October 9, 2015

Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
P.O. Box 938
Yellowknife, NT
X1A 2N7

Attention: Chuck Hubert, Senior Environmental Assessment Officer

Re: EA1314 - 01 Jay Project, Dominion Diamond Corporation Developer's Assessment Report – Responses to Jay Project Hearing Undertakings

Dear Mr. Hubert:

Accompanying this letter, Dominion Diamond is pleased to submit responses to the undertakings received following Jay Project Hearings, held September 14 to September, 21 2015 in Yellowknife, Behchokǫ̀, Lutsel K'e, and Kugluktuk.

The responses included with this submission correspond to the undertakings that were addressed to Dominion Diamond, comprising the following:

- responses to the undertaking requests posted to the public registry by the Mackenzie Valley Environmental Impact Review Board (MVEIRB) on September 14, 16, and 17 following Jay Project Hearings (document code identifiers DAR-MVEIRB-UT2-01 to DAR-MVEIRB-UT2-15). Note, undertakings 3, 4, 9, 10, and 15 were addressed to other parties, and as such, responses are not provided.

- response to MVEIRB's September 29, 2015, letter with an additional information request in relation to cumulative water quality effects to Lac de Gras from mine water discharge. To address this request, Dominion Diamond is providing the attached technical memorandum titled 'Jay Project Alternative Discharge Water Quality Model', in response to this letter.

Undertaking #2 (DAR-MVEIRB-UT2-2; greenhouse gas emissions) was previously submitted to the Review Board public registry on September 14, 2015.

We hope this submission provides clarity and addresses the remaining concerns that all parties may have regarding the Jay Project.

Once again, we would like to thank the MVEIRB and all parties for the thoughtful review of the Jay Project Developer's Assessment Report and their participation in the review process.

Regards,

Richard Bargery
Manager, Permitting Jay Project
Dominion Diamond Corporation

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DOMINION DIAMOND

Undertaking Number: DAR-MVEIRB-UT2-01

Source: Undertaking from Day 1 (Sept 14) of the Public Hearings

Subject: Socio-economics

DAR Section(s): 14

Request:

DDEC is to review their assessment of socio-economic issues and whether they assess the relation of gender employment disparity (and wage gap as a pathway) to negative trends in social well-being indicators.

Response:

Income disparity can increase vulnerability to poverty and associated social issues such as access to housing, proper nutrition, and further education. The Developer's Assessment Report (DAR) considered the Jay Project's ability to influence income disparity, while the responses to information requests DAR-MVEIRB-IR-072, DAR-NSMA-IR-29, and DAR-NSMA-IR2-01 provide further discussion of gendered income disparity as related to employment, and the strategies that Dominion Diamond has put in place to address this issue.

DAR-MVEIRB-IR-072 provides additional information related to the issue of income inequality in the Northwest Territories and Impact Benefit Agreement (IBA) communities. While it is difficult for one proponent to address the issue of income inequality in the North, Dominion Diamond is committed to providing income-generating employment opportunities to Northerners through the implementation of IBAs and programs aimed at increasing the employment of Northern candidates.

DAR-NSMA-IR-29 outlines the barriers to the training, recruitment, and employment of women in the mining industry. As outlined in this information request, Dominion Diamond monitors the level of female labour force content at the Ekati Mine, as well as the prevalence of women in non-traditional roles. Also, as noted in DAR-NSMA-IR2-01, Dominion Diamond has undertaken activities to try to minimize the barriers to the training and employment of women, where possible. These activities include: the introduction of scholarships that are earmarked specifically for women; reviewing and adjusting rotation schedules on a case-by-case basis; ensuring a workplace free of harassment and discrimination and providing programs that ensure a work environment welcoming to females; ensuring that our recruitment policy clearly outlines the priority hiring consideration of females both in traditional and non-traditional roles; and that we continue to work closely with external organizations that focus on improving the training, development, and employment of females in industry. In addition to these initiatives as noted in DAR-NSMA-IR2-01, Dominion Diamond also evaluates its programs aimed at improving the training and recruitment of women in the North, and will continue to adapt programs in response to feedback from female employees and community members interested in a career in mining.

With respect to the concern specifically around the potential for gender-wage gaps, Dominion Diamond reviews the company's compensation structure on a regular basis, including a review of "similar pay, for similar work" principles, in order to ensure that pay-equity issues are prevented.

Undertaking Number: DAR-MVEIRB-UT2-05

Source: Undertaking from Day 1 (Sept 14) of the Public Hearings

Subject: Air Quality

DAR Section(s): 7

Request:

DDEC is undertaking to meet with GNWT within the undertaking period to reach an understanding as to what is an appropriate time frame for reporting stack testing results. Dominion will report back to all parties on the outcomes of the discussion.

Response:

Dominion Diamond met with Government of Northwest Territories (GNWT) on September 22, 2015 to discuss appropriate timeframes for reporting incinerator stack testing reporting and follow-up incinerator re-testing. Personnel in attendance are shown in Table 5-1.

Table 5-1: Personnel in Attendance at September 22, 2015 Meeting on Incinerator Stack Testing

Name	Position	Organization
Rick Bargery	Manager Jay Permitting	Dominion Diamond
Claudine Lee	Superintendent Environment	Dominion Diamond
Dustin Chaffee	Environment Advisor Compliance	Dominion Diamond
Aileen Stevens	Air Quality Programs Coordinator for ENR	GNWT

GNWT = Government of Northwest Territories; ENR = Environment and Natural Resources (for the GNWT).

In GNWT's Technical Report (GNWT 2015), the following measures were proposed:

- Dominion Diamond must submit any waste incinerator stack test results to Government of Northwest Territories Environment and Natural Resources (ENR) and Environment Canada (EC) within 45 days of completing a stack test.
- In the event of a failed stack test, Dominion Diamond must develop and submit to ENR and EC an Adaptive Management Response Plan (AMRP) within 90 days of the failed stack test. The AMRP should contain an assessment of the incinerator operations and management that would have contributed to the failed stack test, and methods to improve/rectify them. Dominion Diamond should implement these methods immediately upon submission of the AMRP.
- Dominion Diamond will re-stack test the incinerators within 6 months of the initial failed stack test. The second stack test will verify the effectiveness of the adaptive management response measures and compliance to the Canada-Wide Standards (CWS). All stack tests must be conducted in accordance with national standards, and include detailed documentation to demonstrate that

representative composition and batch size of waste were used during the testing process. Exemptions for the second stack test may occur based on a review conducted by ENR, in consultation with EC.

Dominion Diamond provided the following response:

- The incinerator stack test results will be submitted to ENR and EC within 45 days of receipt of the results from the contracted testing laboratory, unless events beyond Dominion Diamond's control prevent it.
- In the event of a failed stack test, Dominion Diamond will develop and submit to ENR and EC an AMRP within 90 days of the receipt of the results indicating a failed stack test. The AMRP will contain an assessment of the incinerator operations and management likely to have contributed to the failed stack test, and a plan for further investigation or direct rectification of an identified source. Dominion Diamond will implement the AMRP immediately upon submission.
- In the event of a failed stack test, Dominion Diamond will complete a follow-up stack test at a frequency determined to be appropriate through the AMRP until the test is passed. The stack tests will verify the effectiveness of the adaptive management response measures and compliance to the CWS. All stack tests will be conducted in accordance with national standards, and will include detailed documentation to demonstrate that representative composition and batch size of waste were used during the testing process.

During the meeting, GNWT expressed the position that the timing should be linked back to the occurred testing, not the receipt of samples and their belief that if adaptive management is not carried out in a timely fashion, a significant adverse impact may occur.

Dominion Diamond agreed in principle to the reporting requirement but expressed concern that setting a timeline of 60 days from sampling was not logistically possible due to the challenges of sampling at a remote mine and shipping offsite and to an accredited laboratory. Setting a 60 day reporting requirement would mean that Dominion Diamond would not be able to meet the reporting requirement before results were received and reviewed.

To meet both the position of GNWT and to allow for the appropriate timely reporting considering logistical challenges with sampling at a mine in the North, Dominion Diamond and GNWT agreed on the following wording for the reporting of incinerator stack testing results:

- Dominion Diamond must submit any waste incinerator stack test results to ENR and EC no more than 90 days after completing a stack test.

Following the reporting timeline agreed to above, Dominion Diamond and GNWT agreed to the following wording for the development of the AMRP:

- In the event of a failed stack test, Dominion Diamond must develop and submit to ENR and EC an AMRP no more than 120 days after the failed stack test. The AMRP should contain an assessment of the incinerator operations and management that would have contributed to the failed stack test, and

methods to improve/rectify them. Dominion Diamond should implement these methods immediately upon submission of the AMRP.

In regards to the requirement to re-test the incinerators 6 months from a failed stack test, GNWT re-iterated the position that this is an important step to test the AMRP.

Dominion Diamond believes that the schedule for stack testing needs to be linked to the AMRP but has agreed to the measure proposed by GNWT, with the addition of the bolded section below. This bolded wording is taken from the GNWT Technical Report (pages 13-14; GNWT 2015).

- Dominion Diamond will re-stack test the incinerators within 6 months of the initial failed stack test. The second stack test will verify the effectiveness of the adaptive management response measures and compliance to the CWS. All stack tests must be conducted in accordance with national standards, and include detailed documentation to demonstrate that representative composition and batch size of waste were used during the testing process. Exemptions for the second stack test may occur based on a review conducted by ENR, in consultation with EC. ***Exemptions for conducting a second stack test could occur based on factors such as the degree of the original exceedance over the CWS, the confidence from the developer and GNWT/EC in having properly identified and addressed the cause(s) of the exceedance, and the availability of any other indicators to demonstrate the issue(s) has been rectified.***

Dominion Diamond believes that this addition allows for proper consideration of the exceedance and would be included and considered in the AMRP when submitted to ENR and EC.

References:

GNWT (Government of the Northwest Territories). 2015. Technical Report, Jay Project, EA1314-01. Submitted to the Mackenzie Valley Environmental Impact Review Board, July 2015. Yellowknife, NWT, Canada.

DOMINION DIAMOND

Undertaking Number: DAR-MVEIRB-UT2-06

Source: Undertaking from Day 2 (Sept 15) of the Public Hearings

Subject: Caribou Mitigation Measures

DAR Section(s): 12

Request:

Will meet with parties during the undertaking period to identify and evaluate additional compensatory mitigation measures that will improve the health of the Bathurst herd. DDEC will solicit input from GNWT to ensure that they are in agreement with the mitigation measures. DDEC and other parties will provide a joint summary of these meetings. DDEC will also report on any actions that may be taken as a result of these meetings.

Response:

Dominion Diamond met with the Parties on October 1, 2015 to identify and evaluate additional compensatory mitigation measures that will improve the health of the Bathurst herd. The minutes of that meeting were provided to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) on October 9, 2015 for posting on the public registry.

In its response to recommendations in the Technical Reports from the Independent Environmental Monitoring Agency (IEMA), Łutsel K'e Dene First Nation (LKDFN), North Slave Métis Alliance (NSMA), Tłı̨chǫ Government, and Yellowknives Dene First Nation (YKDFN), Dominion Diamond advised that the Jay Project (Project) will use mitigation to avoid, minimize, and reclaim adverse effects associated with the effects pathways. As a result, the Technical Report responses (IEMA-5, LKDFN-3, NSMA-9, Tłı̨chǫ-7, and YKDFN-2) indicated that there are no significant adverse effects from the Project, and no offset mitigation was being proposed.

The residual effects from the Project are expected to contribute little to the cumulative effects on barren-ground caribou energy loss, calf production, and survival. The incremental decrease in fecundity from the Project is predicted to be 0.3 percent (%), before applying actions in the Caribou Road Mitigation Plan (CRMP) (Section 12.4.2.3.2 of the Developer's Assessment Report [DAR]). The cumulative effects analysis shows that natural factors (such as population cycles and insect harassment) remain the determining factors in caribou energetics, abundance and distribution.

Direct habitat loss from the residual physical footprint of the Project (e.g., waste rock storage area [WRSA]) is less than 0.1% of the seasonal ranges of the Bathurst herd. Physical disturbance from previous and existing developments has had little, if any, ecologically measurable influence on the carrying capacity of the seasonal ranges (less than 2% cumulative direct habitat loss).

The population modelling completed for Adequacy Review response DAR-MVEIRB-15 (Adequacy Review Item 8.8) demonstrates that the Bathurst herd's ability to increase is dependent on caribou vital rates and is not prevented by cumulative effects of development disturbance. Importantly, all of the analyses used a precautionary approach to predict maximum effects and manage uncertainty; hence, most ecological effects are likely to be considerably smaller than those presented in the assessment

making them less likely to be measurable. Further, engagement on the Project has directly resulted in the new Ekati Mine Caribou Road Mitigation Plan, which advances our existing mitigation measures to further reduce risks to caribou.

Dominion Diamond also understands and appreciates the concerns expressed by the Parties and community members in their Technical Reports and during the Public and Community Hearings about the decline in the Bathurst caribou herd. As a responsible northern company, Dominion Diamond is committed to eliminate any small residual impacts from the Jay Project on caribou and to work with the Government of the Northwest Territories (GNWT) and Aboriginal governments to support the management and protection of the entire herd.

Dominion Diamond commits to prepare a Caribou Mitigation Plan (Plan) within one year of the acceptance of the Report of Environmental Assessment. The Plan will consist of Project mitigation, financial support for research to inform future actions on the Zone of Influence and the management of the Bathurst caribou herd, offsetting of any small impacts through enhanced mitigation (CRMP) to be applied to the entire Ekati Mine site, enhanced dust suppression, and accelerated progressive reclamation efforts for the Long Lake Containment Facility (LLCF) and WRSAs. Dominion Diamond also commits to engage with Parties over the next year on the development of the full Caribou Mitigation Plan including, at a minimum, another workshop to review and seek input into the Plan in the spring of 2016. Dominion Diamond is also committed to ensuring that Traditional Knowledge (TK) is used to inform the development of the Plan and, to address this, will work with Impact Benefit Agreement (IBA) communities and TK holders during the engagement process.

As noted above, the development of the framework for this Plan was informed by a workshop held with Parties, governments, and regulators on October 1, 2015 in Yellowknife. The framework for the Plan will include the following elements:

1 Caribou Monitoring

Dominion Diamond commits to the development of a Caribou Monitoring Strategy/Plan in collaboration with IBA communities that will be supported with at least $100,000 (either direct financial or in kind support) annually from the start of construction to the end of the operations phase (an estimated $1.3 million total for the Project). This strategy will include some or all of the following:

- Workshops with TK holders, community technical experts, and other representatives;
- Community site-based monitoring programs for the caribou spring and fall migrations to help understand factors influencing caribou and guide scientific studies;
- A review of previous recommendations from communities on how TK should be aligned in the Caribou Monitoring programs;
- Provision of regular caribou engagement reports to IBA communities; and,
- Sharing of scientific information and sampling methods to foster an understanding with the communities on how we monitor caribou at the Ekati Mine.

2. Project Mitigation

An important part of our work on designing the Project is the extensive engagement that we have undertaken and will continue to undertake through site visits, community meetings, and workshops with communities and regulators.

As a result of additional suggestions from the Parties during the October 1, 2015 workshop, Dominion Diamond commits to incorporate additional protective measures as part of the CRMP, as follows:

- During the northern migration:
  - A caribou group will be defined as 1 (one) or more cow caribou.
  - A group of caribou are greater than 500 metres (m) from Jay and Misery roads: speed is 60 kilometres per hour (km/hr).
  - A group of caribou are between 300 and 500 m from Jay and Misery roads: speed limit is lowered to 40 km/hr. Environment staff will assess the direction of caribou movement, traffic will be stopped if the path of caribou movement is anticipated to intersect the Jay or Misery road. If caribou are not moving towards the road, traffic may continue at 40 km/hr.
  - A group of caribou are within 300 m from Jay and Misery roads: driver stops (i.e., road closure). Environment staff will direct the reopening of the road.
- During post-calving/autumn period:
  - The threshold of 0.25% of the cow population of the Bathurst herd will be applied to all distances.
  - 0.25% of the cows in the Bathurst herd greater than 500 m from Jay and Misery roads: speed limit is 60 km/hr.
  - 0.25% of the cows in the Bathurst herd between 300 and 500 m of Jay and Misery roads: speed limit is 40 km/hr.
  - 0.25% of the cows in the Bathurst herd within 300 m of Jay and Misery roads: driver stops (i.e., road closure). Environment staff will direct the reopening of the road. Opening the road could occur if the caribou do not show signs of being disturbed or are not moving towards the road.

These mitigation measures are intended to be adaptively managed and will be reviewed on an annual basis as part of the Wildlife Effects Monitoring Plan (WEMP).

In addition to the mitigation of impacts from the Jay Project, Dominion Diamond commits to offset impacts to the Project by implementing the Caribou Road Mitigation Plan on an Ekati-wide basis at the same time as implementation for the Jay Project.

3 Zone of Influence Research

Dominion Diamond commits to provide a total of $1,050,000 in financial offsetting to support research that assist in determining the drivers of the Zone of Influence (ZOI) and the changes in the Bathurst Caribou Herd. This financial offsetting will include:

Ekati-Specific Research

Dominion Diamond will provide funding in 2017 and 2018 ($300,000 in total) for the installation of 50 geo-fenced collars.

Zone of Influence

Dominion Diamond will provide $125,000 in both 2018 and 2019 ($250,000 in total) to the ZOI Technical Task Group to review the data from the geo-fenced collar program and to help increase the accuracy and precision of the ZOI, and determine the behavioural response of caribou to the Jay and Misery roads and Ekati Mine facilities.

Bathurst Herd Research

Dominion Diamond will provide matching grant funding in the amount of $200,000 in 2017 and $100,000 in each of the following three years (2018-2020) towards research to help determine the magnitude and spatial and temporal extents of the key factors limiting the Bathurst herd (i.e., the primary environmental factors that caused the decline of the herd). Understanding the different scales and strengths that factors other than Jay Project effects influence caribou numbers and distribution is necessary for Dominion Diamond to be able to measure the positive changes from on-site and off-site offsets. In addition, knowledge of the key factors limiting the Bathurst population could lead to the development of strategies and plans by government to improve the health of the herd (another form of offsetting). This funding will be provided to the Bathurst Herd Range Management Working Group as a dollar-for-dollar matching grant upon submission of research proposal(s).

Dominion Diamond expects that TK Holders will be involved in every step of research planning and follow-up with respect to research undertaken by governments and co-management boards – from developing questions and methods, to interpreting and communicating the results.

4. Dust

As discussed during the Compensatory Mitigation Workshop, Dominion Diamond is currently completing a pilot test application of an alternative dust suppressant prior to site-wide use to determine its effectiveness, given the Ekati Mine's unique northern climate and associated challenges. Dominion Diamond commits to expand the pilot study into a more comprehensive trial on the Misery Road with the objective to determine whether this product reduces fugitive dust from roads better than current dust suppression practices. It is assumed that additional or different mitigation that reduces fugitive dust production will also have a corresponding reduction to sensory disturbance of caribou (and would be considered off-site and on-site offsetting). However, it is important to note that the relative contribution of dust as a sensory disturbance mechanism to changes to caribou distribution is unknown. Thus, techniques of monitoring caribou distribution (i.e., magnitude and spatial extent of the ZOI) may not be sensitive enough to detect a small change even if different mitigation reduces the amount or distribution of fugitive dust. A reduction in fugitive dust represents a successful, measurable improvement to dust mitigation that may be applied to Jay and the Ekati site as an offset.

This program is expected to cost $75,000 a year based on a two year minimum project ($150,000). If the initial program is successful, the results of the program will then be utilized on all roads at the Ekati Mine site including Jay, which could represent an expenditure of an additional $975,000 to 2030. *(Note: This does not include the cost of the new product which is approximately 4 times the cost of DL-10 and is expected to be approximately $1.5 million in the first year.)*

Methods

EnviroKleen 2800 and DL-10 will be applied to the Misery Road using a statistically robust study design that incorporates treatment (reference; DL-10) and trial (EnviroKleen) effects to test the efficacy of the two dust suppressants. Dust will be collected from the current dustfall collectors (3 arrays) located on Misery Road and include the addition of 3 more dustfall arrays. Locations will be selected in areas where dust suppressant is continuous (not in sections 30 m from watercourse crossings and waterbodies). Each transect will have dustfall collectors located at distances 30 m upwind of the Misery Haul Road, and 30 m, 90 m, 300 m, and 1,000 m downwind of the Misery Haul Road. The proposed distances are consistent with the transect distances for the current annual dustfall monitoring program at the Misery Road. By having transects on both sides of the road, the sampling results will be less affected by change in prevailing wind direction, and a better understanding of upwind and downwind dust deposition patterns can be derived from the results.

The proposed dustfall sampling program will be conducted from early June to early September over two years (2016 and 2017). The start of the annual program will coincide with the application of the dust suppressant, which typically occurs in early June. Dustfall samples will be collected on an approximately monthly basis until the ground is covered by snow (typically early September). The monthly sampling results will provide insight to potential changes to the effectiveness of the treatment over time. The timing of the monthly sample collection can be aligned with the current dustfall monitoring program at the Ekati Mine, so that the dustfall results from the background sampling stations (AQ-49 and AQ-54) can be directly compared to the results from the proposed program. The success of the trial treatment would be compared with the reference treatment to determine whether the trial product (EnviroKleen 2800) reduces total seasonal fugitive dust over reference product (DL-10) and tested using an appropriate statistical technique. Other external factors, such as, traffic level on the Misery Road, wind speed and precipitation that may also influence the monthly dustfall results would be considered in the analysis. Meteorological data are currently being collected at the Ekati Mine. Traffic data (specifically haul truck traffic count) on the Misery Road will be collected for the duration of the sampling program.

Dustfall samples will be analyzed for both organic and non-organic (also called fixed) dustfall measurements. Total dustfall is defined as the amount of material left after evaporation of the dustfall sample and its subsequent drying. Fixed dustfall is the residue that is left after ignition of the total dustfall sample and represents the non-organic component of the total dustfall. Fugitive dust generated from the Ekati mining activities is mostly nonorganic in nature. Having organic and nonorganic (fixed) dustfall measurements allow further insight to the Mine’s contribution to the total dustfall measured.

Results of the program after Year 1 will be reported in an Interim report and include learnings and proposed improvements.

A final methodology will be developed and circulated for discussion after completion of the dust suppression pilot project report to be completed during the fall of 2015.

The results of the program, if positive, will then be utilized on all roads at the Ekati Mine site as an offset for the Jay Project. Best practices will be shared with other operators.

5. Progressive Reclamation of the Existing Ekati Mine

Long Lake Containment Facility Progressive Reclamation:

The Ekati Mine LLCF is currently the primary containment area for processed kimberlite (PK) storage after the extraction of diamonds from kimberlite ore at the Ekati Mine. The facility has been in operation since 1998, and is the main repository of PK from open pit and underground mines at the existing pits. The overall reclamation goal for the LLCF is the design and construct a long-term cover that will physically stabilize the PK with a landscape that will be available for human and wildlife use. The design concept for the LLCF is outlined in the Ekati Mine's Interim Closure and Reclamation Plan (ICRP) and consists of the following components:

- Combination of vegetation and rock cover system to physically stabilize the PK;
- Construction of spillways and breaching of dams to permit natural flows; and,
- Construction of surface water channels to convey surface water flow through the containment cells.

LLCF reclamation has been ongoing at the Ekati Mine with the overall intent of developing and implementing a final LLCF cover design. For the past two years, reclamation research has been focused to establish and evaluate the vegetation growth directly within the PK. Where successful, the vegetation test areas have been able to provide stabilization of the PK including protection from wind erosion.

The current reclamation schedule for the LLCF is to continue LLCF reclamation research such that a final cover design is approved in a final closure plan and the design is constructed at the end of existing Ekati Mine operations (tentatively scheduled for the year 2020). As indicated in the Jay Project Conceptual Closure and Reclamation Plan (Appendix 3B of the DAR), the development of the Project and increased Ekati mine life will provide opportunities for progressive reclamation.

Dominion Diamond has made a commitment to progressively reclaim the LLCF throughout the operations of the Jay Project. Reclamation of the LLCF restores a substantial disturbance footprint at Ekati, which has the potential for positive impacts to wildlife including caribou. Dominion Diamond is proposing to complete the progressive reclamation of the LLCF at an accelerated rate. This accelerated effort would, therefore, serve as an off-site compensatory measure for the Jay Project.

Waste Rock Storage Areas Access Ramps

An overall site wide reclamation objective for the Ekati Mine is that wildlife are able to safely use the reclaimed areas. Specific to the existing WRSAs at the Ekati Mine (i.e., Fox, Koala/Panda, Pigeon, and Misery), wildlife access ramps have been proposed for each of the WRSAs that will allow wildlife a means of safely accessing the piles, as well as a safe means of leaving the piles. Currently the ICRP has outlined conceptual locations for the WRSA wildlife access ramps; however, their specific locations, and design features will require input from community groups. The locations and design are to be defined based on engagement with local communities and their understanding of caribou migration paths and observations made at the site prior to and during operations. The current reclamation schedule for the design of the wildlife ramps is to have the final designs approved in a final closure plan and have them constructed after the end of existing Ekati Mine operations (tentatively scheduled for the year 2020). Dominion Diamond sees a potential positive impact to wildlife by constructing wildlife access ramps at an accelerated rate. This accelerated effort would serve as a compensatory off-site mitigation for the Jay

Project. The design of the access ramps will require engagement with communities and regulatory groups. A realistic accelerated effort for the access ramps would be to have their design finalized and constructed after the end of the individual WRSA operational periods. For scheduling and discussion purposes, provided below is the current status of the WRSAs, and pending further review and engagement, possible construction schedule of the wildlife access ramps:

- Fox WRSA: Operations have ended and the rock pile is ready for design and construction of wildlife access ramps.
- Panda/Koala WRSA: Operations have partially ended and design process for access ramps can begin. Construction of ramps could be completed in non-operating areas as they become available up to the end of operations (tentatively in year 2019/2020).
- Pigeon/Misery WRSA: Rock piles are currently operating. Design process for access ramps can be initiated and constructing of wildlife access ramps can be completed at end of operations for the rock pile (tentatively in year 2019/2020).

As part of reclamation, Dominion Diamond has involved community groups through programs such as onsite vegetation workshops and community student seed collection programs. The potential accelerated efforts for the reclamation of the LLCF and the design and construction of the wildlife access ramps will require extensive involvement from community groups. This involvement will consist of continued engagement and alignment of TK. Additionally, community involvement will be required in the actual reclamation construction efforts at the LLCF. In order to prepare for this increased effort, Dominion Diamond is proposing the following initial activities for engagement and TK incorporation:

- Complete a community meeting plan and schedule. Various processes will be reviewed on how community meetings will take place to ensure that opportunity is provided for communities to participate (community dependent), and the best format (or method of engagement) is used to ensure effective involvement.
- Summarize findings from the community meetings and questioners, including recommendations on how TK should be incorporated in the LLCF reclamation and wildlife ramps design.
- Complete a long-term strategy for community engagement and TK alignment into the accelerated reclamation efforts.

The overall plan for the development of the accelerated effort will require development through engagement with communities and regulatory groups over the next year and incorporated into the next Progress Report for the ICRP.

Offset Determination and Reporting

Dominion Diamond recognizes that the Jay Project may have some small residual impacts on caribou, notwithstanding the enhanced mitigation measures put in place in the CRMP. Therefore, Dominion Diamond will develop a Caribou Mitigation Plan based on the elements described above. Given this is a new and unprecedented process in the Northwest Territories, Dominion Diamond commits to work with the Department of Environment and Natural Resources to develop an appropriate offset determination

methodology based on the principle that the Project and associated mitigation (including offsetting) will have an overall net neutral or positive impact on the health of the Bathurst caribou herd.

Dominion Diamond will report publicly on the Caribou Mitigation Plan on an annual basis.

Summary

The development of this framework document was informed by a workshop held with Parties, governments, and regulators on October 1, 2015 in Yellowknife. Dominion Diamond believes that the measures described above in this Plan are appropriate and enough to provide compensatory mitigation for the small residual effects of the Jay Project on the Bathurst caribou herd. Dominion Diamond has committed to further engagement on the details within the Plan and will prepare a final Caribou Compensatory Mitigation Plan within one year of the acceptance of the Report of Environmental Assessment, which will be in place before construction commences on the Project. The preliminary costing of this Plan, as proposed in this response and without a final determination on accelerated reclamation, results in a total financial commitment of up to $3,325,000 over the life of the Project.

DOMINION DIAMOND

Undertaking Number: DAR-MVEIRB-UT2-07

Source: Undertaking from Day 2 (Sept 15) of the Public Hearings

Subject: Barren-ground Caribou – CRMP Details

DAR Section(s): 12

Request:

DDEC will provide details from the CRMP regarding how collar data can be incorporated into real-time monitoring efforts, given the scale differences between on-road visual observations and collar data as well as the timing differences between when data is received by the GNWT versus obtained by DDEC.

Response:

Dominion Diamond does not believe that monitoring through caribou Global Positioning System (GPS) or satellite collar locations at intermediate distances (e.g., 14 kilometres [km]) can be completed in real-time to adaptively manage mitigation proposed for the Jay Project (Project). This is because acquisition of location data and distribution by the Department of Environment and Natural Resources (ENR) of the Government of the Northwest Territories (GNWT) may require several days to complete. Reference to this as a trigger for increased mitigation in the Caribou Road Mitigation Plan (CRMP) will be revised accordingly following additional information from communities and the Independent Environmental Monitoring Agency during engagement in the permitting phase of the Project. The requirement of vehicle drivers to report observations of caribou and other wildlife, and monitoring for the presence of caribou by road surveys, represents fail-safes against untimely caribou arrivals and the continued protection of caribou. The frequency of road surveys will be managed in accordance to the presence of caribou as outlined in the CRMP. Dominion Diamond also receives maps of locations of Bathurst caribou distributed weekly throughout the year by the ENR, which will allow the location and movements of collared Bathurst caribou relative to the Project and Ekati Mine to be monitored at distances greater than 30 km.

DOMINION DIAMOND

Undertaking Number:	DAR-MVEIRB-UT2-08
Source:	Undertaking from Day 2 (Sept 15) of the Public Hearings
Subject:	Barren-ground Caribou – Convoys
DAR Section(s):	12

Request:

DDEC will provide specifics regarding thresholds in caribou number and proximity that would trigger convoying rather than short- or long-term road closures. This information will also include specifics regarding land trains.

Response:

Dominion Diamond indicated in the Caribou Road Mitigation Plan (CRMP) submitted to the public registry in July 2015, the following with respect to haul truck convoys as part of Level 2 mitigation (Page 3-9):

Dominion Diamond will consider the use of pilot vehicles and convoys where caribou are observed at distances too far from the road to trigger a road closure but close enough that vehicles moving at slow speeds but with high frequency may be disruptive. This decision will be on a case-by-case basis at the discretion of the Environment Department.

The mitigation and monitoring outlined in the CRMP was organized in a hierarchical manner where Operational and levels 1 to 3 represent successively more intensive mitigation and monitoring for the protection of caribou. In terms of hierarchical mitigation, road closures avoid most sensory disturbances associated with traffic, such as noise, vehicular motion, and fugitive dust production because traffic is suspended. In contrast, convoys would reduce (minimize) these sources of sensory disturbance but these disturbances would still be generated. This is why the use of convoys was described with CRMP Level 2 mitigation instead of with short- and long-term road closures as in Level 3 mitigation. Dominion Diamond does not intend to replace short- or long-term road closures with haul truck convoys. Instead, the CRMP indicates convoys may be used before roads are closed to traffic. As such, the triggers for using haul truck convoys are the same Level 2 triggers provided in Table 3-1 of the CRMP and before Level 3 mitigation triggers are met.

As a result of additional suggestions from the parties during the October 1, 2015 workshop, Dominion Diamond committed to incorporate additional protective measures as part of the Caribou Road Mitigation Plan that will be applied to the Ekati Mine (DAR-MVEIRB-UT2-06) as follows:

- During the northern migration:
  - A caribou group will be defined as 1 (one) or more cow caribou.
  - A group of caribou are greater than 500 metres (m) from Jay and Misery roads: speed is 60 kilometres per hour (km/hr).

  - A group of caribou are between 300 and 500 m from Jay and Misery roads: speed limit is lowered to 40 km/hr. Environment staff will assess the direction of caribou movement, traffic will be stopped if the path of caribou movement is anticipated to intersect the Jay or Misery road. If caribou are not moving towards the road, traffic may continue at 40 km/hr.
  - A group of caribou are within 300 m from Jay and Misery roads: driver stops (i.e., road closure). Environment staff will direct the reopening of the road.

- During post-calving/autumn period:
  - The threshold of 0.25% of the cow population of the Bathurst herd will be applied to all distances.
  - 0.25% of the cows in the Bathurst herd greater than 500 m from Jay and Misery roads: speed limit is 60 km/hr.
  - 0.25% of the cows in the Bathurst herd between 300 and 500 m of Jay and Misery roads: speed limit is 40 km/hr.
  - 0.25% of the cows in the Bathurst herd within 300 m of Jay and Misery roads: driver stops (i.e., road closure). Environment staff will direct the reopening of the road. Opening the road could occur if the caribou do not show signs of being disturbed or are not moving towards the road.

As described in the CRMP, the need to convoy haul trucks is left to the discretion of Environment staff (with input from Aboriginal monitors, if present) based on what they are observing during caribou monitoring. For example, if 0.25% or less of total Bathurst cows are beyond 300 m of the Jay or Misery roads during the post-calving/autumn period and appear disturbed over a prolonged period of time, then Environment staff may choose to convoy haul trucks to facilitate either continued movement toward the road or a change in caribou behaviour to a less disturbed state (e.g., feeding or resting).

Dominion Diamond proposed to use long-haul trucks (referred to as road trains) instead of individual haul trucks to transport ore from the Jay ore transfer pad to the processing plant at the main Ekati Mine site, which in effect is a form of convoying. Travel will be along the Jay Road and Misery Road. A long-haul road train includes a single cab with three trailers in tow and a capacity of 216 tonnes. Technical details of these trains and other Jay Project traffic was provided in Appendix C, *Traffic Associated with the Jay Project*, submitted with the Round 1 information request responses in April 2015.

DOMINION DIAMOND

Undertaking Number: DAR-MVEIRB-UT2-11

Source: Undertaking from Day 3 (Sept 16) of the Public Hearings

Subject: Water Quality and Quantity – Additional Sediment Sampling Results

DAR Section(s): 8

Request:

DDEC will provide the results of the recent additional sediment sampling from within the diked area to the Review Board and IEMA. DDEC will make every effort to provide these results by the undertaking deadline.

Response:

A supplemental sediment sampling program in the proposed diked area of Lac du Sauvage was conducted on September 14, 2015 (Map 11-1). This work was undertaken to address a potential mercury concern in the lake sediments within this area based on baseline sediment quality data in Rescan (2007).

For this supplemental program, five stations were sampled within the diked area, with Station Ac-13 corresponding with the previously sampled location (LdS3; Rescan [2007]), which reported sediment mercury concentrations that exceeded Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guideline (ISQG), and the probable effects level (PEL) guidelines (CCME 2001). Similarly, Stations Ac-14 and Ac-15 corresponded with stations LdS4 and LdS5 from the Rescan (2007) survey, respectively.

For the five stations within the proposed diked area, composite surficial sediment samples were generated from three proximal grab samples using an Ekman sampler. In addition to sediment mercury (Table 11-1), these samples were analyzed for particle size, total organic carbon, and metals (Table 11-2).

Table 11-1 Sediment Mercury Concentrations from Stations in the Proposed Diked Area of Lac du Sauvage

Sediment Constituent	Unit	CCME SQG		Lac du Sauvage Median[a]	Rescan (2007)			Sampling Stations within the Proposed Diked Area				
		ISQG	PEL		LdS3(1)	LdS3(2)	LdS3(3)	Ac-13	Ac-14	Ac-15	Ac-16	Ac-17
Mercury	mg/kg dw	0.17	0.486	0.0175	5.6[I,P]	0.29[I]	0.11	0.0414	0.0211	0.204	0.0224	0.0192

[a] Source: Table 8.2-57 of the Developer's Assessment Report (DAR); Dominion Diamond (2014). The sample count for this dataset is 54 samples.

[I] Concentration is higher than the CCME (2001) Interim Sediment Quality Guideline.

[P] Concentration is higher than the CCME (2001) Probable Effects Level.

CCME = Canadian Council of Ministers for the Environment; ISQG = Interim Sediment Quality Guideline; SQG = Sediment Quality Guidelines; PEL = probable effects level; mg/kg dw = milligrams per kilogram as dry weight.

Sediment mercury concentrations from all five stations within the proposed diked area were below the CCME ISQG and the PEL (CCME 2001) for the protection of aquatic life (Table 11-1). They were also lower than the individual replicate concentrations reported for LdS3 (Table 11-1). Consistent with the baseline sediment data for Lac du Sauvage reported in the Developer's Assessment Report (DAR; Table 8.2-57), guideline exceedances for arsenic (ISQG and PEL) and chromium (ISQG) were also measured in all samples (Table 11-2). All other sediment constituents concentrations were consistent with baseline sediment data collected from Lac du Sauvage in 2006 (Rescan 2007), 2011 (Rescan 2012) and 2013 (Section 8.2.5.3.1 of the DAR [Table 11-2]).

As discussed in the responses to the Technical Reports (LKDFN-08 and IEMA-07), and presented on the Aquatics Day at the Technical Hearing on September 16, the two previously reported sediment samples from Lac du Sauvage with exceedances to sediment mercury guidelines were considered anomalous and not representative of sediment mercury concentrations in this area. This follow-up work supports this contention.

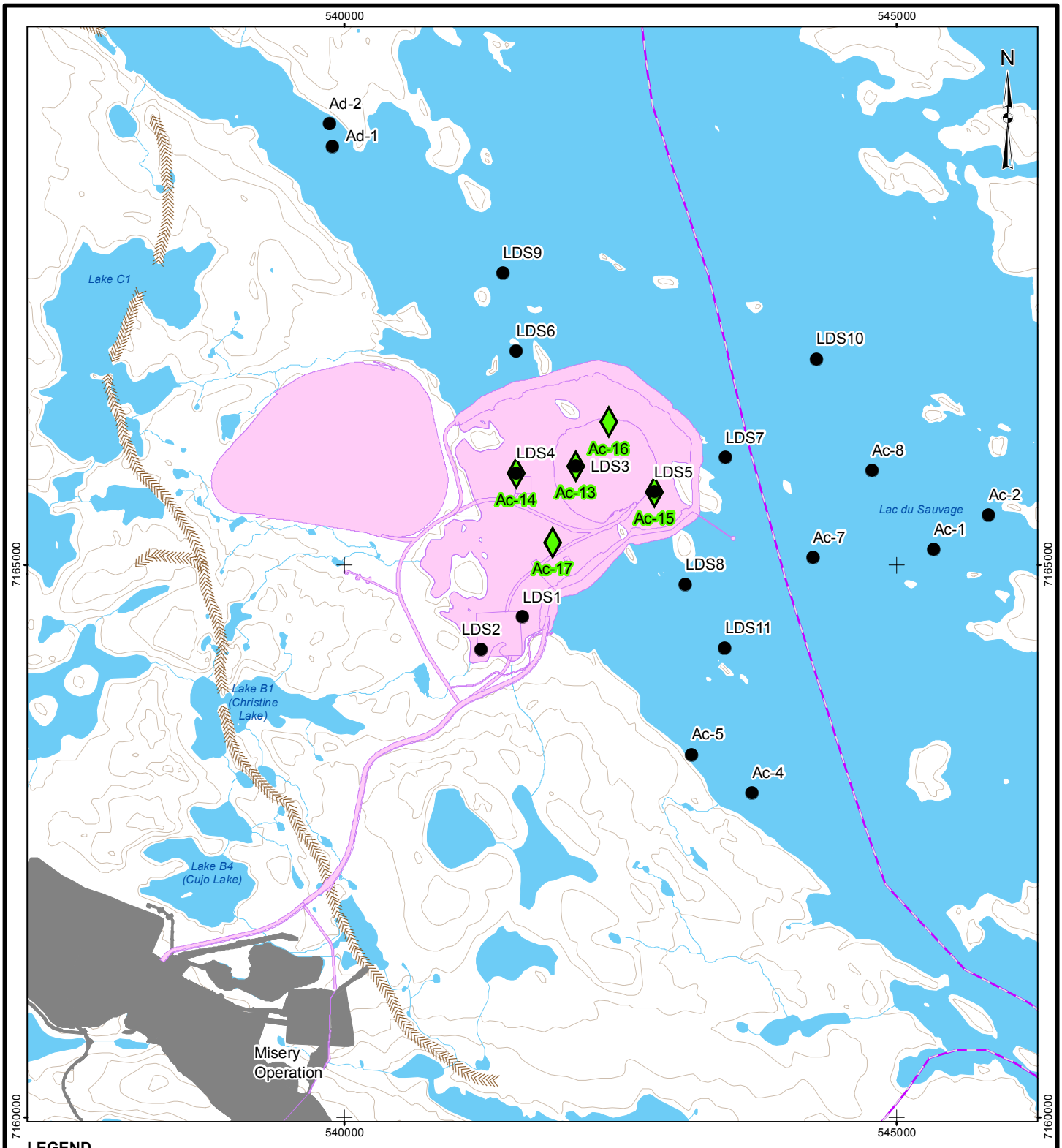
Table 11-2 Sediment Quality from Stations in the Proposed Diked Area of Lac du Sauvage

Location	Unit (Dry Weight)	Guideline[a]		Lac du Sauvage					
Sample Name		ISQG	PEL	Ac-13	Ac-14	Ac-15	Ac-16	Ac-17	Median LDS Baseline[b]
Sampling Season		-	-						
Sample Date		-	-	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	-
Easting (NAD 83, 12W)		-	-	542100	541562	542807	542395	541886	-
Northing (NAD 83, 12W)		-	-	7165897	7165829	7165661	7166291	7165204	-
Physical Parameters									
Water depth	m	-	-	18	9.2	4	9	12	-
% Clay (<0.002 mm)	%	-	-	5.69	16.9	18.6	18.1	14.7	30.5
% Silt (0.002-0.05 mm)	%	-	-	92.4	81.3	76.6	79.6	71.5	49.5
% Sand (2-5 mm)	%	-	-	1.92	1.79	4.83	2.31	13.8	1.9
Texture	-	-	-	Silt	Silt loam	Silt loam	Silt loam	Silt loam	-
Nutrients									
Carbon, Total Organic	%	-	-	1.71	2.11	2.28	2.71	1.46	1.27
Total Metals									
Aluminum	mg/kg	-	-	13,200	17,600	15,300	14,100	16,100	15,300
Antimony	mg/kg	-	-	0.16	0.322	<0.10	<0.10	<0.10	<0.10
Arsenic	mg/kg	5.9	17	**277[I,P]**	**39.1[I,P]**	**127[I,P]**	**15.3[I]**	**20.6[I,P]**	**39.1[I,P]**
Barium	mg/kg	-	-	292	148	197	144	171	171
Beryllium	mg/kg	-	-	0.40	0.51	0.50	0.45	0.48	0.48
Bismuth	mg/kg	-	-	0.26	0.34	0.28	0.26	0.28	0.28
Boron	mg/kg	-	-	<5	<5	<5	<5	<5	-
Cadmium	mg/kg	0.6	3.5	0.132	0.173	0.192	0.115	0.369	0.170
Chromium	mg/kg	37.3	90	**46.2[I]**	**62.5[I]**	**54.3[I]**	**51.2[I]**	**55.2[I]**	**54.3[I]**
Cobalt	mg/kg	-	-	19.0	19.7	22.7	11.7	26.0	19.7
Copper	mg/kg	35.7	197	23.8	31.7	27.2	25.6	27.9	27.2
Iron	mg/kg	-	-	56,600	32,500	48,600	24,100	26,700	32,500
Lead	mg/kg	35	91.3	6.17	8.2	5.59	4.64	5.68	5.70

Table 11-2 Sediment Quality from Stations in the Proposed Diked Area of Lac du Sauvage

Location	Unit (Dry Weight)	Guideline[a]		Lac du Sauvage					
Sample Name		ISQG	PEL	Ac-13	Ac-14	Ac-15	Ac-16	Ac-17	Median LDS Baseline[b]
Sampling Season		-	-						
Sample Date		-	-	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	14-Sep-15	-
Easting (NAD 83, 12W)		-	-	542100	541562	542807	542395	541886	-
Northing (NAD 83, 12W)		-	-	7165897	7165829	7165661	7166291	7165204	-
Lithium	mg/kg	-	-	37.0	41.5	45.2	42.6	42.9	42.6
Manganese	mg/kg	-	-	8,340	753	2,960	384	3,460	2,960
Molybdenum	mg/kg	-	-	8.08	1.74	3.67	1.28	2.01	2.00
Nickel	mg/kg	-	-	34.3	43.5	44.3	33.4	49.8	43.5
Selenium	mg/kg	-	-	<0.20	0.19	<0.20	<0.20	<0.20	<0.20
Silver	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Strontium	mg/kg	-	-	12.3	12.1	12.0	10.8	10.2	12.0
Sulfur	mg/kg	-	-	470	427	700	730	460	470
Thallium	mg/kg	-	-	0.210	0.31	0.268	0.219	0.438	0.270
Tin	mg/kg	-	-	<2	4.63	<2	<2	<2	<2
Titanium	mg/kg	-	-	634	925	769	740	784	769
Uranium	mg/kg	-	-	2.05	3.03	2.55	2.59	2.49	2.55
Vanadium	mg/kg	-	-	39.8	52.6	45.9	43.1	47.7	45.9
Zinc	mg/kg	123	315	53.8	71.4	64.9	56.3	62.8	62.8

Notes:
Bolded concentrations are higher than sediment quality guidelines (CCME 2001).
(I) = value higher than the Interim Sediment Quality Guideline.
(P) = value higher than the Probable Effects Level.
a) Source: CCME (2001). Canadian Environmental Quality Guidelines. Winnipeg, MB, Canada
b) Source: Table 8.2-57, Developer's Assessment Report, Dominion Diamond Jay Project (Oct 2014)
ISQG = Interim Sediment Quality Guideline; PEL = Probable Effects Level; - = no guideline or data; m = metre; mg/kg = milligrams per kilogram; NAD = North American Datum; % = percent; < = less than.



LEGEND

- EKATI MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- BASELINE SEDIMENT QUALITY STATION
- SUPPLEMENTAL SEDIMENT STATION

REFERENCE

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

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

BASELINE AND SUPPLEMENTAL SEDIMENT STATIONS IN LAC DU SAUVAGE

Golder Associates

PROJECT 1419751.3600.60			FILE No.	
DESIGN	CP	29/09/15	SCALE AS SHOWN	REV. 1
GIS	ANK	02/10/15		
CHECK	CP	02/10/15		
REVIEW	JF	02/10/15		

MAP 11-1

G:\CLIENTS\DOMINION\DDEC Jay and Lynx Projects\Figures\1419751 Jay Project Stage 33600_Hearing\60_Follow_up\Baseline_and_Supplemental_Sediment_Stations_LDS.mxd

References:

CCME (Canadian Council of Ministers of the Environment). 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Introduction. Updated. Canadian Environmental Quality Guidelines, 1999, update 2001. Winnipeg, MB, Canada.

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

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

Rescan. 2012. Ekati Diamond Mine 2011 Aquatic Effects Monitoring Program Annual Report. Prepared for BHP Billiton Canada Inc. Yellowknife, NWT, Canada.

Undertaking Number: DAR-MVEIRB-UT2-12

Source: Undertaking from Day 3 (Sept 16) of the Public Hearings

Subject: Water Quality and Quantity – Misery Pit Water Quality

DAR Section(s): 8

Request:

DDEC will compare the length of time the Misery pit walls are exposed in the conservative and lower-bound assessment cases. DDEC will also describe where the water to fill Misery pit would come from and what the water quality in the pit will be when the pit is full under the lower-bound scenario.

Response:

During the Jay Project (Project) Public Hearing (September 16, Day 3), the Government of the Northwest Territories (GNWT) requested Dominion Diamond provide the amount of time wall rock is exposed in Misery Pit during operations (prior to complete back-flooding in closure) for the Lower Bound, Reasonable Estimate, and Updated Assessment (EA Conservative) modelling cases. During Project operations, a 10 metre (m) freeboard in Misery Pit will be maintained to provide the Project with an additional contingency water storage capacity of 3 million cubic metres (m^3) (see Round 1 information request responses DAR-EC-IR-15, DAR-GNWT-IR-30). Therefore, for the purpose of this response, the wall rock exposure timeframe assigned to each modelling scenario corresponds to the timing for when the 10 m freeboard water level elevation is projected to be established in Misery Pit. This timing also corresponds to when pumped discharge from Misery Pit to Lac du Sauvage begins. Table 12-1 provides the Misery Pit wall rock exposure times.

Table 12-1 Misery Pit Wall Rock Exposure Duration

DAR Modelling Scenario	Exposure Period (years)[(a)]
Lower Bound	9.3
Reasonable Estimate	5.9
EA Conservative Case	4.9

[(a)] Number of years during operations that the Misery Pit wall rock is exposed until the pit water level reaches the 10-metre freeboard elevation.

In all model scenarios, the Misery Pit water level was projected to be at the 10 m freeboard elevation at the end of operations. At the commencement of closure, the upper 50 m of water stored in the Misery Pit will be pumped to the bottom of the Jay Pit, leaving a 60 m pit depth in the Misery Pit, which will be back-flooded with catchment runoff and freshwater pumped from Lac du Sauvage. This creates the 60 m freshwater cap closure condition in the Misery Pit. The timing to back-flood the 60 m pit void (and exposed rock) to full pit-supply elevation (i.e., including the 10 m freeboard zone) during the closure phase is the same for all model scenarios (approximately one year).

In addition to the request made by the GNWT, the Mackenzie Valley Environmental Impact Review Board staff requested information on where the water to fill Misery Pit would be sourced from, and what the quality of the water in the pit would be following exposure to the pit wall rock under the Lower Bound Scenario. The responses to these requests are provided below:

- The back-flooding strategy in the water management plan for the Project is the same for the Updated Assessment, Reasonable Estimate, and Lower Bound modelling scenarios. During operations, water in the Misery Pit is sourced from direct precipitation, surrounding catchment runoff inflows to the pit, wall rock runoff, and water pumped from the Jay runoff sump and mine inflow sump (i.e., from the Jay open pit). In the model, each of these sources was assigned a chemical profile based on geochemical testing and operational site monitoring data. Additional details of the water management plan are provided in Section 3.5.5 and Appendix 3A of the Developer's Assessment Report (DAR).
- Water quality constituent concentrations for Misery Pit once the 10 m water level elevation is reached for the Updated Assessment and Reasonable Estimate cases were provided in the Compendium of Supplemental Water Quality Modelling (Golder 2015). Maximum projected concentrations for select water quality constituents of interest (consistent with those identified in the DAR) in the Misery Pit for the Lower Bound Scenario once the 10 m water level elevation is reached are presented in Table 12-2. The constituents of interest include total dissolved solids, chloride, total phosphorus, ammonium, nitrate, total aluminum, and total arsenic. The DAR included chlorophyll *a* in the constituents of interest*;* however, chlorophyll *a* is a constituent limited to the lake models, and is not included in the site water quality model.

Table 12-2 Maximum Misery Pit Discharge Concentrations during Operations – Lower Bound Scenario

Constituent	Units	Maximum Concentrations in Misery Discharge - Mean Daily Values	
		Late Operations	
		Under Ice	Open Water
Lower Bound Scenario			
Total Dissolved Solids	mg/L	207	190
Chloride	mg/L	13	10
Sulphate	mg/L	23	20
Nitrate as N	mg/L N	9.9	8.4
Ammonium as N	mg/L N	5.6	4.8
Phosphorus, dissolved	mg/L	0.046	0.039
Phosphorus, total	mg/L	0.053	0.046
Total Aluminum	mg/L	1.3	1.3
Total Arsenic	mg/L	0.0013	0.0011

mg/L = milligrams per litre; mg/L N = mg/L = milligrams per litre as Nitrogen.

References:

Golder (Golder Associates Ltd.). 2015. Jay Project Compendium of Supplemental Water Quality Modelling. Submitted to Mackenzie Valley Environmental Impact Review Board. April 7, 2015. Yellowknife, NWT, Canada.

DOMINION DIAMOND

Undertaking Number: DAR-MVEIRB-UT2-13

Source: Undertaking from Day 3 (Sept 16) of the Public Hearings

Subject: Cumulative Effects – Synergistic Toxicity

DAR Section(s): 17

Request:

DDEC will describe how synergistic or additive and antagonistic effects of multiple contaminants were assessed with respect to similar or different modes of toxic action. This will include a discussion of toxicity-modifying factors.

Response:

The assessment of the potential for health effects on aquatic health in Lac du Sauvage and Lac de Gras, resulting from modelled changes of individual water quality constituents under the Environmental Assessment (EA) Conservative Case for all Jay Project (Project) phases, was undertaken for the Developer's Assessment Report (DAR) (Section 8.5.5). The aquatic health assessment concluded that changes to concentrations of all water quality constituents as a result of the Project would result in negligible effects to aquatic health in Lac du Sauvage and Lac de Gras. Based on the levels of conservatism carried through the aquatic health assessment, it is unlikely that changes to the receiving environment as a result of Project activities have underestimated the potential for effects to aquatic health. Although a synergistic[1] or additive and antagonistic[2] evaluation was not explicitly conducted in the aquatic health assessment, the applied conservatism is considered sufficient to offset any potential for these effects to aquatic health. It is also important to note that toxicological impairment of aquatic life has not been determined in the Aquatic Effects Monitoring Programs (AEMPs) currently being undertaken at the operating diamond mines in the north (in particular the Ekati and Diavik mines); these AEMPs provide field-based assessment of multiple constituents in the aquatic environment.

To supplement the aquatic health assessment, laboratory acute toxicity testing of simulated minewater was also conducted. The composition of the simulated minewater used in the toxicity testing was based on the projected ionic composition of the minewater (i.e., sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, fluoride, and nitrate) to be discharged from Misery Pit to Lac du Sauvage during operations under the EA Conservative Case (i.e., the modelling scenario that provided the maximum modelled water quality projections for all Project phases). In this manner, the testing incorporated the potential for antagonistic and synergistic effects as they pertain to the modelled upper bound Misery Pit minewater chemistry. This testing used Rainbow Trout and the cladoceran, *Daphnia magna* (water flea), following procedures currently used for toxicity testing of Ekati Mine minewater discharges as prescribed in the Ekati Mine Water Licence (see Appendix 8H of the DAR). The results of this testing showed that simulated minewater to be pumped to Lac du Sauvage in Years 5 to 10 of operations is not likely to be acutely toxic. Dominion Diamond has further committed that only non-acutely toxic effluent will be released. Thus, acute localized effects to aquatic life at the point of discharge into Lac du Sauvage will not occur.

[1] More than one water quality constituent interacting so that the combined effect is greater than the sum of their individual effects.
[2] More than one water quality constituent interacting so that the combined effect is less than the sum of their individual effects.

The aquatic health assessment evaluated the potential for modelled changes to water quality from the Project to cause adverse toxic effects on aquatic health in Lac du Sauvage and Lac de Gras through three exposure pathways:

- direct effects resulting from direct exposure to constituents of potential concern (CoPCs) in the water column;
- indirect effects resulting from direct exposure of food chain components to CoPCs in the water column; and,
- indirect effects resulting from potential accumulation of constituents within fish tissue via uptake from both water and diet.

All three pathways were evaluated as part of the aquatic health assessment:

- Potential effects related to direct waterborne exposure, including indirect effects to food chain components, were assessed based on modelled water quality in Lac du Sauvage and Lac de Gras during all Project phases. Maximum modelled water quality constituent concentrations were compared against concentrations measured under existing conditions, relevant federal and provincial water quality guidelines for the protection of aquatic life (WQG PAL), or site-specific water quality objectives (SSWQOs, which included those developed for the Ekati Mine [i.e., chloride, sulphate, potassium, molybdenum, nitrate, and vanadium], Snap Lake Mine [strontium], and Diavik Mine [i.e., total dissolved solids]). This comparison included consideration of exposure and toxicity modifying factors, such as hardness. No CoPCs were identified in the assessment, because maximum modelled concentrations were within existing conditions and/or WQG PAL/SSWQOs.
- The assessment of indirect effects on fish tissue chemistry was completed using measured baseline water quality, maximum modelled water quality, and measured fish tissue chemistry to predict tissue concentrations of chemicals within aquatic organisms. Predicted tissue concentrations were compared with toxicological benchmarks to evaluate the potential for aquatic health effects related to tissue chemistry.

In terms of the conservatism applied to the aquatic health assessment, there are several areas within the assessment where conservatism is additive. Potential toxic effects to aquatic life were assessed through both waterborne exposure and via uptake into fish tissues using maximum modelled water concentrations from the EA Conservative Case scenario. This provides high confidence that potential effects were not underestimated.

Similarly, predicted fish tissue concentrations were calculated using bioaccumulation factors derived with existing conditions of water and tissue concentrations under the assumption that a linear relationship between water and tissue exists, such that higher water concentrations would result in higher tissue concentrations. As this linear relationship is not likely for the majority of metals[3], and considering that tissue concentrations may actually decrease due to active depuration or sequestration of contaminants in non-bioavailable forms within the organism, this approach was therefore conservative and likely

[3] "Metals" in this context includes metals (e.g., copper and zinc), and metalloids (e.g., antimony and arsenic).

overestimated future tissue concentrations. This provides high confidence that potential effects through the fish tissue uptake pathway were not underestimated.

There is some uncertainty in the selection of toxicity benchmarks used in the assessment, as well as a lack of site-specific toxicity data (common in many of these remote environments). To manage this uncertainty, conservative assumptions and approaches were used. For example, toxicity benchmarks were based on laboratory toxicity testing with naive organisms, incorporated site-specific exposure modifying toxicity factors (e.g., hardness, pH) when possible, and were selected from the lowest reliable toxicity estimate. The use of naive laboratory organisms adds to the conservatism of the assessment, because laboratory organisms may be more sensitive to contaminants, whereas local organisms may have a higher level of adaption to existing conditions. Additionally, the use of benchmarks from individual-level toxicity effects studies were used to evaluate population-level effects; individual-level effects may not result in population-level effects.

Based on the levels of conservatism carried through the aquatic health assessment, it is unlikely that changes to the receiving environment as a result of the Project activities have underestimated the potential for effects to aquatic health (which includes the potential for synergistic or antagonistic effects of multiple constituents). Additionally, Dominion Diamond has made strong and consistent commitments to the monitoring of minewater quality in Misery Pit (e.g., chemistry and toxicity) during operations to verify the water quality projections and the findings of the aquatic health assessment. This monitoring will include a toxicity testing program anticipated to be similar to toxicity testing requirements at the Ekati Mine, which includes acute lethality testing with Rainbow Trout and the cladoceran, *Daphnia magna*, and chronic toxicity testing with the green algae, *Pseudokirchneriella subcapitata*, and the cladoceran, *Ceriodaphnia dubia* (WLWB 2014). In addition, an AEMP will be designed and implemented, which will allow for the assessment of synergistic and antagonistic effects, and the AEMP results will inform adaptive management through the response framework, if necessary.

References:

WLWB (Wek'èezhìı Land and Water Board). 2014. Surveillance Network Program (Effective June 6, 2014) Annexed to Water Licence W2012L2-0001. June 6, 2014. Wek'èezhìı Land and Water Board. Yellowknife, NWT. Canada.

DOMINION DIAMOND

Undertaking Number: DAR-MVEIRB-UT2-14

Source: Undertaking from Day 3 (Sept 16) of the Public Hearings

Subject: Fish and Fish Habitat – Meromictic Lake Fish Populations

DAR Section(s): 9

Request:

DDEC will describe how fish populations changed before and after the formation of meromixis in other relevant pit lakes, if the information is available.

Response:

Dominion Diamond reviewed relevant environmental information from available literature pertaining to aquatic life and habitat of 17 pit lakes with meromictic (stratified) or non-meromictic (mixed) status, which occur in British Columbia, Alberta, Yukon, and Northwest Territories. In many of these pit lake cases, the pits were developed on land, and as such, were not a fish-bearing waterbody before pit development, and as part of reclamation and closure planning, have not been designed to support fish in post-closure. Of the reviewed lakes, however, five resulting pit lakes have documented resident populations of fish, which have resulted through colonization from downstream or upstream connections to fish-bearing waterbodies, or have been stocked by local authorities. The response to this undertaking summarizes the literature of mining pit lakes with a focus on the fish communities that may be present in these lakes.

Open pit mining results in residual pits, which often fill with groundwater and surface inflow at closure, creating a pit lake (Pieters and Lawrence 2014). A pit lake is often characterized by unique physical and chemical characteristics that differ from other types of lakes; for example, they can be brackish, usually deep relative to their surface area, and wind sheltered. These characteristics often result in a state of permanent stratification known as meromixis. As described in Pieters and Lawrence (2014), meromixis occurs when the deep water is sufficiently more saline than the surface water, such that mixing of water is inhibited due to the density differences between the less saline surface water and the saline deep water layers.

Meromixis can also be engineered in a pit lake by adding a cap of freshwater of sufficient depth, which isolates the deeper, poorer quality water (e.g., saline water). The resulting pit lake is a common reclamation strategy for open pit mines, including the closure and reclamation plan for resulting pit lakes at the Ekati Mine, and has been used for a variety of purposes in the mining sector, such as storing process water, sump water from underground workings, acid rock drainage (ARD), neutralization sludge, and excess water from tailings ponds (e.g., reviewed in Gammons et al. 2009). This condition can also occur in natural lakes, for example, when there are subsurface inflows of groundwater, or flows of freshwater over saline water (Oulet and Pagé 1988; Gibson et al. 2002; Hakala 2004; Tomkins et al. 2009). Under these conditions, fish, if present in the waterbody, typically prefer the top mixolimnion layer where there is periodic mixing of water and well-oxygenated conditions within that layer (e.g., Marrer 1975; del Don et al. 2001). The hydrodynamic modelling of the Jay and Misery pits indicates that

meromictic conditions will form and remain stable in the pit lakes following back-flooding (Golder 2015a,b,c).

Thirteen of the 17 pit lakes from the available literature occurring in British Columbia, Alberta, Yukon, and Northwest Territories are characterized as meromictic (stratified) (see References), with the remainder having uncertain stratification (i.e., Grum and Vangorda pits at the Faro Lead-Zinc Mine, Yukon, and the East Pit Lake at the East Pit Coal Mine, Wabamun, Alberta) or possessing holomictic (fully mixed; Main Zone, Equity Silver Mine, British Columbia) characteristics. Most of these pit lakes, however, do not currently have fish populations. For example, the presence of fish has not been documented in the six pit lakes reviewed in Pieters and Lawrence (2014); these include Faro, Grum, Vangorda, Waterline, Main Zone, and Zone 2 pit lakes, which were discussed as part of information requests and the Project hearing (e.g., DAR-GNWT-IR-62, DAR-IEMA-IR-16, DAR-LKDFN-IR-05; and the Mackenzie Valley Environmental Impact Review Board Jay Project, Dominion Diamond [EA14314-01] Public Hearing - Day 3). Fish are not present in most of the pit lakes because closure plans may include water quality that preclude conditions to support fish, or the lake itself may remain hydrologically isolated to adjacent environments (preventing colonization of fish) (e.g., Whittle 2004; INAC 2008; Slater and Moodie 2008; SRK 2008; Pieters and Lawrence 2014). The literature also identified several meromictic pit lakes in the Coal Valley Mine Area in Alberta that also do not currently have fish populations (Hatfield 2011); however, water quality in the top layer of the pit lakes (i.e., the mixolimnion), where surface layer mixing occurs and dissolved oxygen levels are maintained, should be suitable for fish if introduced (Hatfield 2011).

Only five of the reviewed pit lakes have documented resident populations of fish, which have either naturally colonized the lakes through downstream or upstream connections to fish-bearing waterbodies, or have been stocked by local authorities. These pit lakes include Gunnar Lake (Gunnar Uranium Mine, Saskatchewan), Sphinx Lake (Cardinal River Coal Mine, Alberta), Lac des Roches (Cardinal River Coal Mine, Alberta), Pit Lake CD (Gregg River Coal Mine, Alberta), and East Pit Lake (East Pit Coal Mine, Alberta), and it is expected that these lakes continue to support populations of fish with the possible exception of Lac des Roches. Lac de Roches was colonized by Rainbow Trout *(Oncorhynchus mykiss*), Bull Trout (*Salvelinus confluentus*), and Brook Trout (*Salvelinus fontinalis*) shortly after construction of the lake in the mid-1980s; however, a fish removal program was performed in 1999 when the lake was decommissioned.

The following provides a summary of the mining pit lakes and their fish communities based on a review of the available literature.

Gunnar Lake

Gunnar Lake is a meromictic pit lake, created after the closure of the Gunnar Uranium Mine, Saskatchewan, in 1964 (Tones 1982). The lake is anoxic at the bottom of the pit, where contaminants are contained and inaccessible from aquatic organisms that inhabit the top layer of the pit lake. There are higher concentrations of salts and radioactive metals in deeper water. The lake is also contaminated with radionucleides (i.e., uranium, Pb-210, and Ra-226) and was also enriched by wastewater from a fish processing plant from 1971 to 1980. Specific conductivity at the pycnocline, defined as the location where there is strong gradient in water chemistry, (75 to 90 metre [m] depths) is reported to increase 4-fold relative to the surface water.

The pit lake supports a healthy and self-sustaining population of Northern Pike (*Esox lucius*), first studied in 1981 and again in 2009 (Muldoon and Schramm 2009). White Sucker (*Catostomus commersonii*), Longnose Sucker (*Catostomus catostomus*), and Ninespine Stickleback (*Pungitius pungitius*) are also present. All species are assumed to have naturally colonized the pit lake during a brief period of an open connection to Athabasca Lake shortly after construction of the pit lake.

Sphinx Lake

Sphinx Lake is the reclaimed waterbody created from open Pit 51-C6 (operating from 1992 to 1998) at the Cardinal River Coal Mine, Alberta (Sonnenberg 2011). Based on water quality profiles (e.g., recorded differences in specific conductance, alkalinity, and total dissolved solids), Sphinx Lake is classified as a meromictic pit lake with partial mixing tendencies restricted to a mixolimnion layer. Recent water quality profiles also suggest that the mixolimnion occurs at a relatively shallow depth, with a pycnocline occurring at 10 to 15 m depths, and the monimolimnion below 14 to 15 m depths (Brinker et al. 2011). Oxygen depletion below 2 milligrams per litre (mg/L) occurred between 13 m and 15 m depth in 2008 and between 11 m and 12 m depth in 2009. Between 2005 and 2008, all water quality parameters in the mixolimnion were less than that in the monimolimnion (Brinker et al. 2011).

The construction of the pit required the diversion of Sphinx Creek, a fish-bearing stream, to allow for coal extraction beneath the channel (reviewed in Sonnenberg 2011). Upon reclamation of the pit in 2005, the pit lake was re-connected to Sphinx Creek, creating Sphinx Lake and opportunities for natural colonization of fish from nearby populations. The top layer of the lake may function in a similar fashion to shallow sub-alpine lakes near the Cardinal River Coal Mine, but at the same time provide important deep water habitat for overwintering and escape cover for larger adult fish in a system that may be limited by such cover (Sonnenberg 2011). In 2008 and 2009, Rainbow Trout density in Sphinx Lake was recorded as 23 fish per hectare (for fish larger than 190 centimetres in length) (Brinker et al. 2011). Furthermore, the density of Rainbow Trout occupying Sphinx Creek downstream of Sphinx Lake was significantly greater than densities recorded at the other streams near the Cardinal River Coal Mine.

Lac des Roches

Lac des Roches is a pit lake located at the Cardinal River Coal Mine, Alberta, which began operations in the mid-1980s (reviewed in Sonnenberg 2011). The pit lake is characterized as a meromictic pit lake with partial mixing tendencies within the mixolimnion (i.e., the depth of the mixolimnion may fluctuate over time). The lower stratum of Lac des Roches does not mix with the upper stratum, with a mixolimnion extending to about 20 m deep in Lac des Roches (Luscar 1994). However, water quality profiles in 2008 suggested that the mixolimnion in Lac des Roches may extend deeper than 20 m (Rutkowski and Christensen 2008).

The fish community (primarily Rainbow Trout, Brook Trout, and Bull Trout) developed in Lac des Roches while it was temporarily connected to West Jarvis Creek (Luscar 1994). Furthermore, there is evidence to suggest that fish growth in Lac des Roches surpassed growth rates for trout in other natural mountain lakes in Alberta (Luscar 1994). In 1999, however, the lake was decommissioned and the fish were removed (Schwartz 2002).

Pit Lake CD

Pit Lake CD is located at the Gregg River Mine, Alberta. The pit lake reached the full supply level and began flowing at the outlet during fall of 2002. The pit lake is characterized as a meromictic lake with partial mixing of water restricted to a mixolimnion layer (Sonnenberg 2011). The mixolimnion varied from 28 to 29 m from the surface in 2008 and 2009, with dissolved oxygen depletion occurring at these approximate depths. The top layer of the pit lake may function in a similar fashion to shallow waters in sub-alpine lakes near the Gregg River Mine (Sonnenberg 2011). The lower monimolimnion in the pit lake displays a tendency towards a saline condition, given the recorded differences in specific conductance, alkalinity, and total dissolved solids.

The outlet to the pit lake is hydrologically connected to downstream waterbodies that support fish, and the presence of fish in the pit lake was first documented in 2008 (Sonnenberg 2011). The density of Rainbow Trout occupying the creek downstream of Pit Lake CD was found to be much greater than densities recorded at the other streams near the Gregg River Mine. These observations suggest that the pit lake may provide important deep water habitat as refugia for larger adult fish in the stream network where the pit lake is situated.

East Pit Lake

East Pit Lake, Alberta, is an example of a pit created by mining that has been reclaimed into a lake that currently supports a productive recreational fishery and provides an array of other recreational opportunities (reviewed in Gammons et al. 2009). After mining ended in the 1980s, the East Pit was filled with groundwater to replace two small waterbodies that had to be drained to access the coal (Sumer et al. 1996). Upon refilling of the pit with water, the newly created East Pit Lake was stocked with Rainbow Trout (Sumer et al. 1996). Although this lake is essentially a put-and-take fishery, and is continually stocked, East Pit Lake continues to sustain a recreational fishery for Rainbow Trout. Although there are currently no available water quality data for East Pit Lake (to the knowledge of the authors of this undertaking; also see Gammons et al. 2009), East Pit Lake has similar dissolved oxygen concentrations to natural lakes in the area, and given the successful establishment of aquatic organisms in this waterbody (Sumer et al. 1996), it is likely that other water quality parameters, such as pH, salinity, and metal concentrations, are also acceptable within the top layer of the lake for aquatic life (Gammons et al. 2009).

Summary

Self-sustaining populations of fish can persist under meromictic conditions in both natural and engineered pit lakes. The mixolimnion layer in an meromictic lake can provide water quality conditions similar to shallow waters of natural lakes, and can extend deep enough to provide cover as overwintering and refugia habitat for adult, large-bodied fish species (e.g., salmonids). However, the potential for fish colonization of any pit lake is primarily related to connectivity with the downstream or upstream environments and whether adjacent waterbodies support fish.

As described in Section 9.4.3.1.1 of the Developer’s Assessment Report, once the dike is breached in Lac du Sauvage at closure, the physical and chemical environment of the area will allow re-establishment of a healthy functioning aquatic ecosystem. Natural currents and fish in the water will be able to move in and out of the area. The upper level (at least 40 m) of the Jay Pit is expected to remain well-oxygenated

through the winter due to its depth and will provide a substantial increase of overwintering refugia for fish and thermal refugia for fish in summer that was not present prior to the Jay Pit development.

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TECHNICAL MEMORANDUM

DATE October 9, 2015 **PROJECT No.** 1419751-3600-20

TO Richard Bargery
Dominion Diamond

CC Claudine Lee, Elliot Holland (Dominion Diamond), Eric Denholm (E. Denholm Consulting), Kristine Mason, Steve Strawson (Golder Associates Ltd.)

FROM Alison Snow, Michael Herrell and John Faithful **EMAIL** mherrell@golder.com

JAY PROJECT – ALTERNATIVE DISCHARGE WATER QUALITY MODEL

1.0 INTRODUCTION

Dominion Diamond Ekati Corporation (Dominion Diamond) submitted a Developer's Assessment Report (DAR) for the Jay Project (Project) to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) in November 2014. As part of the DAR, a water balance model was developed that indicated discharge from the Project would not be required until approximately Year 5 (2024) with minewater being managed through the mined-out Misery Pit. This model relied on several conservative assumptions related to the groundwater inflows to the Jay Pit. Subsequent modelling (Golder 2015a,b), in which groundwater inflows to the Jay Pit were projected to be lower, indicated that the actual timing of discharge could be later in the mine life.

As part of their technical report (GNWT 2015), the Government of the Northwest Territories (GNWT) recommended Dominion Diamond modify the water management plan to begin discharge from the Misery Pit to Lac du Sauvage in Year 3 (2022), precluding the need to discharge in Years 9 (2028) and 10 (2029). In their technical report response, Dominion Diamond disagreed with this recommendation on the following basis (Dominion Diamond 2015):

- delaying the discharge allows for additional operational monitoring of the minewater in Misery Pit in the absence of discharge to Lac du Sauvage to further study and understand the key controls on water quality in the Jay and Misery pits and initiate adaptive management, if required;
- discharging from Misery Pit later in the mine life precludes concurrent operational discharge with the Diavik Mine, thereby reducing cumulative effects in Lac de Gras; and,
- the exposed wall rock in Misery Pit is composed of approximately 50% metasediment and expediting the back-flooding of Misery Pit will more quickly achieve the closure objectives for this facility and reduce loadings of potential contaminants sourced from wall rock runoff into the Misery Pit during operations.

Additionally, water quality modelling (Golder 2015a,b) indicates that the timing to discharge is dependent on the expected groundwater inflows to the Jay Pit. For example, model results indicated that discharge from Misery Pit would not be required until the last year of operations if the Jay Pit groundwater inflows are similar to those projected from the Lower Bound Scenario (Golder 2015b). Therefore, Dominion Diamond also disagrees with

GNWT's recommendation on the basis that mandating a discharge earlier in the mine life may increase the direct impacts to Lac du Sauvage and Lac de Gras if actual groundwater inflows to the Jay Pit are similar to those projected for the Lower Bound Scenario (Golder 2015b).

The GNWT also raised the alternative discharge scenario during the Public Hearing in September 2015. Dominion Diamond restated the rationale for disagreeing with the recommendation, but also indicated that there is flexibility in the water management strategy to discharge earlier in the mine life if it is determined during the early years of operation that there are benefits to discharging prior to Year 5. Dominion Diamond also noted that if an earlier discharge would be considered, appropriate updates to the water quality model would be filed with the Wek'èezhìı Land and Water Board (WLWB) for review prior to initiating discharge.

During the Public Hearing, the MVEIRB technical advisors commented that if Dominion Diamond considered an earlier discharge, this would result in an information gap since the cumulative effects to Lac de Gras of a concurrent discharge from the Misery Pit and the Diavik Mine would not have been assessed as part of the environmental assessment review process. Based on publically available information, and as discussed in the response to information request (IR) DAR-MVEIRB-IR-78 regarding the A21 pit, the current mine plan for the Diavik Mine has production ending in 2023; as result, it is not expected that the two discharges will overlap.

However, to cover off potential cumulative effects from adaptive management approaches, the MVEIRB submitted a formal IR (MVEIRB 2015) subsequent to the Public Hearing requesting Dominion Diamond provide water quality predictions for a model scenario that considered the following:

- Misery Pit discharge from Years 3 to 8 (2022 to 2027); and,
- An extension of the Diavik Mine operation and concomitant site discharge to Lac de Gras until 2025.

Dominion Diamond retained Golder Associates Ltd. (Golder) to develop an additional model scenario considering the above changes. This memorandum provides the details of the model updates, assumptions, and a discussion of the results for this model scenario, referred to herein as the Alternative Water Management Scenario.

2.0 MODEL UPDATES

As part of the DAR, several models were developed that were linked at key times and nodes for the purposes of evaluating Misery Pit discharge water quality, and the influences of the discharge on Lac du Sauvage and Lac de Gras (Appendix 8F of the DAR). Due to the timeframe allocated to this request, it was not feasible to do update all of these models and several additional assumptions had to be included in the Alternative Water Management Scenario. These include:

- the alternative water management would not result in a change to the discharge water quality from the Misery Pit, and therefore, the projected total dissolved solids (TDS) concentrations in the Reasonable Estimate Case were used to represent the Misery Pit discharge water quality in the Alternative Water Management Scenario;
- only the model developed as part of the Reasonable Estimate Case was updated for the water management assumptions in the Alternative Water Management Scenario. In the Reasonable Estimate Case, discharge from the Misery Pit only occurs between Years 6 and 10 (2025 to 2029); water will be discharged for a longer period of time in the Alternative Water Management Scenario (2022 to 2027). Additionally, the projected discharge water quality for the Reasonable Estimate Case was assumed to be constant for the additional pumping months at the end of the Alternative Water Management Scenario;

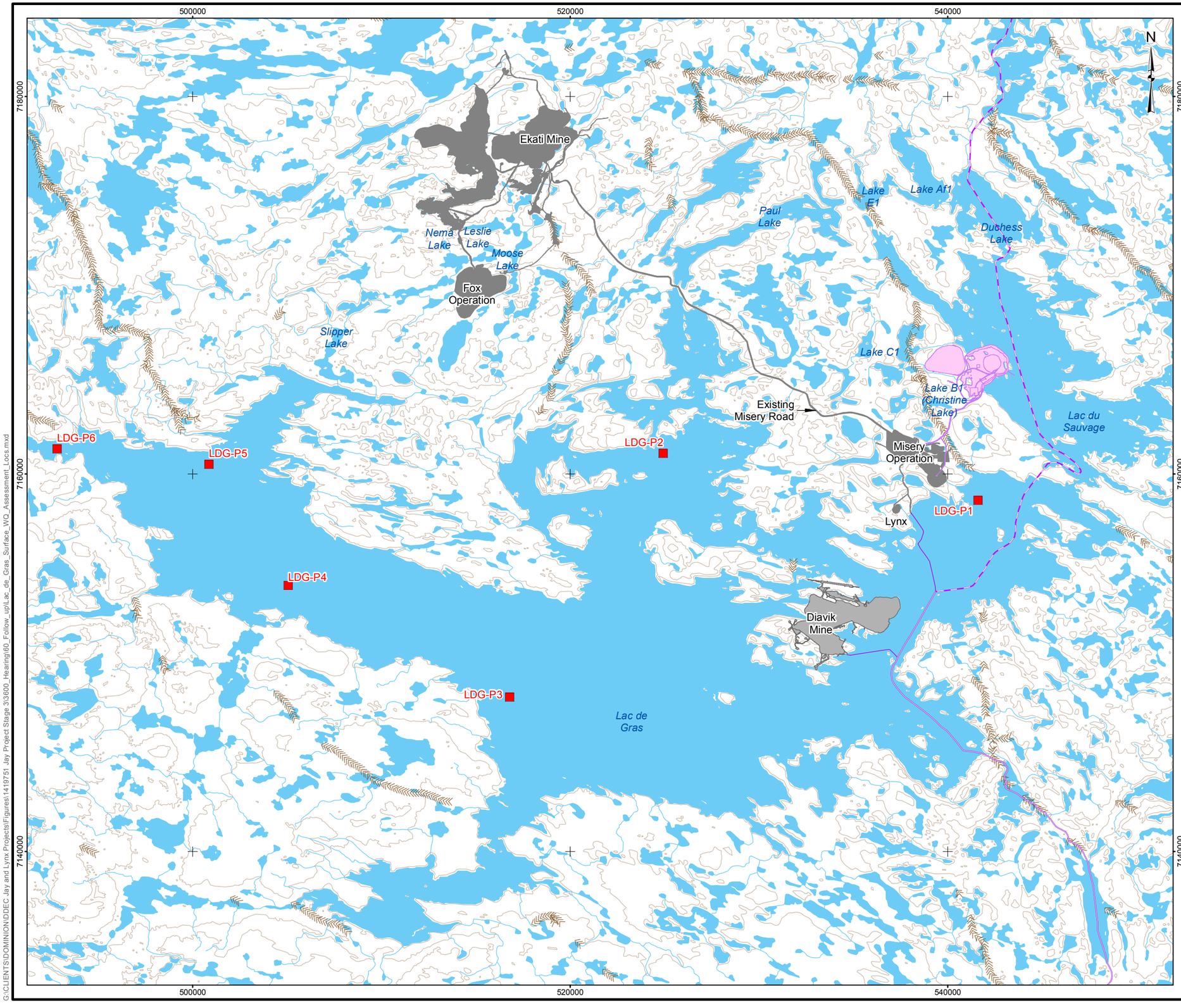
- a constant pumping rate (425 cubic metres per hour [m^3/h]) was assumed from Misery Pit to Lac du Sauvage during the operational discharge period. The objective of the pumping rate for the Alternative Water Management Scenario was to ensure sufficient capacity was available to store minewater produced during the last two years of operations in Misery Pit; a constant pumping rate was considered appropriate to achieve this objective. In the DAR, the pumping rate was established to pump any excess water above 430 metres [m] to a maximum pump rate of 2,000 m^3/h, resulting in higher rates during the freshet and lower rates during summer and winter months; and,
- flows provided in version 13 of the Diavik Diamond Mines Inc. (DDMI) water management plan (DDMI 2014) and discharge concentrations (Golder 2015a) were assumed to be constant from the Diavik Mine from 2023 to 2025.

Using the above assumptions, the lake hydrodynamic water quality models (Appendix 8F of the DAR) were updated to evaluate TDS concentrations at the Lac de Gras assessment locations (Figure 1).

3.0 RESULTS

The influence of the Alternative Water Management Scenario on surface water quality was evaluated at the six surface water quality assessment locations in Lac de Gras (Figure 1). Maximum depth-averaged, maximum water column, and maximum surface water concentrations from each assessment node are provided in Tables 1 to 3, respectively. Figures 2 to 7 present the time series results at each assessment location. For discussion purposes and context, results of the Reasonable Estimate Case are also provided in the tables and figures.

In general, predicted concentrations of TDS were similar in Lac de Gras for the Reasonable Estimate Case and the Alternative Water Management Scenario (Tables 1 to 3, and Figures 2 to 7). The earlier discharge from the Jay Project and the extended discharge from the Diavik Mine result do, however, result in small increases in TDS concentrations in Lac de Gras. For example, the peak increase was reported to occur at assessment node location LDG-P1 (Figure 2). During the open-water periods in late operations, the maximum projected water column (Table 1) and surface water (Table 3) TDS concentrations increased from 18 and 17 milligrams per litre (mg/L) to 21 and 20 mg/L, respectively, for the Reasonable Estimate Case and the Alternative Water Management Scenario (Tables 2 and 3).



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
- ELEVATION CONTOUR (20 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- ASSESSMENT LOCATION

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 1:200,000 KILOMETRES

PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
LAC DE GRAS SURFACE WATER QUALITY ASSESSMENT LOCATIONS

Golder Associates

PROJECT 1419751.3600.60			FILE No.	
DESIGN	CP	14/08/14	SCALE AS SHOWN	REV 0
GIS	ANK	06/10/15		
CHECK	MKH	06/10/15		
REVIEW	JF	08/10/15		

FIGURE 1

G:\CLIENTS\DOMINION\DDEC_Jay and Lynx Projects\Figures\1419751_Jay Project Stage 3\3600_Hearing\60_Follow_up\Lac_de_Gras_Surface_WQ_Assessment_Locs.mxd

Table 1: Predicted Maximum Water Column Total Dissolved Solids Concentrations

Parameter	Units	Early Operations (2019 - 2023)		Late Operations (2024 - 2029)		Closure - Pit Refilling Period (2030 - 2033)		Post-Closure (2034 - 2060)	
		Under Ice	Open Water	Under Ice	Open Water	Under Ice	Open Water	Under Ice	Open Water
LDG-P1									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	25	21	28	21	25	18	21	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	25	21	25	18	22	16	20	14
LDG-P2									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	29	19	29	21	27	20	24	17
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	19	28	19	23	17	23	16
LDG-P3									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	28	18	28	20	26	19	24	16
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	18	26	19	22	17	22	15
LDG-P4									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	30	17	29	18	26	17	24	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	17	28	18	22	16	23	14
LDG-P5									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	30	18	29	19	27	18	24	16
Total dissolved solids (Reasonable Estimate Case)	mg/L	29	18	29	19	22	16	24	15
LDG-P6									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	28	18	30	19	28	18	24	16
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	18	30	19	23	16	24	15

mg/L = milligrams per litre.

Table 2: Predicted Maximum of Depth-Averaged Total Dissolved Solids Concentrations

Parameter	Units	Early Operations (2019 - 2023)		Late Operations (2024 - 2029)		Closure - Pit Refilling Period (2030 - 2033)		Post-Closure (2034 - 2060)	
		Under Ice	Open Water	Under Ice	Open Water	Under Ice	Open Water	Under Ice	Open Water
LDG-P1									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	19	18	20	19	18	17	15	14
Total dissolved solids (Reasonable Estimate Case)	mg/L	19	18	18	17	16	16	15	14
LDG-P2									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	19	17	20	20	19	18	17	16
Total dissolved solids (Reasonable Estimate Case)	mg/L	19	17	18	18	16	16	15	15
LDG-P3									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	19	17	19	19	18	18	16	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	19	17	18	18	16	16	15	14
LDG-P4									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	19	17	19	18	18	17	16	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	19	17	18	17	16	15	15	14
LDG-P5									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	19	17	19	18	18	17	16	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	19	17	19	18	16	15	15	15
LDG-P6									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	22	18	22	18	21	17	19	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	21	17	22	18	18	15	18	14

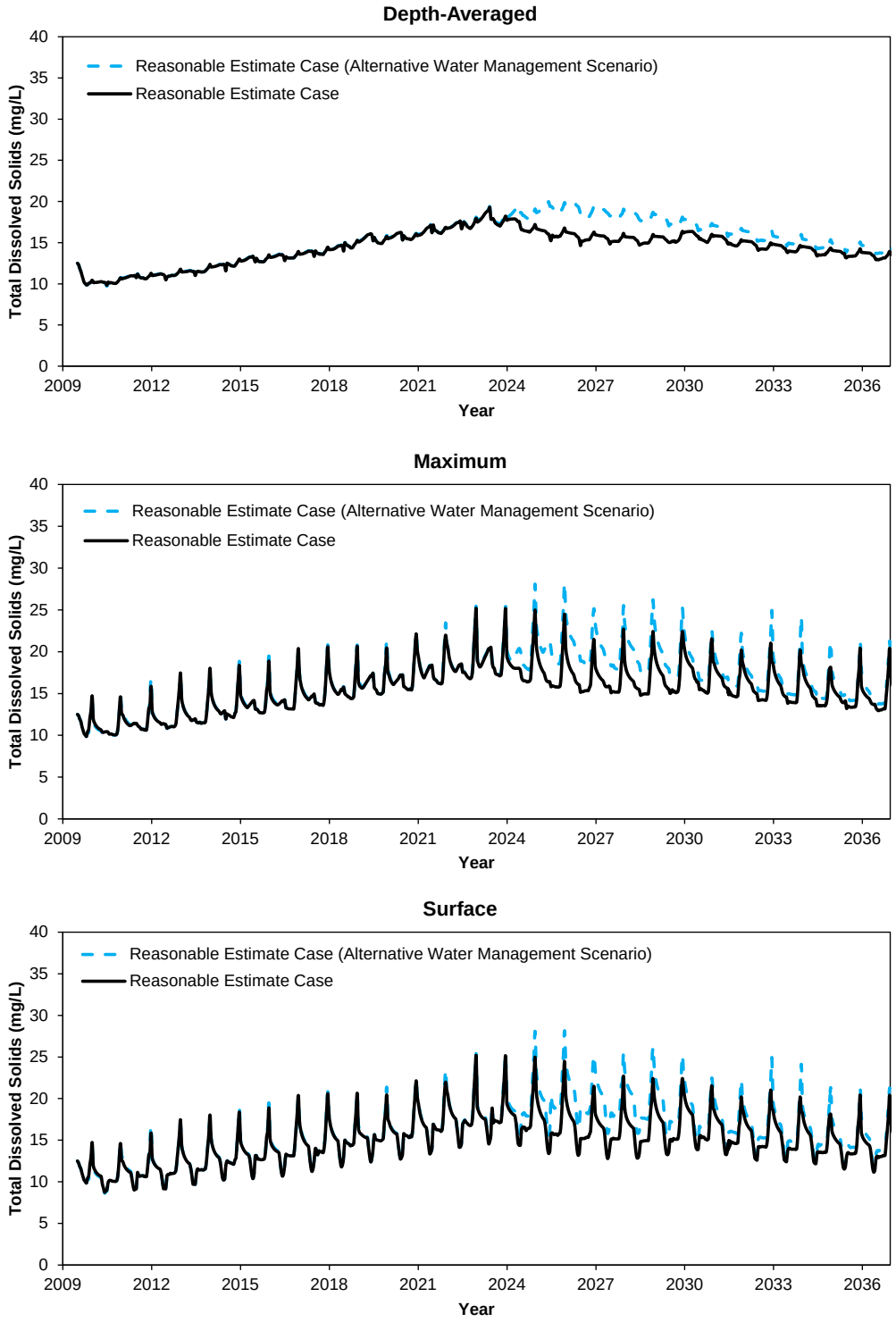
mg/L = milligrams per litre.

Table 3: Predicted Maximum Surface Water Total Dissolved Solids Concentrations

Parameter	Units	Early Operations (2019 - 2023)		Late Operations (2024 - 2029)		Closure - Pit Refilling Period (2030 - 2033)		Post-Closure (2034 - 2060)	
		Under Ice	Open Water	Under Ice	Open Water	Under Ice	Open Water	Under Ice	Open Water
LDG-P1									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	25	19	28	20	25	17	21	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	25	19	25	17	22	16	20	14
LDG-P2									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	29	17	29	18	27	17	24	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	17	28	17	23	15	23	14
LDG-P3									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	28	17	28	18	26	17	24	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	17	26	17	22	15	22	14
LDG-P4									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	30	17	29	18	26	17	24	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	17	28	18	22	15	23	14
LDG-P5									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	30	18	29	18	27	17	24	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	29	18	29	18	22	15	24	15
LDG-P6									
Total dissolved solids (Alternative Water Management Scenario)	mg/L	28	18	30	18	28	17	24	15
Total dissolved solids (Reasonable Estimate Case)	mg/L	28	18	30	18	23	15	24	14

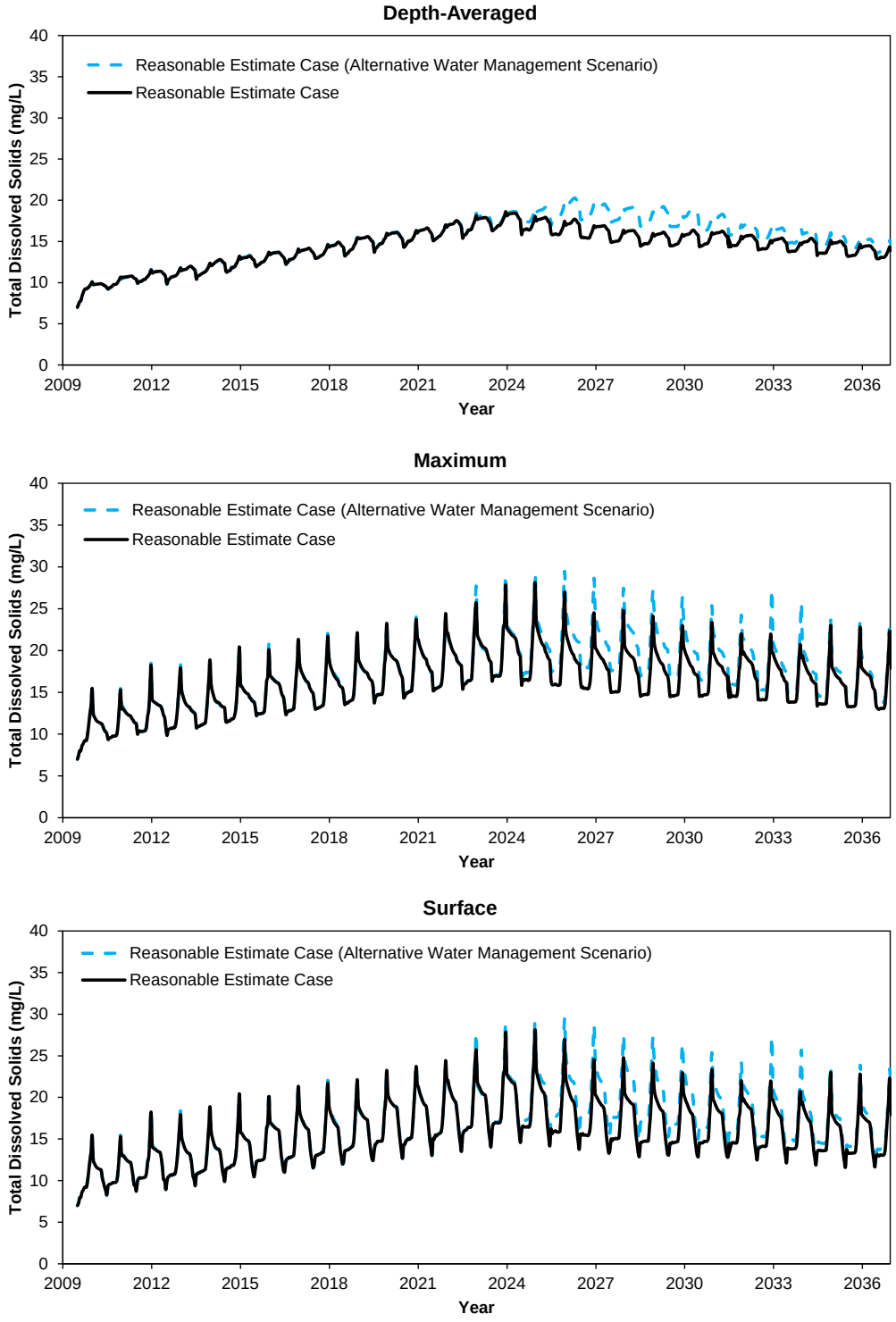
mg/L = milligrams per litre.

Figure 2: Predicted Total Dissolved Solids Concentrations in Lac de Gras at LDG-P1



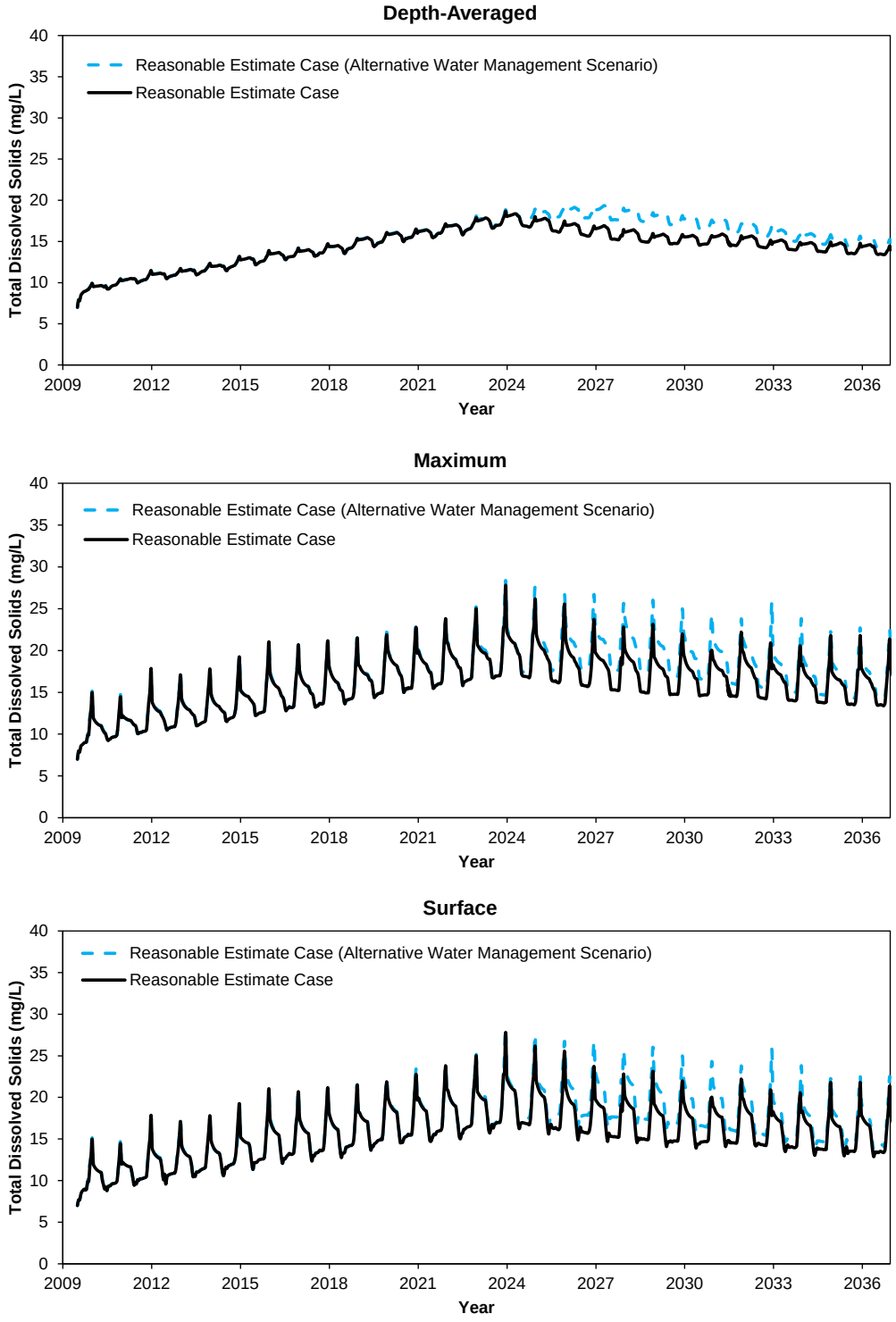
mg/L = milligrams per litre

Figure 3: Predicted Total Dissolved Solids Concentrations in Lac de Gras at LDG-P2



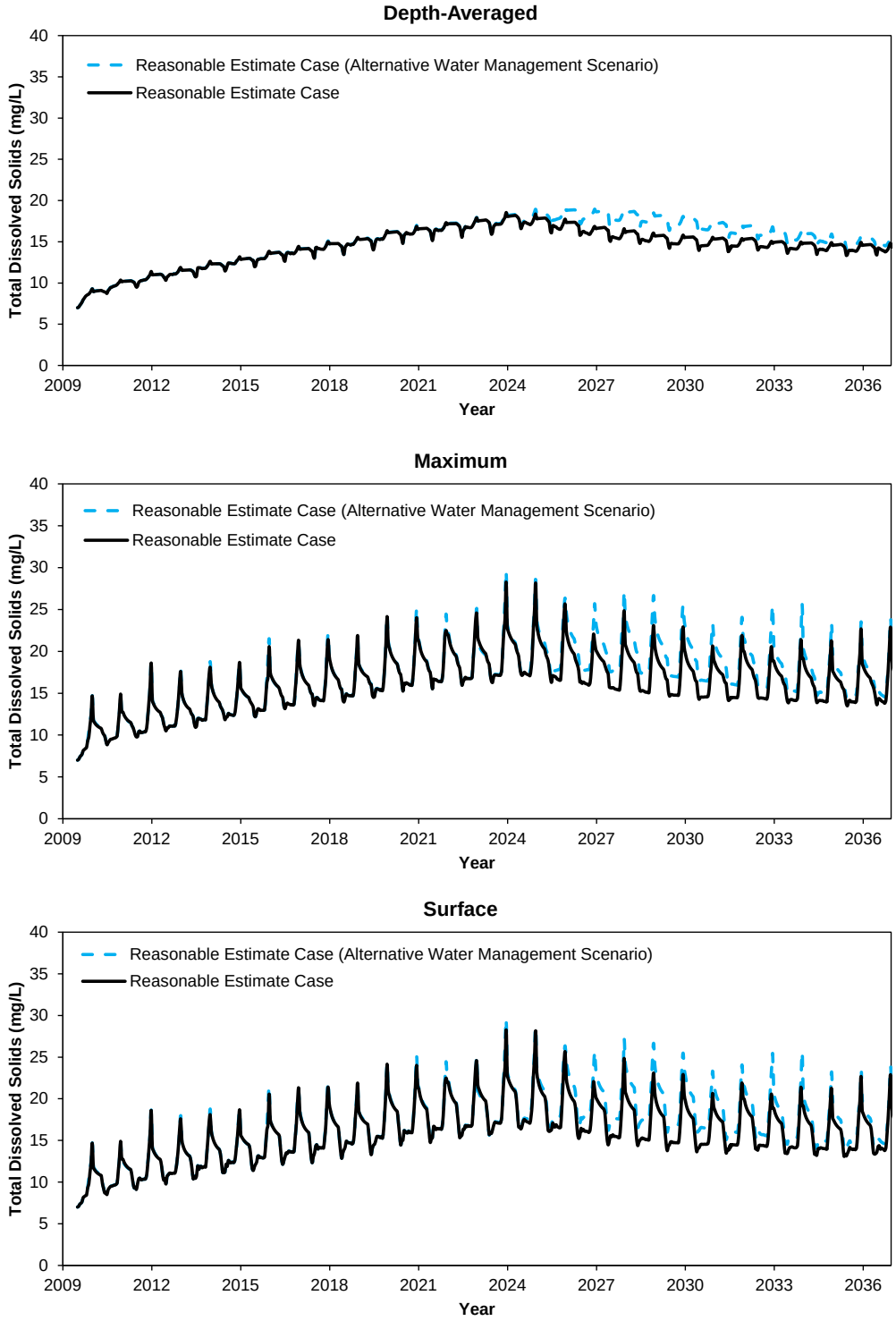
mg/L = milligrams per litre

Figure 4: Predicted Total Dissolved Solids Concentrations in Lac de Gras at LDG-P3



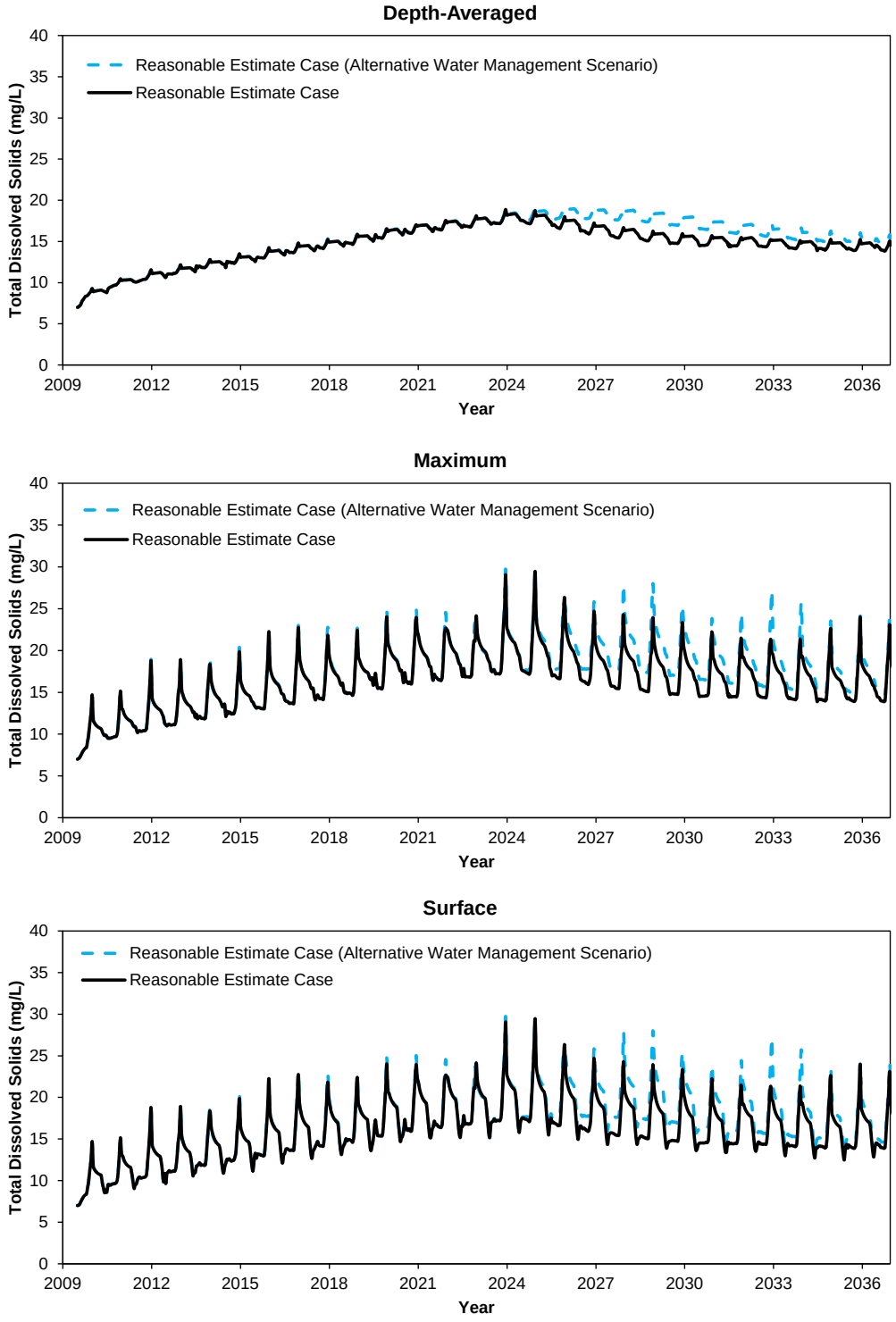
mg/L = milligrams per litre

Figure 5: Predicted Total Dissolved Solids Concentrations in Lac de Gras at LDG-P4



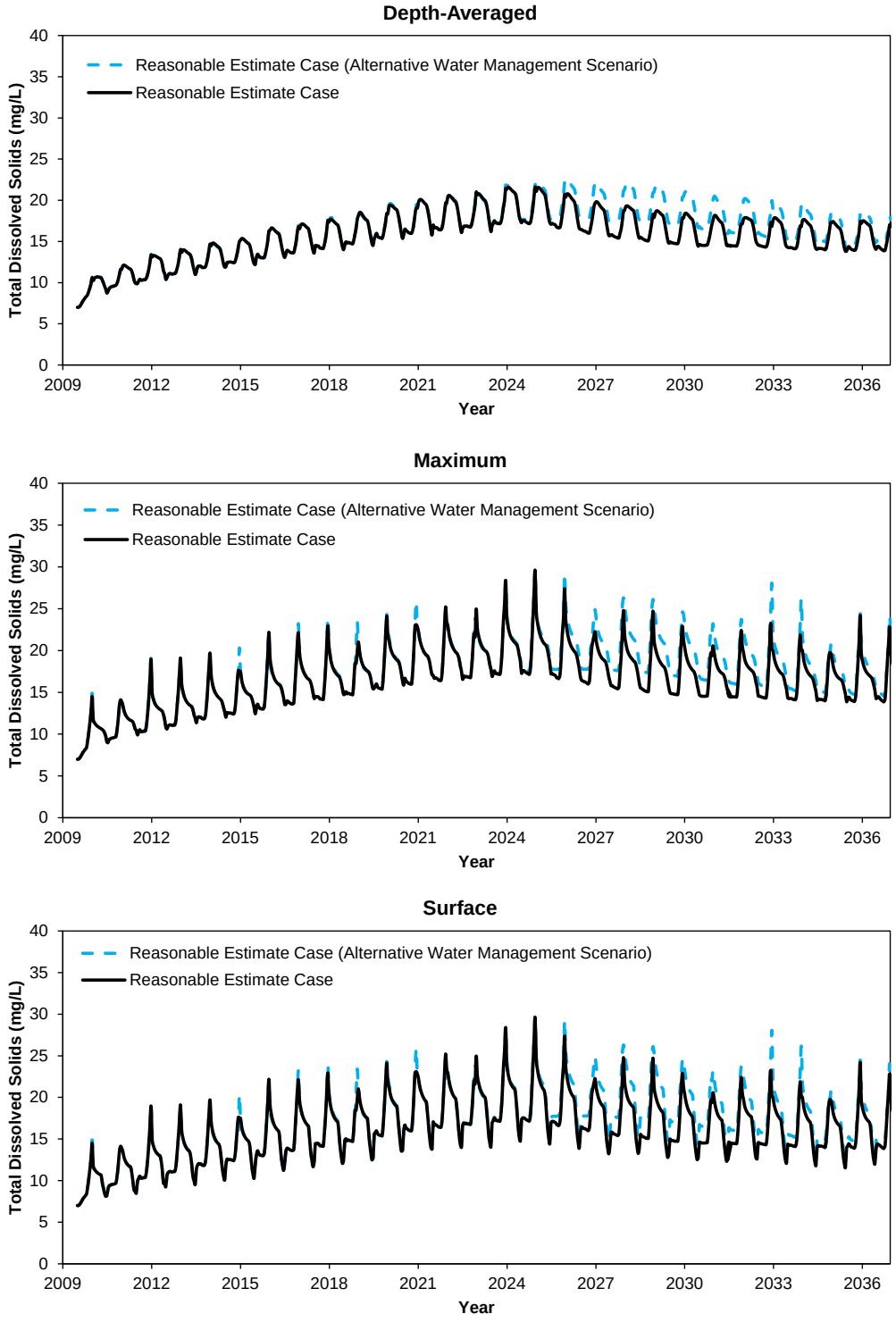
mg/L = milligrams per litre

Figure 6: Predicted Total Dissolved Solids Concentrations in Lac de Gras at LDG-P5



mg/L = milligrams per litre

Figure 7: Predicted Total Dissolved Solids Concentrations in Lac de Gras at LDG-P6



mg/L = milligrams per litre

4.0 DISCUSSION AND CONCLUSIONS

At the request of MVEIRB (2015), the Project water quality model was updated for an alternative water management strategy that considered the following:

- discharge from Misery Pit from Years 3 to 8 (2022 to 2027) in contrast to discharge from Years 5 to 10 (2024 to 2029) as per the model case included in the DAR; and,
- an extension of the Diavik Mine operation and concomitant site discharge to Lac de Gras until 2025.

The Lac du Sauvage and Lac de Gras hydrodynamic models (Appendix 8F of the DAR) were updated for the Reasonable Estimate Case (Golder 2015a) to project TDS concentrations in Lac de Gras for the above scenario. Projected TDS concentrations for the alternative water management strategy at surface water quality assessment locations in Lac de Gras were only slightly higher in comparison to the Reasonable Estimate Case projections (Figures 2 to 7; Tables 1 to 3). There are two key reasons TDS concentrations remain similar in the alternative water management and reasonable estimate scenarios:

- a constant pumping rate of 425 m^3/h was assumed in the Alternative Water Management Scenario to ensure there was sufficient capacity in the Misery Pit to store minewater inflows during the last two years of operations.

  In the Reasonable Estimate Case, the Misery Pit was maintained with a 10 m freeboard by varying the discharge pumping rate between 429 and 2,000 m^3/h after the Misery Pit was filled to the operational freeboard elevation.

  TDS concentrations in the Misery Pit discharge water quality for the alternative water management strategy were assumed to be the same as projected in the Reasonable Estimate Case. Therefore, while the cumulative life of mine TDS loading for the alternative management strategy is greater, peak loadings are less in comparison to the Reasonable Estimate Case, thereby reducing peak concentrations that may occur in Lac du Gras; and,
- The relative TDS loads entering Lac de Gras from the Jay Project and the Diavik Mine, even under the extended discharge period, are small in comparison to all other inflows to the lake, which have much lower TDS concentrations but represent a much greater proportion of the total inflow to Lac de Gras.

The resultant TDS concentrations in Lac de Gras under the Alternative Water Management Scenario are only slightly higher than that presented for the Reasonable Estimate Case. As projected for the Reasonable Estimate Case, there is also pronounced seasonality in the TDS concentrations, with substantially higher annual concentration trends occurring during under-ice conditions. Following operations (2030 onwards), TDS concentrations decrease and then realign with TDS concentration projections as modelled for the Reasonable Estimate Case (post 2033); this decrease is a result of end of operations (cessation of discharge) for the Project (i.e., 2030). Although this remodelling step focuses on TDS, the small change in concentrations projected in Lac de Gras under this alternate strategy does not change the conclusions of the DAR with respect to no significant adverse effects to WQ, and no adverse effects to aquatic health, the sustainability of the aquatic ecosystem, and the continued opportunity for traditional use or drinkability of the water are not anticipated.

It is important to note that, due to the time constraints allocated to this IR, several assumptions had to be carried forward into the water quality model (see Section 2.0), which introduce uncertainty. The key assumptions made include assuming a constant discharge rate from the Misery Pit and TDS concentrations equal to those projected for the Reasonable Estimate Case (Golder 2015a). Modifying the discharge rate has the potential to change

Misery Pit discharge concentrations and this was not evaluated as part of the current assessment. If Dominion Diamond considers implementing the alternative water management strategy during the permitting process, as presented in this memorandum, a more detailed assessment of the actual pumping rates and resultant discharge water quality may be required.

5.0 CLOSURE

We trust this memorandum satisfies your current requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

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AS/MKH/JF

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