CONCEPTUAL AQUATIC EFFECTS MONITORING PROGRAM DESIGN PLAN FOR THE JAY PROJECT

DRAFT

Prepared for: Dominion Diamond Ekati Corporation

Prepared by: Golder Associates Ltd.

June 2015

Table of Contents

Maps

Tables

Abbreviations

Abbreviation	Definition
AANDC	Aboriginal Affairs and Northern Development Canada
AEMP	Aquatic Effects Monitoring Program
BACI	before-after control-impact
DAR	Developer's Assessment Report
DELT	deformities, eroded fins, lesions, and tumours
DFO	Fisheries and Oceans Canada
Diavik Mine	Diavik Diamond Mine
Dominion Diamond	Dominion Diamond Ekati Corporation
e.g.	for example
EA	Environmental Assessment
Ekati Mine	Ekati Diamond Mine
EROD	ethoxyresorufin-O-deethylase
FF2	Far-field 2
FPK	fine processed kimberlite
i.e.	that is
IBA	Impact Benefit Agreement
ICRP	Ekati Mine Interim Closure and Reclamation Plan
KLOI	key line of inquiry
LLCF	Long Lake Containment Facility
MVEIRB	Mackenzie Valley Environmental Impact Review Board
Narrows	Lac de Gras-Lac du Sauvage Narrows
NF	Near field
NWT	Northwest Territories
Project	Jay Project
QA/QC	quality assurance and quality control
SNP	Surveillance Network Program
SOP	standard operating procedures
TDS	total dissolved solids
TK	Traditional Knowledge
TKN	total Kjeldahl nitrogen
TOR	Terms of Reference
TSS	total suspended solids
VC	valued component
Water Licence	Type A Water Licence
WLWB	Wek'èezhìi Land and Water Board
WRSA	waste rock storage area

Units of Measure

Unit	Definition
%	percent
ha	hectare
km	kilometre
m^2	square metre
m^3/hr	cubic metres per hour
masl	metres above sea level

1 INTRODUCTION

1.1 Background

Dominion Diamond Ekati Corporation (Dominion Diamond) is a Canadian-owned and Northwest Territories (NWT) based mining company that mines, processes, and markets Canadian diamonds from its Ekati Diamond Mine (Ekati Mine). The existing Ekati Mine is located approximately 200 kilometres (km) south of the Arctic Circle and 300 km northeast of Yellowknife, NWT (Map 1.1-1). The Ekati Mine is located within the headwaters of the Coppermine River drainage basin, which flows north to the Arctic Ocean.

Dominion Diamond is proposing to develop the Jay kimberlite pipe (Jay pipe) located beneath Lac du Sauvage. The proposed Jay Project (Project) will be an extension of the Ekati Mine, which is a large, stable, and successful mining operation that has been operating for 16 years. Most of the facilities required to support the development of the Jay pipe and to process the kimberlite currently exist at the Ekati Mine. The Project is located in the southeastern portion of the Ekati claim block, approximately 25 km from the main facilities and approximately 7 km to the east of the Misery Pit, in the Lac de Gras watershed (Map 1.1-2). Open-pit mining of the Jay pipe represents another 10 years of additional mine life (based on current ore processing rates), beyond the currently anticipated closure date of 2019.

The proposed approach to mining the Jay pipe is to isolate the area of Lac du Sauvage overlying the pipe within a water-retaining dike and then dewater the diked area to allow for open-pit mining. The approach is similar in concept to those implemented for the Diavik Diamond Mine (Diavik Mine) and the Meadowbank Gold Mine in Nunavut. The Project will also require an access road, pipelines, and power lines to the new open pit. The project overview and detailed project description included in the Developer's Assessment Report (DAR; Dominion Diamond 2014) provide information pertaining to new developments and activities associated with the Project.

Substantial monitoring of the Project site and receiving environment is anticipated. Because the Ekati Mine has been operating for 17 years, multiple environmental monitoring programs and management plans are in place, and have been effectively improved over time through adaptive management. Monitoring programs and management plans required for the Project are outlined in Section 1.2.3.2 of the DAR and can be divided into two categories, which will be applicable during the development, operations, and closure of the Project:

- **Compliance monitoring** – monitoring activities, procedures, and programs undertaken to confirm the implementation of approved design standards, mitigation, and conditions of approval and company commitments. The Surveillance Network Program (SNP) is an example of compliance monitoring.
- **Follow-up monitoring** – monitoring programs designed to assess the accuracy of the predictions in the DAR and the effectiveness of mitigation measures, evaluating the short-term and long-term effects on the physical, chemical and biological components of the aquatic ecosystems affected by the Project, estimating the spatial extent of effects, and providing the necessary input for implementation of adaptive management throughout the developmental lifespan of the Project. Examples of follow up monitoring include the Aquatic Effects Monitoring Program (AEMP), the Wildlife Effects Monitoring Program, and fisheries offsetting monitoring.

LEGEND

- JAY PROJECT
- EXISTING MINE OR PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- ALL-SEASON ROAD
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- TREELINE
- WATERCOURSE
- WATERBODY

150 0 150

SCALE 1:6,000,000 KILOMETRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

LOCATION OF THE JAY PROJECT

DRAFT

PROJECT	1419751.4100.40		FILE No.
DESIGN	CH	25/05/15	SCALE AS SHOWN — REV. 0
GIS	ANK	25/05/15	
CHECK			MAP 1.1-1
REVIEW			

Golder Associates

REFERENCE

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

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\1419751 Jay Project Stage 3\4100_Licencing and Permitting\40_AEMP_Design_Plan\Location_of_Jay_Project.mxd

LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- KIMBERLITE PIPE
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

3 0 3
SCALE 1:150,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
EKATI PROPERTY MAP

Golder Associates

PROJECT	1419751.4100.40		FILE No.	
DESIGN	CH	25/05/15	SCALE AS SHOWN	REV 0
GIS	ANK	25/05/15	MAP 1.1-2	
CHECK				
REVIEW				

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\1419751 Jay Project Stage 3\4100_Licencing and Permitting\40_AEMP_Design_Plan\Ekati_Property_Map.mxd

An AEMP will be required of the Project by the Water Licence, and will involve programs focused on the aquatic receiving environment. Given that the Project is an extension of the existing Ekati Mine, it is anticipated that the AEMP for the Project will be an expansion of the existing AEMP under the current Water Licence #W2012L2-0001 issued by the Wek'èezhìı Land and Water Board (WLWB 2014).

This conceptual AEMP Design Plan provides an overview of the scope of monitoring to be added to the existing Ekati Mine AEMP. It describes anticipated monitoring for the first iteration of the AEMP Design Plan that covers dewatering and early operations (2016 to 2019). Operations extend to 2029, and during this period, there will be opportunities to adjust the sampling design at appropriate intervals following issuance of the Water Licence, and as required by the AEMP Response Framework based on annual results. An Aquatic Effects Re-evaluation Report will be prepared after three years of data have been collected (or as specified by the WLWB), and at similar intervals thereafter. These reports will, among other tasks, will provide recommendations with rationale for proposed changes to the AEMP Design Plan. Based on results of the re-evaluation reports, revised AEMP Design Plans will also be prepared for WLWB review and approval.

The AEMP Design Plan for later operations, closure, and post-closure periods will be prepared later in the life of the Project, taking into account knowledge and experience accumulated over a decade of monitoring under the AEMP.

1.2 Objectives

The AEMP is one of a number of monitoring and management plans that employ an adaptive approach to reduce the magnitude, frequency, and extent of effects of the Project on the environment.

The specific objectives of the AEMP will be to:

- determine the short- and long-term effects of the Project on the receiving environment;
- test the aquatic effect predictions made in the DAR or in other submissions to the WLWB regarding the impacts of the Project on the receiving environment;
- assess the efficacy of mitigation measures that are used to minimize the effects of the Project on the receiving environment; and,
- identify the need for additional mitigation measures to reduce or eliminate Project related effects.

The objectives of this Conceptual AEMP Design Plan are as follows:

- to provide a conceptual design for the AEMP as a basis for Dominion Diamond to engage in and elicit feedback on planned aquatic effects monitoring from regulatory agencies and Aboriginal communities; and,
- to provide an indication on how water, sediment, and biological monitoring (e.g., plankton, benthic invertebrates, fish) will be conducted and how the results of the AEMP will be used to inform adaptive management.

2 REGULATORY HISTORY AND PROCESS

With the exception of the Inuvialuit Settlement Region, the regulatory process in the NWT is set out in the *Mackenzie Valley Resource Management Act*. The Land and Water Boards of the Mackenzie Valley are responsible for performing initial review and preliminary screenings of proposed projects, and regulating the use of the land and water as well as the deposition of waste within their respective regions. The Project is located within the Wek'èezhìı settlement area where all development applications are processed by the Wek'èezhìı Land and Water Board (WLWB). The WLWB provides for the conservation, development, and use of land and water resources for optimum benefit to the residents in their settlement areas and the Mackenzie Valley, and to all Canadians.

In October 2013, Dominion Diamond submitted an application to the WLWB requesting a Land Use Permit and Class A Water Licence to enable mining of the Jay pipe as an extension project of the Ekati Mine. In Dominion Diamond's initial submissions for the Project, the community engagement for the Project's pre-application indicated that the Project "might cause significant public concern" and, because of these potential concerns, it was concluded that the Project would be appropriate for referral to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for an Environmental Assessment (EA). In November 2013, the Project was referred to the MVEIRB for an EA by Aboriginal Affairs and Northern Development Canada (AANDC), under paragraph 126(2)(a) of the *Mackenzie Valley Resource Management Act* (S.C. 1988, c.25).

The MVEIRB issued Terms of Reference (TOR) for the Jay-Cardinal Project Environmental Assessment in February 2014 (MVEIRB 2014). Dominion Diamond submitted an addendum to the initial Project Description in June 2014, and the MVEIRB issued the revised TOR for the Jay Project in July 2014 (Appendix 1A of the DAR; Dominion Diamond 2014). Respecting the initial feedback received through the engagement process, Dominion Diamond prepared a revised Project description and amendments to the TOR for the Jay Project based, in large part, on community feedback. The Project revision removed the development of the Cardinal kimberlite pipe, which substantially reduces the Project's footprint in Lac du Sauvage. In November 2014, Dominion Diamond submitted the Jay Project DAR to address the requirements stipulated in the TOR to support Dominion Diamond's application for the Jay Project.

Dominion Diamond is currently developing environmental management and monitoring plans, as part of the permitting stage of the Project. Following the approval of the EA, Dominion Diamond would be eligible to proceed through the required regulatory process for issuance of a Water Licence and Land Use Permit.

3 ENGAGEMENT

Dominion Diamond is committed to engaging with potentially affected communities, government, regulators and stakeholders in an open, timely, and comprehensive manner. This approach is set out in the Ekati Mine Engagement Plan, and is a culmination of successful engagement activities that have developed and become well established since the Ekati Mine was first licenced and became operational in 1998.

Dominion Diamond regularly and routinely undertakes community engagement activities as part of its management of the Ekati Mine. Engagement activities include:

- formal Impact Benefit Agreement (IBA) meetings with leadership from each of the Ekati Mine IBA groups;
- workshops on specific issues; and,
- site-based activities wherein leadership, elders, and youth are invited to visit the Ekati Mine for site visits or to take part in the environmental monitoring programs.

Dominion Diamond's approach to Project-based engagement is to develop an engagement plan that includes, but is not limited to, such key activities as pre-application engagement beginning before initial submissions to the WLWB, in addition to ongoing Project engagement. An engagement plan is a document, developed in accordance with the Mackenzie Valley Land and Water Board's June 2013, or subsequent editions, *Engagement and Consultation Policy* and the *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits*, that clearly describes how, when, and which engagement activities will occur with an affected party during the life of the Project.

Based on Dominion Diamond's Community Engagement Plan, NWT regulatory requirements, and community expectations, Dominion Diamond's engagement activities have focused on communicating the technical, environmental, and socio-economic aspects of the Project. These activities have also served as an opportunity for Dominion Diamond to develop its understanding of community concerns and aspirations related to Dominion Diamond's plan to extend the life of the Ekati Mine through the development of the Project.

Dominion Diamond will continue with engagement activities through the development of the AEMP, largely through workshops, which allow informal dissemination of information related to AEMP design, discussion of regulator and community concerns, and gathering of feedback regarding the proposed monitoring approach.

4 INCORPORATION OF TRADITIONAL KNOWLEDGE

Traditional knowledge (TK) is sought for use in environmental monitoring programs by involving communities in program planning and implementation, and providing opportunities for community members to teach TK to the site's environmental staff. Dominion Diamond strives to use TK to improve environmental monitoring programs at the Ekati Mine, and will continue to do so for the Project.

Dominion Diamond is committed to collecting and incorporating TK into the AEMP through the following means:

- conducting community TK workshops;
- engaging TK holders to collect relevant information for the design of monitoring programs;
- arranging annual site visits for Elders and youth from local communities; and,
- engaging on specific issues during the quarterly community engagement meetings.

In addition, Special Studies (Section 10), may be also conducted for this purpose. It is expected that TK will be incorporated in a manner consistent with current practice at the Ekati Mine established over 16 years of mine operations and environmental monitoring, and other AEMP programs in the area (De Beers 2013; Golder 2014). Dominion Diamond's commitment to TK is outlined in more detail in Section 5 of the DAR.

5 MINE OVERVIEW

Dominion Diamond is proposing to develop the Jay pipe located beneath Lac du Sauvage. The Project will be an extension of the existing Ekati Mine, located approximately 200 km south of the Arctic Circle and 300 km northeast of Yellowknife, NWT. The Project is located in the southeastern portion of the Ekati claim block, approximately 25 km from the main facilities and approximately 7 km to the east of the Misery Pit, in the Lac de Gras watershed.

5.1 Schedule

Once Dominion Diamond has obtained the necessary operational permits, licences, and authorizations, the construction phase will be initiated. The primary time constraint for the Project is that kimberlite must be delivered to the processing plant by 2020 to avoid a shut-down of the Ekati Mine. An overview of the timeline and general Project activities are provided in Table 5.1-1.

Table 5.1-1 Overview of Jay Project Timeline and General Project Activities

Year	Project Phase	General Activities
2016	Construction	• construction of roads, power line, dike, pipelines, and pumping facilities initiated
2017 to 2018	Construction	• construction of roads, dike, pipelines, and pumping facilities continues • construction of Sub-Basin B Diversion Channel • fish-out within diked area
2019	Construction/ Operations	• construction completed • dewatering of the diked area • use of the Misery Pit for dewatering water management • back-flooding of Lynx Pit • pre-stripping for Jay open pit • production of kimberlite to processing plant from Jay open pit begins
2020 to 2029 (10 Years)	Operations	• mining of the Jay open pit • Misery Pit used for minewater management • storage of waste rock at Jay waste rock storage area • storage of fine processed kimberlite in the mined-out Panda and Koala pits, and coarse kimberlite reject in the coarse kimberlite reject management area
2030 to 2033 (4 Years)	Closure	• pumping minewater from the Misery Pit to the Jay Pit • back-flooding the Jay Pit and the dewatered area of Lac du Sauvage • back-flooding of the Misery Pit with a cap of water from Lac du Sauvage • roads and Sub-Basin B Diversion Channel decommissioned • Reclamation of surface facilities

5.2 Mine Phases

5.2.1 Construction

Construction is expected to require approximately three years (2016 to 2019; Table 5.1-1) and will include the following activities:

- Granite will be quarried for construction material, and/or granite mined from the Lynx Pit will be used for construction of components of the Jay Project.
- A road will be extended from the Misery Road to the Lac du Sauvage shoreline.
- A lay-down area near Lac du Sauvage will be constructed to support dike construction and operations.
- A small lunchroom, office, and washroom facility with emergency shelter, storage and field maintenance facilities will be constructed at the lay-down area.
- A horseshoe-shaped water retention dike will be built from the shoreline out into Lac du Sauvage to isolate the portion of the lake overlying the Jay pipe. The dike will be approximately 5 km long.
- The portion of Lac du Sauvage within the diked area will be fished out.
- Pumping systems, pipelines, and a power line for dewatering the diked area and for ongoing operational water management will be constructed from the Jay Pit area to the Misery Pit.
- The isolated portion of Lac du Sauvage will be dewatered to expose the lakebed overlying the Jay kimberlite pipe. Approximately 29.6 million cubic metres (m^3) of water will be removed from the diked area during dewatering. Initial dewatering will be directed to Lac du Sauvage; once water quality is no longer suitable for direct discharge (i.e., higher levels of total suspended solids [TSS]), pumping will be directed to the mined-out Lynx and Misery pits.
- A small drainage area on the west shore of Lac du Sauvage (Sub-Basin B Diversion Channel) will be diverted to direct the Christine Lake outflow south, around the diked area into the main basin of Lac du Sauvage.

Once the lakebed is exposed in the diked area, mining operations will begin.

5.2.2 Operations

The construction period will be followed by an approximately ten-year operational period (2019 to 2029) during which kimberlite from the Jay Pit will be mined and processed. The Jay Pit will be mined using conventional open-pit truck-shovel operations. Mining is expected to end in Year 2029.

During operations, the mined-out Misery Pit will be used for minewater management (i.e., to contain surface runoff and groundwater inflows to the Jay Pit). After approximately Year 5 of operations, when the Misery Pit has reached operational storage capacity level with safety freeboard to the pit outlet, water will be pumped to Lac du Sauvage. Waste rock will be stored at the Jay waste rock storage area (WRSA), which will be located on the west shore of Lac du Sauvage. Fine processed kimberlite from the processing plant will be placed in the mined-out Panda and Koala pits, and coarse kimberlite reject will be placed in the coarse kimberlite reject management area.

Operation of the mine will include the following activities:

- The Jay open pit will be developed using the conventional drill and blast techniques. Overburden, waste rock, and kimberlite will be moved by truck and shovel operations.
- Mining rock trucks will haul waste rock and overburden from the pit to the Jay WRSA, which will be located on the shore of Lac du Sauvage adjacent to the pit.
- Mining rock trucks will haul kimberlite from the pit to ore transfer pads, which will be located near the Jay Pit and near the Misery Road.
- Long-haul trucks will then haul kimberlite from the ore transfer pads at the Jay Pit and near the Misery Road to the processing plant or to a stockpile near the processing plant. The haul is approximately 4 km along the new Jay Road, and 25 km along the existing Misery Road. The use of kimberlite stockpiles provides operational efficiencies and allows flexibility to maintain a consistent feed rate at the processing plant, while accommodating possible brief segmented road closures, if necessary, for poor weather or caribou presence.
- The kimberlite will be processed in the existing processing plant to recover diamonds.
- Water for the processing plant is taken from the existing Long Lake Containment Facility (LLCF).
- The fine processed kimberlite (FPK) will be deposited in the mined-out Panda and Koala open pits via pipelines from the processing plant to the pits. This method has been successfully demonstrated at the Beartooth Pit.
- Ongoing operational water management will divert natural runoff away from the Jay Pit, and will include collection of surface minewater and open pit minewater within the diked area. Open pit minewater will be pumped to the base of the Misery Pit. Surface minewater will be pumped to the top of the Misery Pit. Beginning in approximately Year 5, water will be drawn from the top of the Misery Pit and discharged into Lac du Sauvage through a diffuser.

Once the open pit is completed, mining operations will cease and closure will begin.

5.2.3 Closure

Reclamation of some existing facilities that have no operational value will proceed during the Project. This will include, for example, Cells A, B, and C of the LLCF. Reclamation of other existing facilities will proceed upon completion of the Project. This will include, for example, the Ekati main camp and processing plant.

Active closure will occur after the completion of mining, and is currently scheduled to take place over four years starting in 2030. This will include removal of site infrastructure and disposal of materials, either on-site or off-site as appropriate. Water will be pumped from the Misery Pit to the bottom of the Jay Pit, and the diked area will be back-flooded with water from Lac du Sauvage. Roads and the

Sub-Basin B Diversion Channel will be decommissioned. The Misery, Panda, and Koala pits will be covered with a freshwater cap.

Once monitoring has shown that water quality within the diked area is suitable, the dike will be breached and the isolated portion of Lac du Sauvage will be reconnected. The Misery Pit will be allowed to overflow to Lac de Gras once water quality is suitable. Monitoring will continue until it is shown that the site meets all regulatory closure objectives. Version 2.4 of the Ekati Mine Interim Closure and Reclamation Plan (ICRP) was approved by the WLWB in November 2011 (BHP Billiton 2011) and is anticipated to be updated to incorporate the Project as part of future regulatory processes.

5.3 Summary of Water Management

The goal of the dewatering and mine water management will be to minimize the impact of the Project on surrounding aquatic ecosystems, in terms of both water quantity and quality.

The Mine Water Management Plan (Appendix 3A of the DAR) for the Project encompasses all stages of mine development. The proposed water management infrastructure was designed to first reduce the amount of minewater by intercepting and diverting runoff water away from the mine site. It was also designed to minimize the quantity of minewater that requires management, to collect runoff and minewater and store it for management and monitoring before discharge to the environment, and to implement monitoring plans to allow for the identification and development of adaptive management strategies as required.

The main water management infrastructure includes:

- turbidity curtains during construction;
- a diversion channel;
- collection sumps within the diked area of Lac du Sauvage;
- pumps and pipelines; and,
- mined-out Lynx and Misery pits, which will be used for water management.

During the Project life, the number of discharge points from the mine site to the receiving environment will be limited to the following:

- two discharge locations (total of three pipes, two discharging in one location, and one discharging in the other location) to Lac du Sauvage for the early stages of dewatering of the diked area, when TSS concentrations are suitable for direct discharge to the environment; and,
- one diffuser outfall location in Lac du Sauvage for the discharge of water from the Misery Pit during the second part of the mine operations (i.e., after water in the Misery Pit has reached storage capacity).

5.3.1 Dewatering of Diked Area (Jay Open Pit) During Construction

Operating experience at the Ekati Mine and other mines suggests that TSS concentrations during dewatering from within the diked area may increase beyond acceptable levels during the late stages of dewatering. Therefore, dewatering of the diked area in Lac du Sauvage will occur in two stages:

- Water will be pumped from the dewatered area over the dike into the main basin of Lac du Sauvage to the extent that TSS concentrations are acceptably low. It is conservatively estimated that TSS concentrations will be acceptable for the first 50% of the dewatering volume.
- Water will be pumped to the Lynx Pit or the Misery Pit for settlement of solids when TSS concentrations are greater than the acceptable concentration

The acceptable limit for TSS concentrations in dewatering water is anticipated to be addressed during the water licencing stage of the Project following successful completion of the EA review process. The TSS concentrations threshold is envisioned to be consistent with past experience and current requirements of the Ekati Mine water licence. The estimated volume of water to be pumped from the dewatered portion of Lac du Sauvage during the construction phase of the Project is 29.6 million m^3. The total duration of diked area dewatering is assumed to be six months, equivalent to an average dewatering rate of approximately 6,500 cubic metres per hour (m^3/hr). The Lynx and Misery pits will allow for the natural settlement of suspended solids over time. Water within the Lynx Pit will remain in the pit for closure.

5.3.2 Operations

The Mine Water Management Plan provides for secure storage of minewater in the mined-out Misery Pit, and defers the need for discharge to the local receiving environment for approximately five years into the open pit operation. This approach eliminates the need for construction of a large, new minewater management facility and reduces cumulative effects in Lac de Gras (given the current published shut-down of the Diavik Mine in 2023).

The Mine Water Management Plan for operations consists of the following components:

- minewater from the Jay open pit (i.e., inflows to the Jay Pit containing chloride-rich groundwater) will be pumped to the bottom of the Misery Pit;
- surface minewater (surface runoff and Jay Dike seepage) reporting to the dewatered area within the dike will be pumped to the top of the Misery Pit; and,
- when the water level in the Misery Pit approaches maximum operating levels (anticipated five years into open pit operations), water from the surface of the Misery Pit will be pumped to the discharge location in Lac du Sauvage at a rate that maintains a safe freeboard within the Misery Pit.

Water management pipelines will be constructed from the open pit and diked area to the water management facilities (Lynx and Misery pits). The pipelines will be operated year-round and used during construction (i.e., dewatering), operations, and closure.

During Project operations, the anticipated annual volume to be managed would increase from approximately 5.93 million m^3 to 9.76 million m^3 throughout the Project life. During operations, the quantity and quality of main minewater sources will be monitored to verify assumptions made during the development of the water quantity and quality models, and apply targeted adaptive management strategies where required to meet established performance standards. Data will be collected, compiled, and managed internally by Dominion Diamond, and will be reported to the WLWB.

5.3.3 Refilling of Diked Area (Jay Open Pit) in Closure

At completion of Jay pipe mining, a portion of the minewater contained within the Misery Pit (approximately 16.75 million m^3) will be pumped to the bottom of the Jay Pit and subsequently covered with freshwater from Lac du Sauvage. The shape and location of the Jay open pit is expected to create the conditions for long-term meromixis within the submerged open pit. Because meromixis would result in this denser water remaining within the submerged open pit, this water would be prevented from having a negative influence on water quality in overlying Lac du Sauvage.

The objectives for reclamation of the dewatered area of Lac du Sauvage include the following:

- natural lake water levels will be re-established; the dewatered area will be re-established to approximately 416 metres above sea level;
- Lac du Sauvage will be the primary source for back-flooding the dewatered diked area;
- back-flooding time will be reduced based on a reasonable balancing of time/costs with environmental protection;
- a Jay Pit and diked area back-flooding pumping plan will be developed prior to closure to protect fish habitat in the Lac du Sauvage Narrows and to maintain flow rates within the natural range;
- water quality within the back-flooded diked area will meet pre-defined acceptability criteria before permanent breaching of the dike or return to natural flow paths;
- the Sub-Basin B Diversion Channel will be re-graded to promote natural drainage;
- local fish will be able to naturally re-enter the back-flooded area of Lac du Sauvage after the dike has been breached; and,
- local navigation will be re-established as required.

The predicted total volume of water required to back-flood the dewatered area is 120.48 million m^3: 93.84 million m^3 for the Jay Pit itself, and 26.64 million m^3 for the dewatered area of Lac du Sauvage. Water from Lac du Sauvage will be pumped over the dike in a manner to control the generation of TSS; available pumping rates are the same as operational capacity, as no additional pumping systems are proposed for reclamation. Back-flooding is anticipated to take approximately four years.

6 SUMMARY OF PREDICTED EFFECTS ON THE AQUATIC ENVIRONMENT

6.1 Water Quantity and Quality

The water quality and quantity key line of inquiry (KLOI) in the DAR considered potential changes to the valued components (VCs) of hydrogeology, surface hydrology, and water quality from the Project. Based on predicted water quality and water quantity during the Project phases, the DAR concluded that the Project will not have a significant adverse effect on the maintenance or suitability of water to support a healthy and sustainable ecosystem. Supplementary information responses for the DAR also indicated that the Project would not have significant adverse effects on drinking water (Dominion Diamond 2015).

Key Project activities from construction through closure with the potential to affect discharge and water levels at the outlets of Lac du Sauvage, Lac de Gras, and Desteffany Lake are dewatering activities during construction, operational water uses, and back-flooding of the pits during closure. Construction dewatering, operational water usage, and back-flooding of the pits and diked area during closure will be carried out in a manner that protects source water and downstream areas against adverse effects. This includes limiting changes to water levels and hydrological regimes in Lac du Sauvage and Lac de Gras. No adverse effects to channel stability or bank erosion are anticipated due to Project activities.

Key Project activities from construction through closure with the potential to affect water quality are those related to the collection and management of minewater, diversion of runoff water, and release of minewater. Existing developments (Ekati Mine and Diavik Mine) have measurable effects on water quality and have the potential to continue to affect water quality. Predicted concentrations of water quality parameters at all locations in Lac du Sauvage and Lac de Gras, during all Project phases, are lower than the screening thresholds, and thus, are not predicted to have significant adverse effects on the maintenance or suitability of water to support a healthy and sustainable ecosystem.

Based on the conservative assumptions in the water quality modelling, elevated nutrient concentrations in the minewater discharge from the Misery Pit during operations were predicted to result in increased concentrations of nutrients in Lac du Sauvage, with a maximum total phosphorus concentration in the mesotrophic range. Based on the predicted concentrations of total phosphorus, Lac du Sauvage is predicted to be remain oligotrophic to slightly mesotrophic. However, this increase was predicted to result in an enrichment effect on aquatic biota in Lac du Sauvage and a less pronounced enrichment effect in the eastern part of Lac de Gras.

6.2 Fish and Fish Habitat

The Project is not expected to affect the ability of Arctic Grayling, Lake Trout, and Lake Whitefish populations to be self-sustaining and ecologically effective. Nor is it expected to affect ongoing fisheries productivity or the ability of other aquatic life (e.g., plankton, benthic invertebrates) to support ongoing fisheries productivity.

Residual effects to fish will primarily be a result of habitat losses (i.e., Project footprint impacts) from the construction of the Jay horseshoe dike and the dewatering of the diked area in Lac du Sauvage where the open pit will be located. At the scale of the population for Arctic Grayling, Lake Trout, and Lake Whitefish, the magnitude of direct changes to habitat quantity and connectivity from the Project and other developments was predicted to be low. An offsetting plan will be developed in discussion with Fisheries and Oceans Canada (DFO) and local Aboriginal communities during the permitting phase of the Project, and will be submitted as part of the Application for Authorization under the *Fisheries Act*.

Before the isolated portion of Lac du Sauvage is dewatered, a fish-out plan will be developed through engagement with local Aboriginal communities and DFO. The predicted number of fish to be removed would be small compared to the entire population in Lac du Sauvage and Lac de Gras (i.e., less than 1%). Therefore, the fish-out would not affect self-sustaining and ecologically effective populations of fish in Lac du Sauvage and Lac de Gras.

Based on the aquatic health assessment, the Project was predicted to result in negligible effects to aquatic health in Lac du Sauvage and Lac de Gras. As a result, adverse effects to Arctic Grayling, Lake Trout, and Lake Whitefish health are unlikely, and thus, no effects would be expected to the self-sustaining and ecologically effective populations of these VCs.

The effect of increased nutrient concentrations from minewater discharge to Lac du Sauvage during operations is expected to result in a general increase in productivity at lower trophic levels in the main basin of Lac du Sauvage and a similar but less pronounced effect in the eastern part of Lac de Gras. Large shifts in composition of plankton and benthic invertebrate communities are not expected. However, biomass of phytoplankton, zooplankton, and benthic invertebrates will likely increase during operations, as these communities take advantage of the increased nutrient and food supply. Following closure, plankton and benthic invertebrate communities are expected to return to baseline conditions. Due to the increased food base, there may also be a minor increase in growth and reproduction rates in the fish VCs. Effects will be limited primarily to Lac du Sauvage during the late operations phase and potentially into closure.

During back-flooding at closure, the flow depth, channel widths, and riparian conditions of the Narrows will remain within the range of natural variability, maintaining habitat connectivity for fish passage between the two lakes. A back-flooding pumping plan will be developed prior to closure to protect fish habitat in the Lac du Sauvage Narrows and to maintain flow rates within the natural range. The dike will be breached when water quality in the diked area meets acceptability criteria. Recolonization of the back-flooded area is expected to occur immediately from adjacent habitat areas and will likely be populated by fish of all species and life-stages. Remnant portions of the dike represent the permanent loss of less than 54.3 hectares of lake area (or less than 1% of area of Lac du Sauvage and Lac de Gras). Remaining dike material will remain as islands in Lac du Sauvage, potentially providing habitat functions for spawning, rearing, and foraging fish.

In the impact classification, primary pathways influencing measurement indicators of ongoing fisheries productivity (i.e. self-sustaining and ecologically effective populations of Arctic Grayling, Lake Trout, and Lake Whitefish) and ongoing support for fisheries productivity were determined to be of low magnitude. The geographic extent of the effects are local to regional (i.e., measurable in Lac du Sauvage and Lac de Gras, and possibly for a short distance past the outlet of Lac de Gras). Most impacts, including those from changes in water quality, were classified as reversible. Impacts from the construction of the horseshoe dike and Jay Pit within Lac du Sauvage were classified as permanent.

Cumulative effects from the Project were predicted to not have a significant adverse impact on the ability of Arctic Grayling, Lake Trout, and Lake Whitefish populations to be self-sustaining and ecologically effective. Self-sustaining and ecologically effective populations of fish VCs is the foundation for ongoing fisheries productivity. Cumulative effects from development on aquatic life other than fish were also predicted to not have a significant adverse impact to ongoing support of fisheries productivity.

7 CONCEPTUAL SITE MODEL

7.1 Introduction

Conceptual site models illustrate potential interactions of stressors of potential concern, exposure pathways, and receptors of potential concern. A detailed conceptual site model will be developed for the for the AEMP in the form of a diagram, to assist in communicating potential effects of the mine to the structure and function of ecological components of the study area.

In preparation for developing the conceptual site model, this section provides information on:

- the aquatic ecosystem of the Lac de Gras watershed;
- the pathways by which Project-related stressors may influence the aquatic ecosystem;
- preliminary impact hypotheses used to focus the AEMP analyses; and,
- proposed assessment and measurement endpoints applicable to the AEMP.

7.2 Aquatic Ecosystem

In a lake environment, at the base of the food-web, phytoplankton in the water column and periphyton on shoreline rocks use nutrients and light to produce carbon for growth, and provide food to benthic invertebrates and zooplankton. Zooplankton feed on phytoplankton, while benthic invertebrates feed on periphyton and decaying organic material (dead plankton or sloughed-off periphyton) that settle onto bottom sediments. Fish feed on zooplankton and benthic invertebrates, and larger predatory fish feed on smaller fish. Wildlife also use water and biota in lakes as drinking water and a food source.

The stream environment is similar to the lake environment, although plankton play a smaller role, while periphyton and benthic invertebrates play a larger role. Wildlife also use water and biota in streams as drinking water and a food source.

Further details on the aquatic ecosystem associated with the Project area can be found in the Fish and Fish Habitat Section of the DAR (Section 9), as well as the Plankton Baseline (Annex XII), Benthic Invertebrate Baseline (Annex XIII) and Fish and Fish Habitat Baseline (Annex XIV) of the DAR.

The broad categories of biological receptors of the aquatic ecosystem in the Lac de Gras watershed are:

- primary producers: periphyton and phytoplankton communities;
- primary consumers: zooplankton and benthic invertebrate communities; and,
- secondary/tertiary consumers: fish.

7.3 Pathways of Exposure

The pathways by which Project-related stressors may influence the aquatic ecosystem are both direct and indirect. Direct pathways involve a direct influence on a receptor, for example, direct toxicity to fish as a result of elevated concentration of an ion or a metal. Indirect pathways often include several levels of receptors; for example, discharge of Project-affected water may result in an increase in nutrient concentration and primary productivity, which in turn may reduce dissolved oxygen and the capacity of a waterbody to support aquatic life (e.g., invertebrates and fish).

The key exposure pathways relevant to the AEMP in the Lac de Gras watershed are as follows:

- change in the quality of aquatic habitat through nutrient enrichment resulting from operational discharge of water from the Misery Pit;
- direct contact of aquatic organisms with total dissolved solids (TDS) and associated ions and metals; and,
- alteration of the quantity and quality of aquatic habitat with construction of the dike in Lac du Sauvage, and Project-related changes to water levels and flows.

Predictions of elevated nutrient concentrations resulting from the discharge of water from the Misery Pit are the primary concern to the aquatic ecosystem in Lac du Sauvage. Increased concentrations of nutrients during operations may increase aquatic ecosystem productivity and result in changes to lower trophic community composition. Nutrient-enhanced growth of phytoplankton increases biomass available for zooplankton to feed upon, which in turn may increase food availability for fish species or life stages that feed on zooplankton. In addition, enhanced periphyton growth and an increased settling rate of organic detritus on the lake bottom from enhanced planktonic biomass would provide more food for benthic invertebrates, and ultimately for fish.

Altered balance of nutrients (e.g., increased nitrogen, but not phosphorus) may affect the aquatic food web through changes in algal biomass and edibility. A change in algal species composition could increase the proportion of inedible algae, and also reduce the food supply even though the biomass of algae remains the same or increases. Increased concentrations of silica could also increase the proportion of diatoms. Therefore, altering the ratios of nutrients could shift phytoplankton community composition, and potentially affect the quantity and quality of food available to zooplankton and, therefore, fish.

Although of minor concern in Lac du Sauvage based on water quality predictions, increased concentrations of TDS and its constituent ions, and metals in lake water or sediments may have detrimental effects on aquatic biota. Direct toxicity to biota may alter the abundance and community composition of plankton, benthic invertebrates, and fish. These effects may propagate through the food web and may also result in bioaccumulation of toxic substances (e.g., in fish tissues). For example, zooplankton are an important food source for pelagic (open water) fish (particularly younger life stages) and, therefore, any degradation of the zooplankton community in response to decreased algal food supply could have a potential indirect effect on the pelagic fish community. Benthic invertebrates exposed directly to degraded water (i.e., sediment porewater and/or water column) are a key food supply for fish feeding on the lake bottom. Therefore, degradation of the benthic invertebrate community could have a potential indirect effect on the fish community.

Construction of the dike will result in direct removal of habitat area and may temporarily increase TSS concentrations in Lac du Sauvage. Changes to water levels and flows from dewatering or back-flooding activities may have direct and indirect effects on aquatic habitat. Elevated water levels increase the overall habitat area, and the quality of waters and sediments may be affected through the introduction of terrestrial materials. Increased flows (e.g., through the Narrows) may affect habitat through the suspension of bed material, which would increase TSS in the water column, erode bed and bank material, scour periphyton, and cover downstream habitat. Decreased flows during the period of back-flooding may affect fish habitat through loss of available habitat area from reductions in channel width, or changes in habitat characteristics and fish passage through changes to flow depth and velocity conditions.

7.4 Preliminary Impact Hypotheses

In consideration of the key pathways of exposure of the aquatic environment to Project-related effects (Section 7.3), the following three impact hypotheses will be tested in the AEMP:

- Nutrient Enrichment Hypothesis: Nutrient Enrichment could occur due to the releases of nutrients (primarily phosphorus and nitrogen, and, for some species, silica, and TDS).
- Toxicological Impairment Hypothesis: Toxicity to aquatic organisms could occur due to the releases of substances of toxicological concern (e.g., metals, TDS).
- Physical Alteration Hypotheses: Construction of the dike in Lac du Sauvage and associated changes in flows and water levels from Project activities may affect fish and fish habitat.

These hypotheses will be evaluated using information generated through monitoring of measurement indicators (Section 7.5).

7.5 Proposed Assessment Endpoints and Measurement Indicators

The terms "*assessment endpoint*" and "*measurement indicator*" are commonly applied in environmental assessments and monitoring programs and provide concise statements of what environmental issues are being examined in a particular assessment or monitoring program.

Assessment endpoints are defined as formal narrative expressions of the actual environmental values to be protected (Suter 1993; Suter et al. 2000). Considerations in the selection of assessment endpoints include ecological relevance, policy goals, future land use, societal values, susceptibility to substances of potential concern, and the ability to define the endpoint in operational terms. At a minimum, assessment endpoints include an ecological component and a property (attribute) of that ecological component to be evaluated. Assessment endpoints are the ultimate properties of the VCs that should be protected or developed for use by future human generations.

Measurement indicators are quantifiable (i.e., measurable) expressions of the aquatic environment that influence the assessment endpoints. They are measures of the potential for adverse ecological effects, and may include measures of exposure (e.g., comparison of chemistry to environmental quality guidelines), as well as measures of effects (e.g., biomass, community composition, toxicity relative to reference condition). The United States Environmental Protection Agency (USEPA 1998) provides guidance on selection of appropriate measurement indicators, including:

- the relationship between measurement and assessment endpoints must be clearly described and scientifically based;
- statistical power and sample size should be considered;
- site-specific species, and community and habitat characteristics should be considered;
- the sensitivity to the stressors and the ability to detect change should be evaluated; and,
- close correspondence between measurement indicators and assessment endpoints is desired.

7.5.1 Endpoints and Indicators Selected for the Aquatic Effects Monitoring Program

The primary objective of the AEMP will be to collect monitoring data to support protection of the VCs of hydrology, water quality, fish, and aquatic life other than fish. Data will be collected to support this objective and to support the assessment of the impact hypotheses (Section 7.4). Assessment endpoints are the properties of the VCs that should be protected or developed for use by future human generations, and measurement endpoints are the quantifiable (i.e., measurable) expressions of the aquatic environment that influence the assessment endpoints.

The proposed assessment endpoints and measurement indicators for the AEMP and the aquatic components that form the VCs are listed in Table 7.5-1. The assessment endpoints are based on maintaining existing aquatic ecosystems, as well as the recovery of a functioning aquatic ecosystem in the diked area of Lac du Sauvage once the dike has been breached and the area has been recolonized post-closure. Measurement indicators are the specific characteristics and variables (i.e., indicators of exposure to mine-related stressors or potential ecological change) that will be measured and analyzed by the AEMP to monitor for changes in the environment.

The AEMP will be designed to detect early warning changes in measurement indicators. Monitoring of small-bodied fish will be proposed as a surrogate to conducting a lethal large-bodied fish program such as the broad-scale monitoring approach (Sandstrom et al. 2009). Environmental impacts should be identified in small-bodied fish before they are detected in top predators such as Lake Trout (Munkittrick 1992). Changes in the early warning measurement indicators will be used to indirectly assess potential Mine-related effects on fish habitat and fish populations. Should the measurement indicators suggest that fish habitat (i.e., water quality, sediment quality), fish food (i.e., lower trophic organisms or small-bodied fish health) have changed by a magnitude or in a direction that could negatively impact fish populations (including abundance), additional monitoring would be initiated through the Response Framework.

DRAFT

Table 7.5-1 Summary of Valued Components, Assessment Endpoints, Key Assessment Attributes, Monitoring Components, and Measurement Indicators for the AEMP

Valued Components	Assessment Endpoints	Key Assessment Attributes	Monitoring Component	Measurement Indicators
• Surface Hydrology • Surface Water Quality	• Maintenance or suitability of surface water quantity and quality for healthy and sustainable aquatic and terrestrial ecosystems • Water quality remains suitable for use as drinking water • Ecological function is maintained • Aquatic life is not impaired	• Flows at the outlet of LDS (Narrows) and at the outlet of LDG (Coppermine River) are within the range natural variation • Water quality in LDS and LDG does not pose a risk to aquatic life, wildlife, and/or humans • Maintenance of sediment chemistry in LDS and LDG to support the benthic invertebrate community • Maintenance of surface water flows and levels to support aquatic ecosystems	Hydrology	• Water flows and stream velocities • Stream channel integrity
			Water quality	• In situ water quality measurements (e.g., DO, pH, conductivity, temperature, Secchi depth, turbidity) • TSS during dewatering • Concentrations of water quality parameters, such as TSS, TDS, metals, nutrients (e.g., ammonia, nitrite, nitrate, TKN and TP) in licenced discharges and surface water
			Sediment quality	• Concentrations of sediment quality parameters, such as metals, and nutrients in surficial sediments
• Arctic Grayling • Lake Trout • Lake Whitefish • Aquatic life other than fish	• Ongoing fisheries productivity • Ongoing support of fisheries productivity • Self-sustaining and ecologically effective fish populations	• Maintenance of a healthy plankton community in in LDS and LDG • Maintenance of a healthy benthic invertebrate community in in LDS and LDG • Maintenance of fish community and fish habitat in LDS and LDG • Lack of diseases or deformities in fish attributable to Mine discharge • Fish tissue quality that does not pose a risk to predatory fish	Lower trophic organisms	• Concentrations of chlorophyll *a* and nutrients • Phytoplankton species composition • Phytoplankton abundance and biomass • Zooplankton species composition • Zooplankton abundance and biomass • Total benthic invertebrate density and biomass • Benthic invertebrate community richness • Benthic invertebrate community composition • Benthic invertebrate community diversity
			Fish health and tissue chemistry	• Small-bodied fish abnormalities (e.g., wounds, tumours, parasites, fin fraying, gill parasites or lesions) • Small-bodied fish tissue chemistry (i.e., concentrations of metals) • Small-bodied fish heath (survival, growth, reproduction, condition)

LDG = Lac de Gras; LDS = Lac du Sauvage; DO = dissolved oxygen; TDS = total dissolved solids; TKN = total Kjeldahl nitrogen; TP = total phosphorus; TSS = total suspended solids

8 STUDY DESIGN

This study design describes the proposed monitoring for the first iteration of the AEMP Design Plan that covers dewatering and the beginning of operations (2016 to 2019). Operations will extend to 2029, and during this period, there will be opportunities to adjust the study design at appropriate intervals following issuance of the Water Licence, and as required by the AEMP Response Framework based on annual results.

Although diamond mines currently do not fall under Metal Mining Effluent Regulations, some aspects of the AEMP design will be consistent with the Metal Mining Environmental Effects Monitoring by Environment Canada (2012). The AEMP design will be also be developed based on guidance provided by the *Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the NWT* (INAC 2009), currently accepted aquatic monitoring practices documented in the scientific literature, and experience gained through AEMPs at other operating diamond mines in the NWT.

The shut-down of the Diavik Mine is currently planned for 2023, and as such, the effluent discharge to Lac de Gras would cease at that time. Minewater discharge from the Misery Pit to Lac du Sauvage is not planned to commence until 2024 or later (Year 5 or later of Jay mining operations). Therefore, there would be no concurrent discharges of mine effluent and no or limited cumulative interaction between the two discharges in Lac de Gras. The approach for monitoring cumulative effects in Lac de Gras, if necessary, will be finalized through engagement with Diavik Diamond Mines Inc.

8.1 Monitoring Components

It is anticipated that the following core components of the AEMP will be monitored during each phase of mine development:

- hydrology;
- water quality;
- sediment quality;
- benthic invertebrate community;
- phytoplankton community;
- zooplankton community; and,
- small-bodied fish (fish health, and fish tissue chemistry).

8.2 Existing Ekati Mine Aquatic Effects Monitoring Program

The Ekati Mine has an existing AEMP to monitor mine-related effects on the aquatic environment. Details of the existing AEMP are in the *Ekati Diamond Mine: Aquatic Effects Monitoring Program Plan for 2013 to 2015* (ERM Rescan 2013) and a summary of the Ekati AEMP design is provided in Table 8.2-1. The kimberlite mined by the Project will be processed at the existing Ekati Mine facilities; thus the Project will extend the life of the Ekati Mine operations and contribute to potential aquatic effects in existing Ekati receiving waters. As a result, no changes are anticipated to the Ekati AEMP, which has been developed and adjusted over a number of years.

The AEMP for the Project will be consistent with the existing Ekati AEMP in terms of monitoring components (i.e., hydrology, water and sediment quality, plankton, benthos, fish health/tissue chemistry). However, because the primary receiving environment for the Project (Lac du Sauvage – large lake) will be different from the those of the existing Ekati Mine operations (series of small lakes which ultimately flow into Lac de Gras or Lac du Sauvage), the sampling designs will be different.

Table 8.2-1 Summary of Existing Ekati Mine Aquatic Effects Monitoring Program Design

Component	Parameters	Frequency
Hydrology (streams)	• manual flow measurements • automated stations • staff gauge measurements • hydraulic geometry surveys	• manual flow measurements: varies during the open-water season (May to September) • automated stations: installation prior to freshet and maintained during manual flow measurements • hydrometric levelling surveys: varies during open-water (May to September)
Water quality (lakes and streams)	• conventional parameters (pH, total alkalinity, hardness, conductivity, total dissolved solids, total suspended solids, and turbidity) • major ions (bicarbonate, carbonate, hydroxide, chloride, potassium, silicon, sulphate, and ion balance) • nutrients (total ammonia, nitrate, nitrite, orthophosphate, total phosphorus, total organic carbon, and total Kjeldahl nitrogen) • total metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, sodium, strontium, uranium, vanadium, and zinc)	• lakes: once per year under ice-cover (April) and once during open-water (August) • streams: varies during open-water (June, July, August, and September)
Limnology (lakes)	• Secchi depth (August) • dissolved oxygen (April and August)	• once during ice-cover (April) and once during open-water (August)
Sediment quality	• moisture content • particle size (percent gravel, sand, silt, and clay) • nutrients (total organic carbon, available phosphorus, and total nitrogen) • total metals (aluminum, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, phosphorus, selenium, silver, uranium, vanadium, and zinc)	• every 3 years
Phytoplankton and zooplankton (lakes)	• chlorophyll *a* • phytoplankton: density, diversity, community composition • zooplankton: biomass, density, diversity, and community composition	• annual (August)
Benthos (lakes and streams)	• density • diversity • community composition	• annual (August)

Table 8.2-1 Summary of Existing Ekati Mine Aquatic Effects Monitoring Program Design

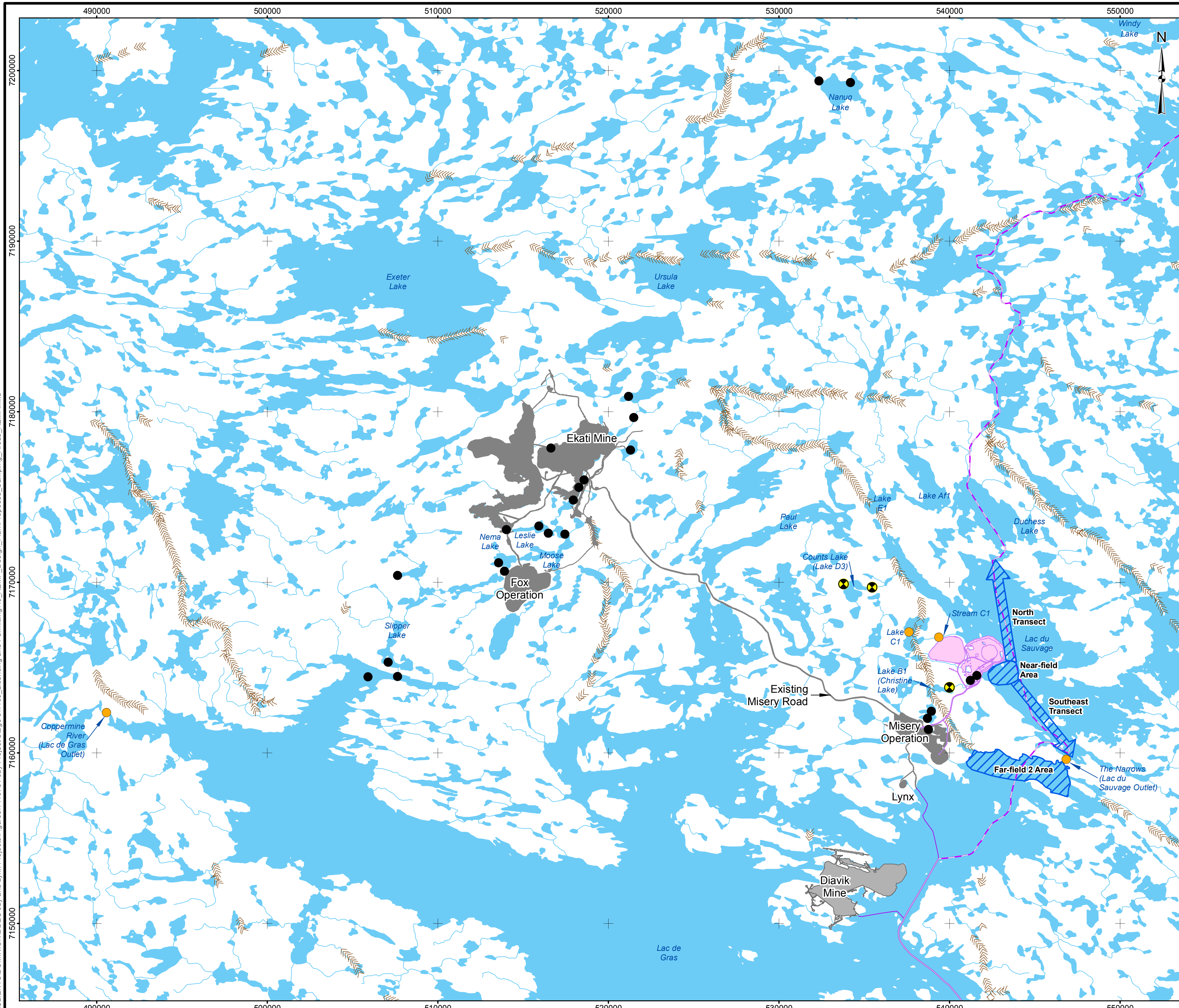
Component	Parameters	Frequency
Fish Health (lakes)	• catch-per-unit-effort (CPUE) • stomach contents • modified deformities, eroded fins, lesions, and tumours (DELT) assessment • parasite prevalence • length, weight, and condition • age • growth rate • sex (mortalities only) • gonad weight (mortalities only) • liver weight (mortalities only • whole body total metal concentrations (slimy sculpin mortalities only) • muscle and liver total metal concentrations (lake trout and round whitefish only) • ethoxyresorufin-O-deethylase (EROD) activity	• every three years for Slimy Sculpin • every six years for Lake Trout and Round Whitefish

Source: ERM Rescan (2013)

8.3 Sampling Areas

The predicted zone of influence during the phases applicable to this iteration of the AEMP Design Plan (i.e., construction and early operations) includes the Project footprint and the Lac de Gras watershed, including Lac du Sauvage, Lac de Gras, and the small lakes and streams located in close proximity to the Project infrastructure. These areas will form the basis of the AEMP and additional monitoring areas may be added to the AEMP to address late operations during future iterations of the AEMP Design Plan as appropriate. This iteration of the AEMP Design Plan will be implemented during construction of the horseshoe dike and dewatering of the diked area of Lac du Sauvage. During early operations, minewater will be stored in the Misery Pit and will not be discharged to Lac du Sauvage until Year 5 under the second iteration of the AEMP Design Plan.

Monitoring will initially be focused in Lac du Sauvage. Monitoring stations will be located at a Near-field (NF) area close to the dike and future location of the diffuser (outside the mixing zone) for all components. Stations will also be located along two transects extending away from the NF area: a transect extending in a northern direction from the NF area (the North [N] Transect), and a transect extending in a south-eastern direction from the NF area towards the Narrows (the Southeast [SE] Transect) (Map 8.3-1). A number of stations will be located along each transect to monitor water quality, sediment quality, plankton, and benthic invertebrates. The objective of sampling along the transects will be to monitor the potential spread of effects within Lac du Sauvage. Monitoring will be conducted at the Narrows (station Ab-S1) by all components (with the exception of plankton and fish), to evaluate potential effects from changes in flows during dewatering/back-flooding and from potential changes in water quality during minewater discharges from the Misery Pit. Monitoring for all components will be conducted in a reference lake that will be selected before implementation of the program (Section 8.3.1), to allow comparisons of temporal trends between Lac du Sauvage (particularly the NF area).



LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ESKER
- WATERCOURSE
- WATERBODY
- EXISTING EKATI AEMP SAMPLING LOCATION
- EXISTING EKATI AEMP SAMPLING LOCATION TO BE INCLUDED IN PROJECT AEMP
- PROPOSED SAMPLING LOCATION
- PROPOSED SAMPLING AREA

DRAFT

NOTE

SPECIFIC STATION LOCATIONS AND NUMBER OF SAMPLING STATIONS WILL BE DETERMINED DURING THE DETAILED AEMP DESIGN PHASE.

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

5 0 5

SCALE 1:225,000 KILOMETRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

PROPOSED SAMPLING AREAS FOR THE JAY PROJECT AQUATIC EFFECTS MONITORING PROGRAM

Golder Associates

PROJECT	1419751.4100.40		FILE No.	
DESIGN	CH	25/05/15	SCALE AS SHOWN	REV 0
GIS	ANK	01/06/15		
CHECK			MAP 8.3-1	
REVIEW				

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\1419751 Jay Project Stage 3\4100_Licencing and Permitting\40_AEMP_Design_Plan\Proposed_Sampling_Areas_AEMP.mxd

Monitoring of stations along the N and SE transects allows adjustments to increase the spatial scale of monitoring. For example, if effects on water quality and aquatic life begin to be observed in the N transect, additional monitoring stations may be added during the AEMP re-evaluation/re-design process to extend monitoring into Duchess Lake. Similarly, effects observed along the SE transect may trigger an extension of the transect to the east towards the Aa basin.

Hydrology monitoring will be conducted at the outlet of Lac du Sauvage (the Narrows) and at the outlet of Lac de Gras (outflow to the Coppermine River) during dewatering. It is anticipated that during the life of the AEMP, monitoring of other components will extend downstream in the east end of Lac de Gras in the Far-field 2 (FF2) area that has been monitored by Diavik. Monitoring in the FF2 area is anticipated to begin one to two years before minewater discharge commences to collect baseline data, and will continue after discharges to Lac du Sauvage begin (i.e., Year 5 of Jay Pit operations). Sampling stations in the FF2 area may include the five original Diavik Mine AEMP stations (i.e., FF2-1 to FF2-5), or new stations may be selected closer to the inflow from Lac du Sauvage. Monitoring in the west end of Lac de Gras (i.e., Slipper Bay) is already being conducted under the current Ekati AEMP; therefore, no changes to this monitoring are proposed under the Project AEMP.

Monitoring in small lakes (i.e., Lake B1 [Christine Lake], Lake C1, and Counts Lake [Lake D4]) and streams (i.e., Stream C1) located close to Project infrastructure will also be considered in the AEMP design plan, as well as the Sub-Basin B Diversion Channel.

8.3.1 Reference Lake Selection

A practicable reference lake will be identified outside the area of influence of the Project. In the Metal Mining Effluent Regulations, a reference area is defined as “water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as is practicable, is most similar to that of the exposure area” (Environment Canada 2012). The Ekati AEMP currently samples three small reference lakes, which are not ideally suited for direct comparisons with the much larger Lac du Sauvage. Larger lakes that are comparable to Lac du Sauvage in siz and position within their drainage system are expected to be more similar to each other in terms of productivity (oligotrophic) and biological communities relative to small lakes, which are subject to greater hydrological variation and a lower degree of connectivity. A single medium- to large- sized reference lake would, therefore, be preferred for the AEMP, and existing differences between Lac du Sauvage and the reference lake will be controlled using appropriate statistical procedures (e.g., before-after control-impact [BACI] design; Underwood 1994).

The focus of reference lake selection will be to seek out a larger lake that is more comparable to Lac du Sauvage than the existing Ekati AEMP reference lakes, and that is practicable to include (i.e., available within a reasonable distance from the Project to allow monitoring using helicopter access). The reference lake will be sought through a desktop analysis, which will include a review of existing Ekati AEMP reference lake data, a literature review of lakes near the Project, and a map-based hydrological analysis of potential reference lakes within the general vicinity of the Ekati Mine. This will include delineation of drainage basins, estimation of lake areas and drainage areas, and descriptions of surficial geology, lake shape, position within the drainage system, and potentially other relevant factors. Input of TK will also be sought during reference lake selection.

8.4 Sampling Design

The proposed sampling to be conducted in each waterbody/watercourse during the first iteration of the AEMP Design Plan (construction and early operations) is identified in Table 8.4-1 and the sampling locations are shown in Map 8.3-1. The specifics of the AEMP design (i.e., frequency of sampling and components sampled) are expected to change over the life of the Project as dictated by changes in potential effects resulting from Project activity.

Frequency and seasonality of sampling will vary by component and Project phase (Table 8.4-2). Hydrology monitoring will be conducted throughout the open-water season, starting with the spring freshet. Water quality in Lac du Sauvage will initially be sampled monthly (three times) through the open-water season to complement the plankton sampling, and once during late ice-cover conditions. Water quality in streams will be sampled once during spring freshet and again during summer. Sediment and benthic invertebrates will be sampled once per year during late summer or early fall, while plankton (phytoplankton and zooplankton) will initially be collected monthly (three times) during the open-water season to assess seasonal variability. If seasonal variability is not observed in the plankton measurement indicators, or a single representative sampling period during the open-water period can be identified, then the sampling frequency for water quality and plankton will be reduced through the AEMP re-assessment/re-design process. The fish component will include a survey for small-bodied fish health and tissue chemistry during late summer or early fall and will be conducted once every three years.

Initially, and during periods of rapid change in water quantity and quality (e.g., dewatering of the diked area in Lac du Sauvage), the monitoring cycle will be annual for all components, but it may be reduced during periods of stable water quality and flows. Frequency of sampling during operations will be evaluated in the Aquatic Effects Re-evaluation Report, which will incorporate the results from the first three years of monitoring (or as specified by the WLWB). Changes to monitoring frequency will require approval by the WLWB through the re-evaluation and re-design process.

Table 8.4-1 Overview of Planned Aquatic Effects Monitoring Under the First Iteration of the Design Plan (2016-2019)

Waterbody/Type	Sampling Area	Hydrology	Water Quality	Plankton	Sediment Quality	Benthic Invertebrates	Fish Health	Fish Tissue Chemistry
Lac du Sauvage	Near-field Area[a]	N	Y	Y	Y	Y	Y	Y
	North Transect[b]	N	Y	Y	Y	Y	N	N
	Southeast Transect[b]	N	Y	Y	Y	Y	N	N
Lac de Gras	Far-field 2 Area[c]	N	Y	Y	Y	Y	Y	Y
Reference Lake	To be selected	Y	Y	Y	Y	Y	Y	Y
Small Lakes[d]	Lake B1 (Christine)	Y	Y	N	Y	N	N	N
	Lake C1	Y	Y	N	Y	N	N	N
	Counts Lake (Lake D3)	N[e]	Y	N	Y	N	N	N
Streams	The Narrows (Lac du Sauvage outlet)	Y	Y	N	Y	Y	N	N
	Coppermine River (Lac de Gras outlet)	Y	N[f]	N	N	N	N	N
	Stream C1[d]	Y	Y	N	N	N	N	N
Sub-Basin B Diversion Channel	Diversion channel[g]	Y	Y	N	N	N	N	N

[a] The North Transect will extend north from the discharge location towards Duchess Lake.

[b] The Southeast Transect will extend southeast from the discharge location to the Narrows.

[c] Sampling locations in the Far-field 2 area may include previous Diavik AEMP stations (i.e., FF2-1 to FF2-5). Sampling in FF2 area will commence 1 to 2 years before minewater discharge to Lac du Sauvage to collect baseline data and continue after discharge begins (i.e., Year 5 of Jay Pit operations).

[d] Small lakes and streams shown are potential monitoring locations only, to be confirmed through the detailed AEMP design process.

[e] Currently monitored by Ekati Mine AEMP.

[f] Currently monitored by Diavik Mine AEMP.

[g] Likely to include surveys of fish movement.

AEMP = Aquatic Effects Monitoring Program; SNP = Surveillance Network Program; Y = yes; N = no.

Table 8-4.2 Overview of Proposed Sampling Frequencies for Aquatic Effects Monitoring Program Components, for the Initial Three Years of Monitoring

Monitoring Component	Annual Frequency	Seasonal Frequency
Hydrology	annual	throughout open-water season
Water quality	annual	Lakes: late winter (April), early spring (July), summer (August), and fall (September) Streams and Sub-Basin B Diversion Channel: freshet and summer (August)
Phytoplankton	annual	early spring (July), summer (August), and fall (September)
Zooplankton	annual	early spring (July), summer (August), and fall (September)
Sediment quality	annual	late summer/early fall (late August to September)
Benthic invertebrates	annual	late summer/early fall (late August to September)
Small-bodied fish health and tissue chemistry	every 3 years	late summer/early fall (late August to September)

8.5 Data Analysis and Interpretation

The primary objectives of the analysis and interpretation of the AEMP data for each component will be to inform the AEMP Response Framework through the Action Levels, and provide input to the overall integration of the results of individual monitoring components. The final study design will be partly dictated by the AEMP Response Framework (yet to be developed for this Design Plan); however, analyses and interpretation of the AEMP data are expected to focus on answering the following key questions:

- Are changes in measurement indicators monitored by the AEMP consistent with predictions in the DAR?
- How do measurement indicators monitored by the AEMP compare to applicable thresholds (e.g. water licence limits, AEMP benchmarks)?
- How do measurement indicators monitored by the AEMP compare to the range of natural variability?
- Are there temporal trends in measurement indicators monitored by the AEMP and are trends consistent with the reference lake?
- Are there spatial and seasonal patterns in measurement indicators monitored by the AEMP?

Each monitoring component will follow a consistent study design and will consider seasonality (e.g. ice-cover and open-water periods) in the measurement indicators. A range of natural variability will be defined for each measurement indicator using methods of defining a normal range (e.g., Kilgour et al. 1998; Barrett et al. 2015) specific to each lake sampling area or stream. The range of natural variability will be defined using 2013 and 2014 baseline data and any other available data. Data collected after the AEMP has been initiated, but before minewater discharge has begun may be considered as supplementary baseline data for estimates of the range of natural variability.

Comparisons to DAR predictions, applicable thresholds, and range of natural variability will be conducted using time series plots and tables. Statistical comparisons among/within lakes and streams will be conducted using one of three study designs:

- BACI design (NF area, FF2 area, and reference lake);
- gradient design (N and SE transects in Lac du Sauvage); and,
- before-after design (Coppermine River, small lakes, streams).

Changes in the NF area of Lac du Sauvage and FF2 area of Lac de Gras will be assessed relative to the reference lake and relative to baseline data using an appropriate statistical design (e.g., BACI design).

An evaluation of trends at the N and SE transects will be conducted visually using scatterplots of each measurement indicator against the distance from the diffuser. Spatial trends along the transects will be assessed using a regression of each measurement indicators on distance from the diffuser. Temporal trends along the N and SE transects will be assessed using analysis of covariance (comparing the slopes and intercepts of the regressions over time). Temporal trends in Lac du Sauvage at the transect sampling stations will also be compared to trends observed at the reference lake using an appropriate statistical design (e.g., BACI design).

Changes in flows at the Coppermine River and the Narrows, and changes in the small lakes and streams will be assessed using comparisons to baseline. Temporal trends will be evaluated visually using time series plots and statistically (e.g., using Mann-Kendall tests) once sufficient data have been collected.

The results of the AEMP will be reported for each monitoring component as required to assess the Action Levels of the Response Framework. The results will also be combined in a separate section of the AEMP annual report to integrate the results of the individual monitoring components. This procedure will be used to assess the overall support for the impact hypotheses.

8.6 Quality Assurance and Quality Control

Quality assurance (QA) refers to plans or programs encompassing internal and external management and technical practices designed to ensure that data of known quality are collected, and that such collections match the intended use of those data (Environment Canada 2012). Quality control (QC) is an internal aspect of quality assurance. It includes the techniques used to measure and assess data quality and the remedial actions to be taken when QC assessment criteria are not met. The QA/QC procedures ensure that field sampling, laboratory analyses, data entry, data analysis, and report preparation produce technically sound and scientifically defensible results.

The QA/QC procedures for the AEMP will apply to the following program components:

- field program (e.g., staff training, procedures and responsibilities; standard operating procedures [SOPs], technical procedures, and specific work instructions to field crews);
- sample collection (e.g., equipment calibration and cleaning; avoidance of cross contamination; duplicate samples; field, travel, and equipment blanks);

- documentation (e.g., field logs, labelling; chain of custody);
- sample handling and shipping;
- sample analysis (e.g., equipment calibration and cleaning; avoidance of cross contamination; duplicate samples; field, travel, and equipment blanks; detection limits; analytical spikes);
- assessment of data quality and decision rules for acceptance/rejection;
- data entry, manipulations, and analyses; and,
- report preparation.

8.7 Integration with Additional Monitoring Programs

The AEMP will be one program of many environmental monitoring programs associated with the Project (Section 1 of the DAR). Relevant data from the SNP and other programs will be incorporated into the interpretation of the AEMP. Specifically, effluent quality and loading, air quality, and WRSA seepage monitoring will be considered in the AEMP in determining the potential effects of the Project on the aquatic receiving environment.

The SNP is a compliance monitoring program required by the Water Licence, with defined sampling stations, frequency, and monitoring parameters. It is anticipated that the current Ekati SNP will be expanded to incorporate the Jay Project as part of the Water Licence issuance process following completion of the EA process. In general, the SNP will involve collecting water quality and other environmental data related to minewater and final effluent released to the receiving environment. As part of the SNP, water quality will be monitored in the open pit, kimberlite containment areas, final effluent, and the mixing zone boundary in Lac du Sauvage to assess compliance with the discharge criteria set out in the Water Licence. The SNP data will be reported monthly, and an annual summary will be provided annually to the WLWB.

Consistent with the existing Ekati Mine AEMP the AEMP for the Project will involve the integration of data from the SNP. Applicable SNP data will be used by the AEMP components to aid in the interpretation of component-specific data. For example, data collected from the SNP monitoring stations at end-of-pipe and near the diffuser within Lac du Sauvage, as applicable, will be integrated into the analysis of the AEMP results. Monitoring at these stations will provide hydrology, water quality (including toxicity), and sediment quality data that will be useful to evaluate the near-field influence of the discharge. Relevant SNP data used for these purposes will be summarized in the AEMP. During interpretation of AEMP results, results of the Air Quality and Emissions Monitoring and Management Plan will also be evaluated in terms of potential effects of dust deposition on surface water quality.

9 AQUATIC EFFECTS MONITORING PROGRAM RESPONSE FRAMEWORK

The Water Licence requires an adaptive management component to be included in the AEMP. The Ekati Aquatic Response Framework (ERM Rescan 2014) is currently being finalized and has been developed to meet the requirements of the existing Water Licence issued by the WLWB (W2012L2-0001), with guidance from the *Guidelines for Adaptive Response Framework for Aquatic Effects Monitoring - Draft* (WLWB 2010). It is anticipated that the Ekati Response Framework will be expanded to incorporate the Jay Project. A summary of concepts related to the anticipated AEMP Response Framework is provided below.

The WLWB defines a Response Framework as "*a systematic approach to responding when the results of a monitoring program indicate that an action level has been reached*" (WLWB 2010). The goal of the Response Framework is to systematically respond to monitoring results such that the potential for significant adverse effects is identified, and mitigation actions are undertaken and confirmed effective to prevent such effects from occurring. This is accomplished by implementing appropriate mitigation at predefined "Action Levels", which are triggered before a significant adverse effect could occur. A level of change that, if exceeded, would result in a significant adverse effect, is termed a "Significance Threshold".

Significance Thresholds are the levels of change in monitored components of the aquatic ecosystem that, if exceeded, would result in significant adverse effects to the environment. Significance Thresholds define the "no-go zone" for the Project, such that management actions and adaptive management are used to prevent a Significance Threshold from being reached. Significance Thresholds are anticipated to be defined as the AEMP and the Response Framework are further developed, and are expected to take the form of narrative statements related to uses of water and fish in the AEMP study area (e.g., water not drinkable).

The WLWB defines an Action Level as "*a predetermined change, to a monitored parameter or other qualitative or quantitative measure, that requires the Licensee to take appropriate actions…*". In a Response Framework, action levels are set to trigger management actions to ensure that Project-related effects on the aquatic receiving environment remain within an acceptable range, or are otherwise minimized to the extent practical. Action Levels range from Low, Medium, and High, with each new level initiating a new set of management actions. Consistent with guidance from WLWB (2010), the initial Response Framework will include definitions of Low Action Levels only. Once a Low Action Level is triggered by AEMP results, Medium and High Action Levels will be defined for the affected monitoring component and measurement indicators in the AEMP Response Plan that is prepared when a Low Action Level has been reached. Low Action Levels will be developed for each Impact Hypothesis (toxicological impairment, nutrient enrichment, and physical habitat alteration), for relevant measurement indicators.

The AEMP Response Framework will develop suggested types of actions (e.g., mitigation, design changes) to be taken if an action level is exceeded. It is anticipated that when reaching an action level, the following AEMP "Best Practices" will be followed when interpreting the AEMP findings:

- confirm cause/linkage to Project;
- examine trends;

- predict trends, where appropriate;
- examine evidence for strength of linkage between exposure, toxicity, and field biological responses;
- examine ecological significance; and,
- confirm that existing benchmarks are appropriate, and revise if warranted.

If an action level is exceeded, a WLWB-approved AEMP Response Plan will be implemented, which may include additional monitoring and possibly management responses (e.g., changes to mitigation), as appropriate. Exact responses detailed in a Response Plan will depend on the component affected, the likely cause of the effect, and the type and magnitude of effect.

10 SPECIAL STUDIES

Special studies are not core components of the AEMP, but rather include research activities that support effects monitoring by AEMP components. These studies may be initiated on an “as needed” basis to address potential data gaps, investigate new sampling and analytical methods, and potentially other topics that require study to support effects monitoring or to integrate TK.

No special studies have been identified at this time. These studies may be identified based on ongoing engagement and initial findings of the AEMP, and would be completed during the implementation of the AEMP.

11 AQUATIC EFFECTS MONITORING PROGRAM REPORTING

11.1 Overview

Reporting for the AEMP involves four types of documents: AEMP Design Plans, AEMP Annual Reports, Aquatic Effects Re-evaluation Reports, and AEMP Response Plans. These various documents represent different chronological events over the AEMP life. First, the AEMP Design Plan, as represented at a conceptual level by this document, is generated to describe how aquatic effects monitoring for the initial phase of the Project will take place; this document is typically updated over the life of the Project to incorporate different phases of the Project and lessons learned from the earlier monitoring results. Next, monitoring is summarized yearly in the Annual Report. After three years of data have been collected (or as specified by the WLWB), an Aquatic Effects Re-evaluation Report is prepared. If, along the way, impacts to the aquatic environment are identified (e.g., if a pre-defined action level is triggered), then an AEMP Response Plan is generated.

To report monitoring results in a timely manner, following each AEMP sampling period, Dominion Diamond will submit a notification letter to the WLWB indicating whether or not an action level has been exceeded for chemical parameters and field-measured biological variables, as outlined in the Water Licence. The analysis of biological community data (i.e., enumerating and identifying the phytoplankton, zooplankton, and benthic invertebrates) has a lengthy turnaround time; therefore, evaluation of potential action level exceedances for biological variables will be provided in the AEMP Annual Report.

Further details on reporting requirements are provided in the sub-sections below.

11.2 Aquatic Effects Monitoring Program Design Plan

Once the AEMP Design Plan for the Project is finalized and approved during the water licencing process, subsequent updates will be generated at regular intervals over the life of the Project. Updates will be take into account annual AEMP results and the evolution of the Project over time, and incorporate adaptive management considerations, when appropriate. When updates are made to the AEMP Design Plan, a summary of changes to the AEMP design since the last approved design will be included in the revised plan, together with a rationale for the changes.

The AEMP Design will be updated approximately every four years from the date the Water Licence is issued. The timing of these updates will follow the preparation of the Aquatic Effects Re-evaluation Report which is prepared after three years of data collection (or as specified by the WLWB) and provides feedback on improvements to the AEMP based on past experience.

11.3 Annual Report

Monitoring results of the AEMP will be presented yearly in the Annual AEMP Report for at least the first three years of the AEMP. The Annual AEMP Report will summarize the data collected in the preceding calendar year and will follow the requirements identified in the Water Licence. If a special study is initiated, its results will be presented in the annual report. Results of individual monitoring components will be integrated in an overall analysis, which will evaluate the strength of evidence for Mine-related effects for each impact hypothesis. Summaries of the results from TK monitoring programs and Special Studies will also be included in the AEMP reports, as they become available.

11.4 Aquatic Effects Re-Evaluation Report

After three years of monitoring (or as specified by the WLWB), an additional AEMP report, referred to as the Aquatic Effects Re-evaluation Report, will be produced and submitted to the WLWB. The purpose of the first re-evaluation report will be to analyze the results of the initial three years of monitoring and compare the actual effects of the Project to date with predicted effects.

The objectives of the Aquatic Effects Re-evaluation Report will be to:

- describe the Project-related effects on the aquatic receiving environment as measured from Project inception and compared against predictions made in the DAR;
- revise predictions of Project-related effects on the aquatic receiving environment based on monitoring results obtained since Project inception; and,
- provide supporting evidence, if necessary, for proposed revisions to the AEMP Design Plan.

An Aquatic Effects Re-evaluation Report will continue to be submitted every three years (or as specified by the WLWB), and will present trends from baseline to current conditions. The content of the Re-evaluation Report will follow the requirements in the Water Licence.

It is anticipated an updated AEMP Design Plan will be developed based on the re-evaluation, as a requirement of the Water Licence. The design of the AEMP is expected to be reviewed every three years (or as specified by the WLWB) through the WLWB public review process.

11.5 AEMP Response Plan

When an action level is triggered based on data collected from the AEMP, Dominion Diamond will notify the WLWB and an AEMP Response Plan will be generated. The Response Plan will be submitted to the WLWB for approval based on the timeline provided in the Response Framework. The Response Framework for the Ekati Mine (ERM Rescan 2014) provides details of AEMP Response Plan development and implementation.

12 REFERENCES

Barrett TJ, Hille KA, Sharpe RL, Harris KM, Machtans HM, Chapman PM. 2015. Quantifying natural variability as a method to detect environmental change: definitions of the normal range for a single observation and the mean of m observations. Environ Toxicol Chem 34: 1185-1195.

BHP Billiton (BHP Billiton Canada Inc.). 2011. Ekati Diamond Mine, Environmental Agreement and Water Licences Annual Report 2010. April 2011.

De Beers (De Beers Canada Inc.). 2013. 2013 Aquatics Effects Monitoring Program Design Plan in Support of Water Licence (MV2011L2-0004), Snap Lake Project. Snap Lake Project. Submitted to the Mackenzie Valley Land and Water Board. Yellowknife, NWT, Canada.

Dominion Diamond (Dominion Diamond Ekati Corporation). 2015. Developer's Assessment Report Information Request Responses for the Jay Project. Prepared by Golder Associates Ltd., January 2015. Yellowknife, NWT, Canada.

Dominion Diamond. 2014. Developer's Assessment Report for the Jay Project. Prepared by Golder Associates Ltd., October 2014. Yellowknife, NWT, Canada.

Environment Canada. 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring (EEM). National EEM Office, Ottawa, ON, Canada.

ERM Rescan (ERM Rescan Environmental Services Ltd). 2013. Ekati Diamond Mine: Aquatic Effects Monitoring Program Plan for 2013 to 2015. Prepared for Dominion Diamond Ekati Corporation by Rescan Environmental Services Ltd: Yellowknife, NWT, Canada.

ERM Rescan. 2014. Ekati Diamond Mine: Aquatic Response Framework. Prepared for Dominion Diamond Ekati Corporation by ERM Rescan: Yellowknife, NWT, Canada.

Golder (Golder Associates Ltd.). 2014. Diavik Diamond Mines Inc. – Aquatic Effects Monitoring Program – Study Design Version 3.5. Prepared for Diavik Diamond Mines (2012) Inc. (DDMI). Yellowknife, NWT, Canada. May 2014.

Kilgour BW, Somers KM, Matthews DE. 1998. Using the normal range as a criterion for ecological significance in environmental monitoring and assessment. Ecoscience 5:542–550.

INAC (Indian and Northern Affairs Canada). 2009. Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the NWT. Prepared by MacDonald Environmental Sciences Ltd., Zajdlik & Associates Inc. and Indian and Northern Affairs Canada, Yellowknife, NWT, Version 1.0, June 2009.

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2014. Draft Terms of Reference for the Dominion Diamond Ekati Corporation Jay-Cardinal Project. February 21, 2014. EA1314-01. Yellowknife, NWT, Canada.

Munkittrick KR. 1992. A review and evaluation of study design considerations for site-specifically assessing the health of fish populations. J Aquat Eco Health 1: 283-293.

Sandstrom S, Rawson M, Lester N. 2009. Manual of Instructions for Broad-scale Fish Community Monitoring; Using Large Mesh Gillnets and Small Mesh Gillnets. Ontario Ministry of Natural Resources. Peterborough, ON, Canada.

Suter GW. 1993. Ecological Risk Assessment. Chelsea, MI; Lewis Publishers.

Suter GW, Efroymson RA, Sample BE, Jones DS. 2000. Ecological Risk Assessment for Contaminated Sites. Lewis Publishers, New York, NY, USA.

Underwood AJ. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecological Applications 4: 3-15.

WLWB (Wek'èezhìi Land and Water Board). 2010. Guidelines for Adaptive Management – A Response Framework for Aquatic Effects Monitoring - Draft. Yellowknife, NWT, Canada.

WLWB. 2014. Wek'èezhìi Land and Water Board Water License #W2012L2-0001. Yellowknife, NWT, Canada.

USEPA (United States Environmental Protection Agency). 1998. Guidelines for Ecological Risk Assessment. Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC, USA. EPA/630/R-95/002F. April 1998.

13 GLOSSARY

Term	Definition
Action level	A predetermined qualitative or quantitative trigger which, if exceeded, requires the Licensee to take appropriate actions including, but not limited to: further investigations, changes to operations, or enhanced mitigation measures and reporting of same.
Adaptive management	The exact definition of adaptive management varies among monitoring programs, but typically adheres to having four themes as follows (WLWB 2010): • learning in order to reduce management uncertainties; • using what is learned to change policy and practice; • focusing on improving management; and, • doing the above in a formal, structured and systematic way.
Adaptive Management Plan	A structured, pre-defined response strategy to changes in regulatory, environmental or operational conditions.
Aquatic Effects Monitoring Program (AEMP)	A monitoring program designed to determine the short- and long-term effects in the Receiving Environment resulting from the Project; to evaluate the accuracy of impact predictions; to assess the effectiveness of planned impact mitigation measures; and to identify additional impact mitigation measures to reduce or eliminate environmental effects.
Assessment endpoint	General statement about what is being protected (e.g., suitability of water quality to support a health aquatic ecosystem) through the operation of the Project, and into the future after the Project has closed down.
Cumulative effects	Those effects that result from a combination of the Project with other past, present, and reasonably foreseeable future developments.
Developer's Assessment Report (DAR)	A stand-alone report that describes the development, the environmental setting, predicts impacts and proposes mitigations. The report is submitted to the MVEIRB for the purpose of an environmental assessment.
Dissolved oxygen (DO)	The amount of free oxygen dissolved in water, usually expressed in milligrams per litre (mg/L), parts per million (ppm), or percent saturation (%Sat). Adequate concentrations of DO are necessary for fish and other aquatic organisms.
Dewatering	Removal of water from a natural waterbody by pumping or draining.
Dike	A long wall or embankment built to prevent flooding.
Discharge	the direct or indirect release of any Water or Waste to the Receiving Environment.
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 assessment, the ecosystem must be defined according to a particular unit and scale.
Fine processed kimberlite	Fine processed kimberlite material with a particle size that smaller than 0.25 mm.
Fish-out	Activity conducted to remove fish from an area resulting in the direct mortality of fish.
Habitat	The physical location or type of environment in which an organism or biological population lives or occurs.
Hydrology	The science that deals with the Earth's water, specifically its movement in relation to land.
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.
Management plan	Describes management actions, objectives, roles and responsibilities, monitoring, and guidelines for specific Project components. Examples include the Surface Water and Effluent Management Plan, Wildlife and Wildlife Habitat Protection Plan, and various Waste Management Plans.
Management Response Plan	Describes the scope of management responses to environmental changes, as well as the mitigation actions in response to an action level being reached. Documents planning, investigation and results; identifies mitigation that must be taken or changes in operations that need to occur to address the effects identified in the annual monitoring reports; and, details investigation as to the source of the environmental change.

Term	Definition
Measurement indicator	Quantifiable measures associated with specific components that have an influence on the assessment endpoints. Used to assess the significance of impacts to Valued Components by linking residual changes in these measures (e.g., chemical concentrations) through comparison with thresholds.
Mitigation	A measure to control, reduce, eliminate, or avoid an adverse environmental impact.
Monitoring components	A term used to broadly describe the aspect of the environment and population that may be impacted and monitored.
Nutrients	Environmental substances (elements or compounds) such as nitrogen or phosphorus, which are necessary for the growth and development of plants and animals.
Open-water season	Summer season when lakes, rivers and streams are free of ice (generally June or July to October).
Overburden	Materials of any nature, consolidated or unconsolidated, that overlie a deposit of useful materials. In the present situation, overburden refers to the soil and rock strata that overlie kimberlite deposits.
Phytoplankton	Small, usually microscopic, plants that live in the water column of lakes and make their food through primary production.
Plankton	Microscopic aquatic organisms (tiny plants [phytoplankton] and animals [zooplankton]) free-floating and suspended in the water column.
Processed kimberlite	The material that remains after all economically and technically recoverable diamonds have been removed from the kimberlite during processing.
Processing plant	The Ekati processing plant located at the Ekati main camp is where the physical processing occurs to get the diamonds from the kimberlite.
Residual effects	Effects that remain after mitigation has been applied.
Response framework	A systematic structure to responding when results of monitoring of specific components indicate that an action level has been reached.
Response plan	A part of the Response Framework that describes the specific actions to be taken by the Licensee in response to reaching or exceeding an Action Level.
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.
Significance threshold	High level narrative statement that bounds the magnitude of change within a specific component, which if reached, would result in significant adverse environmental effects. It is linked to the Assessment Endpoints identified in the Environmental Impact Statement, and clearly states the absolute “no-go zone” for change as a result of the Project.
Seepage	Slow water movement in the subsurface. Flow of water from constructed retaining structures. A spot or zone, where water oozes from the ground, often forming a small spring.
Surveillance Network Program (SNP)	The Surveillance Network Program is a compliance monitoring program required by the Water Licence, with defined sampling stations, frequency, and monitoring parameters.
Terms of Reference (TOR)	The Terms of Reference identify the information required by government agencies for an Environmental Assessment.
Total dissolved solids	The total concentration of all dissolved compounds solids found in a water sample. See filterable residue.
Total Kjeldahl nitrogen	The sum of all organic nitrogen, ammonia (NH_3), and ammonium (NH_4), but excluding nitrate and nitrite.
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 (TK)	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. Knowledge and understanding of traditional resource and land use, harvesting and special places.

Term	Definition
Valued Component (VC)	Represent physical, biological, cultural, and economic properties of the social-ecological system that are considered to be important by society.
Water quality benchmark	For the purposes of Aquatic Response Framework, the term water quality benchmark encompasses water quality guidelines (e.g., Canadian Council of Ministers of the Environment guidelines, provincial guidelines or guidelines from the published literature) and site-specific water quality objectives for the Ekati Diamond Mine. Water quality that meets water quality benchmarks is safe for its identified uses.
Waterbody	An area of water such as a river, stream, lake or sea.
Watercourse	Riverine systems such as creeks, brooks, streams and rivers.
Zooplankton	Small, sometimes microscopic, animals that live in the water column of lakes and mainly eat primary producers (phytoplankton).