 2.5 0 5 Kilometres			
FILE No: E2011-Fish-024-GIS			DATE: October 17, 2012
JOB NO: 11-1365-0001	REVISION NO: 1		**Figure F-3**
OFFICE: GOLD-CAL	DRAWN: DR	CHECK: KM	



LEGEND

- Gahcho Kué Project
- Territorial Capital
- Highway
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Redknife River Culvert
- Redknife 3
- Redknife River Network

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

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GAHCHO KUÉ PROJECT

Reach Break Analysis for Redknife 3

PROJECTION: UTM Zone 12	DATUM: NAD83
Scale: 1:350,000 (5 2.5 0 5 Kilometres)	
FILE No: E2011-Fish-025-GIS	DATE: October 17, 2012
JOB NO: 11-1365-0001	REVISION NO: 1
OFFICE: GOLD-CAL	DRAWN: DR / CHECK: KM

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Figure F-4

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