APPENDIX 9A

CONCEPTUAL OFFSETTING PLAN

Table of Contents

Maps

Photos

Tables

Abbreviations

Abbreviation	Definition
DAR	Developer's Assessment Report
DFO	Fisheries and Oceans Canada
Diavik Mine	Diavik Diamond Mine
Dominion Diamond	Dominion Diamond Ekati Corporation
E	east
e.g.	for example
Ekati Mine	Ekati Diamond Mine
GIS	Geographic Information System
Golder	Golder Associates Ltd.
HTO	Hunters and Trappers Organization
i.e.	that is
LDG	Lac de Gras
LDS	Lac du Sauvage
LiDAR	Light Detection and Ranging
LKDFN	Łutsel K'e Dene First Nation
N	north
NSMA	North Slave Métis Alliance
NTS	National Topographic Service
NWT	Northwest Territories
Project	Jay Project
TDS	total dissolved solids
TSS	total suspended solids
W	west
YKDFN	Yellowknives Dene First Nation

Units of Measure

Unit	Definition
%	percent
<	less than
>	greater than
ha	hectare
km	kilometre
km^2	square kilometre
m	metre
n	number (of)
m^3/s	cubic metres per second
mm	millimetre
m^3	cubic metre
kg	kilogram
m/s	metres per second

9A1 INTRODUCTION

9A1.1 Purpose

The existing Dominion Diamond Ekati Corporation (Dominion Diamond) Ekati Diamond Mine (Ekati Mine) and its surrounding claim block are located approximately 300 kilometres (km) northeast of Yellowknife in the Northwest Territories (NWT) (Map 9A1.1-1). Dominion Diamond proposes to develop the Jay Project (Project), which includes associated mining and transportation infrastructure to add 10 or more years of mine life to the existing Ekati Mine. The majority of the facilities required to support and process the kimberlite currently exist at the Ekati Mine, including:

- Misery Pit mining infrastructure (e.g., fuel facility, explosives magazines);
- primary roads and transportation infrastructure (e.g., Ekati airstrip, Misery Road);
- Ekati main camp and supporting infrastructure;
- Ekati processing plant; and,
- fine processed kimberlite management facilities.

The Jay kimberlite pipe (Jay pipe) is located beneath Lac du Sauvage in the southeastern portion of the Ekati Mine property approximately 25 km from the main facilities and approximately 7 km to the northeast of the Misery Pit. A horseshoe shaped dike will be constructed to isolate the portion of Lac du Sauvage overlying the Jay pipe. The isolated portion of Lac du Sauvage will be dewatered to allow for open-pit mining of the kimberlite pipe. The Project will also require an access road, pipelines, and power lines to the new open pit.

Construction and operation of the mine will cause serious harm to fish (as defined in the *Fisheries Act*) in the Lac du Sauvage watershed. The affected areas include a portion of Lac du Sauvage and adjacent watercourses within the watershed. As such, a *Fisheries Act* Authorization would be required before construction of the Project.

Preliminary offsetting options have been identified through the community and regulatory engagement process associated with the Project. Meetings between Dominion Diamond and Fisheries and Oceans Canada (DFO) have occurred on several occasions. The purpose of the Conceptual Offsetting Plan is to summarize anticipated Project effects on fish and fish habitat, describe the initial options considered for providing offsetting, and outline a proposed conceptual plan to offset the serious harm to fish according to DFO's Policy (DFO 2013a,b). This work demonstrates that it is reasonable to assume at this time that feasible offsetting options exist, and that a final offsetting plan can be identified and implemented for the Jay Project.

Dominion Diamond will continue to advance the initial options presented herein to determine if they are feasible as offsetting measures and acceptable to DFO. Dominion Diamond will also continue to engage with local communities and DFO on additional potential options. A final offsetting plan will be developed in consultation with DFO and with input from local communities during the permitting phase of the Project.

LEGEND

- JAY PROJECT
- EXISTING MINE OR PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- TERRITORIAL/PROVINCIAL BOUNDARY
- TREELINE
- WATERCOURSE
- WATERBODY

150 0 150

SCALE 1:6,000,000 KILOMETRES

REFERENCE

WATER OBTAINED FROM ATLAS OF CANADA
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
PROJECTION: CANADA LAMBERT CONFORMAL CONIC

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

LOCATION OF THE JAY PROJECT

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_031_GIS	
DESIGN	CS	12/09/14	SCALE AS SHOWN	REV. 0
GIS	JE/ANK	20/10/14	MAP 9A1.1-1	
CHECK	CS	20/10/14		
REVIEW	KM	20/10/14		

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\13-1328-0041 Jay & Lynx EA\Aquatics\DAR\DAR_Aqua_031_GIS.mxd

9A1.1.1 Requirements Under the *Fisheries Act*

Subsection 35(1) of the *Fisheries Act* prohibits the carrying on of a work, undertaking or activity that results in serious harm to fish[1] that are part of a commercial, recreational, or Aboriginal fishery or to fish that support such a fishery. However, where it is not possible to completely avoid serious harm to fish such that some residual serious harm to fish remains, an authorization under paragraph 35(2)(b) of the *Fisheries Act* is required to carry on a work, undertaking, or activity. A *Fisheries Act* Authorization will be required for the Project.

The Application for Authorization must include the following information:

- description of proposed work, undertaking, or activity;
- project engineering specifications, scale drawings, and dimensional drawings (for physical works);
- timeline information;
- location information;
- description of fish and fish habitat (aquatic environment);
- description of potential effects on fish and fish habitat;
- description of measures and standards to avoid or mitigate serious harm to fish;
- description of the residual serious harm to fish;
- offsetting plan; and,
- letter of credit, as security for completion of the offsetting plan.

An offsetting plan is developed to undertake offsetting measures to counterbalance the unavoidable residual serious harm to fish from the Project, with the goal of maintaining or improving the productivity of the commercial, recreational, or Aboriginal fishery. DFO's approach to offsetting is described in the Fisheries Protection Policy Statement (DFO 2013a) and Fisheries Productivity Investment Policy (DFO 2013b). A final offsetting plan will be produced during the permitting phase of the Project with engagement of local communities and will need to be submitted as part of the Application for Authorization under the *Fisheries Act*. The plan would be approved by DFO as a condition of the Authorization.

[1] "Serious harm to fish" is defined in Subsection 2(2) of the *Fisheries Act* and means "the death of fish or any permanent alteration to, or destruction of, fish habitat".

As described in the Fisheries Productivity Investment Policy (DFO 2013b), an offsetting plan must include information about the objectives of the offsetting measures, the measures to offset residual serious harm to fish, an analysis of how the offsetting measure will meet their objectives (i.e., methodology used and estimate of the offset), schedule for implementation, and monitoring. Offsetting measures are focused on improving fisheries productivity. The preference of DFO is that offsets occur near a project or within the same watershed; however, offsetting measures can be undertaken in waterbodies or for fish species other than those affected by the project, provided the measures are supported by clear fisheries management objectives or regional restoration priorities. Offsetting plans are negotiated with DFO on a case-by-case basis and would require engagement with Aboriginal groups. Offsetting measures should meet the following principles:

1) offsetting measures must support fisheries management objectives or local restoration priorities;

2) benefits from offsetting measures must balance project impacts;

3) offsetting measures must provide additional benefits to the fishery; and,

4) offsetting measures must generate self-sustaining benefits over the long term.

The three general categories of offsetting measures include: Habitat Restoration and Enhancement; Habitat Creation; and, Chemical or Biological Manipulations. Habitat restoration and enhancement includes physical manipulation of existing habitat to improve habitat function and productivity; examples include: placement of material to improve habitat structures (e.g., spawning beds or reefs); increasing shoreline complexity; river bank stabilization and re-vegetation of riparian areas; improving access to off-channel habitats; removal of anthropogenic barriers to fish migration; and, enhancement of vegetated areas in lakes. Habitat creation involves the development or expansion of aquatic habitat into a terrestrial area, such as creation or expansion of natural stream channels, lakes, side channel habitats, wetlands, or bays. Chemical or biological manipulations may include chemical manipulation of waterbodies or stocking of fish; however, these measures should be used only when the other groups of offsetting measures are not available, and only under specific circumstances, such as where the site-specific issues are well understood, the limitations to fisheries productivity are known, and fisheries management plans contain clear objectives for the fishery (DFO 2013b).

In remote, pristine areas where there is a lack of information about fisheries productivity and where offsetting opportunities are limited, such as near the Project, complementary measures may be considered in addition to other offsetting measures. Complementary measures may include data collection and/or scientific research related to maintaining or enhancing the productivity of commercial, recreational, or Aboriginal fisheries. According to DFO Policy, complementary measures may comprise up to 10 percent (%) of the required amount of offsetting, with the remaining 90% consisting of one or more projects that fall under the habitat enhancement, restoration, creation, or manipulation categories of offsetting measures.

9A2 ENGAGEMENT

9A2.1 Engagement Activities

Engagement meetings started in early 2014 to discuss potential offsetting options being considered by Dominion Diamond for the Jay-Cardinal project (now the Jay Project) and the Lynx project. Many of the offsetting measures discussed may be suitable for both projects, or alternatively, be put towards an offsetting bank for Dominion Diamond. A summary of meetings with DFO and communities is therefore presented for both projects where discussions of offsetting measures occurred.

9A2.1.1 DFO Meetings

The following meetings with DFO took place:

- February 27, 2014 – Meeting attendees included: Stu Nivens and Veronique D'Amours-Gauthier (DFO, Yellowknife); Eric Denholm and Nicole Spencer (Dominion Diamond); and, Kristine Mason, Kasey Clipperton, and Cam Stevens (Golder Associates Ltd. [Golder]). The meeting started with an overview of potential aquatic effects from the Jay-Cardinal project. The primary goal of the meeting was to inform DFO on potential effects to fish and fish habitat from the Jay-Cardinal project and to initiate discussions on what may be required for an Authorization for the Jay-Cardinal project. The second half of the meeting discussed offsetting option and currencies.
- May 26, 2014 –Meeting attendees included: Veronique D'Amours-Gauthier (DFO, Yellowknife); Eric Denholm, Nicole Spencer, Bob Overvold, and Richard Bargery (Dominion Diamond); and Kristine Mason, Kasey Clipperton and Cam Stevens (Golder).The focus of the meeting was on potential offsetting options for the Lynx project (i.e., Noahognik Creek and Kugluktuaryuk Creek), but also included an update on the conceptual offsetting plan for the Jay Project and a brief discussion of the reduction in the Project footprint resulting from excluding the Cardinal pipe. There was a short discussion of accounting currencies and application to large projects and offsets that may be a different ecosystem type (e.g., stream versus lake).
- August 12, 2014 – The meeting was an on-line conference call. Attendees included: Julie Marentette and Kelly Eggers (DFO, Yellowknife); Eric Denholm (Dominion Diamond); and, Kristine Mason, Amy Langhorne, Kasey Clipperton, and Cam Stevens (Golder). The meeting started with a discussion of findings from the reconnaissance field trip for Lynx offsetting, and a discussion of reconnaissance plans for potential local offsetting options around Great Slave Lake for both the Lynx and Jay projects. An outcome of the discussion was agreement to pursue the feasibility of an Inconnu (Coney) stocking program on the Yellowknife River.

9A2.1.2 Community Workshops

Two sets of community workshops took place in March and June, 2014. The first set of meetings with communities was held at the Explorer Inn in Yellowknife. The second set of meetings was held at various venues in Behchokǫ̀, Lutsel K'e, N'Dilo, Yellowknife, and Kugluktuk. Attendees from Dominion Diamond typically included Richard Bargery, Keith Sangris, and Claudine Lee, Superintendent-Environment Operations. Attendees from Golder typically included Shannon Hayden, Cam Stevens, and Damian Panayi.

At each meeting, participants were told that once the Project was explained, they would have the opportunity to learn more about the potential impacts on fish and to discuss the topics in more detail. Participants were invited to introduce themselves around the table. They were encouraged to ask questions and contribute to the topics scheduled for the day (e.g., fish-out, offsetting options). The following meetings with the communities took place:

- March 10, 2014 – North Slave Métis Alliance (NSMA) Community Engagement Workshop.
- March 11, 2014 – Yellowknives Dene First Nation (YKDFN) and Łutsel K'e Dene First Nation (LKDFN) Community Engagement Workshop.
- March 12, 2014 – Tłı̨chǫ Community Engagement Workshop.
- March 13, 2014 – Kitikmeot Inuit Association (KIA) Community Engagement Workshop.
- June 17, 2014 – LKDFN Community Engagement Workshop.
- June 24, 2014 – Kwe Beh Community Engagement Workshop.
- June 25, 2014 – YKDFN Community Engagement Workshop.
- June 26, 2014 – NSMA Community Engagement Workshop.
- June 27, 2014 – KIA Community Engagement Workshop.
- July 15, 2014 – LKDFN Community Engagement Workshop Follow-up.

These meetings described above included presentations and specific discussion of fish offsetting concepts. Other community engagement activities held by Dominion Diamond (described in Section 4 of the Developer's Assessment Report [DAR]) were also used to discuss project effects on fish and fish offsetting concepts on a progressive basis as information was developed.

9A2.1.2.1 *Summary of Comments*

The participants had questions on the details of the construction plans, the fish-out, offsetting plans, and wildlife mitigations. These were noted and discussed. Comments and concerns that were expressed during the discussions related to offsetting in the community meetings included the following (in chronological order of the meetings):

- Concern was expressed by the NSMA members (March 10, 2014) with respect to the location of proposed offsetting plans, preferring local options, and whether the abundance and species of fish outlined adequately reflected those impacted by mine development.
- Several local opportunities were put forward at the YKDFN-LKDFN meeting on March 11, 2014; these included removal of a truck and equipment from Drybones Bay, enhancement of fisheries on the Yellowknife and Cameron rivers, and rehabilitation of a stream near Lutselk'e.
- Improving habitat quality at the northern tip of N'Dilo and Back Bay was also proposed by the YKDFN (March 11, 2014); however, there were concerns this may interfere with ongoing remediation efforts.
- Community-based proposals for offsetting should include fisheries and water quality monitoring in the region, and a focus on employment of local youth (YKDFN, March 11, 2014).

- The Tłı̨chǫ community expressed interest in studying fisheries responses to the Colomac Mine, local dumping, and climate change (March 12, 2014).
- Kitikmeot Inuit Association community representatives suggested local offsetting plans should focus on traditional fishing areas in the region, such as the Tree, Anialik, Kogakyoak, and Coppermine rivers (March 13, 2014). The community representatives expressed interest in funding for aquatic monitoring programs on the north end of the river.
- Interest was expressed by the LKDFN representatives in direct community involvement in fish health and water quality monitoring programs for the region (June 17, 2014).
- Local habitat restoration options are generally preferred for habitat offsetting as they would provide greater benefit to the community and offer greater potential for direct community involvement (YKDFN, June 25, 2014).
- Concerns were expressed regarding the potential loss of spawning habitat in Lac du Sauvage and whether new spawning habitat would be created to replace it (YKDFN, June 25, 2014).
- Interest was expressed in pursuing local fisheries research as a part of habitat offsetting plans, as well as the creation of an inventory of suitable areas that would benefit from habitat restoration, with input from Dominion Diamond, and the community (YKDFN, June 25, 2014).
- Community representatives plan to discuss offsetting plans within their communities and prepare a list of local offsetting options for Dominion Diamond at a later date (YKDFN, June 25, 2014).
- A number of suggestions were made for potential fish habitat offsetting plans by the NSMA (June 26, 2014); these included restocking (no particular species or stocks were identified) the lakes surrounding the Yellowknife area, including Prelude, Pontoon, and other lakes along the Ingraham Trail that have been overfished over the years, the re-establishment of a traditional Walleye fishery at Mosquito Creek, and enhancement of streams along Great Slave Lake, including the Stagg River on the North Arm, to improve the Great Slave Lake fishery.
- Habitat offsetting could be done in a creek that supported Jackfish (Northern Pike) near Lutsel K'e. It was reported that at one time, hundreds of Jackfish moved through the creek, but they do not use the creek anymore because of weeds and overgrowth (LKDFN, July 15, 2014).

An informal meeting between Moise Rabesca (Rabesca's Resources Ltd.) and Cam Stevens and Paul Vescei (Golder) was also held on the afternoon of June 19, 2014 at the Sah Naji Kwe Camp. Golder briefly informed Moise on the Project, potential effects from the Project, and the potential for the application of habitat offsetting on Tłı̨chǫ lands under the Fisheries Productivity Investment Policy (DFO 2013b). Potential offsetting measures in the area were discussed. It was decided that additional follow-up with other Traditional Knowledge holders of fisheries in Marian and Russell lakes, such as Joe MacKenzie, would be beneficial as part of future engagement efforts

9A3 PROJECT ACTIVITIES AFFECTING SURFACE WATERS

9A3.1 Overview of Activities

The Project phases include construction, operation, and closure. Many effects of the Project are temporary and will end when operations cease or at closure.

The timeline of the Project phases are as follows:

- construction – 2016 to 2019;
- operations – 2019 to 2029; and,
- closure – 2030 to 2033

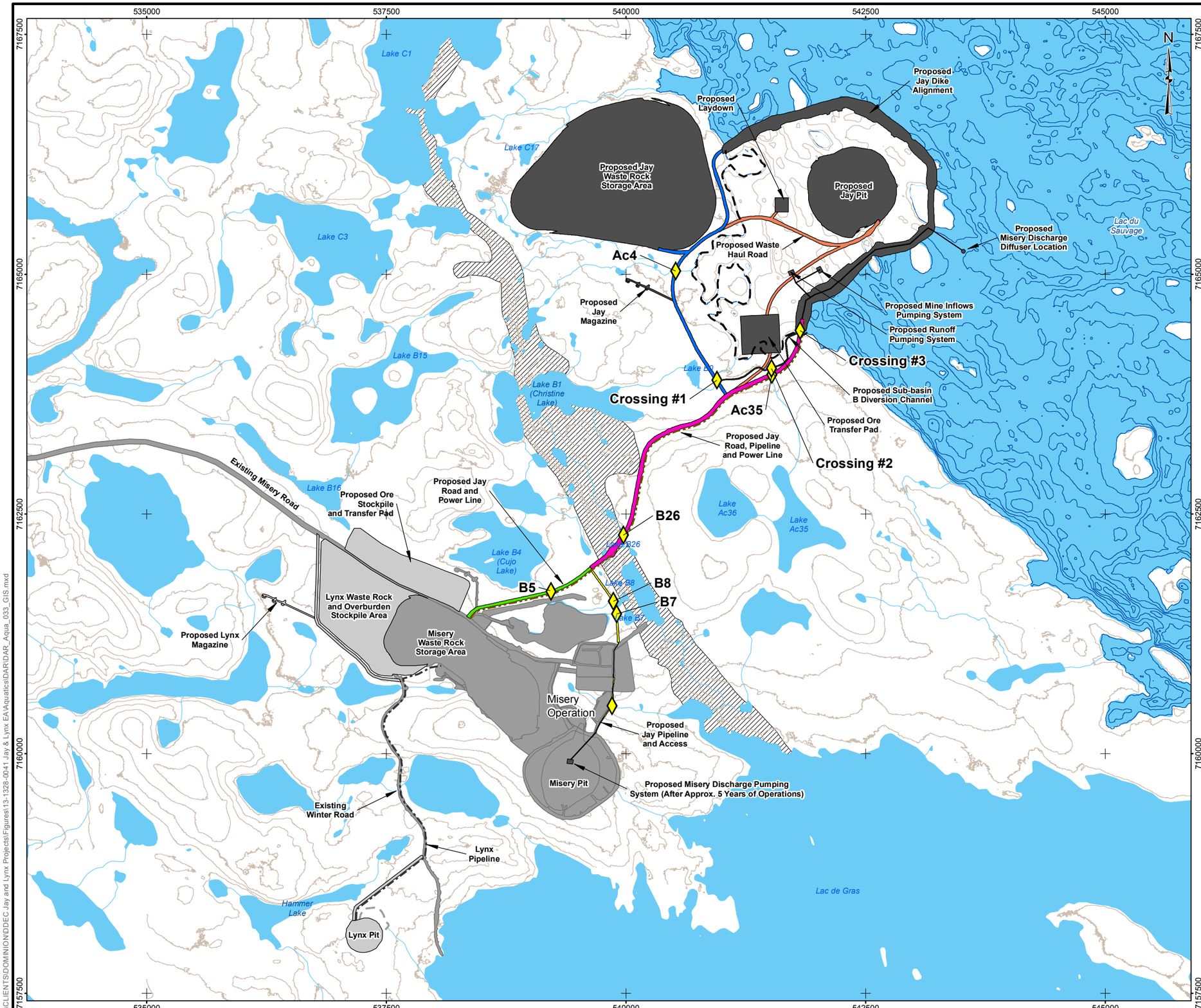
9A3.1.1 Construction and Operations

The Project involves the development of the Jay kimberlite pipe, which is located under water beneath Lac du Sauvage. Before commencing mining activities, a water retaining dike (Jay Dike) will be constructed to isolate the local portion of Lac du Sauvage where the deposit exists (diked area). Dewatering of the isolated portion of the lake will occur to expose the pipe. During the life of the mining operations, water within the diked area will be pumped to the Misery Pit for water storage and management.

The proposed Jay Pit is located within the area of Lac du Sauvage that will be diked and dewatered; this area receives runoff from sub-basin B in addition to a small portion of the Lac du Sauvage main watershed (Map (9A3.1-1). To divert water away from the proposed pit, a diversion channel will be constructed to divert water from two streams to Lac du Sauvage outside the dewatered area (Map 9A3.1-1). Access roads will be constructed from the existing Misery Operations to the Jay Pit. Haul roads will also be constructed. Watercourse crossings will be located on small streams on sub-basins B, Ac4, and Ac35.

9A3.1.2 Closure

Project activities affecting surface waters at closure include water pumping to back-flood the Jay Pit and dewatered area and breaching the Jay Dike. Back-flooding of the Jay Pit will initially include water transferred from the Misery Pit. The top of the pit and the diked area will be back-flooded with natural, local, water from Lac du Sauvage and portions of the Jay Dike will be breached and partially removed (Map 9A3.1-2). Fish can then re-enter the lake area. Remnant sections of the dike will be available to provide potential spawning habitat in the future.



LEGEND

- EKATI MINE FOOTPRINT (MISERY OPERATION)
- BATHYMETRY CONTOUR (5 m INTERVAL)
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- WATERCOURSE CROSSING

JAY PROJECT FOOTPRINT

- EXISTING SHORELINE OF DEWATERED AREA
- POWER LINE
- PROPOSED JAY PROJECT INFRASTRUCTURE
- PROPOSED JAY ROAD NORTH (HAUL ROAD)
- PROPOSED JAY ROAD (HAUL ROAD AND POWER LINE)
- PROPOSED JAY ROAD (HAUL ROAD, PIPELINE AND POWER LINE)
- PROPOSED JAY PIPELINE ROAD (ACCESS ROAD AND PIPELINE)
- PROPOSED OPERATION ROADS

LYNX PROJECT FOOTPRINT

- EXISTING SHORELINE OF DEWATERED LYNX LAKE
- LYNX PIPELINE
- LYNX PROJECT INFRASTRUCTURE

NOTES

ROAD, PIPELINES, AND POWER LINE ARRANGEMENT TO BE DETAILED AS PART OF FURTHER PRE-FEASIBILITY DESIGN. APPROXIMATE CORRIDOR WIDTHS ARE SHOWN.

REFERENCE

JAY PROJECT CONCEPTUAL ENGINEERING REPORT, EKATI MINE, DOC#: 1313280041-E14037-R-REV0-4060, DATED: MAY 13, 2014
JAY PROJECT DESIGN BASIS MEMORANDUM FOR PRE-FEASIBILITY DESIGN OF PROJECT ROADS AND PIPELINE BENCHES, DOC#: 1313280041-E14031-TM-REVD-2020, DATED: AUGUST 1, 2014
LIDAR AND BATHYMETRIC DATA OBTAINED FROM AURORA, 2013
WATER OBTAINED FROM CANVEC © NATURAL RESOURCES CANADA, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

1 0 1
SCALE 1:40,000 KILOMETRES

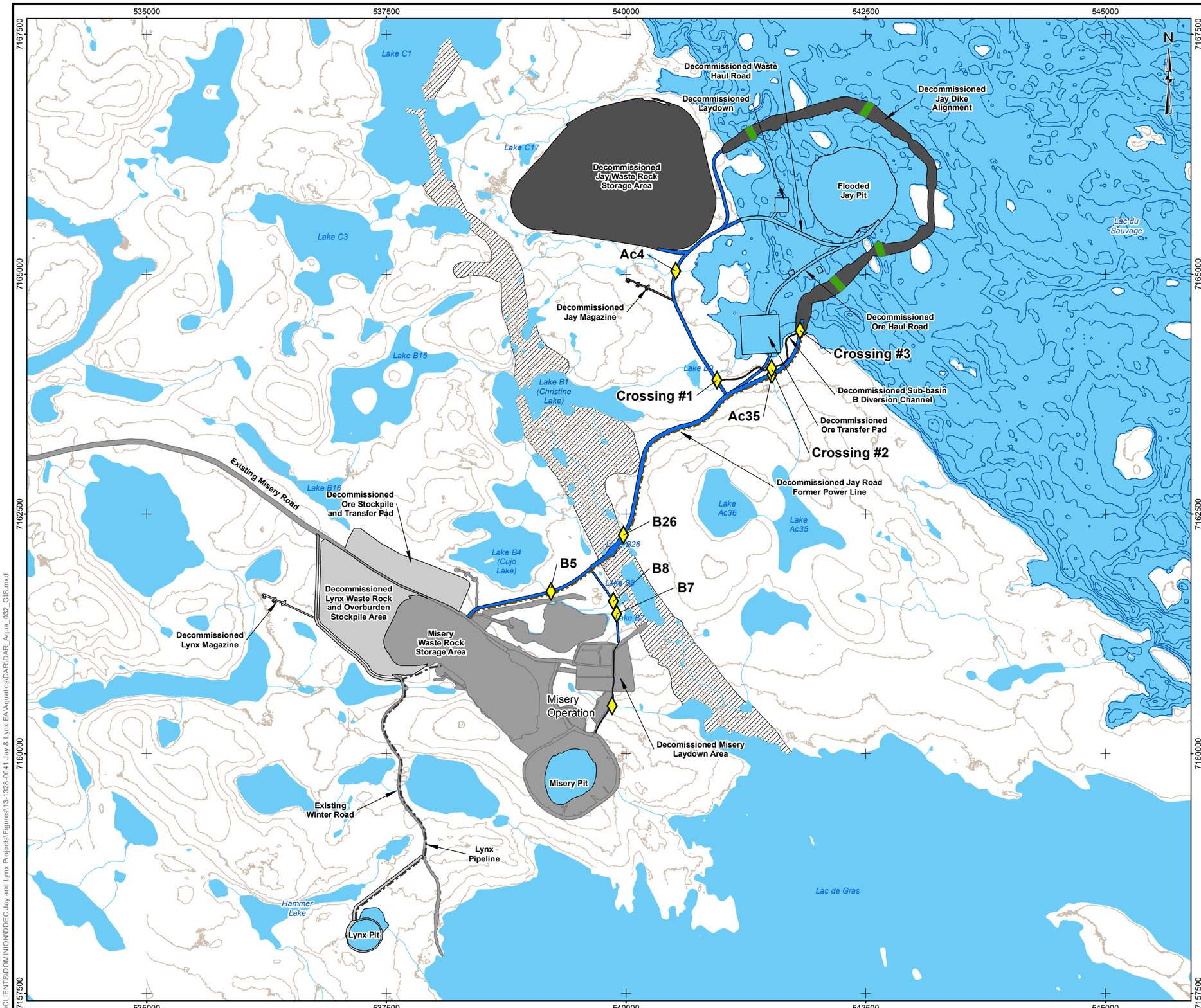
PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
AQUATIC FOOTPRINT FOR THE JAY PROJECT DURING OPERATIONS

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_033_GIS
DESIGN	CS	12/09/14	SCALE AS SHOWN REV 0
GIS	ANK	20/10/14	MAP 9A3.1-1
CHECK	CS	20/10/14	
REVIEW	KM	20/10/14	

G:\CLIENTS\DOMINION\DDEC_Jay and Lynx Projects\Figures\13-1328-0041 Jay & Lynx EA\Aquatics\DAR\DAR_Aqua_033_GIS.mxd



LEGEND

- EKATI MINE FOOTPRINT (MISERY OPERATION)
- BATHYMETRY CONTOUR (5 m INTERVAL)
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- WATERCOURSE CROSSING

JAY PROJECT FOOTPRINT

- FORMER POWER LINE
- DECOMMISSIONED JAY PROJECT INFRASTRUCTURE
- DECOMMISSIONED JAY ROADS
- PROPOSED DIKE BREACHING LOCATION

LYNX PROJECT FOOTPRINT

- LYNX PIPELINE
- LYNX PROJECT INFRASTRUCTURE

NOTES

ROAD, PIPELINES, AND POWER LINE ARRANGEMENT TO BE DETAILED AS PART OF FURTHER PRE-FEASIBILITY DESIGN. APPROXIMATE CORRIDOR WIDTHS ARE SHOWN.

REFERENCE

JAY PROJECT CONCEPTUAL ENGINEERING REPORT, EKATI MINE, DOC#: 1313280041-E14037-R-REV0-4060, DATED: MAY 13, 2014
JAY PROJECT DESIGN BASIS MEMORANDUM FOR PRE-FEASIBILITY DESIGN OF PROJECT ROADS AND PIPELINE BENCHES, DOC#: 1313280041-E14031-TM-REVD-2020, DATED: AUGUST 1, 2014
LIDAR AND BATHYMETRIC DATA OBTAINED FROM AURORA, 2013
WATER OBTAINED FROM CANVEC © NATURAL RESOURCES CANADA, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

1 0 1
SCALE 1:40,000 KILOMETRES

PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
DECOMMISSIONED JAY PROJECT AQUATIC FOOTPRINT AT POST-CLOSURE

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_032_GIS	
DESIGN	CS	12/09/14	SCALE AS SHOWN	REV 0
GIS	JG	20/10/14	MAP 9A3.1-2	
CHECK	CS	20/10/14		
REVIEW	KM	20/10/14		

G:\CLIENTS\DOMINION\DDEC_Jay and Lynx Projects\Figures\13-1328-0041_Jay & Lynx EA\Aquatics\DAR\DAR_Aqua_032_GIS.mxd

9A3.2 Affected Watersheds

The Project is located in the Lac de Gras sub-basin. The sub-basin spans an area of approximately 413,570 ha where there are approximately 1,770 km of streams and 135,035 ha of lakes (Table 9A3.2-1).

Table 9A3.2-1 Existing Baseline Summary of Waterbodies and Watercourses in Drainage Basins Potentially Affected by the Project

Sub-Basin	Total Sub-Basin Area (ha)	Total Length (m)	No. of Lakes per Size Category				Area (ha) of Lakes per Size Category			
			<1 ha	1-10 ha	10-100 ha	>100 ha	<1 ha	1-10 ha	10-100 ha	>100 ha
Lac de Gras[a]	413,570	1,769,809	3,487	2,080	663	106	1,033	7,479	20,678	105,845
Koala Lake[b]	18,573	89,780	187	116	29	5	65	370	998	852
Lac du Sauvage[b]	158,892	611,769	1,163	719	276	58	348	2,529	8,759	37,783
B[c]	1,459	8,639	19	6	5	0	8	15	193	0
C[c]	1,178	5,963	8	6	2	1	2	22	99	163
Ac4[c]	275	5.0	12	1	0	0	4	3	0	0
Ac35[c]	252	1,510	0	0	2	0	0	0	59	0

a) the Lac de Gras drainage basin is inclusive of all subsequent basins/ sub-basins in the table.
b) in Lac de Gras sub-basin
c) in Lac du Sauvage sub-basin.
Note: Watershed statistics based on CanVec National Topographic Service 1:50,000 spatial data.
No. = number; ha = hectare; m = metre; <= less than; >= greater than.

The development of the Project is expected to directly affect fish habitat in Lac du Sauvage through the construction of the Jay Dike and the dewatering of the diked area. It is expected that the spatial extent of affected populations is much larger than the proposed dewatered area for fish species in Lac du Sauvage. Thus, effects are assessed at the spatial scale of the combined Lac du Sauvage and Lac de Gras waterbodies for valued component species in the DAR (Section 9). Both lakes are relatively large and deep, connected by a short outflow, and both lakes have similar species assemblages. The baseline surface area of Lac de Gras (56,910.8 hectares [ha]) and Lac du Sauvage (8,651.1 ha) combined is approximately 65,561.9 ha based on National Topographic Service (NTS) 1:50,000 map and existing lake footprints.

The historical reference surface area for Lac de Gras is 57,107.2 ha (based on NTS 1:50,000 map), approximately 196.4 ha larger than existing baseline. The Diavik Diamond Mine (Diavik Mine) has an existing footprint on Lac de Gras resulting in the different between historic and current baseline areas. For Lac du Sauvage, the historical reference condition is similar to the existing baseline condition because there are no existing developments on Lac du Sauvage.

The scale of the assessment in the DAR (Section 9) was also extended to include tributaries that may support spawning, foraging, and rearing habitat for fish in Lac du Sauvage and Lac de Gras. Total length of tributaries identified for the assessment included 43.3 fluvial km in Lac de Gras and 11.6 fluvial km in Lac du Sauvage. The tributaries included sections of small streams extending from Lac de Gras and Lac du Sauvage to the outlet of a first upstream lake of approximately 10 ha in area or larger. Tributary stream sections ranged in length from 23 metres (m) to 2,611 m (n = 75). There are no existing developments affecting the tributaries for Lac de Gras and Lac du Sauvage that were identified for the assessment.

Although Project effects are primarily restricted to the dewatered area of Lac du Sauvage (Table 9A3.2-2), water levels, flows, and fish distributions may potentially be affected in other areas of the Lac de Gras sub-basin. Road crossings will be constructed for small streams in headwaters of sub-basin B, Ac4, and Ac35 that flow into Lac du Sauvage. Furthermore, tributary stream sections in sub-basins Ac4, Ac35, and B may be affected because of the construction of the horseshoe dike and the Sub-Basin B Diversion Channel (Table 9A3.2-2). These small sub-basins are adjacent to one another, draining easterly into Lac du Sauvage (specifically into internal basin Ac). Sub-basins Ac4 and Ac35 are relatively small in contributing drainage areas (less than 300 ha in size), whereas sub-basin B is larger at 1,459 ha in drainage area (Table 9A3.2-1).

Table 9A3.2-2 Summary of Project Activities and Potential Effects by Drainage Basin

Project Activity	LDG	LDS	B	C	Ac-4	Ac-35	Koala
Surface disturbance and construction activities • Construction or development of site access roads, pits, waste rock storage areas, quarries, support building	X	X	X	X	X	X	
Construction of dike	X	X	X		X	X	
Dewatering within the diked area of Lac du Sauvage	X	X	X		X	X	
Pit development	X	X					
General operational activities • Pit development • Site water management • Surface infrastructure and support facilities • Storage of industrial, domestic, hazardous, and contaminated waste • Vehicle traffic along the access road and winter road	X	X	X	X	X	X	X
Back-flooding Jay Pit and dewatered area of Lac du Sauvage	X	X					
General closure and decommissioning activities • Removal of project infrastructure • Breaching/removal of dikes • Seepage from facilities, groundwater inflows, back-flooded Jay pit	X	X		X	X		X
Post-closure, reconnection of back-flooded area of Lac du Sauvage with downstream	X	X	X			X	

LDG = Lac de Gras; LDS = Lac du Sauvage; Note that Project activities that may result in loss of habitat or physical alteration of habitat are emphasized in the conceptual offsetting plan; see DAR Section 9 for full assessment.

Fish and fish habitat may also potentially be affected through changes in water quality in sub-basin C and the Koala watershed. The Jay waste rock storage area and quarry may affect water quality at downstream locations in sub-basin C, and fine processed kimberlite management in the Panda and Koala pits during operations may influence water quality at downstream locations. These potential changes are addressed in detail in the DAR (Section 9). There are no proposed footprints overlapping with lake and stream habitats in sub-basin C or the Koala watershed (Table 9A3.2-2). Note that Project activities that may result in loss of habitat or physical alteration of habitat are emphasized in the conceptual offsetting plan

At the completion of mining the Jay pipe, the Misery Pit, Jay Pit, and the diked area will be back-flooded with freshwater to create a freshwater cap and re-establish natural water levels within the diked area, and allow the Misery Pit to overflow naturally to Lac de Gras. Water for back-flooding the Jay Pit and diked area and the Misery Pit will come from a combination of local runoff, direct precipitation, and pumping from Lac du Sauvage. The back-flooding period is expected to require approximately three years, nine months of pumping (2030 to 2033) from Lac du Sauvage. Back-flooding of the dewatered area will be carried out in a manner that provides a controlled flow of water to protect source water and downstream areas against adverse impacts. Specifically, this includes mitigation of local fish habitat disturbance during back-flooding and effects on Lac du Sauvage and Lac de Gras in terms of water level and local hydrological regime.

9A3.3 Footprint Area Summary of Affected Surface Waters

The area of the Project footprint within aquatic habitats was calculated from the digitized layout of infrastructure overlaid on aquatic map features using Geographic Information System (GIS) software. The aquatic map was based on CanVec National Topographic Service 1:50,000 spatial data.

The footprint area that will require offsetting will be refined as the Project advances the detailed design and will be updated with the final offsetting plan. The total Project footprint in Lac du Sauvage is approximately 397.0 ha, of which 58.8 ha is the dike footprint (Table 9A3.3-1). These alterations (dike and dewatered area) represent a 4.6% change in surface water area for Lac du Sauvage, and a 0.6% change in surface water area for Lac du Sauvage and Lac de Gras combined. The cumulative change in habitat from previous, existing, and Project developments will be 593.37 ha or 0.9% of lake habitat in Lac du Sauvage and Lac de Gras combined. The determination of what activities and what areas identified in Table 9A3.3-1 that constitute serious harm to fish that require offsetting will be developed through continued consultation with DFO in developing the final offsetting plan during the permitting phase.

Alterations to tributary habitats due to the Project primarily represent changes resulting from a channel diversion within sub-basins B and Ac35 that flow into Lac du Sauvage. The total length of diverted tributaries in Lac du Sauvage is approximately 467 m. This length represents approximately 4.0% of the length of all selected tributaries with potential to provide habitat for spawning, rearing, or foraging habitat in Lac du Sauvage, and 0.9% of the length of tributaries in Lac du Sauvage and Lac de Gras combined.

Stream length to be diverted in sub-basin Ac35 is 112 m of Stream Ac35 (12.1% of the Stream Ac35, or 7.4% of total stream length in sub-basin Ac35), and in sub-basin B is 355 m of Stream B0 (59.5% of Stream B0 or 4.1% of total stream length in sub-basin B). Stream Ac4 (410 m in length) will be isolated from Lac du Sauvage with the construction of the dike, but was classified as an ephemeral, non-fish bearing stream within sub-basin Ac4 during reconnaissance surveys in June and August, 2014 (also see Rescan 2007).

Road crossings are also proposed upstream of the diverted channels and in the sub-basins above the diked area of Lac du Sauvage. One crossing will be located on Stream Ac35 immediately above the diversion channel (40 m wide), and one crossing will be located on Stream B0 where the diversion channel connects to the natural channel. There will be four crossings over small, ephemeral watercourses in the headwaters of a sub-basin near the Misery operation (i.e., Streams B5, B7, B8, and B26).
Some shoreline habitat of small waterbodies (less than 1 ha in size) in the headwaters of sub-basin B will be affected by proposed road developments; these include Lakes B6, B11 and B12. Reconnaissance surveys completed in August 2014 suggest that affected small waterbodies in the headwaters are shallow and less than 2 m in depth, and therefore, unlikely to support a resident fish population. In addition, Stream Ac4 will be altered by a road crossing (30 m wide).

In summary, seven small streams and three small lakes will be affected by road crossings. The total footprint for road crossings over natural stream channels is approximately 214 m, of which 40 m of the altered stream length was classified as fish-bearing (Ac35 crossing) during previous and ongoing baseline studies (Fish and Fish Habitat Baseline Report, Annex XIV). The total footprint from road construction for small, shallow waterbodies is approximately 0.2 ha.

Table 9A3.3-1 Summary of Footprint Area of Affected Surface Waters by Drainage Basin and Project Activity

Sub-Basin	Name	Footprint Type	Lake Area Affected (ha)	Stream Length Affected (m)	Fish-Bearing Status[(b)]
Ac	Lac du Sauvage	dike	58.79	-	yes
		discharge diffuser	0.31	-	yes
		dewatered area, including infrastructure within area	338.17	-	yes
		dewatered area, excluding infrastructure within area[(a)]	246.68	-	yes
		Jay haul road within dewatered area[(a)]	0.19	-	yes
		Jay access road within dewatered area[(a)]	0.04	-	yes
		ore transfer pad within dewatered area[(a)]	14.97	-	yes
		operation road within dewatered area[(a)]	0.10	-	yes
		laydown within dewatered area[(a)]	2.10	-	yes
		Jay Pit within dewatered area[(a)]	64.94	-	yes
		pumping systems within dewatered area[(a)]	0.54	-	yes
B	Lake B6	road footprint	0.04	-	unlikely
	Lake B11	road footprint	0.07	-	unlikely
	Lake B12	road footprint	0.11	-	unlikely
	Stream B0	diverted water	-	355	yes
		road crossing[(c)]	-	38	yes
	Stream B5	road crossing	-	39	unlikely
	Stream B7	road crossing	-	19	unlikely
	Stream B8	road crossing	-	20	unlikely
	Stream B26	road crossing	-	66	unlikely

Table 9A3.3-1 Summary of Footprint Area of Affected Surface Waters by Drainage Basin and Project Activity

Sub-Basin	Name	Footprint Type	Lake Area Affected (ha)	Stream Length Affected (m)	Fish-Bearing Status[(b)]
Ac35	Stream Ac35	road crossing	-	40	yes
		diverted water	-	112	yes
Ac4	Stream Ac4	road crossing[(d)]	-	30	unlikely
		isolation	-	410	unlikely

a) Included in the estimate of lake area within the total dewatered area.

b) Based on previous and ongoing baseline studies (Annex XIV).

c) Included in the estimate of diverted stream length.

d) Included in the estimate of stream length isolated by diked area.

Note: Footprint statistics were generated using spatial information of aquatic features (1:50,000 CanVec National Topographic Service data) and Project infrastructure in a Geographic Information System (GIS) platform.

ha = hectare; m = metre.

9A3.4 Avoidance and Mitigation Measures

Details of mitigation measures that will be implemented for the Project are described in detail in the DAR. A general discussion of measures that result in the avoidance or mitigation of serious harm to fish are discussed briefly below.

9A3.4.1 Diversion Channels

A diversion channel (Sub-Basin B Diversion Channel) of approximately 1,275 m in length will be constructed to divert water that originally flowed from sub-basin B into the dewatered portion of Lac du Sauvage, away from the pit and into the area of Lac du Sauvage outside of the dewatered area. The diversion channel will convey water from two fish-bearing streams, Stream B0 downstream of Christine Lake, and Stream Ac35, a small ephemeral stream downstream of Lake Ac35.

To mitigate for lost habitat connectivity between Lac du Sauvage and upstream waterbodies and watercourses, the diversion channel will be designed to facilitate fish passage of target species (i.e., adult Arctic Grayling, and to a lesser extent, Lake Trout) to upstream locations based on their swimming abilities (Jones et al. 1974; Katopodis 1994; Peake 2008; Katopodis and Gervais 2012). The use of appropriately designed diversion channels for fish passage is a common method of maintaining habitat connectivity when interrupted by human developments (i.e., roads, mines, irrigation, and hydropower facilities; DFO 2007; MDNR 2010; Roscoe and Hinch 2010; Noonan et al. 2012).

The final design of the diversion channel will consider reasonable measures to facilitate fish movement based on expected flow conditions, in particular, maintaining hydraulic conditions that support movement of target fish species. Suitable velocity breaks, such as boulder clusters, may be used to provide flow refugia for fish (Fischenich and Seal 1999; Gaboury 2003; DFO 2006; ODFW 2010). Channel designs will also consider refugia for smaller-bodied fish that may use the lower section of the channel near Lac du Sauvage. The channel design will utilize locally sourced boulder and cobble-sized substrates, which will diversify the hydraulic conditions (i.e., velocities, depths) in the stream (Pander et al. 2013).

Overall, there is high certainty associated with the effectiveness of the proposed diversion channel as a migration corridor for the main target species, adult Arctic Grayling. This assumes that the channel is constructed such that velocities and slopes are similar to natural streams in the area, there are adequate resting areas, and water velocities are within the published swimming capabilities of the target species. There may be less certainty associated with use of the channel by other species (e.g., forage species).

9A3.4.2 Dike Construction

To mitigate the extent of water quality effects during the construction of the Jay Dike in Lac du Sauvage, turbidity curtains will be used to control elevated total suspended solids (TSS) and turbidity from extending beyond a defined zone of influence. The turbidity curtain panels will overlap so there are no gaps between panels and curtains to allow the release of sediments from the enclosed area. Areas within and outside of the curtained area will be regularly monitored for water quality parameters, including turbidity and TSS.

9A3.4.3 Erosion Control

Appropriate sediment and erosion controls during Project activities during construction, operations, and closure (e.g., timing of construction, use of silt curtains within waterbodies or along drainage paths, road watering, site contouring) will be undertaken with practices consistent with those used at the Ekati Mine and based on methods that have been found to be most effective in northern mining operations for erosion and sediment control.

9A3.4.3.1 *General Construction*

Silt fences will be used to reduce the transport of sediment from construction and general land-based land disturbance activities. This mitigation is applied in many mining operations when land disturbances, such as the construction of a dike may directly influence a waterbody. Silt fences are permeable fabric barriers installed vertically on support posts along watershed contours to collect and/or filter sediment laden sheet flow runoff. They effectively cause runoff to pond and coarse sediment to settle out as the fence fabric impounds water through providing a filter to flows and reducing runoff flow velocities (less than 0.03 cubic metres per second [m^3/s]) of sheet flow or overland flow.

9A3.4.3.2 *Diffuser*

Piped discharge from Misery Pit to Lac du Sauvage in operations will be pumped to Lac du Sauvage via a diffuser to disperse discharge energy and rapidly attenuate the discharge. The design objectives for the diffuser will be to maximize dispersion and attenuation of the discharge to reduce the potential for re-suspension of sediments and any potential effects to water and sediment quality and aquatic habitat.

9A3.4.4 Road Crossings

The footprint disturbance area will be limited to the extent practical for Project infrastructure. This includes using Ekati Mine infrastructure where practical to minimize the construction of new roads. Where construction is required, the following mitigation measures will be used to avoid or mitigate serious harm to fish:

- roads will be built as narrow as practical while maintaining safe construction and operation practices;

- roads will follow alignments that minimize stream crossings and if feasible, stream crossings will be perpendicular to watercourses;
- roads will avoid sensitive habitat where feasible; and,
- construction of road crossings at watercourses will take place outside of the timing windows for spring spawning Arctic Grayling in the Northwest Territories (i.e., early May to mid-June) for streams where potential for spring spawning exists (DFO 2014).

To prevent potential barriers to upstream fish passage at any of the proposed road crossings of natural, fish-bearing channels and the diversion channel, culverts will be designed and installed in such a manner to maintain adequate flows and velocities for fish passage, using appropriate federal and territorial guidelines (e.g., DFO 2007; Government of Alberta 2009). For culverts associated with the diversion channel, small rock weirs will be placed immediately downstream of the culvert outlets to backwater the culverts, further facilitating fish passage at low flow. The following maintenance activities will be considered for the life of the mine to further support the success of the diversion channel in providing fish passage:

- regular inspection and maintenance of outlet channels and culverts to remove excess sediment and soil/rock fall material;
- inspection of culvert inlets and outlets for ice and snow build-up before freshet, and removal of excess ice and/or snow that would prevent freshet flow through the culvert; and,
- repair of damaged channel linings immediately to limit the potential for erosion and breach of channels.

9A3.4.5 Water Management

9A3.4.5.1 *Water Quantity*

A dewatering plan will be prepared that will include specified flow rates to the lake environment to attenuate changes in flow. Discharge locations will be determined during the detailed design stage and may be modified based on monitoring results. The outflow capacity of Lac du Sauvage will be maintained during dewatering, and the channel banks of the Lac du Sauvage outlet channel will be monitored for evidence of erosion.

During operations, recycled water will be used in the processing of the mined kimberlite ore at the existing processing plant at the Ekati Mine. As a result, the required volume of water for processing does not have to be supplied from the environment surrounding the Project.

During the back-flooding phase of the Project, water from Lac du Sauvage will be pumped to the Jay Pit and diked area and the Misery Pit. Back-flooding of the pits and dewatered area will be conducted to provide a controlled flow of water to protect source water and downstream areas, including local fish habitat. During low flow time periods, such as winter months, pumping rates out of Lac du Sauvage into the pits would be reduced if necessary to protect fish habitat. Pumping rates will be managed to minimize effects to Lac du Sauvage and be based on an assessment of required flows through the outlet.

9A3.4.5.2 *Water Quality*

For the Project, specific water containment strategies have been incorporated into the water management plan to reduce the potential for downstream water quality effects. The first strategy is the use of the existing Panda and Koala pits, Long Lake Containment Facility, and other water management facilities associated with the main camp area for management of process water, treated effluent from the sewage treatment plant, and site runoff.

In addition, the mined-out Misery pit will be used as a key water management facility for the Project. In the final dewatering phase of dewatering of the diked area of Lac du Sauvage above the Jay Pit, water containing elevated TSS levels will be pumped to the Lynx Pit and/or the Misery Pit, and during operations, minewater, including high total dissolved solids (TDS) groundwater inflows from the Jay open pit, will be pumped to and managed in the Misery Pit.

9A3.4.6 Water Intakes

Freshwater pumping will be required during construction of the dike around the mine area in Lac du Sauvage, during dewatering of the mine area, for operational needs (such as road watering), and during back-flooding of the Jay Pit and dewatered area at closure. Fish screens will be placed on all water intake pipes in fish-bearing waterbodies to minimize potential harm to fish. All measures recommended by DFO to avoid causing harm to fish at screened water intake pipes (DFO 1995; DFO 2014) will be implemented as mitigation to minimize entrainment and impingement of fish.

9A3.4.7 Blasting Plans

Mitigation measures will be implemented to minimize the effects of blasting in the Jay Pit on fish valued components. All blasting will occur in the Jay open pit within the dewatered area of Lac du Sauvage, not in water, and will be managed to avoid adverse impacts to fish. All applicable DFO recommended measures to avoid causing harm to fish from the use of explosives (DFO 2014; Wright and Hopky 1998) will be considered.

9A4 AFFECTED FISHERIES RESOURCES

This section describes existing fish and fish habitat in the waterbodies and watercourses that would be affected by Project activities. Additional details are in the Fish and Fish Habitat Baseline Report (Annex XIV).

9A4.1 Lac du Sauvage

Lac du Sauvage is a large lake with a total surface area of 8,651 ha (NTS 1:50,000 map) and a total volume of 630,320,529 cubic metres (m^3). Lac du Sauvage has a mean depth of 6.8 m and a maximum depth of 40.4 m.

Baseline and historical studies indicate that 11 species of fish are present in Lac du Sauvage: Lake Trout, Arctic Grayling, Northern Pike, Cisco, Round Whitefish, Lake Whitefish, Burbot, Longnose Sucker, Ninespine Stickleback, Lake Chub, and Slimy Sculpin. Historically, Lake Trout were the most abundant species captured in Lac du Sauvage (63%). Lake Whitefish (18%) and Round Whitefish (11%) were the next most abundant species, followed by Cisco (3%). All other species appeared to be much less abundant, but this may have been a reflection of capture methods, as gill netting, which targets larger bodied species, was the most extensively used gear type.

Fish densities were calculated in 2013 for yearling and older fish using echo integration and fish tracking methods, as described in the Fish and Fish Habitat Baseline Report (Annex XIV). The predicted population estimate based on a median statistic was approximately 197,000 fish in Lac du Sauvage. The predicted population estimate using the 75th percentile, as part of an environmentally conservative approach for an environmental assessment, was determined to be approximately 828,000 fish for Lac du Sauvage. However, the actual population estimate for fish (including Cisco, Lake Trout, Lake Whitefish, Round Whitefish, and Arctic Grayling) in Lac du Sauvage may be much lower and closer to the median values reported in Table 9A4.1-1 (i.e., approximately 197,000 individuals based on fish tracking).

Table 9A4.1-1 Percentile (Including Quartile) Statistics for Density and Abundance of Fish Estimated from Hydroacoustic Surveys

	Internal Basin Aa/b			Internal Basin Ac/d/e			
	Fish/100,000 m^3			Fish/100,000 m^3			
Percentile Statistics	>5 m	0 to 5 m	Abundance	>5 m	0 to 5 m	Abundance	Total Abundance
Echo Integration							
50%	94.62	10.88	97,608	35.51	19.63	96,791	194,399
75%	154.03	89.78	242,100	59.25	50.44	195,155	437,255
Fish Tracking							
50%	80.63	27.40	104,106	31.69	21.16	93,316	197,422
75%	213.30	281.03	516,164	71.72	100.89	311,988	828,153

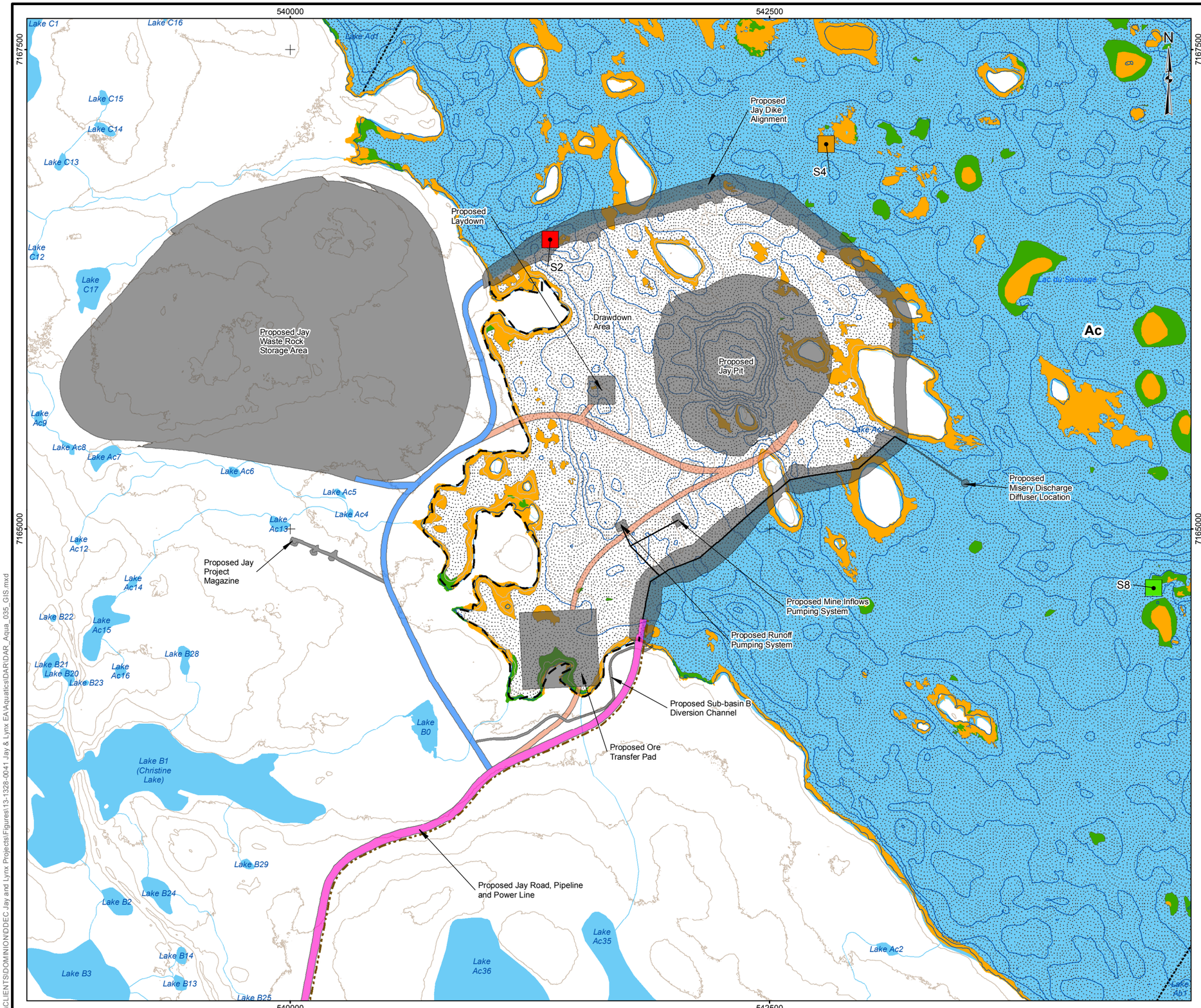
Note: Abundance derived for Aa/b basins using a volume of 89,883,788 m^3 at depths >5m, and 115,446,534 m^3 at depths 0 to 5 m, and for Ac/d/e/ basins using a volume of 167,468,165 m^3 at depths >5 m and 190,191,703 m^3 at depths 0 to 5 m.

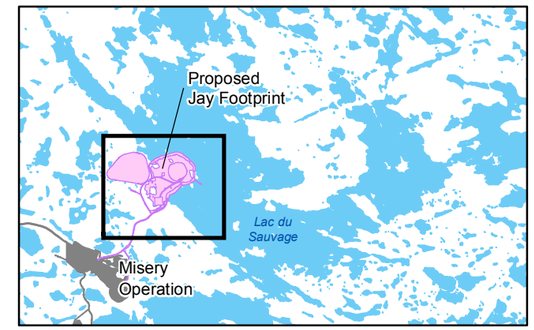
% = percent; m^3 = cubic metre; >= greater than; m = metre.

Substrates in Lac du Sauvage were delineated from hydroacoustic data of the lake bottom for the entire lake, and also by the interpretation of orthophotographs for shallow locations around the shoreline of the lake (0 to 5 m depths). For some of the habitat analysis calculations, the lake shoreline was delineated using georeferenced orthophotos, which resulted in a calculated lake area of 8,668 ha.

The substrate at both deep and shallow locations in Lac du Sauvage, based on hydroacoustics data, was described using three broad categories of substrate: fines (silt, organics, clay), mixed (coarse and fine substrates), and coarse substrates (bedrock, boulder, cobble, gravel) (Map 9A4.1-1). Overall, the dominant substrate type in Lac du Sauvage was fines (87.1%), followed by coarse (8.4%), and mixed substrates (4.5%).

A detailed evaluation of Lac du Sauvage shoreline substrate (0 to 5 m depths) was also performed using orthophotographs and confirmed with ground surveys. The survey found that shallow areas consisted mostly of fines (79%), followed by coarse (14.9%) and mixed (5.1%) substrates representing smaller portions of shoreline habitat (Map 9A4.1-2). Areas identified as cobble substrates often included small areas or patches of gravel based on observations in the field. Such locations could be spawning locations for whitefish species, Lake Trout, and Cisco.





LEGEND

- WATERCOURSE
- WATERBODY
- BATHYMETRY CONTOUR (5 M INTERVAL)
- ELEVATION CONTOUR (10 M INTERVAL)

SPAWNING HABITAT LAKE TROUT

- GOOD
- FAIR
- UNSUITABLE
- INTERNAL BASIN DIVIDE

JAY PROJECT FOOTPRINT

- EXISTING SHORELINE OF DEWATERED AREA
- POWER LINE
- PROPOSED JAY PROJECT INFRASTRUCTURE
- PROPOSED JAY ROAD NORTH (HAUL ROAD)
- PROPOSED JAY ROAD (HAUL ROAD AND POWER LINE)
- PROPOSED JAY ROAD (HAUL ROAD, PIPELINE AND POWER LINE)
- PROPOSED JAY PIPELINE ROAD (ACCESS ROAD AND PIPELINE)
- PROPOSED OPERATION ROADS

BROAD LEVEL SUBSTRATE TYPE

- FINES
- MIXED
- COARSE

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
BATHYMETRIC DATA OBTAINED FROM AURORA, 2013
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

500 0 500
SCALE 1:20,000 METRES

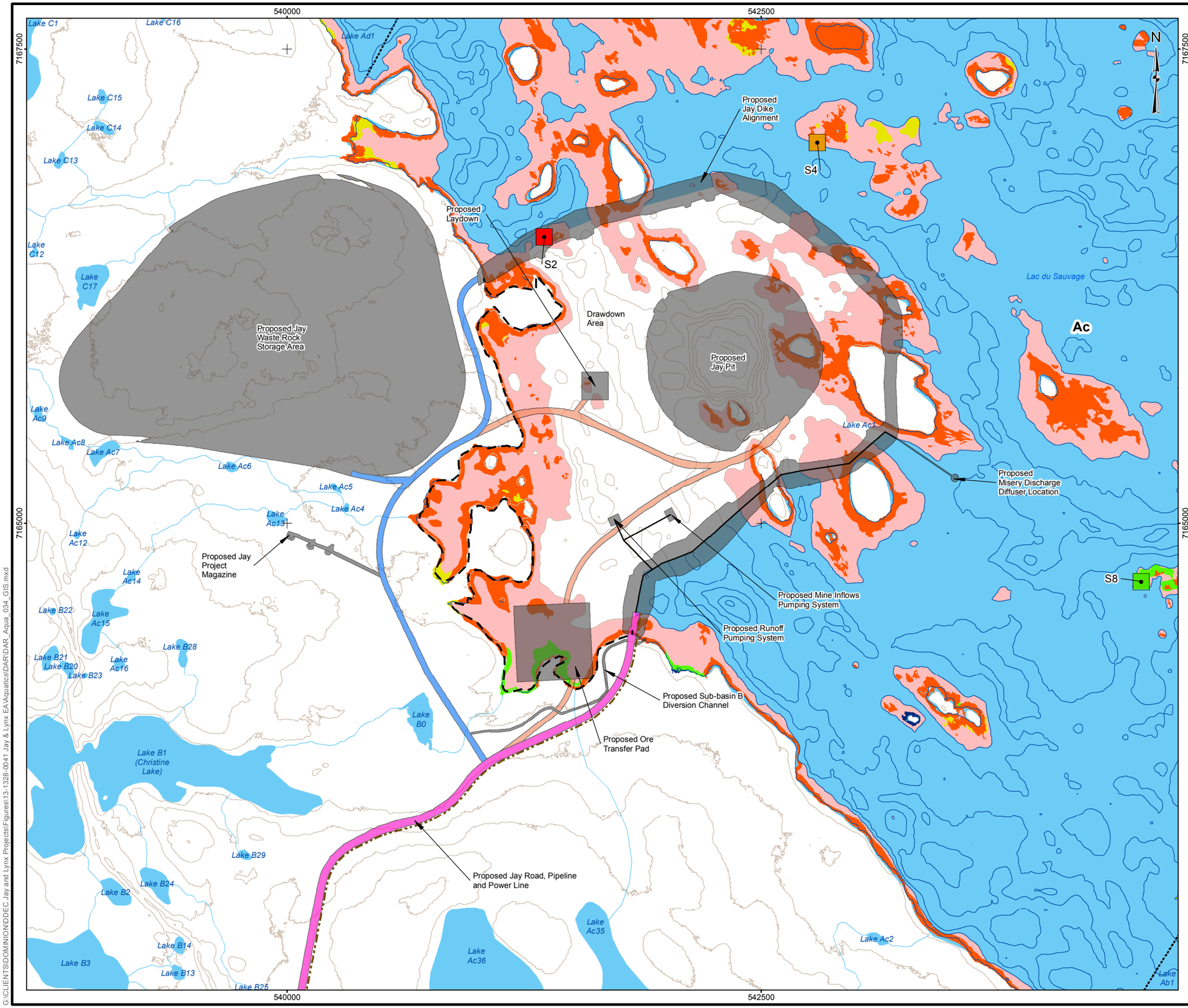
PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
SUBSTRATE MAP NEAR THE PROPOSED JAY PROJECT IN LAC DU SAUVAGE

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_035_GIS	
DESIGN	CS	12/09/14	SCALE AS SHOWN	REV 0
GIS	JE/ANK	20/10/14	MAP 9A4.1-1	
CHECK	CS	20/10/14		
REVIEW	KM	20/10/14		

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\13-1328-0041 Jay & Lynx EA\Aquatics\DAR\DAR_Aqua_035_GIS.mxd



G:\CLIENTS\DOMINION\DEC Jay and Lynx Projects\Figures\13-1328-0041 Jay & Lynx EAAquatics\DAR\DAR_Aqua_034_GIS.mxd

LEGEND

- WATERCOURSE
- WATERBODY
- BATHYMETRY CONTOUR (5 M INTERVAL)
- ELEVATION CONTOUR (10 M INTERVAL)

SPAWNING HABITAT LAKE TROUT

- GOOD
- FAIR
- UNSUITABLE
- INTERNAL BASIN DIVIDE

JAY PROJECT FOOTPRINT

- EXISTING SHORELINE OF DEWATERED AREA
- POWER LINE
- PROPOSED JAY PROJECT INFRASTRUCTURE
- PROPOSED JAY ROAD NORTH (HAUL ROAD)
- PROPOSED JAY ROAD (HAUL ROAD, PIPELINE AND POWER LINE)
- PROPOSED OPERATION ROADS

SUBSTRATE TYPE (0-5 METRES)

- BO/CO - BOULDER/COBBLE
- BO/FI - BOULDER/FINES
- BR - BEDROCK
- FI - FINES
- FI/BO - FINES/BOULDER

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
BATHYMETRIC DATA OBTAINED FROM AURORA, 2013
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

500 0 500
SCALE 1:20,000 METRES

PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
SHORELINE HABITAT MAP NEAR THE PROPOSED JAY PROJECT IN LAC DU SAUVAGE

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_034_GIS	
DESIGN	CS	12/09/14	SCALE AS SHOWN	REV 0
GIS	JE/ANK	20/10/14	MAP 9A4.1-2	
CHECK	CS	20/10/14		
REVIEW	KM	20/10/14		

In addition to 2013 surveys (Annex XIV), the combined results of four historical surveys provide a detailed inventory of habitat availability for fish in Lac du Sauvage (Golder 1997a,b,c,d; Rescan 2007; Map 9.2-26). Surveys identified 21 shoals in Lac du Sauvage (Golder 1997c). Of these, 43% of the shoal locations were determined to provide spawning habitat of "good" or "fair" quality for Lake Trout and Cisco, and only 10% for Round Whitefish. The remaining shoal locations were identified as being unsuitable for Lake Trout, Cisco, and Round Whitefish spawning.

9A4.1.1 Dike-Dewatered Area Footprint

The Project footprint in Lac du Sauvage involves the construction of the Jay Dike and dewatering of the diked area to access the Jay Pit. There are currently no developments in Lac du Sauvage so the reference base case and 2014 base case are considered equivalent in the assessment in the DAR (Section 9).

The total footprint of the Project in Lac du Sauvage is estimated to be 58.8 ha from the dike and 338.2 ha from the dewatered area, resulting in a total loss of approximately 397.0 ha (or 4.6%) of the lake area (Table 9A4.1-2). Previously identified spawning shoals for Lake Trout, and for forage species, such as Cisco and Round Whitefish will remain unaffected by the proposed Project (Annex XIV; Section 9).

Using the hydroacoustic data for Lac du Sauvage, habitat losses will be primarily fines substrate, resulting in a relative loss of 4.6% of the fines substrate in the lake (Table 9A4.1-2). The coarse substrate habitat losses will be primarily at the shallow depths (0-6 m) resulting in a relative loss of 5.9% of the coarse substrate in the lake (Table 9A4.1-2). The mixed substrate habitat losses will be primarily at the shallow depths (0-2 m), resulting in a relative loss of 0.9% of the coarse substrate in the lake (Table 9A4.1-2). The total volume of water in the dewatered area is estimated to be 27,037,305 m^3 or approximately 4.3% of the volume of Lac du Sauvage.

Table 9A4.1-2 Relative Changes in the Area of Lac du Sauvage by Substrate Type and Depth from the Dike and Dewatered Area Footprint from the Base Case (Reference and 2014) to Application Case

Depth of Habitat	Substrate Type	Base Case (ha)	Application Case					
			Dike Footprint (ha)	Dike Footprint Change (%) from Base Case to Application Case	Dewatered Area Footprint (ha)	Dewatered Area Footprint Change (%) from Base Case to Application Case	Total Footprint (ha)	Total Footprint Change (%) from Base Case to Application Case
0-2 m	Coarse	584.82	5.59	-0.95	29.76	-5.09	35.35	-6.04
	Fines	874.29	0.64	-0.07	17.48	-2.00	18.13	-2.07
	Mixed	260.84	-	-	3.10	-1.19	3.10	-1.19
	All	1,719.95	6.23	-0.36	50.35	-2.93	56.58	-3.29
2-6 m	Coarse	134.36	1.82	-1.36	6.03	-4.49	7.86	-5.85
	Fines	2,379.24	22.36	-0.94	104.57	-4.40	126.93	-5.33
	Mixed	96.40	0.05	-0.06	0.18	-0.18	0.23	-0.24
	All	2,609.99	24.23	-0.93	110.78	-4.24	135.01	-5.17
6-10 m	Coarse	11.99	-	0	0.01	-0.05	0.01	-0.05
	Fines	1,772.76	15.59	-0.88	74.28	-4.19	89.88	-5.07
	Mixed	31.82	0.11	-0.35	0.11	-0.34	0.22	-0.68
	All	1,816.57	15.70	-0.86	74.40	-4.10	90.10	-4.96
>10 m	Coarse	0	-	0	-	0	-	0
	Fines	2,521.32	8.08	-0.32	100.13	-3.97	108.21	-4.29
	Mixed	0.01	-	0	-	0	-	0
	All	2,521.34	8.08	-0.32	100.13	-3.97	108.21	-4.29
All	Coarse	731.17	7.41	-1.01	35.80	-4.90	43.21	-5.91
	Fines	7,547.61	46.68	-0.62	296.47	-3.93	343.15	-4.55
	Mixed	389.07	0.16	-0.04	3.39	-0.87	3.55	-0.91

Note: The total footprint value and the total area of the lake may differ from that reported in Table 9A4.1-3 because of the digitizing approach that was used for substrate mapping. Although the reported values provide an approximation of absolute losses per habitat type, the relative losses are deemed accurate for the assessment of effects to habitat types.

ha = hectare; m = metre;% = percent; >= greater than.

The total Project footprint on shallow habitat (less than 5 m depths) delineated using orthophotographs will result in a total loss of 4.2% of the shallow habitat area in Lac du Sauvage (Table 9A4.1-3). Shallow habitat losses will be primarily fines and coarse substrates, resulting in a relative loss of 4.1% of fine substrate, and 8.2% of coarse substrate in the shallow habitats of the lake (Table 9A4.1-3). There will also be a relative loss of 4.3% of mixed substrate area within the shallow habitats.

At closure, the dike will be breached and the Project will result in the permanent loss of approximately 58.8 ha of lake area from the remnant portions of the dike that will remain in Lac du Sauvage post-closure. These portions of the dike will remain as islands in Lac du Sauvage and will be permanently altered physical habitat for fish. The dewatered area of Lac du Sauvage will be back-flooded and the 338.2 ha of aquatic habitat will be returned to Lac du Sauvage in an altered state. Fish will re-enter the dewatered area and remnant sections of the dike at post-closure may provide spawning habitat for fish.

The area of the Jay Pit within the dewatered area will be 64.9 ha. The Jay Pit represents a permanent loss of lake bottom substrate habitat for benthic feeding or bottom dwelling species such as Lake Whitefish and forage species such as Slimy Sculpin, but will include an extended water column as habitat for pelagic species such as Lake Trout and forage species such Cisco. The upper level of the Jay Pit may remain well-oxygenated through the winter due to its depth and may provide additional overwintering refugia for fish and thermal refugia for fish in summer.

Table 9A4.1-3 Relative Changes in the Shallow (<5 m) Area of Lac du Sauvage by Substrate Type and Depth from the Dike and Dewatered Area Footprint from the Base Case (Reference and 2014) to Application Case

Depth of Habitat	Substrate Type	Base Case (ha)	Application Case					
			Dike Footprint (ha)	Dike Footprint Change (%) from Base Case to Application Case	Dewatered Area Footprint (ha)	Dewatered Area Footprint Change (%) from Base Case to Application Case	Total Footprint (ha)	Total Footprint Change (%) from Base Case to Application Case
0-2 m	Bo	0.55	-	0	-	0	-	0
	Bo/Co	570.25	5.59	-0.98	29.76	-5.22	35.35	-6.20
	Bo/Fi	106.98	-	0	2.43	-2.27	2.43	-2.27
	Br	7.55	-	0	-	0	-	0
	Co/Bo	6.55	-	0	-	0	-	0
	Co/Fi	1.62	-	0	-	0	-	0
	Fi	872.85	0.64	-0.07	17.48	-2.00	18.13	-2.08
	Fi/Bo	147.85	-	0	0.68	-0.46	0.68	-0.46
	Fi/Co	7.04	-	0	-	0	-	0
	All	1721.23	6.23	-0.36	50.35	-2.93	56.58	-3.29
2-5 m	Bo	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Bo/Co	128.39	1.82	-1.42	6.00	-4.68	6.41	-4.99
	Bo/Fi	19.29	0.00	0.00	0.16	-0.81	0.16	-0.81
	Br	1.41	0.00	0.00	0.00	0.00	0.00	0.00
	Co/Bo	0.08	0.00	0.00	0.00	0.00	0.00	0.00
	Co/Fi	1.55	0.00	0.00	0.00	0.00	0.00	0.00
	Fi	1839.48	14.68	-0.80	77.83	-4.23	91.71	-4.99
	Fi/Bo	58.87	0.00	0.00	0.00	0.00	0.00	0.00
	Fi/Co	0.79	0.00	0.00	0.00	0.00	0.00	0.00
	All	2049.86	16.50	-0.80	83.99	-4.10	99.68	-4.86

Table 9A4.1-3 Relative Changes in the Shallow (<5 m) Area of Lac du Sauvage by Substrate Type and Depth from the Dike and Dewatered Area Footprint from the Base Case (Reference and 2014) to Application Case

Depth of Habitat	Substrate Type	Base Case (ha)	Application Case					
			Dike Footprint (ha)	Dike Footprint Change (%) from Base Case to Application Case	Dewatered Area Footprint (ha)	Dewatered Area Footprint Change (%) from Base Case to Application Case	Total Footprint (ha)	Total Footprint Change (%) from Base Case to Application Case
All	Bo	0.56	-	0	-	0	-	0
	Bo/Co	698.64	7.41	-1.06	35.77	-5.12	43.18	-6.18
	Bo/Fi	126.27	-	0	2.58	-2.05	2.58	-2.05
	Br	8.96	-	0	-	0	-	0
	Co/Bo	6.63	-	0	-	0	-	0
	Co/Fi	3.16	-	0	-	0	-	0
	Fi	2712.33	15.32	-0.56	95.31	-3.51	110.63	-4.08
	Fi/Bo	206.71	-	0	0.68	-0.33	0.68	-0.33
	Fi/Co	7.82	-	0	-	0	-	0

Bo = boulder; Co = cobble; Fi = fines, Br = bedrock; ha = hectare; m = metre;% = percent.

To estimate the number of fish to be removed the dewatered area, fish densities were calculated for yearling and older fish using hydroacoustic data (Annex XIV). The predicted abundance estimate in the dewatered area was estimated from a median statistic of fish density in the west internal basins of Lac du Sauvage (i.e., the Ac/d/e internal basins). The predicted abundance estimate in the dewatered area was approximately 7,100 fish using the median density statistic and 23,400 fish using the 75th percentile from the fish tracking analysis (Table 9A4.1-4). For comparison, the predicted abundance estimated in Lac du Sauvage was approximately 197,400 fish using the median density statistic and 828,200 fishing using the 75th percentile.

The mean length of all fish detected by hydroacoustics in Lac du Sauvage was calculated to be approximately 166 millimetres (mm); the expected mean length of fish in the dewatered area is 177 mm. Assuming a mean weight of 0.1 kilogram (kg) for fish in the dewatered area, total biomass in the dewatered area may be as high as 2,340 kg.

Based on fish sampling effort in Lac du Sauvage between 2006 and 2013, Lake Trout were the most abundant species (63%), followed by Lake Whitefish (18%), Round Whitefish (11%), Slimy Sculpin (4%), Cisco (3%), and Burbot (1%), with Arctic Grayling, Northern Pike, and Ninespine Stickleback captured least frequently (less than 1% each). Thus, within the dewatered area, initial estimates of fish abundance by species are approximately 234 Arctic Grayling, 14,758 Lake Trout, 4,217 Lake Whitefish, and 4,217 fish of other species, including forage fish (Table 9A4.1-4).

Table 9A4.1-4 Percentile (Including Quartile) Statistics for the Abundance of Fish in the Dewatered Area

Analytical Method	Percentile Statistics	Predicted Abundance in Dewatered Area	Arctic Grayling	Lake Trout	Lake Whitefish	Other
			1% of catch	63% of catch	18% of catch	18% of catch
Echo Integration	10%	1,246	12	785	224	224
	25%	3,018	30	1,901	543	543
	50%	7,404	74	4,665	1,333	1,333
	75%	14,801	148	9,325	2,664	2,664
	90%	44,180	442	27,833	7,952	7,952
Fish Tracking	10%	468	5	295	84	84
	25%	2,315	23	1,458	417	417
	50%	7,111	71	4,480	1,280	1,280
	75%	23,426	234	14,758	4,217	4,217
	90%	55,622	556	35,042	10,012	10,012

Note: Abundance derived using a volume of 13,204,200 m^3 at depths >5m, and 13,833,105 m^3 at depths 0 to 5 m.
% = percent; m^3 = cubic metre; > = greater than; m = metre.

9A4.2 Lac du Sauvage-Lac de Gras Narrows

Lac du Sauvage flows into Lac de Gras through a relatively short outlet stream locally known as the "Narrows". The Lac du Sauvage outlet is a relatively wide (minimum bankfull width of approximately 45 m) and short (210 m in length) stream with a low gradient (less than 0.1%) that drains to Lac de Gras. The highest flow months are in July and August. It is expected that flows are maintained between Lac du Sauvage and Lac de Gras on a year-round basis. The median flood peak discharge is 17.5 m^3/s.

The Narrows may provide an important corridor for fish movement between the two lakes. Based on bathymetry and flow characteristics, open water can remain in the Narrows year-round. The Narrows may also provide productive areas for spawning, rearing, and foraging habitats (Dillon 2002; Fitzsimmons 2013). Based on Traditional Knowledge, Lake Trout, and Lake Whitefish are often caught at the Lac du Sauvage-Lac de Gras Narrows, or near the mouth of the narrows in Lac de Gras (Annex XVII).

9A4.2.1 Changes from Water Withdrawals during Back-flooding

The development of the Project is expected to directly affect the availability of habitat in the Narrows, primarily through effects from the withdrawal of water for back-flooding during closure. A decrease in top width of approximately 3.7 m and decrease in maximum depth of 0.05 m is predicted at the Narrows for the 2-year peak daily flow. No change to fish movements is expected and no serious harm to fish is predicted based on the short-term change to flow at the Narrows.

9A4.3 Stream B0

The entire length of Stream B0 (and B1) was visually assessed in August 2013, with sub-sections sampled for fish by electrofishing. Stream B0 is downstream of Christine Lake. The Christine Lake outlet flows for approximately 1.6 km before entering Lac du Sauvage. The upper reach from Lake B1 (Christine Lake) to a small pond (Lake B0) represents Stream B1 (720 m), whereas the lower reach from Lake B0 to Lac du Sauvage represents Stream B0 (559 m). The slope of the system from Christine Lake to Lac du Sauvage is less than 1%, as determined by Light Detection and Ranging (LiDAR).

Stream habitat (B0 and B1 combined) was characterized by shallow run cover (84%) with occasional flats (12%) and riffle (3%) (Table 9A4.2-1). Potential barrier locations to upstream movements of fish from Lac du Sauvage were identified on August 2013, most of which were assumed to be a result of low flows. Like other small streams in the region, the highest flow month for the stream is June, and low flows may fall to zero under ice-covered conditions. Median flood peak discharge is predicted to be 0.44 m^3/s. Potential barriers to upstream movements of fish from Lac du Sauvage were identified in the upper sections of Stream B1 in August 22 and 23, 2013 (Channel Unit #10, 12, and 13; Table 9A4.2-1). Barriers include boulder gardens, dispersed shallow flows, and sub-surface flows (Photo 94A.2-4).

Young-of-the-year and juvenile Arctic Grayling were observed or captured throughout most of Stream B0 and B1 during electrofishing on August 21 and 22, 2013. Furthermore, the fish community in Stream B1 and B0 was dominated by Arctic Grayling, which comprised 77% of the fish captured or observed in the 2013 baseline study (Annex XIV). Slimy Sculpin was the second most abundant species (16%). Round Whitefish were also present, comprising 14% of the fish captured or observed. Two-way fish traps were installed at Stream B0 and B1 during early June and late August to provide additional information on fish use.

9A4.3.1 Effects from Diversion

Project activities affecting habitat in Stream B0 include the diversion of Stream B0 and a road crossing where the diversion connects with the natural stream. To mitigate effects from the diversion during late spring when flows are highest, the channel will be designed to facilitate passage to upstream locations. All known spawning locations for Arctic Grayling are above the diversion connection to the natural stream. The diverted section of Stream B0 (355 m in length) does not appear to support spawning. Potential spawning habitats for Arctic Grayling were identified in Channel Unit #5, 12, and 13 in Stream B0 and B1 (Table 9A4.2-1) (Photo 94A.2-3).

The section of Stream B0 that is proposed to be diverted currently supports rearing and foraging habitat for small-bodied fish, including young-of-the-year and juvenile Arctic Grayling. Stream B0 was characterized as good rearing habitat with cover provided primarily by emergent/aquatic vegetation, and overhanging riparian vegetation, and to a lesser extent by undercut banks, depth/turbidity, and substrate (Photo 94A.2-1 to 2). The substrate was dominated by organics and silts with similar contributions from boulder and the occasional patch of cobble. At closure, the natural channel will be reconnected to Lac du Sauvage.

Photo 9A4.2-1 Boulder Substrates in Lower Stream B0, June 12, 2014

Photo 9A4.2-2 Run Habitat in Lower Stream B0, June 12, 2014

Photo 9A4.2-3 Arctic Grayling Spawning Location Immediately Downstream of Lake B0 (Facing Upstream), June 12, 2014

Photo 9A4.2-4 Cascade Habitat below Christine Lake on Upper Stream B1, June 12, 2014

Table 9A4.2-1 Habitat Descriptions for Stream B0 and B1 for August 22 to 23, 2013

Site		UTM Coordinates (Zone 12W)		Stream Channel Characteristics						Instream Cover (% Area)						Substrate (% Area)						
Channel Unit No.	ID	Easting	Northing	Habitat Type	Approx. Length (m)	Max. Depth (m)	Avg. Bankfull Width (m)	Avg. Wetted Width (m)	Defined Channel	SUB	SWD	D/T	AV	OV	UC	Or	Si	Sa	Gr	Co	Bo	Br
1	B0	541140	7164101	R3	6	0.2	2.9	3.8	Yes	30	1	0	11	10	5	0	5	5	0	50	40	0
2	B0	541137	7164096	R3/RF	315	0.3	1.7	1.6	Yes	20	1	15	148	123	50	0	15	5	0	20	60	0
3	B0	540947[a]	7163962	R3	267	0.7	8.9	5.7	Yes	5	0	50	17	85	60	47	47	0	0	0	6	0
4	B0	540818	7163798	R3	138	0.3	11.8	2.2	Yes	40	0	0	65	15	0	20	15	0	0	5	60	0
5	B0	540799	7163790	R3	38	0.4	9.4	1.6	Yes	10	0	2	60	40	0	15	15	0	20	20	30	0
6	B0	540765	7163813	FL	36	0.2	37	9.3	No	0	0	0	105	40	0	50	50	0	0	0	0	0
7	B0[b]	540746	7163843	P1	216	2	120	120	Yes	0	0	0	2	0	0	100	0	0	0	0	0	0
8	B1	540634	7164038	FL	30	0.6	37	13.0	No	10	0	0	120	0	0	50	50	0	0	0	0	0
9	B1	540606	7164021	R3	15	0.6	16.4	6.4	Yes	60	0	0	62	10	0	15	15	0	0	0	70	0
10	B1	540589	7164021	BG	1,627	0.3	6	4	Yes[c]	90	0	0	0	10	5	0	0	0	0	0	100	0
11	B1	540454	7163987	R3	451	0.2	3	3	No	0	0	0	0	0	0	10	0	0	0	10	80	0
12	B1	540101	7163836	P3/BG	83	0.3	3.2	2.2	Yes[c]	40	0	0	0	42	15	0	0	0	5	20	65	10
13	B1	540024	7163831	BG	66	0.4	3.5	3	Yes[c]	50	0	0	40	5	0	0	0	0	2	18	80	0
14	B1	539960	7163823	R3	63	0.3	14.3	10.4	Yes	10	0	0	35	10	0	70	0	0	0	10	20	0

a) Diversion channel to intersect at approximately 540950 east (E), 7163895 north (N), just below the start of channel unit #3.

b) Lake B0.

c) Included boulder gardens and/or braided channels with low flows that may present a barrier to upstream fish movements in summer.

Approx. = approximately; Avg. = average; Max. = maximum; R = run (R3 = lowest quality of classes R1 to R3; generally shallow; low instream cover in all but high flows), RF = riffle, P = pool (P1=highest quality class of classes P1 to 3 based on size and depth with potential for overwintering habitat, P3 = low quality pool, shallow and/or small), F = flat; BG = boulder garden; SUB = substrate, SWD = small woody debris, D/T = depth or turbulence, AV = aquatic vegetation, OV = overhanging vegetation, UC = undercut banks; Or = organics; Si = silt; Sa = sand, Gr = gravel; Co = cobble, Bo = boulder; Br = bedrock.

9A4.4 Stream Ac35

The entire length of Stream Ac35 was visually assessed during high and low flow conditions, with sub-sections sampled for eggs by kick sampling and for fish by electrofishing; habitat conditions were documented with detailed habitat maps and photos (Photos 9A4.3-1 to 9A4.3-4). Stream Ac35 is an ephemeral stream that drains Lake Ac35 and supports flows for fish during the freshet, based on surveys in June 2014, but provides minimal flows and unsuitable habitat during the summer based on surveys in August 2014. The entire length of the stream is approximately 1,284 m with an overall gradient of 2.7% (based on LiDAR). The steep gradient of the stream may preclude use of the stream by species with weaker swimming abilities (e.g., Northern Pike, Whitefish spp.; Peake 2008).

Although results are preliminary, a number of barriers to fish passage were identified during the June program, including a small cascade (0.5 m height) 20 m upstream from the mouth at Lac du Sauvage, and a large boulder garden with subsurface flows starting approximately 185 m downstream of Lake Ac35 for a distance of approximately 100 m.

Between the cascade and large boulder garden, the channel was typically braided with dispersed flows and silts and sands as the dominant substrate type with patches of coarse substrates. Fish were not observed or captured in this middle section of Ac35. Arctic Grayling eggs, juveniles, and adults were recorded above the boulder garden near the outflow of Lake Ac35. Good quality locations for spawning and rearing habitat were noted immediately below the outflow of Lake Ac35 (but above the boulder garden), including combinations of boulder, cobble, and gravel where eggs were recorded (Photos 9A4.3-3 and 9A4.3-4).

9A4.4.1 Effects from Diversion

Project activities on Stream Ac35 include diverting the lower section of the stream (above the cascade location but below the boulder garden location) to the proposed diversion channel and into the area of Lac du Sauvage outside of the diked area. Stream length to be diverted in sub-basin Ac35 is 112 m of Stream Ac35 (12.1% of the length of Stream Ac35).

An Arctic Grayling spawning area will be lost because of the diversion. Below the cascade, substrates were boulder/cobble dominant with patches of gravel. Arctic Grayling eggs and juveniles were recorded on a patch of gravel in June 2014 (Photo 9A4.3-1 to 2).

Based on a review of preliminary design information, it appears that the diversion channel may bypass the cascade section as a potential barrier for Arctic Grayling. Thus the diversion channel may improve access to upstream locations (approximately 890 m of stream length) where there is potential for spawning and rearing substrates for Arctic Grayling.

Photo 9A4.3-1 **Mouth of Stream Ac35, June 13, 2014 (Facing Downstream, Lac du Sauvage in Background)**

Photo 9A4.3-2 **Boulder Substrates and Willow Cover in Lower Stream Ac35, June 13, 2014 (Facing Downstream, Lac du Sauvage in Background)**

Photo 9A4.3-3 **Boulder Garden on Upper Stream Ac35, June 13, 2014 (Facing Upstream, Lake Ac35 in Background)**

Photo 9A4.3-4 **Arctic Grayling Spawning Location on Upper Stream Ac35, below Lake Ac35, June 13, 2014.**

The proposed road would cross Stream Ac35 upstream of the diversion channel but within the section between the boulder garden and cascade that is thought to be non-fish-bearing. In June 2014, the proposed crossing location on Ac35 had a bankfull width and wetted width of 0.4 m and a maximum depth of 0.2 m. The stream had some braiding along the reach surveyed (20%) with a single channel for most of the reach (80%). The surface velocity was moderate (0.4 metres per second [m/s]) at the proposed crossing location. The habitat was 20% gravel, 40% sand, and 40% organics with small pools and good coverage from willows. Although no fish were captured at the stream crossing, there is habitat potential and access to the middle section of the stream may be possible with the construction of the diversion channel.

At closure, the dike will be breached, the diversion channel and road crossing will be reclaimed and the natural channel will be reconnected to Lac du Sauvage. However, there is the possibility that habitat function (and fisheries productivity) of Stream Ac35 will be improved with the construction of the diversion channel. The diversion channel may improve access to upstream locations, including locations for spawning Arctic Grayling.

9A5 OFFSETTING OPTIONS

9A5.1 Background

Offsetting measures will be required for the Project to counterbalance losses in habitat function and fisheries productivity, incurred primarily from the construction of the Jay Dike and the dewatering of the diked area, and to a lesser extent, from the diversion of streams B0 and Ac35. Offsetting investigations for the Project are ongoing and have included locations where offsets may be both logistically feasible and beneficial for habitat function and fisheries productivity. Key messages from community engagement were to focus on local fisheries of concern and engage communities by providing training and employment opportunities as much as possible. Furthermore, offsetting measures that support local restoration priorities are explicit within the first principle of the new policy for offsetting (DFO 2013b).

Standard habitat enhancement and creation offsetting measures were included for consideration, primarily focused on improving access to spawning locations or increasing structures for spawning and rearing fish (e.g., substrate placement, in-stream structures). However, suitable habitat enhancement and creation offsetting options in the vicinity of the Project are limited as most habitats remain undisturbed.

Proposed offsetting options also considered a fish stocking program under the category of "biological manipulation" in the Fisheries Productivity Investment Policy (DFO 2013b). The goal would be to develop a community-run hatchery program for stocking Inconnu in the Yellowknife River. Community based fish stocking has a long history of successes for a variety of species in other jurisdictions (e.g., www.communityhatcheries.com; CHP 2014). This approach may assist with the recovery of the Yellowknife River Inconnu stock that was nearly extirpated from commercial fishing during the 1960s (VanGerwen-Toyne et al. 2013).

The biological manipulation offsetting option should only be used under specific circumstances (DFO 2013b), for example:

- site-specific issues are well understood;
- limitations to fisheries productivity are known;
- fisheries management plans contain clear objectives for the fishery; and,
- option falls within the guiding principles of the Fisheries Productivity Investment Policy (Section 9A1.1.1)

A list of preliminary options was discussed with DFO and communities to confirm that all of the options would satisfy the criteria for offsetting and warranted further investigation. As no immediate concerns were identified with the proposed options, investigations of the potential offsetting options were performed in summer 2014 and investigations are ongoing in support moving the development of an offsetting plan forward. Multiple offsetting options were investigated because more than one option may be required to offset losses in fisheries productivity incurred by the Project. Results from these investigations, summarized in the Conceptual Offsetting Plan, form the basis for the Project final offsetting plan (the Offsetting Plan) to be submitted and approved by DFO.

9A5.2 Preliminary Investigations

A number of candidate offsetting locations were investigated in summer 2014 (Maps 9A5.2-1 and 9A5.2-2). Locations were selected based on feedback received during community meetings, and follow-up discussions with community members. An important consideration in the selection of a site was whether a community-based project could be applied, and whether benefits to habitat function and fisheries productivity would be a measurable contribution to counterbalancing losses incurred at the Project.

Candidate locations for habitat enhancement offsetting included the following:

- Arctic Char fisheries on Kugluktuaryuk and Noahognik creeks near Kugluktuk, Nunavut;
- Walleye fishery at Mosquito Creek, NWT;
- Fisheries on Russell Lake, NWT; and,
- Northern Pike fishery at a small unnamed creek ("Gilbert's" Creek), near Lutsel K'e, NWT.

Preliminary investigations of fisheries habitat were also performed on the Yellowknife and Cameron Rivers. Locations were qualitatively assessed for their suitability for releasing eggs and/or fry as part of a fish stocking offsetting option for the Inconnu fishery.

-850000 -800000 -750000 -700000

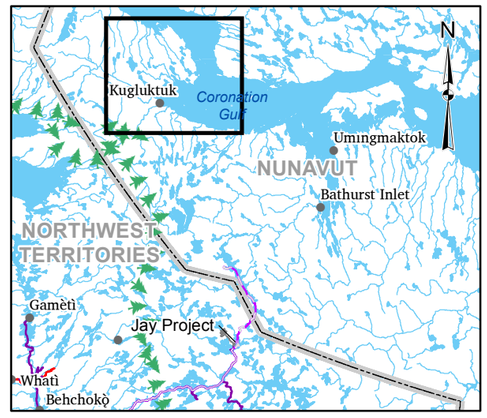
3350000 3300000 3250000 3200000

Souths Bay
Stapylton Bay
Read Island
Simpson Bay
Bernard Harbour
Harding River
Nulahugyuk Creek
Kugluktuaryuk Creek
Noahognik Creek
Paisley Cove
Basil Bay
Rae River
Richardson River
Richardson Bay
Coronation Gulf
Kugluktuk
Coppermine River
Bloody Falls

N

LEGEND

- POPULATED PLACE
- TREELINE
- WATERCOURSE
- WATERBODY
- OFFSET OPTION INVESTIGATED FOR 2014



REFERENCE

WATER OBTAINED FROM ATLAS OF CANADA
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
COORDINATE SYSTEM: CANADA LAMBERT CONFORMAL CONIC

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

15 0 15
SCALE 1:750,000 KILOMETRES

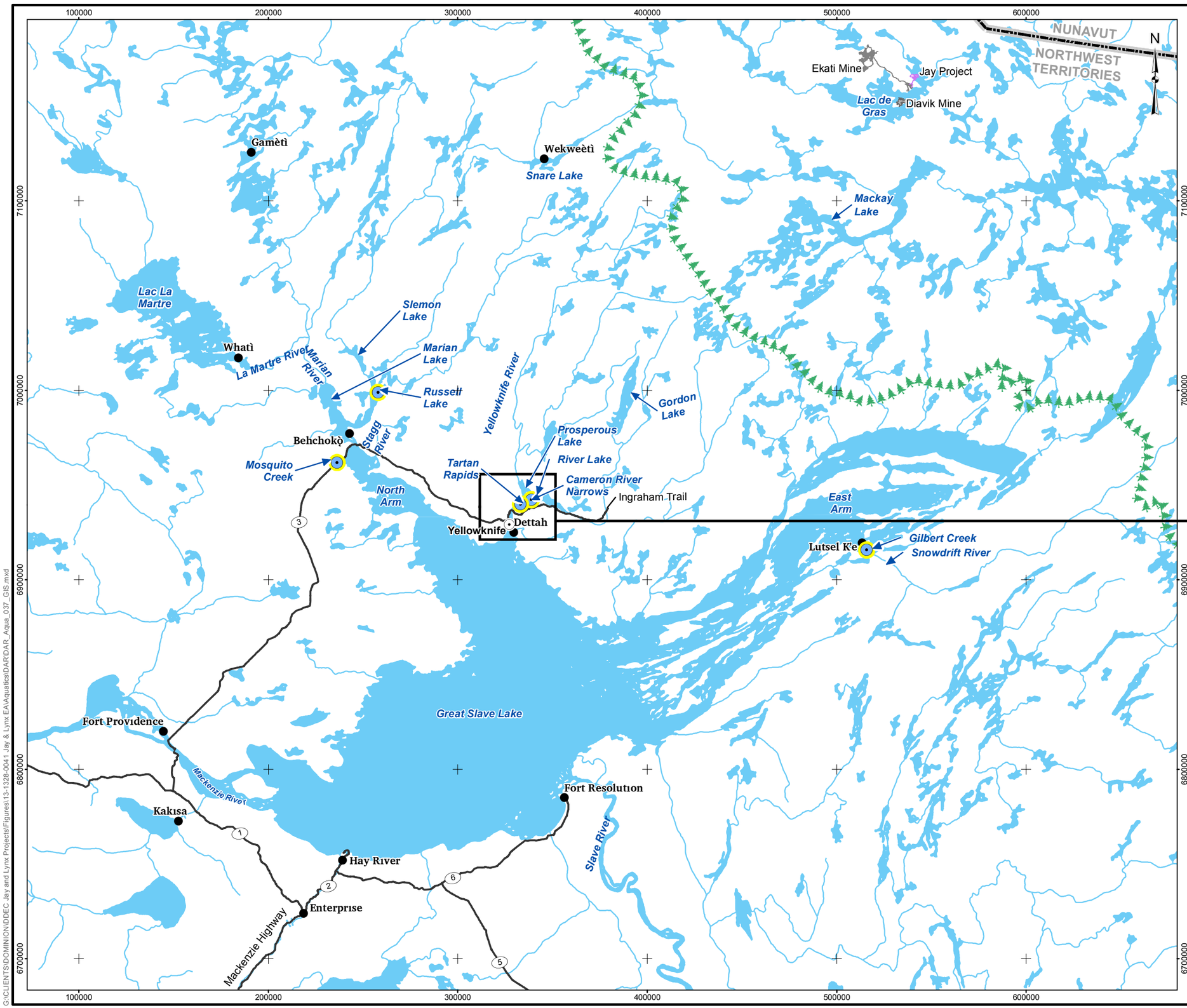
PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

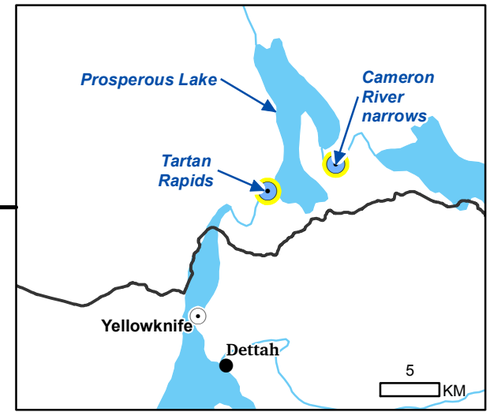
TITLE
JAY OFFSETTING OPTIONS NEAR KUGLUKTUK, NUNAVUT

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_038_GIS	
DESIGN	CS	12/09/14	SCALE AS SHOWN	REV 0
GIS	JE/ANK	20/10/14	MAP 9A5.2-1	
CHECK	CS	20/10/14		
REVIEW	KM	20/10/14		

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\13-1328-0041 Jay & Lynx EA\Aquatics\DAR\DAR_Aqua_038_GIS.mxd





LEGEND

- TERRITORIAL CAPITAL
- POPULATED PLACE
- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- HIGHWAY
- TREELINE
- TERRITORIAL/PROVINCIAL BOUNDARY
- WATERCOURSE
- WATERBODY
- OFFSET OPTION INVESTIGATED FOR 2014

REFERENCE

NATIONAL TOPOGRAPHIC BASE DATA (NTDB) 1:250,000
CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

50 0 50
SCALE 1:2,000,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
JAY OFFSETTING OPTIONS FOR THE GREAT SLAVE LAKE AREA, NORTHWEST TERRITORIES

Golder Associates

PROJECT		13-1328-0041	FILE No. DAR_Aqua_037_GIS	
DESIGN	CS	12/09/16	SCALE AS SHOWN	REV 0
GIS	JE/ANK	20/10/14	MAP 9A5.2-2	
CHECK	CS	20/10/14		
REVIEW	KM	20/10/14		

G:\CLIENTS\DOMINION\DDEC - Jay and Lynx Projects\Figures\13-1328-0041 Jay & Lynx EA\Aquatics\DAR\DAR_Aqua_037_GIS.mxd

9A5.2.1 Kugluktuk Creeks

Golder biologists, assisted by members of the local Hunters and Trappers Organization (HTO), performed reconnaissance surveys for a community-based offsetting option for an Arctic Char fishery at creek locations north of Kugluktuk from July 27 to August 3, 2014. The objective of the reconnaissance was to identify a creek with migration conditions similar to that previously described at Nulahugyuk Creek, Bernard Harbour (Golder 2013). The candidate creeks (Kugluktuaryuk and Noahognik; Map 9A5.2-1) were identified by the local HTO as locations where water levels may have declined, boulders may be blocking the upstream migration of fish to spawning and overwintering areas, and where the abundance of Arctic Char in the upstream lake may be in decline. Improving fish access to the upstream lake by repositioning boulders in the creek for fish passage may result in localized gains in fish production. Additional Traditional Knowledge was provided by Gerry Attatahak and Isaac Klengenberg who have cabins at the creeks and who fish in the lakes above the creeks.

The evaluation of Kugluktuaryuk Creek identified a small gorge near the mouth of the creek as a major barrier to upstream migrations (Photo 9A4.5-1) (609494 east [E], 7611052 north [N], Zone 11 W). The barrier would suggest that the existing population of Arctic Char in Kugluktuaryuk Lake is land-locked (Photo 9A4.5-2), and the juvenile Arctic Char observed in the lower section of the creek were dispersals. Although the fate of the observed juveniles is unknown, movement to suitable overwintering habitat would be required. It was determined that movement back upstream to the lake would not be possible due to the barrier and that it is unlikely the creek would provide suitable overwintering habitat since the creek is shallow and would freeze to the bottom. The only movement pathway for these fish before winter was determined to be downstream to the ocean.

Based on the reconnaissance survey, it was determined that Kugluktuaryuk Creek could potentially be a viable offsetting option for the Project. The general approach would be to improve migration conditions (i.e., access to spawning and overwintering habitat) for anadromous Arctic Char by creating steps with appropriate depths and velocities for passage through the gorge and small waterfalls. The feasibility of executing an engineered offsetting measure (e.g., a fish ladder) to open access to the upstream lake for anadromous char has not been determined; however, it is unlikely that fish passage can be improved without the aid of heavy machinery or the use of explosives.

Photo 9A4.5-1 Small Gorge at Lower Kugluktuk Creek Near Mouth, July 28, 2014

Photo 9A4.5-2 Juvenile Arctic Char Above Gorge but Below Uppermost Waterfall on Kugluktuaryuk Creek, July 29, 2014

The evaluation of Noahognik Creek at Paisley Cover identified 'good' migration conditions for Arctic Char (617700 E, 7593100 N, Zone 11 W). Fish passage conditions in Noahognik Creek were noticeably better than those previously described at Nulahugyuk Creek (Bernard Harbour) during the same time of year (Golder 2013). No obvious barriers to fish were identified for the entire length of the creek and relatively deep fish movement corridors (e.g., depths exceeding 0.5 m) were observed when crossing the stream (Photo 9A4.5-3 to 4). Although no char were observed during the site investigation and the timing of the run is unknown, it was assumed that observed flows were approaching seasonal base flows and conditions were likely similar to what would be expected later in August or early September when the char may be running. It was concluded that habitat enhancements are not required and Noahognik Creek was not a suitable site for an offsetting project.

Photo 9A4.5-3 Noahognik Creek, August 1, 2014

Photo 9A4.5-4 Standing in a Thalweg of Noahognik Creek, August 1, 2014

9A5.2.2 Mosquito Creek

A reconnaissance survey to investigate an offsetting option for the Walleye fishery at Mosquito Creek was conducted on August 12, 2014. Approximately 1.5 km of stream length downstream of the highway bridge was evaluated. Mosquito Creek, situated on the North Arm of Great Slave Lake, once supported a popular sport fishery in early spring (543105 E, 6951592 N, Zone 11 V; Map 9A5.2-2). Currently there is a "no fishing" restriction from May 1 to June 30 on Mosquito Creek. The Walleye fishery in Mosquito Creek, like fisheries at other readily accessible locations from the Mackenzie Highway, may be particularly vulnerable to overharvesting by anglers (Stewart 1997).

The objective of the reconnaissance investigation was to provide a qualitative evaluation of stream flows, fish passage, and availability of substrate for spawning, and then identify a habitat enhancement project to improve the fishery. Overall, habitat conditions were suitable for supporting fish and no offsetting options could be readily identified (Photos 9A4.5-5 to 9A4.5-8). No fish were observed during the reconnaissance, either from visual observation from the shore or by underwater video in the larger, deeper pools. The habitat present, even under low flow conditions, would be suitable to support fish for the entire open-water period and possibly even provide overwintering in some of the deeper pools. No specific offsetting option was identified through habitat enhancement.

Photo 9A4.5-5 Mosquito Creek Highway Crossing Facing Upstream, August 12, 2014

Photo 9A4.5-6 Exposed Cobble-Gravel Bar at Mosquito Creek, August 12, 2014

Photo 9A4.5-7 Small Scour Pool In Higher Gradient Section of Mosquito Creek, August 12, 2014

Photo 9A4.5-8 Deep Pool (>2 m) in Lower Gradient Section of Mosquito Creek, August 12, 2014

>= greater than.

9A5.2.3 Russell Lake

Offsetting options for improving fisheries on Russell Lake were investigated on August 16 and 17, 2014. Russell Lake has traditionally been used by the community of Behchokǫ̀ for fisheries, travel, community events, and seasonal residency. Russell Lake is a large, shallow waterbody with several species of fish (e.g., Lake Whitefish, Inconnu) harvested by the nearby community (WRRB 2014). The outflow of Russell Lake flows into the North Arm of Great Slave Lake near Behchokǫ̀ (Map 9A5.2-2).

Moise Rabsesca (local outfitter) and Joe MacKenzie (retired NWT conservation officer) provided local and Traditional Knowledge and assisted in the field reconnaissance of Russell Lake and a few of the small unnamed tributary lakes. The crew searched for a location for a potential habitat enhancement project. Potential research topics on local fisheries were also discussed.

The investigation failed to identify a tributary stream or shoreline area suitable for offsetting. Shorelines and tributary streams were described as high quality habitats around the entire lake (Photos 9A4.5-9 and 9A4.5-10). It was concluded that the productivity of fisheries (e.g., Lake Whitefish) in Russell Lake remains stable with no noticeable reductions in productivity over the last 50 years, with the exception being the Inconnu fishery (e.g., VanGerwen-Toyne et al. 2012). However, based on local knowledge, the Inconnu fishery has made a recovery in recent years, likely because of closures of commercial fishing in Great Slave Lake.

Photo 9A4.5-9 Typical Shoreline of Russell Lake, August 16, 2014

Photo 9A4.5-10 Dore Creek at Confluence with Marian Lake, August 17, 2014

9A5.2.4 "Gilbert's" Creek

A small unnamed creek near Lutsel K'e was identified as a potential offsetting project to restore a Northern Pike (Jackfish) fishery (July 15, 2015, LKDFN Community Meeting). Gilbert Abel identified the creek as a possible offsetting option during a community meeting in Lutsel K'e (514876 E, 6919560 N, Zone 12 V; Map 9A5.2-2). The creek (i.e., "Gilbert's" Creek) is locally known to support a run of Northern Pike and to a lesser degree, Longnose Sucker, that migrate upstream from Great Slave Lake in the spring (Photo 9A4.5-11). The problem was initially described as a series of barriers (mounds of soil and debris) in upper sections of the creek. Total creek length is less than 200 m, and flows from a network of small ponds where it is assumed that spawning takes place (Photo 9A4.5-12). The creek is accessible from a road crossing and is located approximately 1 km east of the community of Lutsel K'e.

Creek conditions were evaluated on August 15, 2014 by Paul Vescei (Golder) and Gilbert Abel (LKDFN community member) to assess whether habitat enhancements could provide a measureable improvement to the fishery. At the outlet of the first upstream pond, there is a barrier resembling an abandoned beaver dam with vegetation overgrowing the dam (Photo 9A4.5-13). A short distance downstream of the beaver dam, there is a debris mound barrier caused by bank slumping (from erosion) that represents a partial, but more likely total, blockage depending on water conditions and season (Photo 9A4.5-14). There was no flow of water during the site visit, likely preventing an out-migration of adults and young-of-the-year.

The survey results suggest that Gilbert's Creek may be a viable offsetting option. The general approach would be to improve migration conditions in the creek for passage of Northern Pike, for example, by creating a more stable and defined channel with appropriate depths for passage from the mouth of the creek to the first upstream pond.

Photo 9A4.5-11 Lower Section of Gilbert's Creek Entering the East Arm of Great Slave Lake, August 15, 2014.

Photo 9A4.5-12 Potential Spawning Pond for Northern Pike Above Barriers on Gilbert's Creek, August 15, 2014.

Photo 9A4.5-13 Old Beaver Dam Earth Mound as a Barrier on Gilbert's Creek, August 15, 2014

Photo 9A4.5-14 Earth Mound Created from Slumping on Gilbert's Creek, August 15, 2014

9A5.2.5 Yellowknife River

The Yellowknife River system was investigated on August 23, 2014 for potential locations for releasing eggs and/or fry that would ultimately assist with the recovery of the river's Inconnu stock. Locations were identified based on proximity to locally known spawning locations of Lake Whitefish, which share similar habitat requirements with Inconnu (RL&L 1985). Offsetting stocking locations were also selected based on what is known on Inconnu habitat in the region, and most of this knowledge is based on a few studies performed in the Slave River from 1983 to 1985 (RL&L 1985). The studies described spawning locations as typically in erosional rather depositional habitats, often situated on the outside perimeter of river meanders. Channel depths characteristics ranged from 2 to 7 m, and mean column velocities typically are in the range of 0.5 metres per second (m/s) to 0.75 m/s. Spawning substrates ranged from coarse particle sizes (gravel, cobble, and boulder), clay or compacted sand. A consistent feature of the spawning locations was the minimal occurrence of silt-dominated substrates.

Two offsetting stocking locations were identified during the reconnaissance survey that may meet specifications for spawning habitat of Inconnu in the Slave River. A location immediately downstream of Tartan Rapids on the Yellowknife River (below Prosperous Lake) was selected as a potential stocking location (Photos 9A4.5-15 and 9A4.5-16) (642880 E, 6939432 N, Zone 11 V). Habitat at this location was characterized by sandy and coarse substrate types, and water depths of 2 to 4 m. The Cameron River narrows between Prosperous Lake and River Lake was also selected as a potential stocking location, approximately 12 km upstream from Yellowknife Bay (Photos 9A4.5-17 and 9A4.5-18) (647131 E, 6941450 N, Zone 11 V). Substrates were typically a combination of boulder and cobble. Depths measured approximately 3 m in the middle of the channel.

Photo 9A4.5-15 Yellowknife River below Tartan Rapids (Facing Upstream), August 23, 2014

Photo 9A4.5-16 Tartan Rapids (Prosperous Lake in Background), August 23, 2014

Photo 9A4.5-17 Cameron River Narrows, Facing Downstream, August 23, 2014

Photo 9A4.5-18 Boulder Substrates at Cameron River Narrows, August 23, 2014

9A5.3 Candidate Offsetting Options

More than one offsetting option may be required to offset losses in fisheries productivity incurred by the Project. There may also be opportunities for Dominion Diamond to bank offsetting gains; for example, benefits that exceed the requirements for losses incurred at the Lynx project, may apply to the Jay Project (and vice versa). Based on 2014 site investigations, three offsetting options were identified as candidates for further study of their feasibility.

9A5.3.1 Habitat Creation at Kugluktuaryuk Creek

9A5.3.1.1 *Approach*

The approach proposed for this option would be to create access for anadromous Arctic Char to upstream spawning and overwintering locations in a large lake. The lake is known to support a resident Arctic Char population. Fish passage to the lake from the ocean is currently blocked by a small gorge and series of small waterfalls in the lower 200 m section of the creek. Creating access to the lake will require an engineered solution (e.g., blasting) to create a small series of steps around the impassable sections of the creek.

9A5.3.1.2 *Location*

The offsetting location is Kugluktuaryuk Creek (609494 E, 7611052 W, Zone 11 W). The location is approximately 90 km north of Kugluktuk at a heading of approximately 20 degrees. Travel to the site by boat from Kugluktuk is approximately 3 hours in duration. An elder from the community by the name of Isaac Klengenberg maintains a camp near the mouth of the creek. The small creek is approximately 1 km in length from the outlet of Kugluktuaryuk Lake (approximately 10 square kilometres [km^2] in area) before entering the ocean.

9A5.3.1.3 *Target Species*

Based on local knowledge, Kugluktuaryuk Lake supports resident populations of Lake Trout and Arctic Char, and the abundance of fish in the lake may be in decline. Potential causes of the reported decline are unknown. The target species would be anadromous Arctic Char, and possibly Lake Trout, which are also known to exhibit anadromy.

9A5.3.1.4 *Community Involvement*

Opportunities for community involvement would include positions for assisting with monitoring the Arctic Char run (e.g., field assistants), positions to assist with camp operations (e.g., wildlife watch), boat operators, and boat rentals for travel to the site from Kugluktuk. The potential for broader community involvement during construction and maintenance of the project is likely very limited due to the remote location and expected specialized construction techniques likely required.

9A5.3.1.5 *Fisheries Benefit*

It is expected that the creation of an anadromous Arctic Char fishery will result in substantial increases in fisheries production in the Kugluktuaryuk Lake system. For example, the existing land-locked population of char is expected to be limited by the available food resources in Kugluktuaryuk Lake where oligotrophic conditions may prevail, as is the situation for many Arctic lakes (Johnson 1976). In contrast, anadromous stocks of Arctic Char are expected to be less limited by available food resources when they move to ocean habitats. Anadromous fish can grow faster and larger than their land-locked counterparts (Gross 1987; Gross et al. 1988). Almost all gains in body mass for anadromous fish are from foraging in the ocean during the open water season. Overall fish production (measured in biomass or numbers) should increase when a closed system changes to an open system connected to the resources that an ocean can provide (Gross 1987; Gross et al. 1988), as feeding conditions in the ocean are more favourable than in freshwater systems.

Benefits may extend beyond the local fishery at Kugluktuaryuk Lake to stabilizing a broader fishery in the Coronation Gulf where there are commercial, recreational and aboriginal users. A key assumption is that adult Arctic Char in the nearby ocean will positively respond as predicted to offsetting changes. To be successful, dispersing adults (from other systems) must select Kugluktuaryuk Creek rather than their natal lake for spawning, or juveniles emigrating from the Kugluktuaryuk Lake must return as adults to spawn. Initial gains of only a few adult char entering the system should magnify over time when their offspring return as adults.

9A5.3.1.6 *Next Steps*

To proceed to the next step, the proposed option requires further engagement with the Ekati Mine Impact Benefit Agreement communities and DFO on acceptability of the option, as well as the community on the design of the habitat creation offsetting measure. A feasibility study by a watercourse engineering team would also be required.

9A5.3.2 Habitat Enhancement at Gilbert's Creek

9A5.3.2.1 *Approach*

The approach proposed for this option is to improve access for Northern Pike on a small stream to upstream spawning ponds (e.g., wetland habitat). Fish passage to ponds from Great Slave Lake may be completely or partially blocked by an older beaver dam and debris from slumping along the stream banks. Improving access to the ponds may involve clearing the debris and defining and creating a low-flow channel with appropriate depths for fish passage. The outlet channel will be at an elevation to allow young-of-the-year to emigrate into Great Slave Lake. The habitat enhancement offsetting option may be completed without the use of heavy or specialized machinery.

9A5.3.2.2 *Location*

The offsetting location is at an unnamed creek (Gilbert's Creek; 514876 E, 6919560 N, Zone 12 V). The location is approximately 1 km east of Lutsel K'e. The site is accessible from a road crossing. The small creek is approximately 250 m length from the outlet of first upstream pond. Preliminary investigations identified three small, headwater ponds, each of which are approximately 1 ha in area.

9A5.3.2.3 *Target Species*

Based on local knowledge of local fisherman, Gilbert Abel, the system supports Northern Pike and Longnose Sucker, and the abundance of Northern Pike that run during the spring (spawning) season has recently declined. Potential causes of the decline are presumed to be barriers in the creek, limiting access to upstream spawning locations. The target species is Northern Pike. The local stock of Northern Pike at Gilbert's Creek is part of an Aboriginal and recreational fishery.

9A5.3.2.4 *Community Involvement*

Opportunities for community involvement would include technical positions for assisting with monitoring programs (e.g., field assistants). Most of the restoration efforts, follow-up investigations, and maintenance of the channels would be completed by the community, including students. There will be many opportunities for community involvement because of the close proximity of this offsetting option to Lutsel K'e and the accessibility of the creek from the road crossing. Traditional Knowledge would be integrated into the offsetting plan where applicable.

9A5.3.2.5 *Fisheries Benefit*

Benefits to the local fishery are predicted upon restoration of fish passage conditions. Post-restoration gains in fisheries production will depend on existing baseline conditions and the potential of the offsetting option for benefiting the fishery. Based on local knowledge, it has been assumed that under baseline conditions, no fish or limited numbers of fish are reaching the upstream spawning area. Post-restoration gains in fisheries production will depend on the response of Northern Pike in Great Slave Lake in spring, and the capacity of the upstream habitats in providing spawning habitat (e.g., emergent vegetation). To be successful, it is likely that dispersing adults (from other systems) must select Gilbert's Creek rather than their natal lake for spawning. However, initial gains of only a few adult Northern Pike entering the system should magnify over time when their offspring return as adults. A similar project on Northern Pike habitat in the Stagg River, NWT, proved to be successful in enhancing habitat function and fisheries productivity (Cott 2004).

9A5.3.2.6 *Next Steps*

A baseline evaluation of conditions during the spring migration is required to describe the extent of the problem. The baseline program can confirm the potential for improving the fishery. Baseline monitoring may include monitoring of the abundance of the Northern Pike run combined with a detailed hydrological assessment of the creek and sub-basin. Details on the design of the habitat restoration offsetting measure will be finalized upon further engagement with the community and DFO.

9A5.3.3 Inconnu Stocking in Yellowknife River

9A5.3.3.1 *Approach*

The approach proposed for this option is to develop a community-run hatchery program for stocking Inconnu in the Yellowknife River. The goal would be to aid the recovery of the stock that was nearly extirpated decades ago because of commercial fishing. Ripe adults would be targeted from a viable stock in the Great Slave Lake area during the fall (e.g., Slave River). Eggs would be fertilized in a temporary shelter and then immediately transferred to designated release sites. Guidelines for fish culture and stocking will be followed, and more advanced culture methods may be pursued in the future if deemed necessary.

9A5.3.3.2 *Location*

The general location of the fish stocking offsetting option is the Yellowknife River system. The Yellowknife River is an important river for the Weledeh Yellowknives Dene (Weledeh Yellowknives Dene 1997). The traditional name of the Yellowknife River is the Weledeh River (the translation is Inconnu River).

Preliminary investigations of release locations include potential spawning areas downstream of Tartan Rapids, below Prosperous Lake (642856 E, 6939475 N, Zone 11 V), and the narrows of the Cameron River, a tributary to Prosperous Lake (647131 E, 6941450 N, Zone 11 V). Other locations on the rivers may be more suitable pending further study of river habitats and available literature on Inconnu life history.

9A5.3.3.3 *Target Species*

Inconnu, the target species, remain a part of a commercial, recreational, and Aboriginal fishery in the Great Slave Lake system. Inconnu was once very abundant in the Yellowknife River. Unfortunately, the stock on the Yellowknife River started to decline as early as the 1940s when commercial fisherman targeted Inconnu with their nets during annual migrations (Weledeh Yellowknives Dene 1997). The stock has not recovered to this day according to local knowledge.

9A5.3.3.4 *Community Involvement*

Opportunities for community involvement would be in all stages of the offsetting program. Community-based fish stocking has a long history of successes for a variety of species in other jurisdictions (e.g., www.communityhatcheries.com; CHP 2014). Community involvement would begin with providing feedback on the conceptual offsetting plan. The selection of release locations would require input from Traditional Knowledge. Local youth could be trained as technical staff to assist with capturing, rearing, and translocating Inconnu. Broad-based community involvement is possible because of the accessibility of the Yellowknife River from the Ingraham Trail.

9A5.3.3.5 *Fisheries Benefit*

The stocking offsetting option may result in measurable benefits to the Yellowknife River Inconnu fishery. Benefits of the proposed stocking offsetting option may extend beyond the local fishery in the Yellowknife River to stabilizing a broader fishery in Great Slave Lake where there are many stakeholders in the fishery (commercial, recreational, and Aboriginal users). Uncertainties include the suitability of release locations for egg and larval development, general survival of young-of-the-year and juveniles in the Yellowknife River until emigration to Great Slave Lake, and the likelihood of released offspring returning to the Yellowknife River to spawn as adults.

The practice of fish culture and stocking is well established and there are many programs for similar species (e.g., Lake Whitefish) to model in the development of a fish stocking option for offsetting. Inconnu have also been successfully raised in hatcheries in Russia since the 1920s (Alt 1969). If successful, production of Inconnu could be high and magnify upon the return of adult offspring to release locations. Inconnu exhibits a rapid growth rate for an Arctic fish species (Alt 1969), which can further contribute to the annual fishery production in the region resulting from this offsetting option.

9A5.3.3.6 *Next Steps*

The next step for the proposed option is further engagement with DFO and the communities on the offsetting option. A review of Traditional Knowledge may assist with planning the offsetting option and identifying suitable spawning locations. Similarly, a review of the literature on Inconnu spawning habitat, with follow-up habitat mapping of the Yellowknife and Cameron rivers may be required. This information will inform the suitability of the release locations and the likelihood of success. Field studies of known spawning locations in the Great Slave Lake area may be required to supplement data gaps.

9A5.4 Other Options

Investigations of potential measures for offsetting for the Project are ongoing. Future meetings with the communities and DFO will provide opportunities for new ideas and locations to be investigated. Habitat enhancement offsetting options that may be explored in the future include the following:

- Creation of habitat enhancement features around the perimeter of the Jay Pit and along the remnants of the breached dike at closure before back-flooding to provide additional habitat complexity and areas for spawning and rearing habitat at closure.
- The improvement of migration conditions for Arctic Grayling in Stream Ac35 (within the fish and fish habitat baseline study area for the Project); this option may involve an engineered channel to improve access to upstream spawning locations.
- The improvement of migration conditions for Arctic Char in the Kimigyoak River on Victoria Island (near Read Island), Nunavut; this option may involve the use of community-built low-flow channels to improve access to upstream spawning locations.
- The construction of watercourse crossings for all-terrain vehicles at fish-bearing locations affected by high-use (i.e., where erosion is high) in close proximity to the community of Kugluktuk.

9A5.5 Complementary Measures

In remote areas where there are low levels of human developments, there are often limited opportunities for measures to offset fisheries productivity losses. Community meetings and site investigations to date have demonstrated few offsetting opportunities located in the central Canadian Arctic for the Project. Because of the remoteness of the Project, there is also a limited understanding of fisheries populations. Thus, investments in data collection and scientific research may also be considered when they take into account the guiding principles outlined in the Fisheries Productivity Investment Policy. Research must relate to improving the state of knowledge around maintaining or enhancing the productivity of commercial, recreational, or Aboriginal fisheries to be considered as a complementary measure. Complementary measures that are being considered for the Project may include the following:

- Contribution of life history, population, and environmental information to a regional database on lakes that have been fished out in the NWT with data to be collected as described in the Final Fish-out Plan (based on the Conceptual Fish-out Plan; Appendix 9B).
- An evaluation of spawning habitat selection of Inconnu in the Great Slave Lake region, which may involve a desktop literature review combined with ground-truthing spawning locations in the region to develop models to predict occupancy of spawners at locations in the Yellowknife River. This work could be done in collaboration with DFO and align with existing research objectives for Inconnu in the Great Slave Lake region.
- An assessment of the status of the recovering Marian River stock of Inconnu. The stock can be 'easily' studied during the annual upstream spawning migration below the falls on the river and could provide an opportunity to involve the community in monitoring an important subsistence food fish in the region. This project could also be done in collaboration with DFO and align with existing research programs and fisheries management objectives for Inconnu in the Great Slave Lake region.
- Other potential research projects that may be identified through ongoing engagement with communities or DFO.

9A6 SUMMARY

The preliminary options investigated to support the conceptual offsetting plan have been identified through community engagement, meetings with DFO, and through local knowledge of biologists and resource users in the region. The options remain conceptual at this stage and require further development to understand feasibility and magnitude of gains that can be achieved relative to losses attributable to the Project. Suitable projects focused on options that allowed for community involvement and would result in a measurable benefit to a local or regional fishery.

It is likely that multiple offsetting options, in combination with research programs as complementary measures, will be required to counterbalance the unavoidable residual serious harm to fish from the Project. The options explored to date, particularly the fish stocking option on the Yellowknife River, have the potential to provide substantial gains to regional fisheries production, and can satisfy the offsetting requirements and objective outline in DFO's Fisheries Productivity Investment Policy (DFO 2013b).

9A6.1 Next Steps

The conceptual offsetting plan provides an initial overview of options that are considered to be likely achievable. The final offsetting plan will be developed and submitted as part of the *Fisheries Act* Authorization. The next steps being considered in moving the offsetting plan development forward include:

- continued engagement with communities and DFO on the identification of potential offsetting options and continued investigations of potential offsetting options as they are identified (ongoing);
- continued engagement with DFO on the application of a common currency for quantifying losses that result in serious harm to fish and offsetting gains to counterbalance the serious harm (ongoing);
- continued engagement with the communities on the design and implementation of proposed offsetting measures for habitat enhancement offsetting at Gilbert's Creek, habitat creation offsetting at Kugluktuaryuk Creek, and Inconnu stocking offsetting for the Yellowknife River (2014 to 2015);
- baseline evaluation of passage conditions of Gilbert's Creek during spring 2015 and preliminary assessment of channel characteristics of Gilbert's Creek by a watercourse engineering team (2015);
- Traditional Knowledge studies for candidate offsetting locations (2014 to 2015);
- development of a study plan for complementary measures, including review of the literature on Inconnu spawning habitat, with follow-up habitat mapping of the Yellowknife and Cameron rivers in 2015; field studies of known spawning locations in the Great Slave Lake area to supplement data gaps in 2015; and,
- final plan to be developed for the *Fisheries Act* Authorization permitting process (2015/16).

9A7 REFERENCES

Alt KT. 1969. Taxonomy and ecology of the inconnu *stenodus-leucichthys-nelma* in Alaska. Biological papers of the University of Alaska no 12, pp. 1-53

CHP (Community Hatchery Program). 2014. www.communityhatcheries.com. www.communityhatcheries.com. Accessed Sept 9, 2014.

Cott PA. 2004. Northern pike (*Esox lucius*) habitat enhancement in the Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Science 2528: vii + 32 p.

DFO (Fisheries and Oceans Canada). 2006. Ecological restoration of degraded aquatic habitats: a watershed approach. DFO Oceans and Science Branch, Gulf Region. ISBN: 0-662-42818-8. 180p

DFO. 2007. Practitioners guide to fish passage for DFO habitat management staff. Version 1.1.

DFO. 2013a. Fisheries Protection Policy Statement. Ottawa, ON, Canada. ISBN 978-1-100-22885-3.

DFO. 2013b. Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting. Ottawa, ON, Canada. ISBN 978-1-100-22930-0.

DFO. 2014. Measures to avoid causing harm to fish and fish habitat. DFO, Winnipeg, MB, Canada. Website: http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html. Accessed July 21, 2014.

Dillon (Dillon Consulting Ltd.). 2002. Lake Trout Habitat Utilization Study, 2001. Technical Report – Final. Prepared for Diavik Diamond Mines Inc. Yellowknife, NWT, Canada.

Fischenich C, Seal R. 1999. Boulder clusters. EMRRP Technical Noted Collection (ERDC TN-EMRPP-SR-11). U.S. Army Engineer Research and Development Center. Vicksburg, MS, USA. www.wes.army.mil/el/emrrp

Fitzsimmons JD. 2013. Assessment of the use of dikes at Diavik Diamond Mine Lac de Gras for Lake Trout Spawning 2011. Unpublished Report. Available http://www.mvlwb.ca/Boards/WLWB/; accessed September 21, 2014. 24 pages.

Gaboury M. 2003. Englishman River - Fish Habitat Restoration Designs. LGL Limited environmental research associates. Sidney, BC, Canada. EA1574. 40p+app

Golder 1997a. Technical Memorandum #12-2, Shoal Habitat Survey, Lac de Gras and Lac du Sauvage, Summer 1996. Environmental Baseline Program. Submitted to Diavik Diamond Mines Inc. Yellowknife, NWT, Canada. Doc No. TM12-2.

Golder. 1997b. Technical Memorandum #13-3, Inland Lake Survey Report. 1996 Environmental Baseline Program. Submitted to Diavik Diamond Mines Inc. Yellowknife, NWT, Canada. Doc No. TM13-3.

Golder. 1997c. Technical Memorandum #14-2, Intensive Shoreline Habitat Survey. 1996 Environmental Baseline Program. Submitted to Diavik Diamond Mines Inc.. Yellowknife, NWT, Canada. Doc No. TM14-2.

Golder. 1997d. Technical Memorandum #15-2, Extensive Shoreline Habitat Survey. 1996 Environmental Baseline Program. Submitted to Diavik Diamond Mines Inc. Yellowknife, NWT, Canada. Doc No. TM15-2.

Golder. 2013. 2012 Field report: stream restoration and community stewardship of Arctic Char at Nulahugyuk (Bernard Harbour. Submitted to Environment Canada. 27 pages plus appendices.

Government of Alberta. 2009. Guidelines and procedures for watercourse crossings in Alberta. Government of Alberta Transportation.

Gross MR, Coleman RM, McDowall RB. 1988. Aquatic productivity and the evolution of diadromous fish migration. Science 239:1291-1293.

Gross MR. 1987. Evolution of diadromy in fishes. American Fisheries Society 52 Symposium 1:14-25.

Johnson L. 1976. Ecology of Arctic populations of lake trout, *Salvelinus namaycush*, lake whitefish, *Coregonus clupeaformis*, Arctic char, *Salvelinus alpinus*, and associated species in unexploited lakes of the Canadian Northwest Territories. J Fish Res Bd Canada 33: 2459-2488.

Jones DR, Kiceniuk JW, Bamford OS. 1974. Evaluation of the swimming performance of several fish species from the Mackenzie River. J Fish Res Bd of Canada, 31(10): 1641-1647.

Katopodis C, Gervais R. 2012. Ecohydraulic analysis of fish fatigue data. River Research and Applications 28: 444-456.

Katopodis C. 1994. Analysis of ichthyomechanical data for fish passage or exclusion system design. In Proceeding of an International Fish Physiology Symposium, Vancouver, BC, Canada, p. 318.

MDNR (Minnesota Department of Natural Resources). 2010. MDNR, Fergus Falls, MN, USA. January 2010.

Noonan MJ, Grant JW, Jackson CD. 2012. A quantitative assessment of fish passage efficiency. Fish, *13*(4), 450-464.

ODFW (Oregon Department of Fish and Wildlife). 2010. Guide to placement of wood, boulders, and gravel for habitat restoration. Salem, OR. USA. 33p

Pander J, Mueller M, Geist J. 2013. "Ecological functions of fish bypass channels in streams: migration corridor and habitat for rheophilic species." River Res Appl 29: 441-450.

Peake S. 2004. Effect of approach velocity on impingement of juvenile northern pike at water intake screens. N Am J Fish Manage 24(2): 390-396.

Peake SJ. 2008. Swimming performance and behavior of fish species endemic to Newfoundland and Labrador: a literature review for the purpose of establishing design and water velocity criteria for fishways and culverts. Canadian Manuscript Report for Fisheries and Aquatic Sciences 2843: v + 52 p.

Rescan (Rescan Environmental Services Ltd.). 2007. Ekati Diamond Mine 2006 Jay Pipe Aquatic Baseline. Prepared for BHP Billiton Canada Inc. Yellowknife, NWT, Canada.

Rescan. 2012. EKATI Diamond Mine: Panda Diversion Channel Monitoring Program Final Report. Prepared for BHP Billiton Canada Inc. by Rescan Environmental Services Ltd.: Yellowknife, NWT, Canada.

RL&L (RL&L Environmental Services Ltd.). 1985. Fall fish spawning habitat survey 1983 – 1985. Submitted to the Slave River Hydro Study Group. Edmonton, AB, Canada.

Roni P, Bennett T, Morley S, Pess GR, Hanson K, Slyke DV, Olmstead P. 2006 . Rehabilitation of bedrock stream channels: the effects of boulder weir placement on aquatic habitat and biota. River Res Appl 22: 967-980.

Roscoe DW, Hinch SG. 2010. Effectiveness monitoring of fish passage facilities: historical trends, geographic patterns and future directions. Fish Fish, *11*(1), 12-33.

Savitz J, Bardygula-Nonn LG, Nonn RA, Wojtowicz G. 1998. Impingement and entrainment of fishes within a high volume-low velocity deep water intake system on Lake Michigan. J Freshwater Ecol, 13(2), 165-169.

Scrimgeour GJ, Tonn WM, Jones NE. 2014. Quantifying effective restoration: reassessing the productive capacity of a constructed stream 14 years after construction. Can J Fish Aquat Sci, 71(4): 589-601.

VanGerwen-Toyne M, Day AC, Taptuna F, Leonard D, Frame S, Tallman R. 2013. Information in support of Assessment of Buffalo River Inconnu, Stenodus leucichthys, Great Slave Lake, Northwest Territories, 1945-2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/069. Vii + 80 p.

Vehanen T, Huusko A, Yrjänä T, Lahti M, Mäki-Petäys A. 2003. Habitat preference by grayling (*Thymallus thymallus*) in an artificially modified, hydropeaking riverbed: a contribution to understand the effectiveness of habitat enhancement measures. J Appl Ichthyol 19: 15-20.

Weledeh Yellowknives Dene. 1997. Weledeh Yellowknives Dene: A Traditional Knowledge Study of Ek'ati. Yellowknives Dene First Nation Council, Dettah, NWT, Canada.

Wright DG, Hopky GE. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Canadian technical report of fisheries and aquatic sciences 2107. DFO, Winnipeg, MB, Canada.

WRRB (Wek'èezhìı Renewable Resources Board) 2014. Common fish in the Tłı̨chǫ Region. 22 pages.

9A8 GLOSSARY

Term	Definition
Application Case	The Environmental Assessment case that includes the Project and existing and approved developments or activities.
Base Case	The assessment case that includes existing environmental conditions as well as existing and approved projects or activities, before the construction of the Project in question, acts as reference against which data from construction and operational phases of development will be compared.
Baseline	Background or reference; conditions before Project development.
Baseline study area	The area where direct effects and small-scale indirect effects from the Project are expected to occur.
Basin	A geographic area in which all water running off the land drains into a single point at lower elevation, such as a river or lake.
Bathymetry	Measurement of water depths in a lake.
Benthic invertebrates	Animals without backbones that live on river and lake bottoms. Benthic refers to the bottom.
Biomass	The weight of living matter in a given area or sample.
Boulder garden	An area of a stream with exposed, large boulders providing instream cover, and potentially a barrier to upstream passage of fish at low flows.
Boulder substrate	Substrates with a particle size greater than 256 mm in diameter.
Braided	Flowing in an interconnected network of channels that divide and reunite.
Cascade habitat	A succession of steep, small falls where water falls over a vertical drop.
Cobble substrate	Substrates with a particle size between 64 and 256 mm in diameter.
Dewatering	Removal of water from a natural waterbody by pumping or draining.
Discharge	The volumetric rate of flow of water in a watercourse at a specified point, expressed in units of cubic metres per second or equivalent.
Drainage basin	The area drained by a river or stream; see also watershed.
Echo Integration	The processing technique that determines the average squared echosounder output voltage for selected range intervals and average times. The integrator output is proportional to fish density or biomass.
Ecosystem	An integrated and stable association of living and non-living resources functioning within a defined physical location. A community of organisms and its environment functioning as an ecological unit. For the purposes of evaluation, the ecosystem must be defined according to a particular unit and scale.
Ephemeral	Lasting for a short time or part of a complete cycle. In reference to water, typically describes a stream that flows for only part of the open-water period.
Fine/organic substrate	Substrates with a particle size less than 2 mm in diameter.
Fish community	A group or assemblage of fish species inhabiting the same location at the same point in time.
Fish tracking	Raw acoustic tag echoes which have been selected and assigned a tag ID through an auto-tracking method. Also referred as auto-tracked.
Freshet	The period of increased stream flow in spring caused by the melting snow pack.
Geographic Information System (GIS)	Computer system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.
Gradient	The slope of a stream channel or lake shoreline.
Habitat	The physical space within which an organism lives, and the abiotic and biotic entities (e.g., resources) it uses and selects in that space.
Headwater	The source of water at the top of a watershed, typically a lake or marsh.
Hydroacoustics	The study or use of sound in water to remotely obtain information related to the physical characteristics of the waterbody, its bathymetry, or biotic populations.

Term	Definition
Hydrology	The study of flowing water and effects of flowing water on the Earth's surface, in the soil and underlying rocks, and in the atmosphere.
Inflow	Water flowing into a lake.
Infrastructure	Basic facilities, such as transportation, communications, power supplies and buildings, which enable an organization, project or community to function.
Invertebrates	Animals without backbones.
Kimberlite	Igneous rocks that originate deep in the Earth's mantle and intrude the Earth's crust. These rocks typically form narrow pipe-like deposits that sometimes contain diamonds.
Kimberlite pipe	Vertical structures on which kimberlites occur in the Earth's crust.
Life history	The full range of changes, habits, and behaviors of an individual over the course of its life.
Mean	Arithmetic average value in a distribution.
Median	A single statistical value used to characterize a series of data values. Half of the data values are larger than the median value, and half of the data values are less than the median value.
Nutrients	Elements or chemicals essential to growth or repair of organic bodies, including carbon, oxygen, nitrogen, phosphorus, and silica.
Oligotrophic	Designation for peatlands that are poor to extremely poor in nutrients and with low biological activity.
Open-water period	Summer season when lakes, rivers and streams are free of ice (generally June or July to October).
Outflow	Water flowing out of a lake.
Parameter	A particular physical, chemical, or biological property that is being measured in a groundwater system; whatever it is you measure in a groundwater system.
Pelagic	Relating to fish or other aquatic organisms that live offshore in the middle or lower part of the water column.
pH	The negative log of the concentration of the hydronium ion. The pH is a measure of the acidity or alkalinity of all materials dissolved in water, expressed on a scale from 0 to 14, where 7 is neutral, values below 7 are acidic, and values over 7 are alkaline.
pH	A measure of the acidity or alkalinity of water.
Pool habitat	An area of stream where the water velocity is slow and stream depths are relatively deep.
Population	A group of individuals of one species in one area; it often means the group of organisms that is convenient and practical to count. A population is also defined as individuals of a species that are close enough to each other for there to be at least occasional mating between them.
Processed kimberlite	The residual material left behind when the processing of kimberlite has been completed to extract the diamonds.
Processing plant	A facility where the kimberlite is physically processed. The process involves size reduction (crushing); washing (also referred to as scrubbing); screening (filtering the material by size); and primary and secondary concentration (separating the material by density).
Riffle habitat	An area of stream where the water velocity is fast and stream depths are relatively shallow causing broken water.
Riparian	Relating to the banks or shoreline area of a stream or lake often referring to nearshore vegetation.
Run habitat	An area of stream where the water velocity is moderate, depths are greater than a riffle and most of the surface is not broken.
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.
Shoal	A shallow, offshore reef in a lake.

Term	Definition
Silt	As a particle size term: a size fraction between 0.002 and 0.05 mm equivalent diameter, or some other limit (geology or engineering).
Species	A group of organisms that actually or potentially interbreed and are reproductively isolated from all other such groups; a taxonomic grouping of genetically and morphologically similar individuals; the category below genus.
Sub-basin	A smaller scale basin within a larger basin. The sub-basin contributes runoff to the drainage system of the larger basin.
Substrate	The bottom of a waterbody, usually consisting of sediments of various particle sizes (e.g., sand, silt, clay, gravel, cobble, boulder) and organic material (e.g., living or dead plant material).
Surface area	The area of the lake water surface, excluding islands.
Total dissolved solids	The dissolved matter found in water comprised of mineral salts and small amounts of other inorganic and organic substances.
Total suspended solids	The amount of suspended substances in a water sample. Solids, found in wastewater or in a stream, which can be removed by filtration. The origin of suspended matter may be artificial or anthropogenic wastes or natural sources such as silt.
Traditional Knowledge	Knowledge systems embedded in the cultural traditions of regional, indigenous, or local communities. It includes types of knowledge about traditional technologies, the environment and ecology.
Tributary	A stream that flows into a larger stream or lake.
Turbidity	A measure of light penetration dependent on the concentration of suspended solids.
Valued component (VC)	Valued components represent biophysical, economic, social, heritage and health properties of the environment that are considered to be important by society.
Waterbody	An area of water such as a river, stream, lake or sea.
Watercourse	A flowing body of water, such as a stream or river.
Watershed	The upstream land area drained by a river network.
Wetland	Land having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetlands or aquatic processes as indicated by hydric soils, hydrophytic vegetation and various kinds of biological activity which are adapted to the wet environment.
Wetted width	The width of the water surface measured at right angles to the direction of flow. Multiple channel widths are summed to obtain total wetted width.
Yearling	An animal in its second year.
Young-of-the-year	Fish at age 0, within the first year after hatching.