TECHNICAL MEMORANDUM

DATE October 4, 2012 **PROJECT No.** 11-1365-0012/DCN-105

TO Veronica Chisholm
De Beers Canada Inc.

CC John Faithful and Amy Langhorne, Golder Associates Ltd.

FROM Nathan Schmidt, Golder Associates Ltd. **EMAIL** Nathan_Schmidt@golder.com

POTENTIAL EFFECTS TO NAVIGATION ASSOCIATED WITH THE PROPOSED GAHCHO KUÉ PROJECT DEVELOPMENT – INFORMATION REQUIREMENTS FOR A NAVIGABLE WATERS ASSESSMENT

1.0 INTRODUCTION

This technical memorandum (memo) provides information that is necessary to complete a Navigable Waters assessment, as outlined in the Transport Canada Round 2 Information Requests TC-1 and TC-2. More specifically, this memo provides Transport Canada with information, as outlined in the guidance document provided by Transport Canada to De Beers on June 21, 2012, which includes:

i) navigational use in the affected area;

ii) likely effects to navigable waterbodies that relate to navigation;

iii) project elements that may not affect waterbodies but may affect navigational use;

iv) concerns of the public and aboriginal groups related to Transport Canada's potential Navigable Water Protection Act approvals and an indication of any measures taken to address these concerns;

v) projected impacts to navigation considering i), ii), iii) and iv); and

vi) cumulative effects to navigation of the Gahcho Kué Project in combination with impacts of other developments that have happened in the past, are currently happening or are reasonably foreseeable.

This information is provided in the following sections.

2.0 CURRENT NAVIGATIONAL USE

De Beers has engaged aboriginal communities on several occasions prior to submitting the December 2010 EIS (De Beers 2010, Section 4) to discuss the potential impacts and concerns of the proposed Gahcho Kué Project (Project). During these meetings, De Beers presented the project description, including the dewatering plans for Kennady Lake, as well as describing changes to the downstream environment. In addition, De Beers submitted an update to the community engagement on the MVEIRB Public Registry on June 14, 2012 within a document entitled, "*Community Engagement Update Report (May 2012)"*. The aboriginal communities all indicated that the Project area occurs within their traditional territory.

In August-September 2012, representatives from Aboriginal communities attended site workshops at the Project site, which included a boat tour of Kennady Lake and an aerial tour of Kennady Lake and the downstream watersheds. During these workshops, De Beers was informed by community members, specifically members from Łutsel K'e Dene First Nation (LKDFN) and Yellowknives Dene First Nation (YKDFN), that in the past Kennady Lake was an area they would travel in the winter to hunt caribou and trap; it was also indicated that on several trips, nets were set to collect fish in the winter for their dog teams. There was also mention of a recent trip by YKDFN members to the Kennady Lake Exploration Camp. Based on the discussions to date, it would appear that there were more traditional land use activities that were undertaken in the vicinity of Kennady Lake in the past; there did not appear to be frequent use of the area in recent time. De Beers has provided funding to support a number of traditional knowledge studies with communities, such that the information relating to past and current navigation use of Kennady Lake can be validated, and have encouraged communities to complete and share information on the MVEIRB Public Registry. There is currently one traditional land use study entitled, "*Tlicho Knowledge for De Beers Canada proposed Gahcho Kué Diamond Project (March 2012)*", which is available on the MVEIRB Public registry.

In addition to ongoing discussions with the Aboriginal communities, De Beers also discussed use of the areas and potential concerns with Mr. Dave Olesen, who is an East Arm Great Slave Lake resident (September 6, 2012). The purpose of the conversation was to determine to what extent Kennady Lake was utilized by Mr. Olesen and his family. Mr. Olesen indicated that he had not spent any time on Kennady Lake, either canoeing in the summer, or by dog team in the winter, and it wasn't until he did work in the area with his float plane did he visit the lake. Mr. Olesen did state that he visits lakes that are part of the Hoarfrost River system, which is in a separate, but adjacent, watershed to Kennady Lake. These include Cook Lake and Walmsley Lake and several unnamed lakes. Certain lakes in the lower Hoarfrost system are used for domestic fish netting, in order to feed the dogs. As for other uses in the area, Dave mentioned that Louis Drybones has previously used a portage route up Bedford Creek to Goodspeed Lake, which is located south and west of Kennady Lake. There was a cabin there in the past but, according to Mr. Olesen, has since gone to ruin.

3.0 LIKELY EFFECTS ON NAVIGATION

Effects on navigation due to works associated with the proposed Gahcho Kué Project (Project) were addressed in the technical memo, titled 'Anticipated Works for the Proposed Gahcho Kué Project and the *Navigable Waters Protection Act*' (Golder 2012), which was submitted to the Mackenzie Valley Review Board public registry on October 2, 2012. This memo provided Transport Canada with a list of all works for the proposed Project that De Beers Canada Inc. (De Beers) anticipates will need to be assessed and evaluated for approval under the *Navigable Waters Protection Act,* or will interest Transport Canada's Navigable Waters Protection Program, and included dewatering, dyke construction, rock pile, tailings and pit developments in the mine or Project controlled area.

This section focuses on potential effects on downstream and adjacent waterbodies because of changes in flow regime due to the Project. These include:

- discharges to Lake N11 and Kennady Lake Area 8 during dewatering of Kennady Lake Areas 2 to 7, during construction;
- diversions of runoff from Kennady Lake tributary watersheds B, D and E to Lake N14 during operation;
- reductions in flow to Kennady Lake Area 8 during operation and closure; and
- diversions from Lake N11 during refilling of Kennady Lake Areas 3 to 7, during closure.

During the post-closure phase of the Project, flow regimes of downstream and adjacent waterbodies will be similar to pre-development.

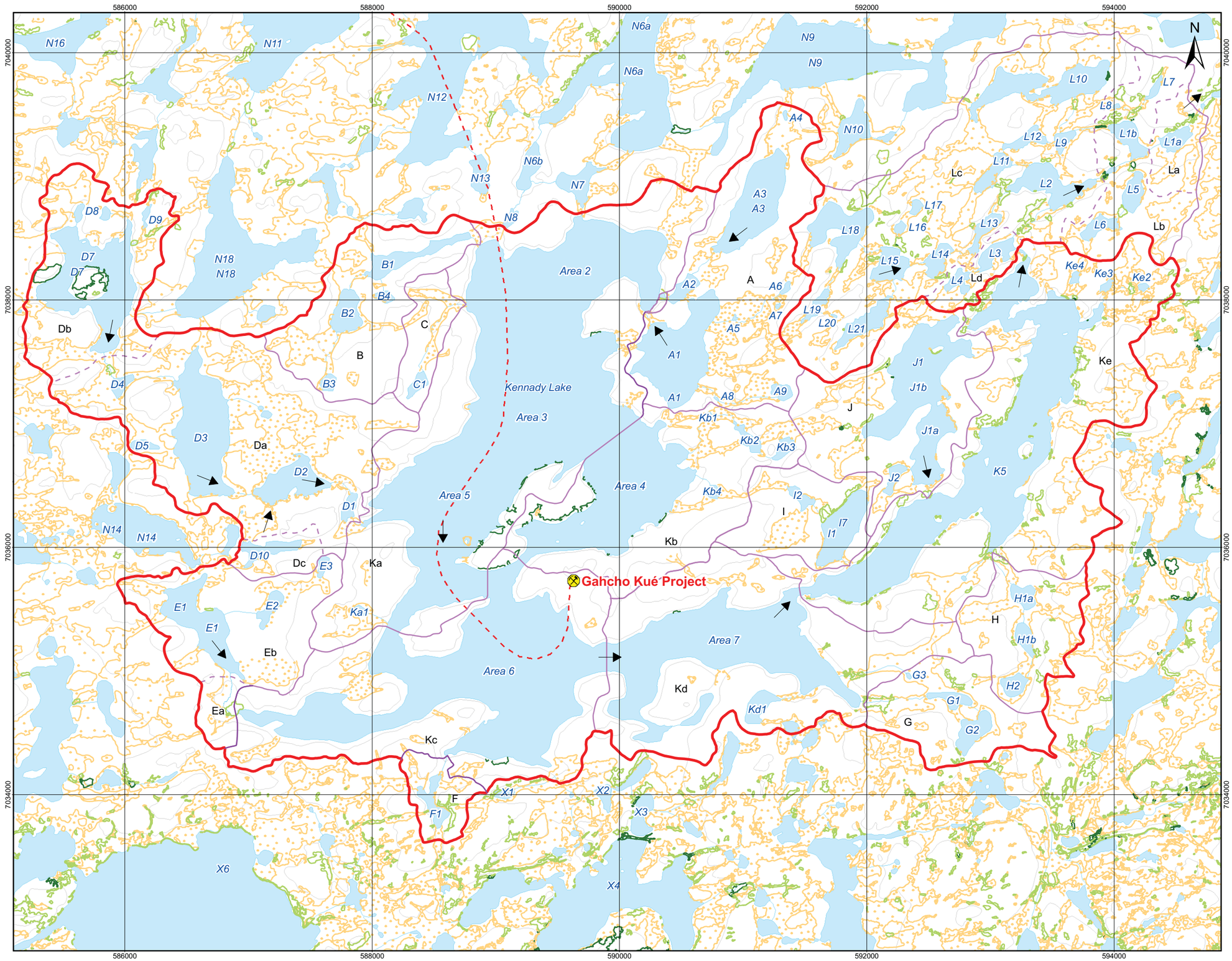
Downstream waterbodies from Kennady Lake Area 8 to Lake L1 are shown in Figure 1, and downstream waterbodies in the downstream M watershed and adjacent N watershed are shown in Figure 2.

The assessment of likely effects on navigation downstream of the Kennady Lake Controlled Area, including Kennady Lake Area 8, and Lakes L3, L2, L1c, L1b, L1a, M4, M3, M2, M1 and 410, is presented in Section 3.2. The assessment of likely effects on navigation in adjacent watersheds, including Lakes N14, N17, N16, N15, N11 and N1, is presented in Section 3.3. These two flow paths meet at Lake 410, beyond which effects on flows and water levels are expected to be small.

The discussion of each waterbody addresses lake and outlet channel physical characteristics and changes due to Project activities. Photographs of lake outlet channels are also provided. Changes to representative flow parameters, and associated lake water levels, are provided for selected reaches of each flow path.

3.1 Kennady Lake Watershed

Changes within the Kennady Lake watershed were addressed in Golder (2012).



LEGEND

- Gahcho Kué Project
- Winter Access Road
- Watercourse
- Waterbody
- Contour (10m interval)
- L Watershed Boundary
- L Watershed Interior Sub-watershed Boundary
- Kennady Lake Watershed Boundary
- Kennady Lake Sub-watershed Boundary
- Kennady Lake Interior Sub-watershed Boundary
- Drainage Direction
- Brush
- Fen
- Tree
- K5 Lake Identifier
- Ke Sub-watershed Identifier1

NOTES

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

GAHCHO KUÉ PROJECT

Kennady Lake Watershed and L Watershed

PROJECTION: UTM Zone 12	DATUM: NAD83	DE BEERS CANADA
Scale: 1:30,000 (500 250 0 500 Metres)		
FILE No: B-Hydro-012-GIS		DATE: October 21, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	**Figure 1**
OFFICE: GOLD-CAL	DRAWN: JH / CHECK: NS	

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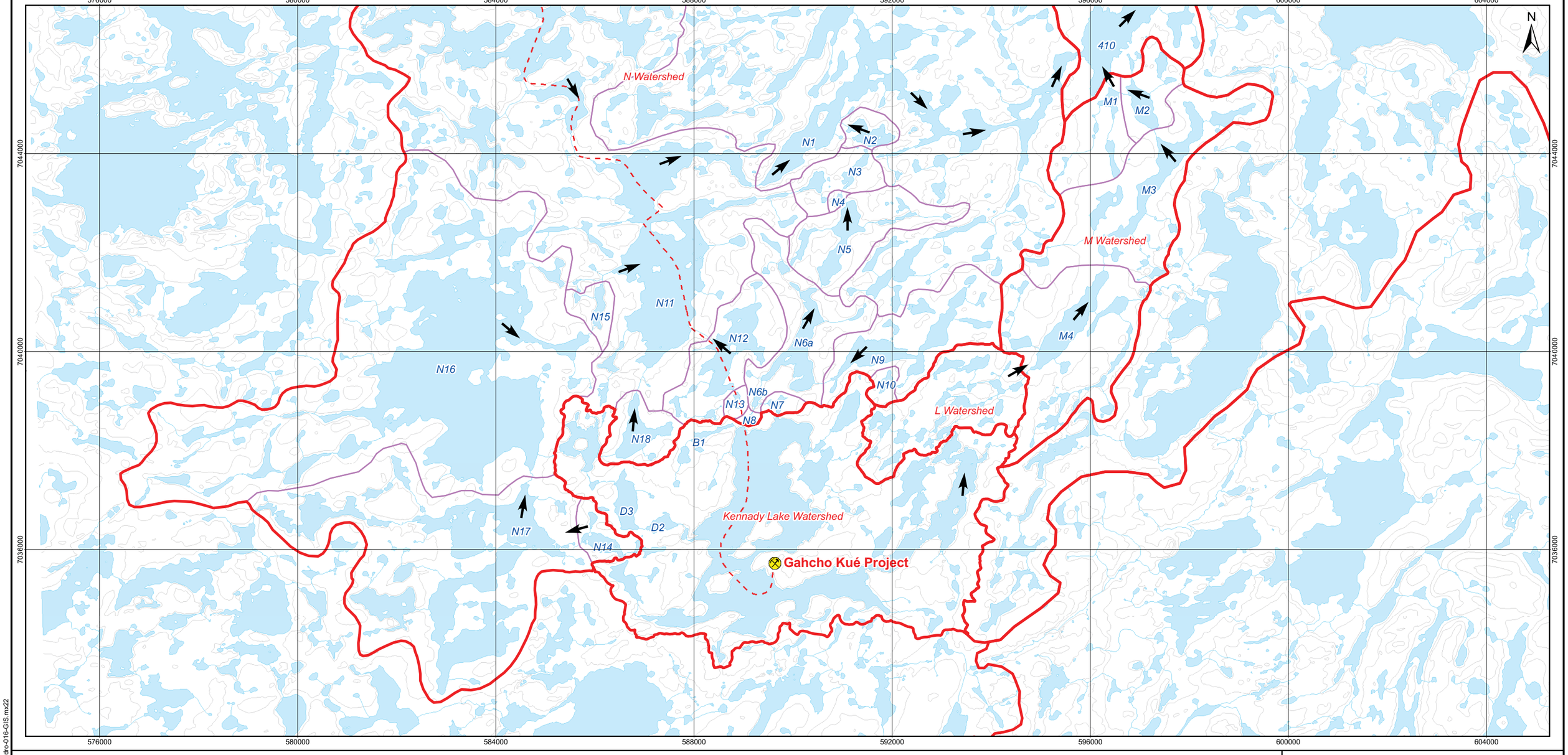

LEGEND

- Gahcho Kué Project
- Winter Access Road
- Watercourse
- Waterbody
- Contour (10m interval)
- Sub-Watershed Boundary
- Watershed Boundary
- Drainage Direction

NOTES

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

GAHCHO KUÉ PROJECT

M and N Watersheds

PROJECTION: UTM Zone 12	DATUM: NAD83	
Scale: 1:75,000 (1 0.5 0 1 Kilometres)		DE BEERS CANADA
FILE No: B-Hydro-016-GIS		DATE: October 21, 2010
JOB NO: 09-1365-1004	REVISION NO: 5	Figure 2
OFFICE: GOLD-CAL	DRAWN: JH / CHECK: NS	

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3.2 Lakes Downstream of Kennady Lake Controlled Area

The drainage system downstream of Kennady Lake from its outlet at Kennady Lake Area 8 to Lake 410 consists of a sequence of lakes with relatively short connection channels. Kennady Lake Area 8 drains into the L watershed, which then drains into the M watershed, which drains into Lake 410. The L and M watersheds are also subdivided into smaller sub-watersheds. Lakes were assigned identifying numbers in sequence starting at the downstream end of each watershed and proceeding upstream (e.g., Lake M1 is the most downstream lake in watershed M). In some cases a tertiary lower case letter was added to the lake name to allow separate designations of portions of a single lake separated by a narrows, or by a short, wide channel section.

Changes due to the Project

- **Construction:** Kennady Lake Area 8 will be closed-circuited from the remainder of Kennady Lake, starting during construction. It will receive dewatering discharges for one year during construction, which will decrease flood flows and water levels, but increase flows and water levels during the post-freshet period. For the remainder of construction, flows and water levels will be reduced, due to loss of the upstream tributary area and the use of the area for Project potable water supply. This will be partially mitigated by diversion of the A watershed to Kennady Lake Area 8, via Lake J1.
- **Operations:** Flows and water levels will be reduced, due to loss of the upstream tributary area and the use of the area for Project potable water supply. This will be partially mitigated by diversion of the A watershed to Kennady Lake Area 8, via Lake J1.
- **Closure:** Flows and water levels will be reduced, due to loss of the upstream tributary area and the use of the area for Project potable water supply. This will be partially mitigated by diversion of the A watershed to Kennady Lake Area 8, via Lake J1.
- **Post-Closure:** Flows and water levels will be similar to baseline, with small changes due to changes to land and lake areas in the upstream watershed.

Changes will in general be greatest at the most upstream lake in this flow path (Kennady Lake Area 8) and become muted with downstream distance to the most downstream lake (Lake M1). Lake 410 will be affected by changes to flows at Kennady Lake Area 8 as well as by changes in flows within the N watershed. Figures and tables extracted from the 2011 EIS Update (De Beers 2011), showing these changes, are reproduced in Appendix A.

3.2.1 Kennady Lake Area 8

Lake and Outlet Description

Kennady Lake Area 8 is located immediately downstream of Dyke A, and discharges to Lake L3. The physical characteristics of the lake and outlet are shown in Table 1. The lake location is shown on Figure 1 and photographs of the outlet are provided in Table 2.

Table 1: Kennady Lake Area 8 and Outlet - Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	1.43 km^2	EIS Annex H, Appendix H.IV, Table H.IV-2
	Maximum Depth	10.2 m	Round 1 Information Request Response GKP 14, Table GKP 14-1 (De Beers 2012)
	Bathymetry	yes	EIS Annex H, Figure H5.9-1
Outlet Channel	Channel Length	100 m	EIS Annex H, Table H6.3-3
	Elevation Drop	0.140 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.0014 m/m	Derived
	Bed Material	Cobble/Boulder	Visual
	Bankfull Width	22.0 m	Field measurements August 2007
	Bankfull Depth	0.60 m	Field measurements August 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.4 m from the median October level to the 100-year flood level. The most extreme change anticipated during construction (dewatering) is an increase in lake water level of 0.30 m during the late summer low flow period and the most extreme change anticipated during operations and closure is a decrease in lake water level of 0.16 m during the early summer high flow period. These changes do not exceed natural flood water levels and are only slightly lower (by approximately 0.1 m) than drought water levels. This is unlikely to affect navigation on Kennady Lake Area 8.

The Kennady Lake Area 8 outlet channel is shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 2: Photographs of Kennady Lake Area 8 Outlet Channel

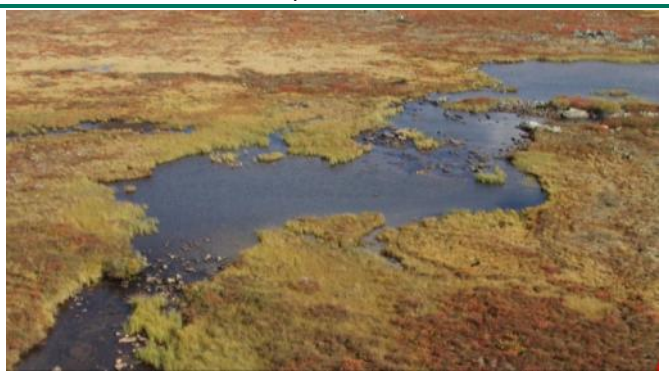
Kennady Lake Area 8 Outlet, View Downstream – Sep 2007

Kennady Lake Area 8 Outlet, View Upstream – Jul 2012

Kennady Lake Area 8 Outlet, Panoramic View Upstream – Sep 2007

Kennady Lake Area 8 Outlet, Panoramic View Downstream – Sep 2007

Kennady Lake Area 8 Outlet, View Downstream – Jul 2011



Kennady Lake Area 8 Outlet, View Upstream – Aug 2011

3.2.2 Lake L3

Lake and Outlet Description

Lake L3 is located immediately downstream of Kennady Lake, and discharges to Lake L2. The physical characteristics of the lake and outlet are shown in Table 3. The lake location is shown on Figure 1 and photographs of the outlet are provided in Table 4.

Table 3: Lake L3 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.049 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	1.0 m	EIS Annex J, Table J4.1-2
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-8
Outlet Channel	Channel Length	463 m	EIS Annex H, Table H6.3-3
	Elevation Drop	1.360 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.003 m/m	Derived
	Bed Material	Boulders 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	13.0 m	Field measurements August 2007
	Bankfull Depth	0.40 m	Field measurements August 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

Hydrological model results for Lake L3 are not provided in Appendix A, but changes to flows are similar to those for Kennady Lake Area 8. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake L3.

The Lake L3 outlet channel is shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

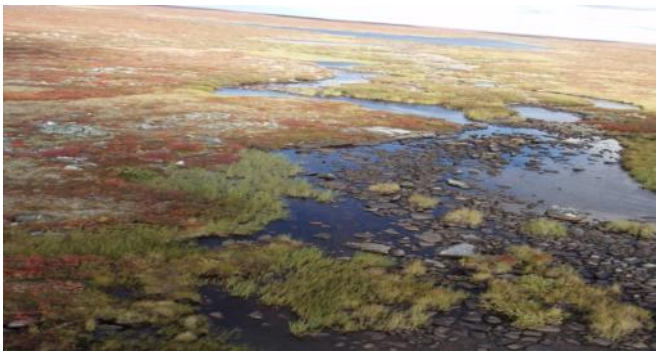
Table 4: Photos of Lake L3 Outlet

Lake L3 outlet, View Downstream-2007

Lake L3 outlet, View Downstream- July 2012

Lake L3 Outlet, Panoramic View Upstream – Sept 2007

Lake L3 Outlet, Panoramic View Downstream - Sept 2007



Lake L3 Outlet, View Downstream - 2007

Lake L3 Outlet, July 2012

3.2.3 Lake L2

Lake L2 is located immediately downstream of Lake L3, and discharges to Lake L1c. The physical characteristics of the lake and outlet are shown in Table 5. The lake location is shown on Figure 1 and photographs of the outlet are provided in Table 6.

Table 5: Lake L2 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.126 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	3.4 m	EIS Annex J, Table J4.1-2
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-7
Outlet Channel	Channel Length	300 m	EIS Annex H, Table H6.3-3
	Elevation Drop	1.640 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.005 m/m	Derived
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	4.27 m	Field measurements August 2007
	Bankfull Depth	0.52 m	Field measurements August 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

Hydrological model results for Lake L2 are not provided in Appendix A, but changes to flows are similar to those for Kennady Lake Area 8. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake L2.

The Lake L2 outlet channel is shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 6: Photographs of Lake L2 Outlet Channel

Lake L2 Outlet, Flow is Right to Left-July 2012

Lake L2 Outlet, View from Downstream- July 2012

Lake L2 Outlet, Panoramic View Downstream- Sept 2007

Lake L2 Outlet, Panoramic View Upstream- Sept 2007

Lake L2 Outlet, View facing Upstream- 2007

Lake L2 Outlet, View facing Downstream- 2007

3.2.4 Lake L1c

Lake L1c is actually a large pool in the outlet channel of a larger lake, and was assigned a lake designation to facilitate discussion of aquatic resources. Lake L1c is located immediately downstream of Lake L2, and discharges to Lake L1b. The physical characteristics of the lake and outlet are shown in Table 7. The lake location is shown on Figure 1 and photographs of the outlet are provided in Table 8.

Table 7: Lake L1c and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.005 km^2	EIS Annex J, Table J4.1-2
	Maximum Depth	-	Not available
	Bathymetry	no	Not available
Outlet Channel	Channel Length	94 m	EIS Annex J, Table J4.1-5
	Elevation Drop	0.5 m	Derived
	Channel Slope	0.005 m/m	EIS Annex J, Table J4.1-5
	Bed Material	Boulder	Visual
	Bankfull Width	Not measured	Not available
	Bankfull Depth	Not measured	Not available

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

Hydrological model results for Lake L1c are not provided in Appendix A, but changes to flows are similar to those for Kennady Lake Area 8. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake L1c.

The Lake L1c outlet channel is shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 8: Photographs of Lake L1c Outlet Channel

Lake L1c Outlet, Panoramic View Downstream - Sept 2007

Lake L1c Outlet, Panoramic View Upstream- Sept 2007

Lake L1C Outlet, Upstream View- July 2011

Lake L1C Outlet, Downstream View- July 2011

3.2.5 Lake L1b

Lake L1b is located immediately downstream of Lake L1c, and discharges to Lake L1a. The physical characteristics of the lake and outlet are shown in Table 9. The lake location is shown on Figure 1 and photographs of the outlet are provided in Table 10.

Table 9: Lake L1b and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.061 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	1.8 m	EIS Annex J, Table J4.1-2
	Bathymetry	no	Not available
Outlet Channel	Channel Length	85 m	EIS Annex H, Table H6.3-3
	Elevation Drop	0.655 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.008 m/m	Derived
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	Braided	Field measurements August 2007
	Bankfull Depth	0.43 m	Field measurements August 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

Hydrological model results for Lake L1b are not provided in Appendix A, but changes to flows are similar to those for Kennady Lake Area 8. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake L1b.

The Lake L1b outlet channel is shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

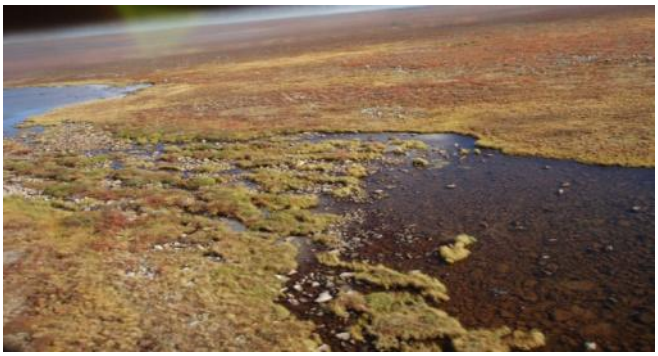
Table 10: Photographs of Lake L1b Outlet Channel

Lake L1b Outlet, Flow from Right to Left- July 2012

Lake L1b Outlet, Flow from Right to Left- July 2012

Lake L1b Outlet, Panoramic View Upstream- Sept 2007

Lake L1b Outlet, Panoramic View Downstream- Sept 2007



Lake L1b Outlet, Downstream facing View- Sept 2007

Lake L1b Outlet, Downstream Facing View- July 2011

3.2.6 Lake L1a

Lake L1a is located immediately downstream of Lake L1b, and discharges to Lake M4. The physical characteristics of the lake and outlet are shown in Table 1. The lake location is shown on Figure 1 and photographs of the outlet are provided in Table 12.

Table 11: Lake L1a and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.043 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	1.2 m	EIS Annex J, Table J4.1-2
	Bathymetry	no	Not available
Outlet Channel	Channel Length	346 m	EIS Annex H, Table H6.3-3
	Elevation Drop	4.408 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.013 m/m	EIS Annex J, Table J4.1-5
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	Braided	Field measurements August 2007
	Bankfull Depth	0.57 m	Field measurements August 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.43 m from the median October level to the 100-year flood level. The most extreme change anticipated during construction (dewatering) is an increase in lake water level of 0.18 m during the late summer low flow period and the most extreme change anticipated during operations and closure is a decrease in lake water level of 0.18 m during the early summer high flow period. These changes do not exceed natural flood water levels and are only slightly lower (by approximately 0.1 m) than drought water levels. This is unlikely to affect navigation on Lake L1a.

The Lake L1a outlet channel is braided, shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

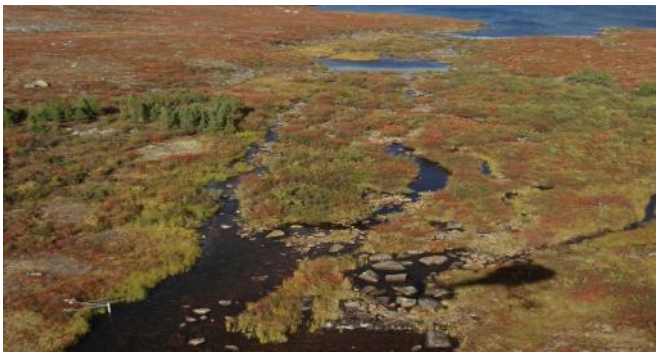
Table 12: Photographs of Lake L1a Outlet Channel

Lake L1a Outlet, Upstream Facing View- July 2012

Lake L1a Outlet, Flow from Right to Left-July 2012

Lake L1a Outlet, Panoramic View Upstream-Sept 2007

Lake L1a Outlet, Panoramic View Downstream-Sept 2007



Lake L1a Outlet, Downstream Facing View- Sept 2007

Lake L1a Outlet, Downstream Facing View- 2007

3.2.7 Lake M4

Lake M4 is located immediately downstream of Lake L1a, and discharges to Lake M3. The physical characteristics of the lake and outlet are shown in Table 13. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 14.

Table 13: Lake M4 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.806 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	13.0 m	EIS Annex J, Table J4.1-2
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-18
Outlet Channel	Channel Length	305 m	EIS Annex H, Table H6.3-3
	Elevation Drop	0.916 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.003 m/m	Derived
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	10.0 m	Field measurements September 2007
	Bankfull Depth	0.45 m	Field measurements September 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

Hydrological model results for Lake L1b are not provided in Appendix A, but changes to flows are similar to those for Lake L1a. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake M4.

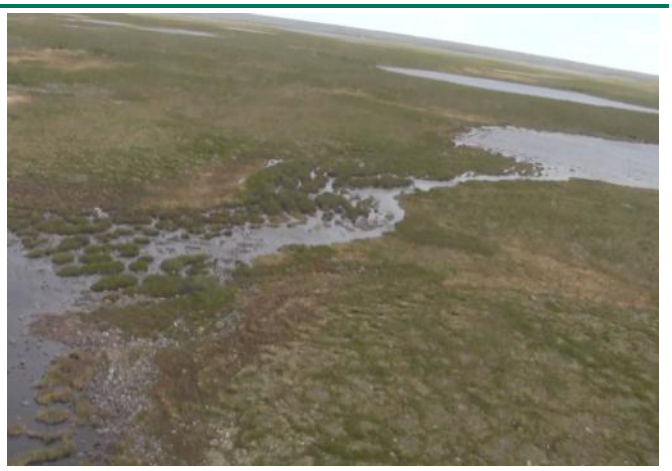
The Lake M4 outlet channel is braided, shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 14: Photographs of Lake M4 Outlet Channel

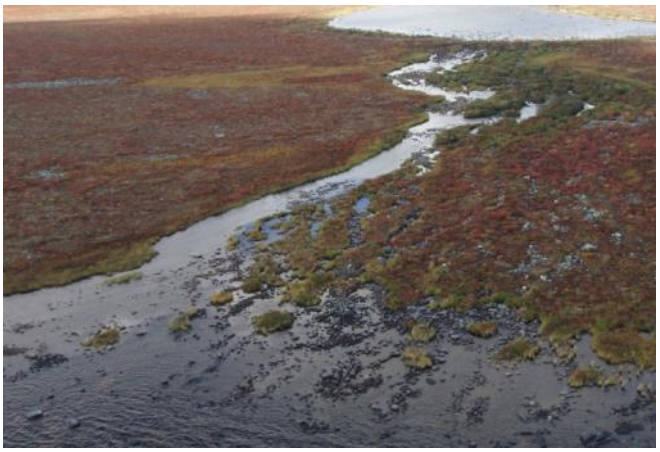
Lake M4 Outlet, Downstream Facing View-2007

Lake M4 Outlet, Upstream Facing View-July 2011

Lake M4 Outlet, Downstream Facing View-July 2011



Lake M4 Outlet, Flow from Right to Left- July 2012



Lake M4 Outlet, Downstream Facing View- Sept 2007

Lake M4 Outlet, Flow from Left to Right-2007

3.2.8 Lake M3

Lake M3 is located immediately downstream of Lake M4, and discharges to Lake M2. The physical characteristics of the lake and outlet are shown in Table 15. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 16.

Table 15: Lake M3 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.910 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	7.5 m	EIS Annex J, Table J4.1-2
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-17
Outlet Channel	Channel Length	101 m	EIS Annex J, Table J4.1-5
	Elevation Drop	0.10	Derived
	Channel Slope	0.001 m/m	EIS Annex J, Table J4.1-5
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	Braided	Field measurements September 2007
	Bankfull Depth	0.70 m	Field measurements September 2007

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

Hydrological model results for Lake M3 are not provided in Appendix A, but changes to flows are similar to those for Lake L1a. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake M3.

The Lake M3 outlet channel is braided, shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 16: Photographs of Lake M3 Outlet Channel

 *M3 Outlet, Downstream Facing View-Sept 2007*	 *Lake M3 Outlet, Downstream Facing View- 2007*
 *Lake M3 Outlet, Upstream Facing View- 2007*	 *Lake M3 Outlet, Upstream Facing View-2007*

3.2.9 Lake M2

Lake M2 is located immediately downstream of Lake M3, and discharges to Lake M1. The physical characteristics of the lake and outlet are shown in Table 17. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 18.

Table 17: Lake M2 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.321 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	5.7 m	EIS Annex J, Table J4.1-2
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-16
Outlet Channel	Channel Length	211 m	EIS Annex H, Table H6.3-3
	Elevation Drop	0.555 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.003 m/m	Derived
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	22.0 m (2 channels)	Field measurements September 2007
	Bankfull Depth	0.63 m	Field measurements September 2007

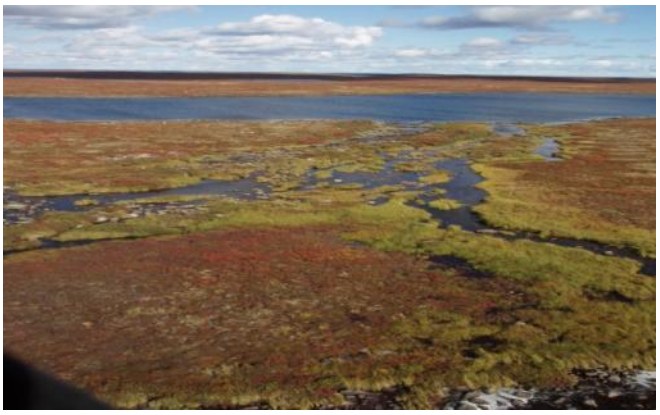
Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

Hydrological model results for Lake M2 are not provided in Appendix A, but changes to flows are similar to those for Lake L1a. Given the outlet channel characteristics, lake water levels will not exceed natural flood water levels during dewatering and will be only slightly lower during operations and closure. This is unlikely to affect navigation on Lake M2.

The Lake M2 outlet channel is braided, shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 18: Photographs of Lake M2 Outlet Channel

 *Lake M2 Outlet, Upstream Facing View- Sept 2007*	 *Lake M2 Outlet, Downstream Facing View- Sept 2007*
 *Lake M2 Outlet, Upstream View in Left Channel-2007*	 *Lake M2 Outlet, Downstream View in Left Channel-2007*
 *Lake M2 Outlet, Upstream View in Right Channel- 2007*	 *Lake M2 Outlet, Downstream View in Right Channel-2007*

3.2.10 Lake M1

Lake M1 is located immediately downstream of Lake M2, and discharges to Lake 410. The physical characteristics of the lake and outlet are shown in Table 19. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 20.

Table 19: Lake M1 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.110 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	1.9 m	EIS Annex J, Table J4.1-2
	Bathymetry	no	Not available
Outlet Channel	Channel Length	237 m	EIS Annex H, Table H6.3-3
	Elevation Drop	0.283 m	EIS Annex H, Table H6.3-3
	Channel Slope	0.001 m/m	Derived
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	22.0 m	Field measurements September 2007
	Bankfull Depth	0.52 m	Field measurements September 2007

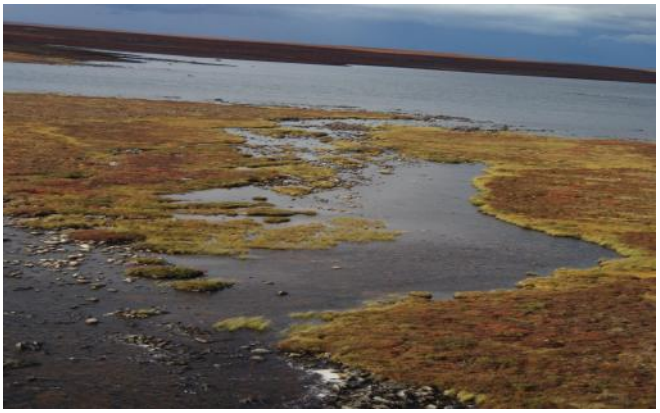
Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.72 m from the median October level to the 100-year flood level. The most extreme change anticipated during construction (dewatering) is an increase in lake water level of 0.23 m during the late summer low flow period and the most extreme change anticipated during operations and closure is a decrease in lake water level of 0.16 m during the early summer high flow period. These changes do not significantly exceed natural flood water levels and are only slightly lower (by less than 0.1 m) than drought water levels. This is unlikely to affect navigation on Lake M1.

The Lake M1 outlet channel is braided, shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 20: Photographs of Lake M1 Outlet Channel



Lake M1 Outlet, Downstream Facing View-Sept 2007

Lake M1 Outlet, Downstream Facing View- 2007

Lake M1 Outlet, Upstream Facing View- 2007

Lake M1 Outlet, Panoramic View Downstream-Sept 2007

3.2.11 Lake 410

Lake 410 is located immediately downstream of Lake L1b, and discharges to Lake P8b. The physical characteristics of the lake and outlet are shown in Table 21. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 22.

Table 21: Lake 410 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	5.79 km^2	EIS Annex H, Table H6.3-2
	Maximum Depth	9.1 m	EIS Annex J, Table J4.1-2
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-19
Outlet Channel	Channel Length	181 m	EIS Annex J, Table J4.1-5
	Elevation Drop	Not measured	Not available
	Channel Slope	Not measured	Not available
	Bed Material	Boulder 200-1000 mm dia.	EIS Annex H, Section H6.3.4
	Bankfull Width	Not measured	Not available
	Bankfull Depth	Not measured	Not available

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre; mm dia. = millimetre diameter.

Effects Summary

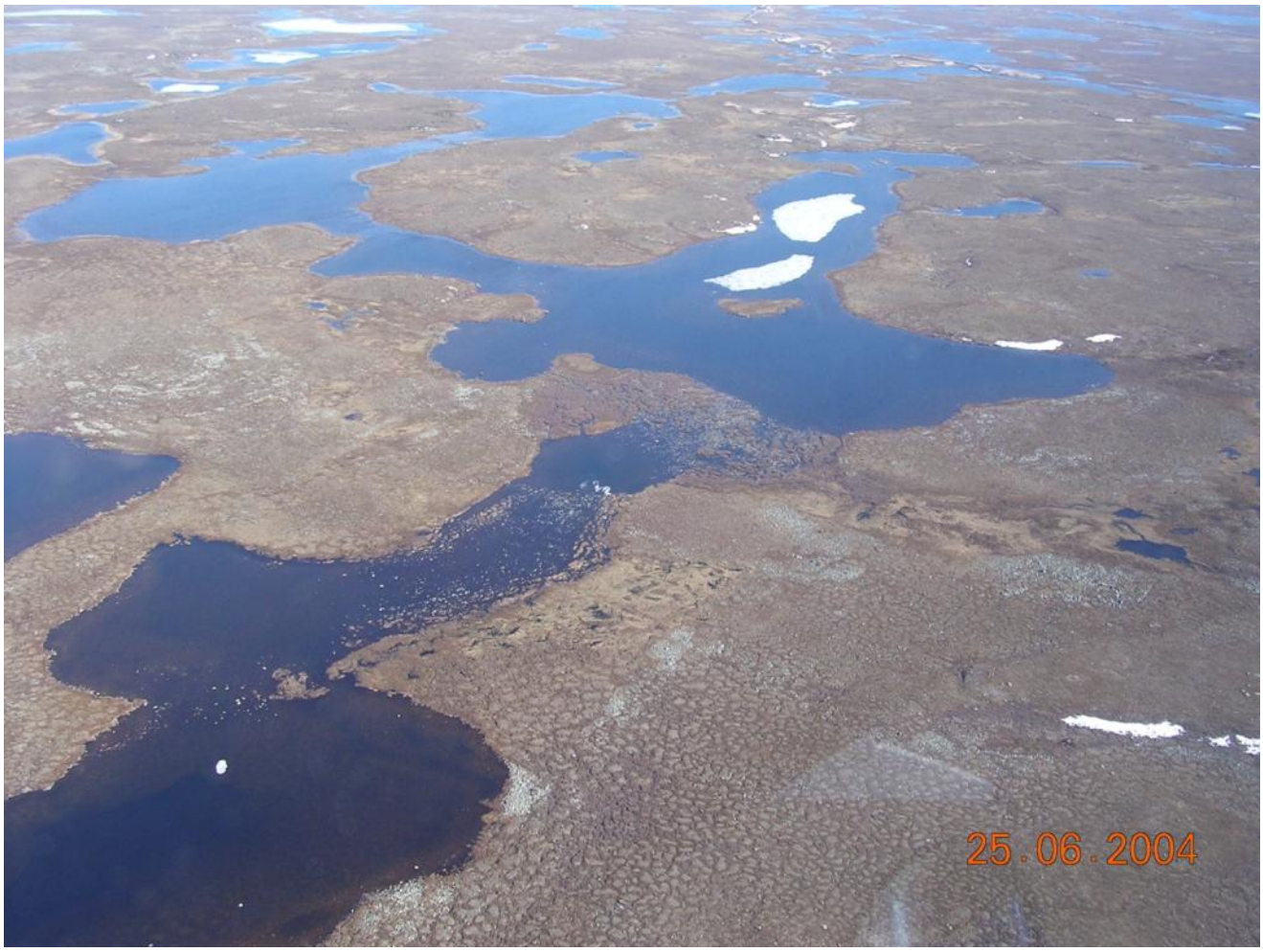
The figures and tables in Appendix A show that baseline lake water levels vary by approximately 1.1 m from the median October level to the 100-year flood level. The most extreme change anticipated during construction (dewatering) is an increase in lake water level of 0.17 m during the late summer low flow period and the most extreme change anticipated during operations and closure is a decrease in lake water level of 0.02 m during the late summer low flow period. These changes do not significantly exceed natural flood water levels and are only slightly lower (by less than 0.02 m) than drought water levels. This is unlikely to affect navigation on Lake 410.

The Lake 410 outlet channel is extremely broad, braided, shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 22: Photographs of Lake 410 Outlet Channel

Lake 410 Outlet, Downstream Facing View-Aug 2004

Lake 410 Outlet, Upstream Facing View-Aug 2004



Lake M1 Outlet, Aerial View Facing Downstream-June 2004

3.3 Lakes Adjacent to Kennady Lake

The N watershed is adjacent to Kennady Lake, and also drains into Lake 410. The lakes in the N watershed were assigned numerical identifiers in a similar manner to those described previously, with the exception that the downstream decrease in lake number is not entirely consistent. The N watershed does not currently receive flow from the Kennady Lake watershed, where the project activities are centred. Some lakes in the N watershed will experience increased discharges due to diversions from the Kennady Lake watershed during construction and operations, and decreased discharges due to diversions to the Kennady Lake watershed during closure.

Changes due to the Project

- **Construction:** Dewatering discharges from Kennady Lake will be conveyed to Lake N11 during construction, with effects on Lake N11 and downstream Lake N1.
- **Operations:** The western Kennady Lake tributaries (watersheds B, D and E) will be diverted to the N watershed during operations. Lake N14 will receive flow from the D and E watersheds, which will affect flows and water levels in Lakes N14, N17, N16, N15, N11 and N1. Lake N8 will receive a very small diversion from the B watershed, which will have a very small effect (not assessed here) on flows and water levels in Lakes N8, N6, N5, N4, N3, N2 and N1. Also during operations, some diversion from Kennady Lake to Lake N11 may occur, though at rates lower than during construction.
- **Closure:** During closure, the diversions of the western Kennady Lake tributaries will be removed. Water will be diverted from Lake N11 to Kennady Lake to assist in refilling. This will reduce flows and water levels in Lake N11 and Lake N1.
- **Post-Closure:** Flows and water levels will be similar to baseline, with small changes due to changes to land and lake areas in the upstream watershed.

Changes will in general be greatest at the most upstream lakes in this flow path (Lakes N14 and N11) and become muted with downstream distance to the most downstream lake (Lake N1). Figures and tables extracted from the 2011 EIS Update (De Beers 2011), showing these changes, are reproduced in Appendix A.

3.3.1 Lake N14

Lake N14 is a small headwater lake in the N watershed and discharges to Lake N17. The physical characteristics of the lake and outlet are shown in Table 23. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 24.

Table 23: Lake N14 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.211 km^2	EIS Annex H, Table H6.4-2
	Maximum Depth	4.0 m	EIS Addendum HH, Figure HH.III-12
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-12
Outlet Channel	Channel Length	500 m	EIS Annex H, Table H6.4-3
	Elevation Drop	2.051 m	EIS Annex H, Table H6.4-3
	Channel Slope	0.004 m/m	Derived
	Bed Material	Organics/ Fine grained soils	EIS Annex H, Section H6.4.4
	Bankfull Width	8.9 m	Field surveys 2011
	Bankfull Depth	0.45 m	Field surveys 2011

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

Hydrological model results for Lake N14 are not provided in Appendix A, but changes to flows will be similar to those for Lake N17. Lake water levels are not expected to exceed natural flood water levels during operations.. This is unlikely to affect navigation on Lake N14.

The Lake N14 outlet channel is shallow and bouldery in the upstream reach, with many mid-channel rocks exceeding the channel bankfull elevation, and more vegetated in the downstream reach. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation. No decrease in flow will occur due to the Project.

Table 24: Photographs of Lake N14 Outlet Channel

 *Lake N14 Outlet, Downstream facing View- Aug 2005*	 *Lake N14 Outlet, Streambed Material-Aug 2005*
 *Lake N14 Outlet-2010*	 *Lake N14 Outlet-2010*

3.3.2 Lake N17

Lake N17 is located immediately downstream of Lake N14 and discharges to Lake N16. The physical characteristics of the lake and outlet are shown in Table 25. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 26.

Table 25: Lake N17 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	4.01 km^2	EIS Annex H, Table H6.4-2
	Maximum Depth	13.0 m	EIS Addendum HH, Figure HH.III-15
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-15
Outlet Channel	Channel Length	348 m	EIS Annex H, Table H6.4-3
	Elevation Drop	0.255 m	EIS Annex H, Table H6.4-3
	Channel Slope	0.001 m/m	Derived
	Bed Material	Boulder	Visual
	Bankfull Width	5.5 m	September 2007 survey
	Bankfull Depth	0.51 m	September 2007 survey

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.50 m from the median October level to the 100-year flood level. The most extreme change anticipated during operations is an increase in lake water level of 0.08 m during high flow periods. These changes do not significantly exceed natural flood water levels. This is unlikely to affect navigation on Lake N17.

The Lake N17 outlet channel is shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation. No decrease in flow will occur due to the Project.

Table 26: Photographs of Lake N17 Outlet Channel

Lake N17 Outlet, Downstream View-Aug 2005

Lake N17 Outlet, Downstream View in Upper Channel-Sept 2007

Lake N17 Outlet, Upstream View in Upper Channel-Sept 2007

Lake N17 Outlet, Downstream View in Upper Channel-Sept 2007

Lake N17 Outlet, Upstream View in Lower Channel-Sept 2007

Lake N17 Outlet, Downstream View in Lower Channel-Sept 2007

Lake N17 Outlet, Downstream View-Aug 2005

Lake N17 Outlet, Downstream View in Upper Channel-Sept 2007

Lake N17 Outlet, Upstream View in Lower Channel-Sept 2007

Lake N17 Outlet, Downstream View in Lower Channel-Sept 2007

3.3.3 Lake N16

Lake N16 is located immediately downstream of Lake N17 and discharges to Lake N15. The physical characteristics of the lake and outlet are shown in Table 27. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 28.

Table 27: Lake N16 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	10.69 km^2	EIS Annex H, Table H6.4-2
	Maximum Depth	>6.5 m	EIS Section J4.2.2
	Bathymetry	no	Not available
Outlet Channel	Channel Length	538 m	EIS Annex J, Table J4.1-6
	Elevation Drop	Not measured	EIS Annex J, Table J4.1-6
	Channel Slope	Not measured	EIS Annex J, Table J4.1-6
	Bed Material	Boulder	Visual
	Bankfull Width	Not measured	Not available
	Bankfull Depth	Not measured	Not available

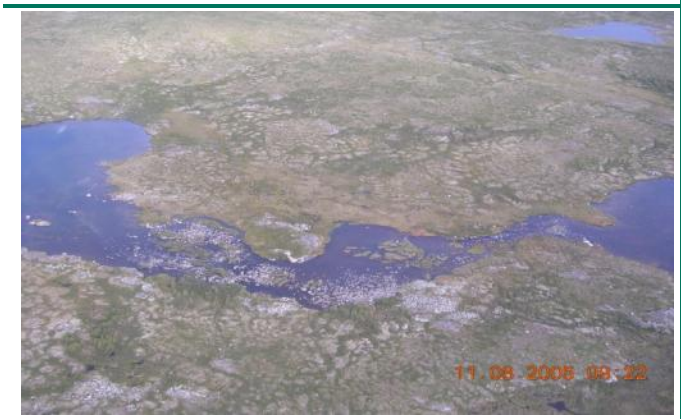
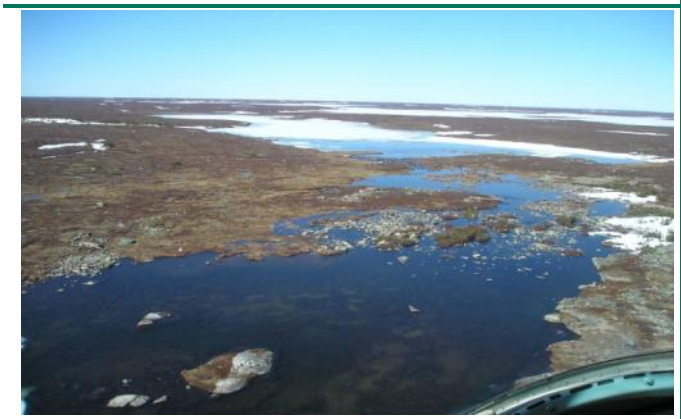
Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre.

Effects Summary

The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.50 m from the median October level to the 100-year flood level. The most extreme change anticipated during operations is an increase in lake water level of 0.03 m during high flow periods. These changes do not significantly exceed natural flood water levels. This is unlikely to affect navigation on Lake N16.

The Lake N16 outlet channel appears shallow and bouldery, with many mid-channel rocks exceeding the channel bankfull elevation. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation. No decrease in flow will occur due to the Project.

Table 28: Photographs of Lake N16 Outlet Channel

	
Lake N16 Outlet-2010	*Lake N16 Outlet-2010*
	
Lake N16 Outlet Channel, Flow from Left to Right-Aug 2005	*Lake N16 Outlet, Upstream Facing View-Jun 2005*
	
Lake N16 Outlet, Downstream Facing View-Jun 2005	*Lake N16 Outlet-2010*

3.3.4 Lake N15

Lake N15 is located immediately downstream of Lake N16 and discharges to Lake N11. The physical characteristics of the lake and outlet are shown in Table 29. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 30.

Table 29: Lake N15 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	0.134 km^2	EIS Annex H, Appendix H.IV, Table H.IV-3
	Maximum Depth	Unknown	Not available
	Bathymetry	no	Not available
Outlet Channel	Channel Length	382 m	EIS Annex J, Table J4.1-6
	Elevation Drop	Not measured	EIS Annex J, Table J4.1-6
	Channel Slope	Not measured	EIS Annex J, Table J4.1-6
	Bed Material	Boulder	Visual
	Bankfull Width	Not measured	Not available
	Bankfull Depth	Not measured	Not available

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre.

Effects Summary

Hydrological model results for Lake N15 are not provided in Appendix A, but changes to flows are almost identical to those for Lake N16. Given the outlet channel characteristics, lake water levels will not significantly exceed natural flood water levels during operations. This is unlikely to affect navigation on Lake N15.

The Lake N15 outlet channel appears to be braided, shallow and bouldery. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation. No decrease in flow will occur due to the Project.

Table 30: Photographs of Lake N15 Outlet Channel

Lake N15 Outlet – August 2005 (downstream to right)

3.3.5 Lake N11

Lake N11 is located immediately downstream of Lake N15 and discharges to Lake N1. The physical characteristics of the lake and outlet are shown in Table 31. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 32.

Table 31: Lake N11 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	5.38 km^2	EIS Annex H, Table H6.4-2
	Maximum Depth	10.0 m	EIS Addendum HH, Figure HH.III-11
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-11
Outlet Channel	Channel Length	174 m	EIS Annex H, Table H6.4-3
	Elevation Drop	4.5 m	EIS Annex H, Table H6.4-3
	Channel Slope	0.026 m/m	Derived
	Bed Material	Boulder / Bedrock	Visual
	Bankfull Width	15.5 m	August 2007 survey
	Bankfull Depth	0.80 m	August 2007 survey

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.47 m from the median October level to the 100-year flood level. The most extreme change anticipated during construction (dewatering) is an increase in lake water level of 0.16 m during the late summer low flow period and the most extreme change anticipated during closure is a decrease in lake water level of 0.07 m during the early summer high flow period. These changes do not significantly exceed natural flood water levels and will not fall below natural drought water levels. This is unlikely to affect navigation on Lake N11.

The Lake N11 outlet channel is steep, shallow and bouldery, with a very steep bedrock chute midway along its length. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 32: Photographs of Lake N11 Outlet Channel

Lake N11 Outlet, View Facing Downstream

Lake N11 Outlet

Lake N11 Outlet, View Facing Upstream

Lake N11 Outlet, View Facing Upstream at Control Section

Lake N11 Outlet, Panoramic View, Flow from Right to Left

3.3.6 Lake N1

Lake N1 is located immediately downstream of Lake N11 and discharges to Lake 410. The physical characteristics of the lake and outlet are shown in Table 33. The lake location is shown on Figure 2 and photographs of the outlet are provided in Table 34.

Table 33: Lake N1 and Outlet- Physical Characteristics

	Parameter	Value	Source
Lake	Surface Area	3.76 km^2	EIS Annex H, Table H6.4-2
	Maximum Depth	17.0 m	EIS Addendum HH, Figure HH.III-11
	Bathymetry	yes	EIS Addendum HH, Figure HH.III-11
Outlet Channel	Channel Length	70 m	EIS Annex J, Table J4.1-6
	Elevation Drop	1.12 m	Derived
	Channel Slope	0.016 m/m	EIS Annex J, Table J4.1-6
	Bed Material	Boulder	Visual
	Bankfull Width	69 m	September 2007 survey
	Bankfull Depth	0.78 m	September 2007 survey

Source: 2010 EIS (De Beers 2010).
Notes: km^2 = square kilometre; m = metre; m/m = metre per metre.

Effects Summary

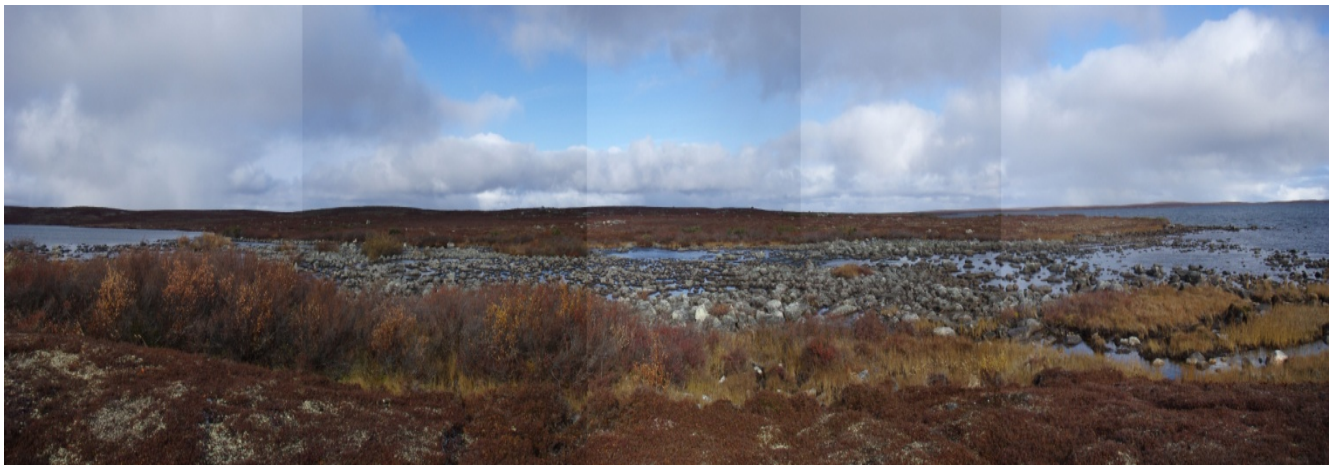
The figures and tables in Appendix A show that baseline lake water levels vary by approximately 0.56 m from the median October level to the 100-year flood level. The most extreme change anticipated during construction (dewatering) is an increase in lake water level of 0.07 m during the late summer low flow period and the most extreme change anticipated during closure is a decrease in lake water level of 0.02 m during the early summer high flow period. These changes do not significantly exceed natural flood water levels and will not fall below natural drought water levels. This is unlikely to affect navigation on Lake N1.

The Lake N1 outlet channel is steep, broad, shallow and bouldery. Effects on channel depths are likely to be similar to changes in lake water surface elevations, and given the nature of the channel, are unlikely to significantly affect navigation.

Table 34: Photographs of Lake N1 Outlet Channel

Lake N1 Outlet- Sept 2010

Lake N1 Outlet-Sept 2010



Lake N1, Panoramic View from Right Bank Flow from Left to Right-Sept 2007

3.4 Summary

Effects on lake water levels during construction, operations and closure of the Project not expected to significantly exceed natural flood levels and are limited to less than 0.1 m below natural drought levels. This is not expected to affect navigation on lakes downstream of the Kennady Lake Controlled Area or in adjacent watersheds.

Effects on channel water levels are expected to be similar to those on lake water levels, as lake outlet channels are generally short, shallow, rocky and in most cases impassable by watercraft under natural conditions. The small changes to water level regimes due to the Project are unlikely to affect navigation in lake outlet channels.

4.0 PROJECT ELEMENTS THAT MAY NOT AFFECT WATERBODIES, BUT MAY AFFECT NAVIGATIONAL USE

The only project elements that will occur on the landscape in post-closure are two mine rock piles, the fine process kimberlite containment (PKC) facility and the coarse processed kimberlite (PK) pile. The total permanent loss to the Kennady Lake basin is 162 ha, which will be addressed through a No Net Loss Plan that will be submitted to Fisheries and Oceans Canada (DFO). With respect to navigation, these features or project elements will be quite evident from distances away from the Project site, such that they would not significantly affect longer-term navigation of the lake post closure. In addition, all internal structures, such as dykes and dams that will be in constructed for operation of the Project, will either be breached or removed. As result there are no long-term impacts from these internal structures to navigation of Kennady Lake post-closure.

5.0 PUBLIC AND FIRST NATIONS CONCERNS AND PROPOSED MITIGATION

There were no noted specific concerns regarding impacts to navigation through the engagement with the communities, although the community members did ask questions regarding the length of time required to restore Kennady Lake and to specific impacts to downstream waters. De Beers explained both concerns in the meetings (and noted these concerns are also addressed in the 2012 EIS Supplement [De Beers 2012]), that it will take approximately 8 years to re-fill Kennady Lake post closure and that the lake is expected to be reclaimed to similar baseline conditions. In addition, De Beers indicated that potential impacts to downstream lakes and channels would be minimal and, as described throughout, would not impact navigation from baseline conditions.

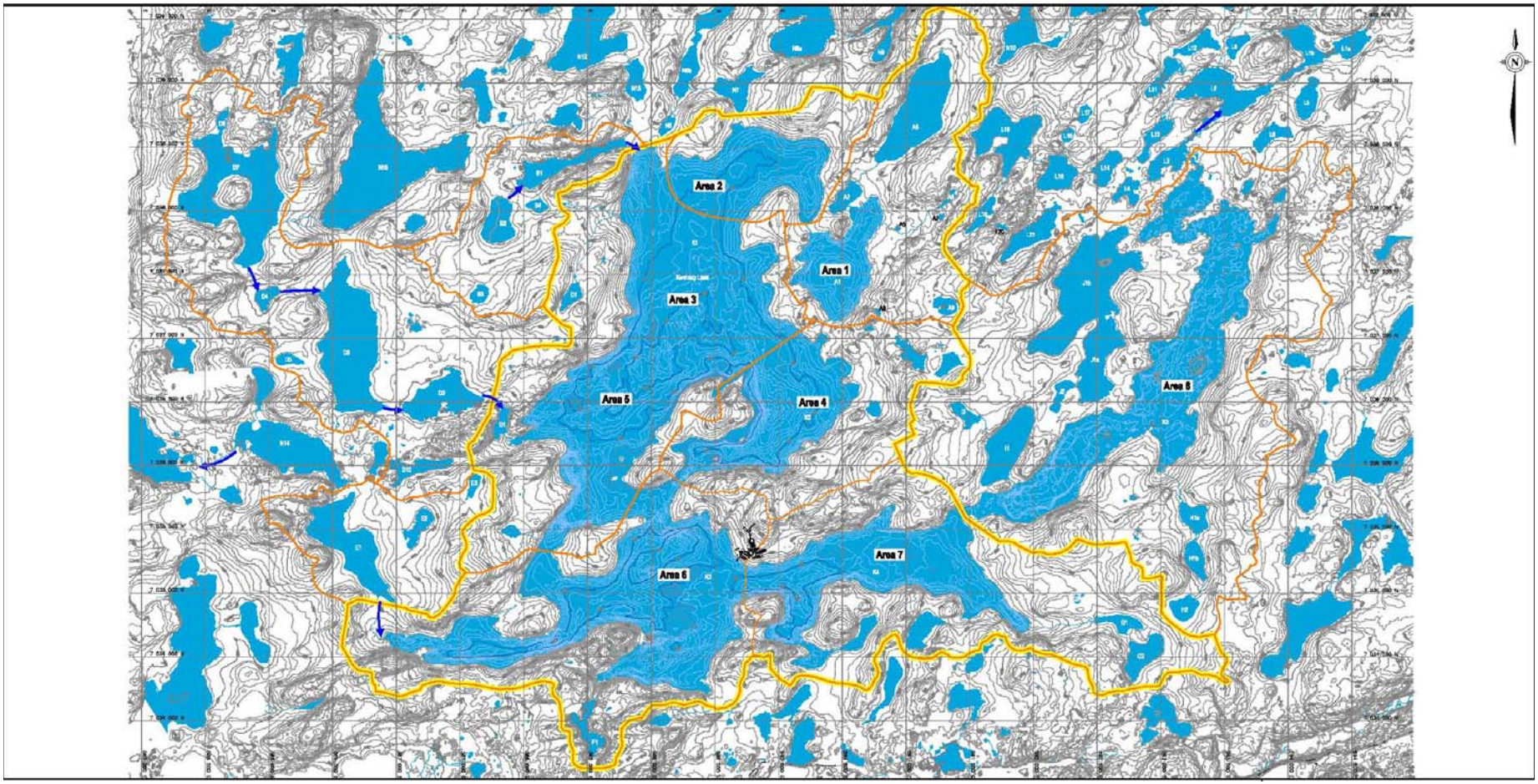
6.0 SUMMARY OF PROJECTED IMPACTS

Effects on navigation due to works associated with the Project were addressed in the technical memo, titled "*Anticipated Works for the Proposed Gahcho Kué Project and the Navigable Waters Protection Act*" (Golder 2012), which was submitted to the Mackenzie Valley Review Board public registry on October 2, 2012. Specifically, the effects are restricted to dewatering of Kennady Lake during construction, operation and closure and limited to the Project's established controlled area (Figure 3). In post-closure, after Kennady Lake has been refilled and reconnected to downstream waters, navigation is expected to return to similar conditions as baseline. Effects to downstream lakes and channels, as discussed above, are not expected to result in impacts to navigation during construction, operations or closure.

7.0 CUMULATIVE IMPACTS

There are no other existing or planned developments in the regional hydrological study area, other than the Project; therefore, the only impacts to navigation are those associated with the Project during construction, operation and closure when Kennady Lake is isolated from the downstream watershed. As a result, the cumulative impacts to navigation are limited to the controlled area of the Project (Figure 3) during construction, operation and closure. In post-closure, after Kennady Lake has been refilled and reconnected to downstream waters, navigation is expected to return to similar conditions as baseline. Cumulative impacts to downstream lakes and channels, as discussed above, are not expected to result in impacts to navigation.

Figure 3: Kennady Lake Sub-watersheds and Controlled Area Boundary



8.0 CLOSURE

We trust this technical memorandum provides you with the information you require at this time. Should you have any questions, or require further information please contact the undersigned.

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NS/JF/kl

9.0 REFERENCES

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De Beers. 2012. Gahcho Kué Panel Information Request Responses – Gahcho Kué Project Environmental Impact Review. Submitted to Mackenzie Valley Environmental Impact Review Board. April 2012.

Golder (Golder Associates Ltd.). 2012. Anticipated Works for the Proposed Gahcho Kué Project and the *Navigable Waters Protection Act*. Submitted to De Beers Canada Inc. October 2012.

Appendix A

Hydrological Model Results for Selected Lakes and Lake Outlets (including Kennady Lake Area 8, Lake L1, Lake M1, Lake 410, Lake N17, Lake N16, Lake N11, Lake N1)

Figure A-1: Effects on Kennady Lake Area 8 Discharges during Construction and Operations (2011 EIS Update Figure 8.7-1)

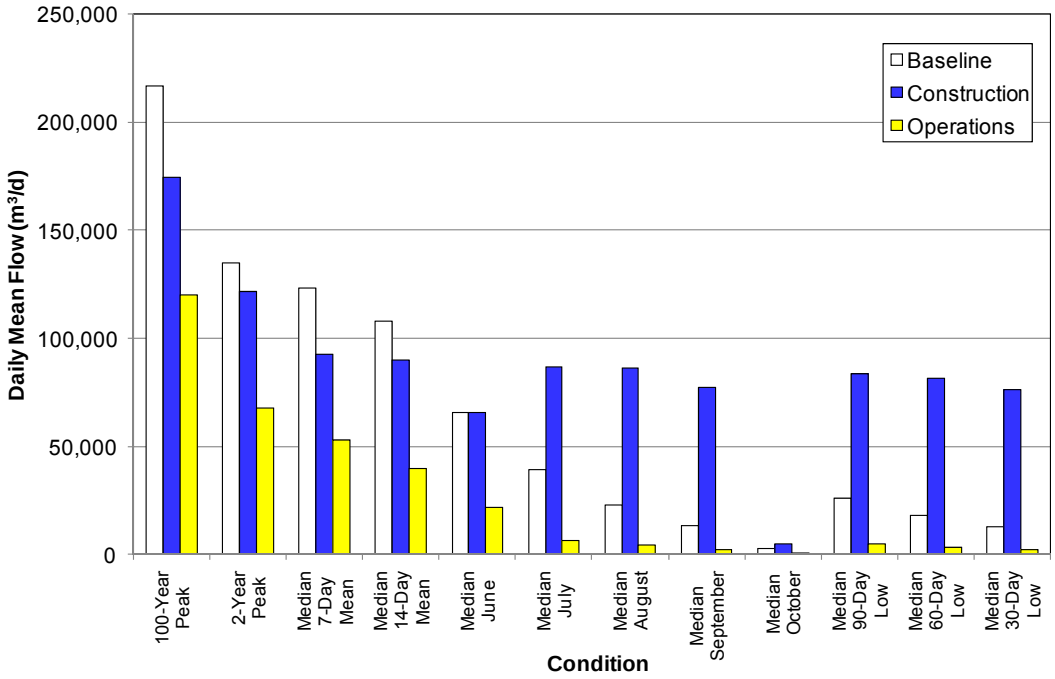

Figure A-2: Effects on Kennady Lake Area 8 Outlet Water Levels during Construction and Operations (2011 EIS Update Figure 8.7-2)

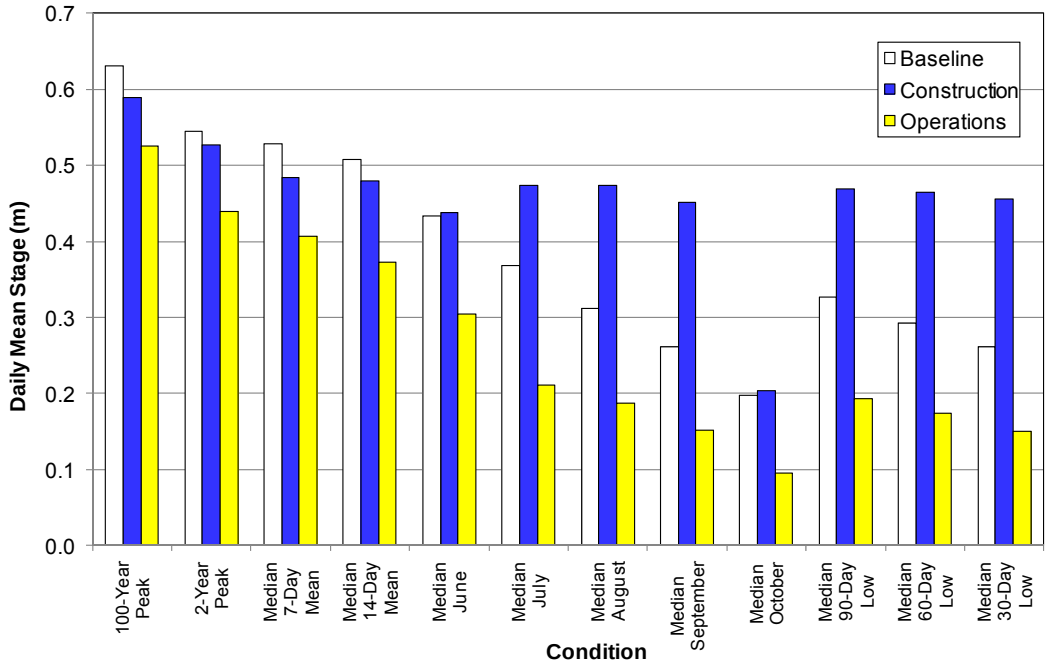

Table A-1: Mean Daily Outflows at Kennady Lake Area 8 – Construction and Operations (2011 EIS Update Table 8.7-7)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume [m^3]				
			June	July	August	September	October
Wet	100	baseline	121,000	86,500	59,600	68,600	13,500
		construction	91,500	92,800	93,300	90,800	18,400
		operations	35,500	19,600	14,700	16,900	2,030
	10	baseline	97,600	61,900	38,100	29,200	6,640
		construction	83,800	89,600	89,700	88,100	10,200
		operations	30,700	12,000	8,680	6,620	967
Median	2	baseline	65,900	39,300	22,800	13,200	3,070
		construction	65,700	86,600	86,500	77,200	4,680
		operations	21,900	6,670	4,580	2,460	371
Dry	10	baseline	36,900	23,100	13,900	6,880	1,430
		construction	41,000	85,500	85,400	57,300	1,880
		operations	12,000	3,570	2,310	892	91
	100	baseline	12,900	12,000	9,420	4,910	878
		construction	6,470	84,900	84,800	43,800	1,270
		operations	2,380	1,880	1,390	496	18

Table A-2: Discharges at Kennady Lake Area 8 – Construction and Operations (2011 EIS Update Table 8.7-8)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	2.51	192,000	167,000	48,900	52,500	59,000
		construction	2.02	103,000	96,900	91,800	90,100	89,200
		operations	1.39	85,200	61,000	10,500	14,100	13,300
	10	baseline	2.14	166,000	145,000	26,200	32,300	41,000
		construction	1.68	97,600	93,100	88,100	87,500	87,700
		operations	1.11	71,700	52,600	5,070	7,200	8,450
Median	2	baseline	1.56	123,000	108,000	12,800	18,300	26,000
		construction	1.41	92,600	89,900	76,100	81,400	83,800
		operations	0.78	52,900	39,900	2,100	3,390	4,830
Dry	10	baseline	0.798	64,600	59,900	6,990	10,900	16,000
		construction	1.24	89,400	88,000	56,700	71,800	77,500
		operations	0.46	31,100	23,700	900	1,820	2,720
	100	baseline	0.0013	1,680	9,110	4,760	7,480	10,500
		construction	1.16	88,100	87,200	42,300	64,000	72,200
		operations	0.21	10,800	7,400	473	1,260	1,680

Table A-3: Mean Daily Water Levels at Kennady Lake Area 8 Outlet – Construction and Operations (2011 EIS Update Table 8.7-9)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.531	0.471	0.425	0.443	0.315
		construction	0.497	0.492	0.492	0.490	0.291
		operations	0.367	0.297	0.267	0.283	0.166
	10	baseline	0.498	0.430	0.370	0.341	0.256
		construction	0.479	0.484	0.484	0.483	0.254
		operations	0.348	0.257	0.231	0.214	0.137
Median	2	baseline	0.433	0.368	0.311	0.262	0.197
		construction	0.438	0.474	0.474	0.452	0.204
		operations	0.304	0.210	0.187	0.152	0.096
Dry	10	baseline	0.361	0.312	0.270	0.217	0.156
		construction	0.392	0.472	0.472	0.392	0.163
		operations	0.250	0.174	0.153	0.113	0.059
	100	baseline	0.299	0.269	0.246	0.197	0.136
		construction	0.356	0.472	0.472	0.343	0.139
		operations	0.203	0.149	0.133	0.095	0.039

Table A-4: Water Levels at Kennady Lake Area 8 – Construction and Operations (2011 EIS Update Table 8.7-10)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	0.631	0.607	0.582	0.397	0.406	0.421
		construction	0.590	0.501	0.491	0.483	0.480	0.479
		operations	0.525	0.472	0.425	0.246	0.270	0.265
	10	baseline	0.600	0.581	0.557	0.327	0.349	0.376
		construction	0.557	0.492	0.485	0.477	0.476	0.476
		operations	0.490	0.447	0.406	0.197	0.219	0.230
Median	2	baseline	0.544	0.529	0.508	0.262	0.293	0.327
		construction	0.527	0.484	0.480	0.456	0.465	0.470
		operations	0.439	0.407	0.373	0.150	0.174	0.194
Dry	10	baseline	0.442	0.433	0.423	0.217	0.249	0.281
		construction	0.507	0.479	0.477	0.416	0.448	0.458
		operations	0.373	0.345	0.317	0.115	0.143	0.162
	100	baseline	0.060	0.140	0.236	0.193	0.222	0.246
		construction	0.496	0.477	0.475	0.380	0.432	0.448
		operations	0.290	0.249	0.221	0.094	0.128	0.140

Figure A-3: Effects on Lake L1 Discharges during Construction and Operations (2011 EIS Update Tables 9.7-5,9.7-6, 9.7-61, 9.7-62)

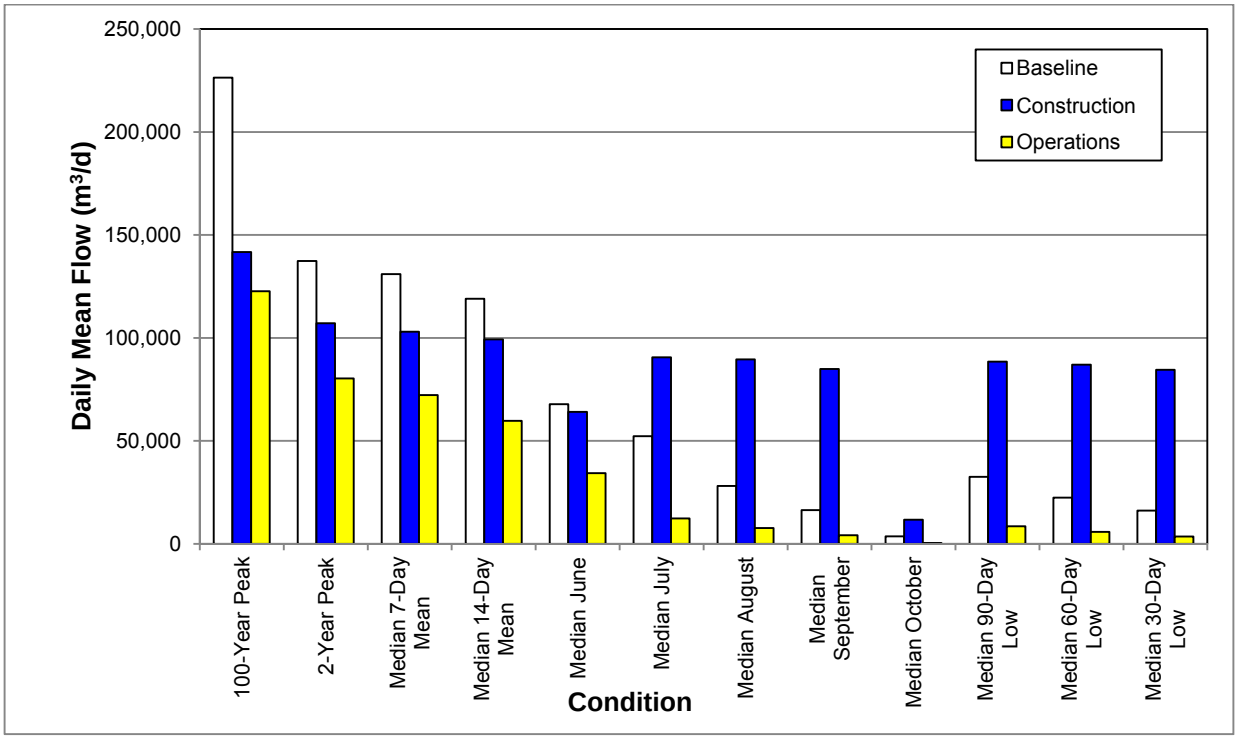

Figure A-4: Effects on Lake L1 Outlet Water Levels During Construction and Operations (2011 EIS Update Tables 9.7-7,9.7-8, 9.7-63, 9.7-64)

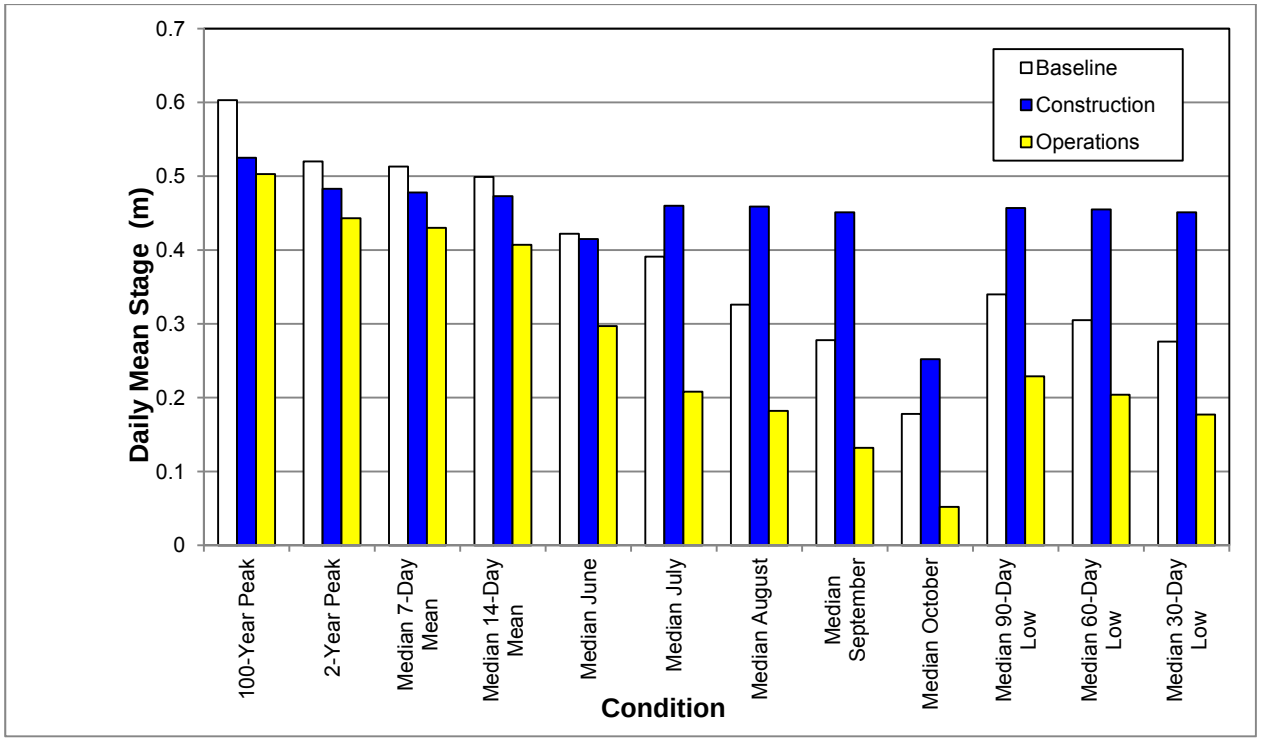

Table A-5: Mean Daily Outflows at Lake L1 – Construction and Operations (2011 EIS Update Table 9.7-5, 9.7-61)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume [m^3/d]				
			June	July	August	September	October
Wet	100	baseline	130,000	111,000	67,700	85,000	20,600
		construction	94,200	102,000	98,900	98,400	50,800
		operations	57,000	36,100	23,600	31,300	8,690
	10	baseline	102,000	81,400	45,700	38,900	9,240
		construction	82,700	95,700	93,700	93,400	29,100
		operations	47,200	22,700	14,400	12,800	2,140
Median	2	baseline	67,800	52,300	28,100	16,400	3,630
		construction	64,100	90,600	89,600	84,900	11,700
		operations	34,300	12,300	7,690	4,190	376
Dry	10	baseline	35,700	29,300	17,100	8,310	1,620
		construction	39,000	87,100	86,900	72,500	3,720
		operations	20,500	6,140	3,940	1,310	57
	100	baseline	10,700	14,200	11,300	5,750	976
		construction	12,100	85,100	85,500	58,500	1,520
		operations	8,500	2,980	2,130	448	4

Table A-6: Discharges at Lake L1– Construction and Operations (2011 EIS Update Table 9.7-6, 9.7-62)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	2.62	214,000	189,000	57,000	63,400	76,800
		construction	1.64	129,000	120,000	92,500	95,800	97,100
		operations	1.42	112,000	89,500	17,000	23,300	23,000
	10	baseline	2.25	185,000	164,000	31,300	38,900	51,900
		construction	1.42	115,000	109,000	90,100	92,200	93,200
		operations	1.23	96,200	77,900	8,570	12,100	14,800
Median	2	baseline	1.59	131,000	119,000	16,100	22,400	32,500
		construction	1.24	103,000	99,300	84,500	87,000	88,500
		operations	0.93	72,200	59,700	3,540	5,780	8,520
Dry	10	baseline	0.86	71,700	66,800	7,980	13,000	19,900
		construction	1.12	94,700	92,700	73,600	80,700	84,000
		operations	0.54	42,100	35,500	1,300	3,100	4,770
	100	baseline	0.23	20,000	21,000	5,770	9,970	15,000
		construction	1.06	89,600	88,900	57,600	74,500	80,400
		operations	0.13	12,000	10,200	427	2,120	2,860

Table A-7: Mean Daily Water Levels at Lake L1 Outlet – Construction and Operations (2011 EIS Update Table 9.7-7,9.7-63)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.512	0.488	0.422	0.451	0.297
		construction	0.465	0.476	0.472	0.471	0.388
		operations	0.401	0.351	0.309	0.336	0.23
	10	baseline	0.476	0.446	0.376	0.358	0.235
		construction	0.448	0.468	0.465	0.464	0.329
		operations	0.38	0.306	0.267	0.258	0.152
Median	2	baseline	0.422	0.391	0.326	0.278	0.178
		construction	0.415	0.46	0.459	0.451	0.252
		operations	0.345	0.255	0.222	0.186	0.091
Dry	10	baseline	0.35	0.33	0.281	0.227	0.14
		construction	0.359	0.455	0.454	0.431	0.179
		operations	0.297	0.208	0.182	0.132	0.052
	100	baseline	0.245	0.266	0.249	0.204	0.121
		construction	0.254	0.452	0.452	0.404	0.138
		operations	0.229	0.168	0.152	0.096	0.023

Table A-8: Water Levels at Lake L1 – Construction and Operations (2011 EIS Update Table 9.7-8, 9.7-64)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	0.603	0.593	0.571	0.401	0.414	0.438
		construction	0.525	0.511	0.5	0.463	0.468	0.47
		operations	0.503	0.49	0.458	0.281	0.308	0.307
	10	baseline	0.576	0.568	0.548	0.336	0.358	0.39
		construction	0.503	0.494	0.486	0.459	0.462	0.464
		operations	0.482	0.468	0.44	0.229	0.254	0.27
Median	2	baseline	0.52	0.513	0.499	0.276	0.305	0.34
		construction	0.483	0.478	0.473	0.451	0.455	0.457
		operations	0.443	0.43	0.407	0.177	0.204	0.229
Dry	10	baseline	0.433	0.429	0.42	0.225	0.259	0.294
		construction	0.469	0.466	0.463	0.433	0.445	0.45
		operations	0.377	0.367	0.349	0.132	0.17	0.193
	100	baseline	0.292	0.295	0.299	0.204	0.24	0.271
		construction	0.462	0.459	0.457	0.403	0.434	0.444
		operations	0.25	0.253	0.242	0.095	0.152	0.166

Figure A-5: Effects on Lake M1 Discharges during Construction and Operations (2011 EIS Update Tables 9.7-9, 9.7-10, 9.7-65, 9.7-66)

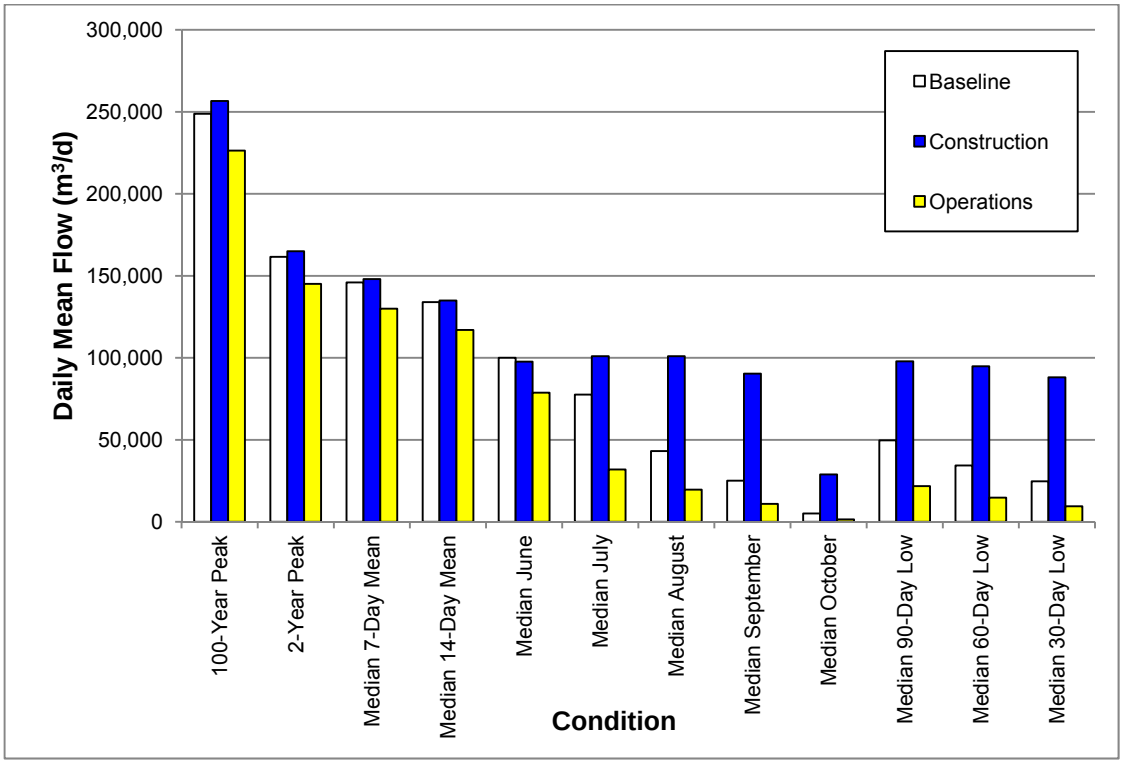

Figure A-6: Effects on Lake M1 Outlet Water Levels during Construction and Operations (2011 EIS Update Tables 9.7-11, 9.7-12, 9.7-67, 9.7-68)

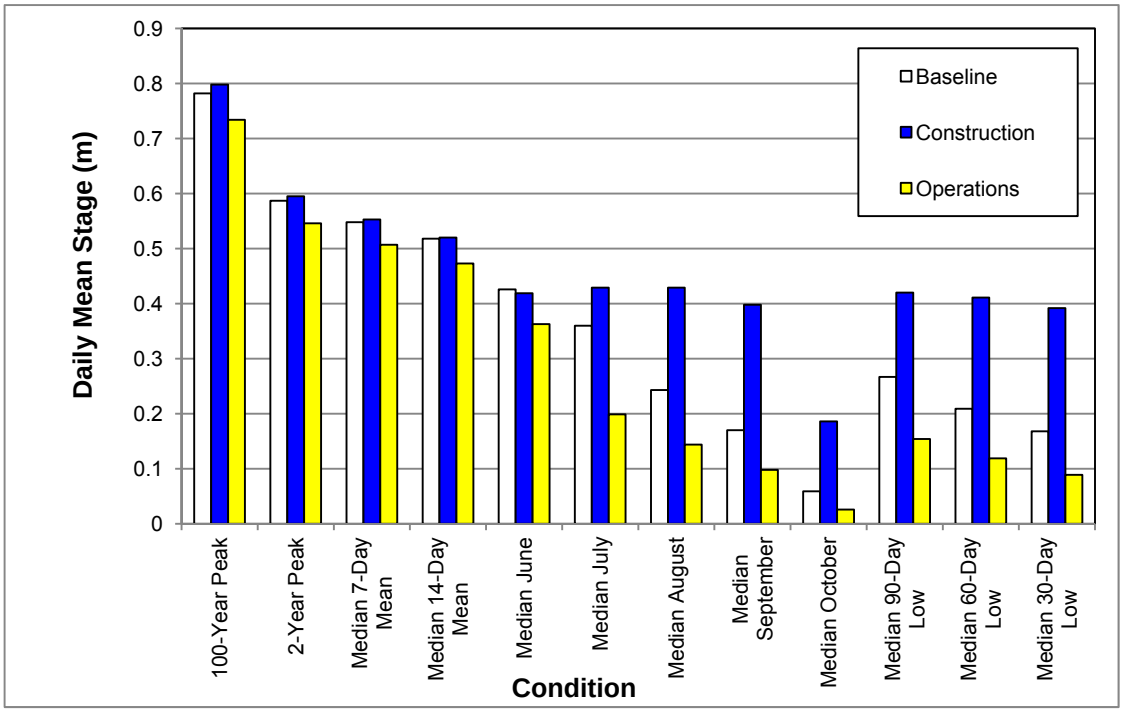

Table A-9: Mean Daily Outflows at Lake M1 – Construction and Operations (2011 EIS Update Table 9.7-9, 9.7-65)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume [m^3/d]				
			June	July	August	September	October
Wet	100	baseline	178,000	152,000	102,000	116,000	29,300
		construction	149,000	140,000	135,000	143,000	46,400
		operations	126,000	83,900	57,800	70,300	8,410
	10	baseline	142,000	116,000	69,100	56,400	13,500
		construction	126,000	118,000	116,000	109,000	41,100
		operations	106,000	55,600	35,800	30,500	4,450
Median	2	baseline	100,000	77,600	43,200	25,100	5,140
		construction	97,700	101,000	101,000	90,400	28,900
		operations	78,800	31,900	19,600	11,000	1,500
Dry	10	baseline	61,000	43,900	27,300	12,900	1,880
		construction	69,600	91,200	91,400	82,600	15,300
		operations	48,000	16,300	10,600	3,890	0
	100	baseline	30,800	19,800	19,100	8,800	762
		construction	46,800	86,000	86,600	79,700	8,280
		operations	20,100	7,750	6,180	1,640	0

Table A-10:Discharges at Lake M1 – Construction and Operations (2011 EIS Update Table 9.7-10, 9.7-66)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	2.88	220,000	205,000	84,900	92,300	105,000
		construction	2.97	215,000	200,000	115,000	127,000	131,000
		operations	2.62	187,000	169,000	44,200	57,600	54,800
	10	baseline	2.45	189,000	176,000	48,200	58,500	75,700
		construction	2.4	181,000	166,000	98,900	107,000	111,000
		operations	2.22	165,000	149,000	22,400	30,200	36,400
Median	2	baseline	1.87	146,000	134,000	24,700	34,400	49,700
		construction	1.91	148,000	135,000	88,100	94,900	97,900
		operations	1.68	130,000	117,000	9,470	14,800	21,800
Dry	10	baseline	1.26	96,400	85,100	13,200	21,300	31,200
		construction	1.57	122,000	113,000	82,400	88,900	91,900
		operations	1.09	83,500	73,600	3,790	8,480	12,800
	100	baseline	0.73	50,300	38,600	8,380	15,200	20,200
		construction	1.37	104,000	99,300	79,900	86,400	89,400
		operations	0.56	34,300	28,300	1,600	6,170	8,000

Table A-11:Mean Daily Water Levels at Lake M1 Outlet – Construction and Operations (2011 EIS Update Table 9.7-11, 9.7-67)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.626	0.563	0.432	0.47	0.188
		construction	0.556	0.533	0.52	0.541	0.255
		operations	0.497	0.379	0.296	0.337	0.082
	10	baseline	0.538	0.47	0.333	0.291	0.112
		construction	0.497	0.476	0.47	0.451	0.235
		operations	0.443	0.288	0.215	0.193	0.053
Median	2	baseline	0.426	0.36	0.243	0.17	0.059
		construction	0.419	0.429	0.429	0.398	0.186
		operations	0.363	0.199	0.144	0.098	0.026
Dry	10	baseline	0.306	0.246	0.179	0.109	0.03
		construction	0.335	0.401	0.401	0.375	0.122
		operations	0.261	0.127	0.095	0.049	-
	100	baseline	0.194	0.145	0.141	0.084	0.016
		construction	0.257	0.385	0.387	0.366	0.081
		operations	0.146	0.077	0.067	0.027	-

Table A-12:Water Levels at Lake M1 – Construction and Operations (2011 EIS Update Table 9.7-12, 9.7-68)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	0.782	0.721	0.687	0.382	0.404	0.44
		construction	0.798	0.71	0.676	0.468	0.5	0.51
		operations	0.734	0.647	0.604	0.247	0.295	0.285
	10	baseline	0.702	0.651	0.621	0.262	0.298	0.354
		construction	0.693	0.633	0.597	0.423	0.446	0.457
		operations	0.658	0.595	0.556	0.157	0.192	0.217
Median	2	baseline	0.587	0.548	0.518	0.168	0.209	0.267
		construction	0.595	0.553	0.52	0.392	0.411	0.42
		operations	0.546	0.507	0.473	0.089	0.119	0.154
Dry	10	baseline	0.451	0.416	0.383	0.11	0.152	0.196
		construction	0.522	0.486	0.462	0.374	0.394	0.403
		operations	0.409	0.378	0.347	0.048	0.082	0.108
	100	baseline	0.314	0.269	0.226	0.082	0.121	0.147
		construction	0.477	0.437	0.424	0.367	0.386	0.395
		operations	0.263	0.209	0.184	0.027	0.067	0.079

Figure A-7: Effects on Lake 410 Discharges during Construction and Operations (2011 EIS Update Tables 9.7-23, 9.7-24, 9.7-69, 9.7-70)

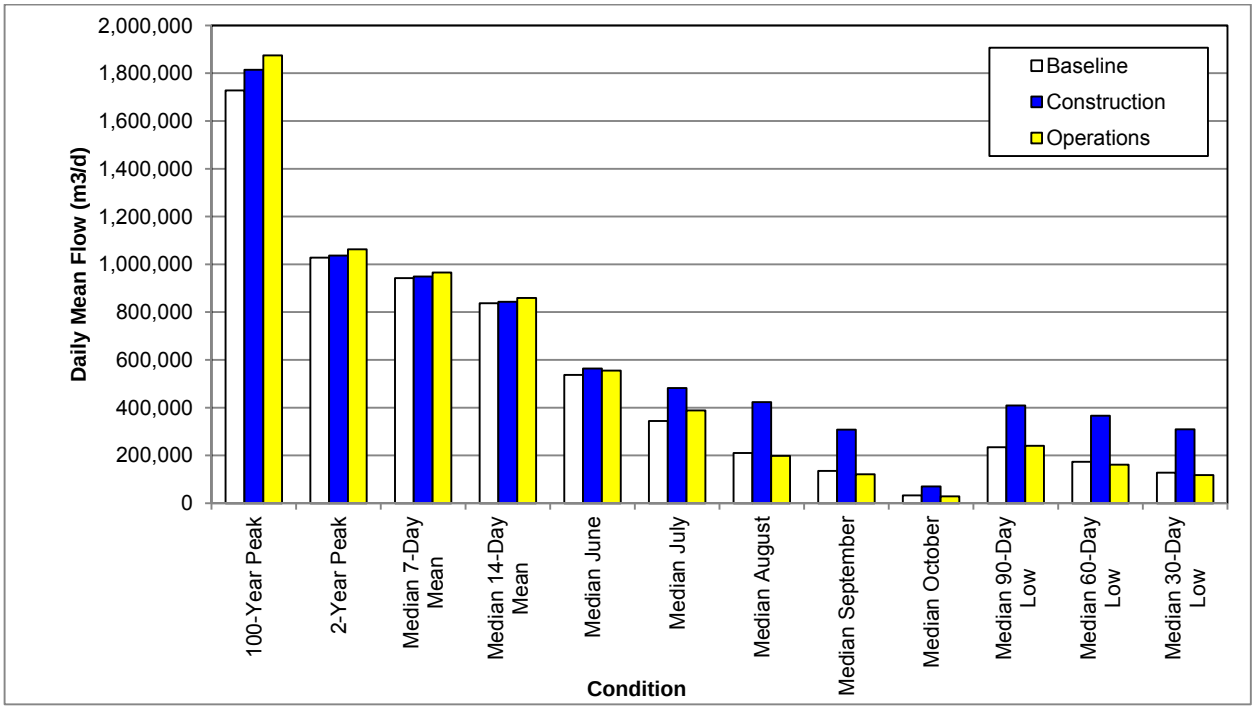

Figure A-8: Effects on Lake 410 Outlet Water Levels during Construction and Operations (2011 EIS Update Tables 9.7-25, 9.7-26, 9.7-71, 9.7-72)

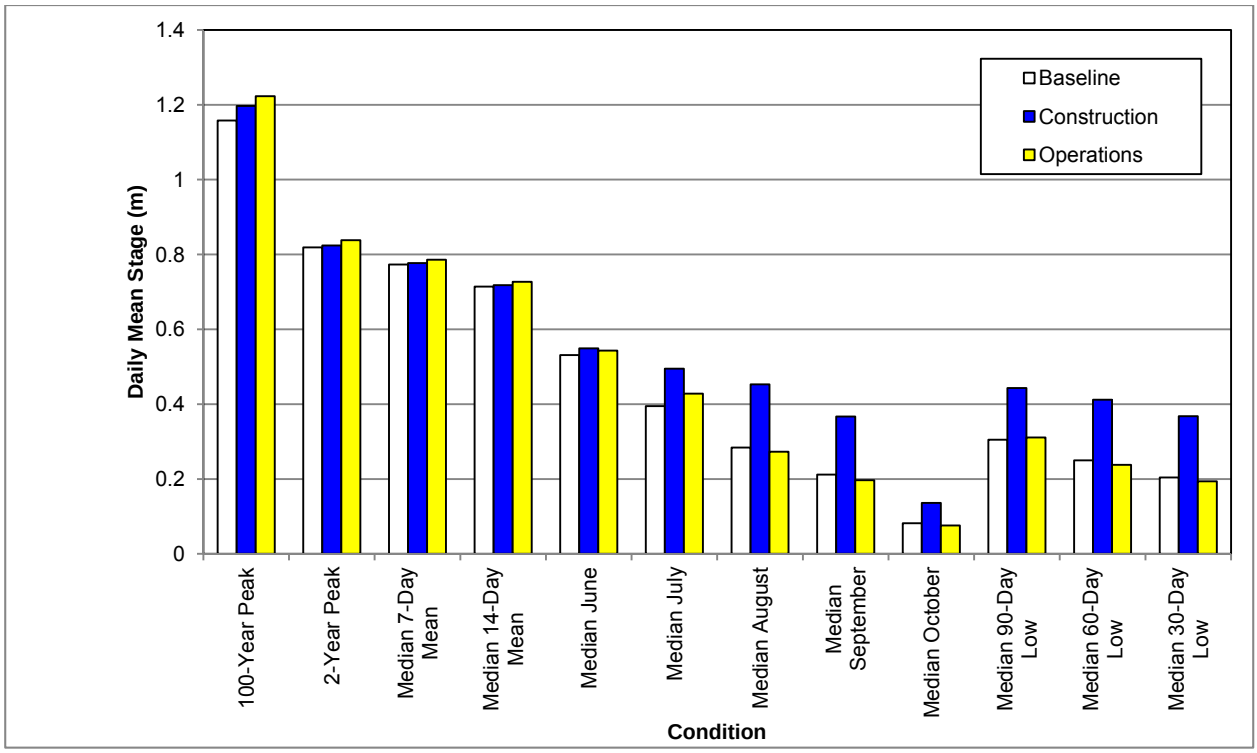

Table A-13: Mean Daily Outflows at Lake 410 – Construction and Operations (2011 EIS Update Table 9.7-23, 9.7-69)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume (m^3/d)				
			June	July	August	September	October
Wet	100	baseline	934,000	678,000	475,000	587,000	135,000
		construction	929,000	732,000	640,000	656,000	178,000
		operations	935,000	710,000	467,000	534,000	123,000
	10	baseline	759,000	514,000	329,000	278,000	70,700
		construction	762,000	603,000	518,000	460,000	114,000
		operations	762,000	553,000	317,000	264,000	63,400
Median	2	baseline	537,000	344,000	210,000	135,000	32,700
		construction	564,000	482,000	423,000	308,000	69,900
		operations	555,000	388,000	198,000	121,000	28,900
Dry	10	baseline	329,000	203,000	132,000	73,900	16,000
		construction	374,000	392,000	365,000	217,000	46,400
		operations	353,000	248,000	123,000	65,400	14,000
	100	baseline	190,000	106,000	90,100	49,800	9,660
		construction	225,000	337,000	336,000	170,000	35,700
		operations	193,000	149,000	82,800	46,100	8,420

Table A-14: Discharges at Lake 410 – Construction and Operations (2011 EIS Update Table 9.7-24, 9.7-70)

Condition	Return Period (years)	Snapshot	Peak Daily Q (m^3/s)	7-Day Mean Peak Q (m^3/d)	14-Day Mean Peak Q (m^3/d)	30-Day Low Flow Q (m^3/d)	60-Day Low Flow Q (m^3/d)	90-Day Low Flow Q (m^3/d)
Wet	100	baseline	20	1,420,000	1,240,000	404,000	443,000	491,000
		construction	21	1,480,000	1,290,000	546,000	601,000	630,000
		operations	21.7	1,490,000	1,280,000	388,000	441,000	495,000
	10	baseline	16.5	1,230,000	1,080,000	237,000	287,000	355,000
		construction	16.7	1,240,000	1,090,000	426,000	472,000	513,000
		operations	17.4	1,280,000	1,110,000	224,000	276,000	358,000
Median	2	baseline	11.9	942,000	837,000	128,000	173,000	234,000
		construction	12	949,000	843,000	309,000	366,000	409,000
		operations	12.3	966,000	859,000	118,000	161,000	240,000
Dry	10	baseline	7.11	580,000	523,000	74,200	108,000	150,000
		construction	8.08	652,000	588,000	220,000	298,000	338,000
		operations	7.33	596,000	539,000	66,300	100,000	159,000
	100	baseline	3.03	219,000	200,000	50,900	77,500	100,000
		construction	5.27	407,000	375,000	162,000	260,000	296,000
		operations	3.44	241,000	218,000	44,500	72,300	113,000

Table A-15: Mean Daily Water Levels at Lake 410 Outlet – Construction and Operations (2011 EIS Update Table 9.7-25, 9.7-71)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.769	0.621	0.49	0.564	0.212
		construction	0.766	0.653	0.597	0.607	0.255
		operations	0.769	0.64	0.484	0.529	0.199
	10	baseline	0.669	0.516	0.383	0.343	0.138
		construction	0.671	0.574	0.519	0.479	0.189
		operations	0.671	0.542	0.374	0.331	0.128
Median	2	baseline	0.531	0.395	0.284	0.212	0.082
		construction	0.549	0.495	0.453	0.367	0.136
		operations	0.543	0.428	0.273	0.197	0.076
Dry	10	baseline	0.383	0.278	0.209	0.142	0.051
		construction	0.418	0.431	0.411	0.29	0.104
		operations	0.402	0.318	0.199	0.131	0.047
	100	baseline	0.266	0.18	0.162	0.109	0.036
		construction	0.298	0.39	0.389	0.247	0.087
		operations	0.269	0.226	0.153	0.103	0.033

Table A-16: Water Levels at Lake 410 – Construction and Operations (2011 EIS Update Table 9.7-26, 9.7-72)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	1.158	1.016	0.928	0.44	0.467	0.501
		construction	1.197	1.045	0.953	0.537	0.573	0.591
		operations	1.223	1.049	0.948	0.428	0.466	0.503
	10	baseline	1.019	0.923	0.847	0.308	0.35	0.403
		construction	1.027	0.928	0.852	0.455	0.488	0.515
		operations	1.056	0.948	0.862	0.297	0.341	0.406
Median	2	baseline	0.819	0.773	0.714	0.204	0.25	0.305
		construction	0.824	0.777	0.718	0.368	0.412	0.443
		operations	0.838	0.786	0.727	0.194	0.238	0.311
Dry	10	baseline	0.581	0.559	0.522	0.142	0.182	0.227
		construction	0.633	0.605	0.565	0.293	0.359	0.39
		operations	0.593	0.57	0.533	0.132	0.173	0.236
	100	baseline	0.329	0.292	0.275	0.11	0.146	0.173
		construction	0.476	0.442	0.418	0.239	0.328	0.357
		operations	0.358	0.312	0.291	0.101	0.14	0.188

Figure A-9: Effects on Lake N17 Discharges during Operations (2011 EIS Update Tables 9.7-43, 9.7-44)

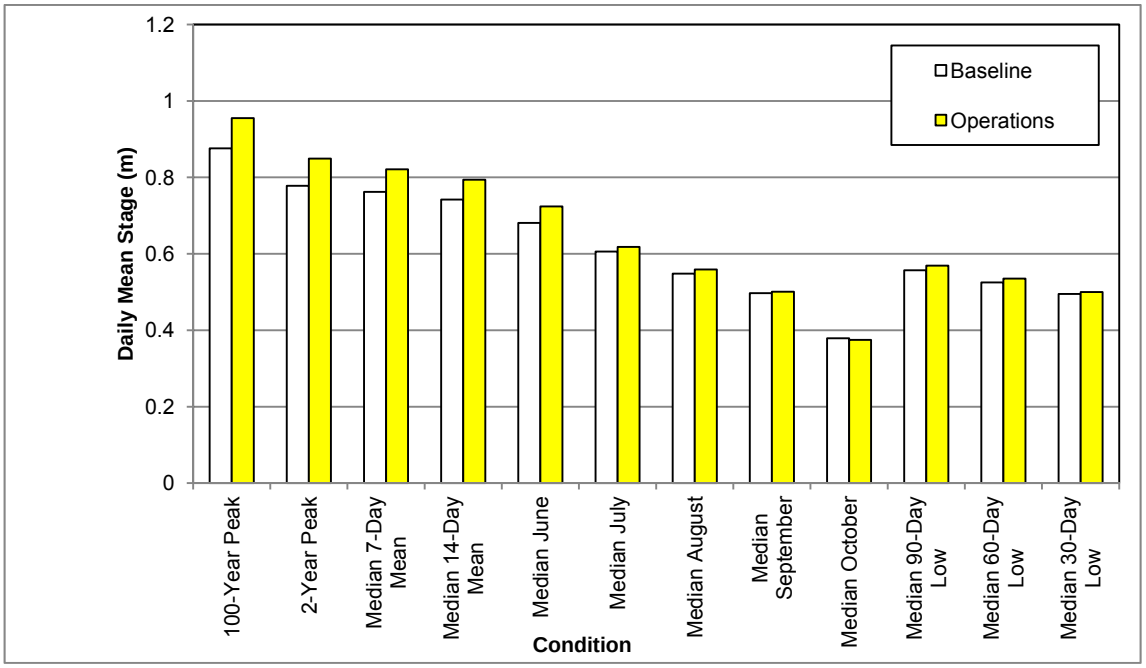

Figure A-10: Effects on Lake N17 Outlet Water Levels during Operations (2011 EIS Update Tables 9.7-45, 9.7-46)

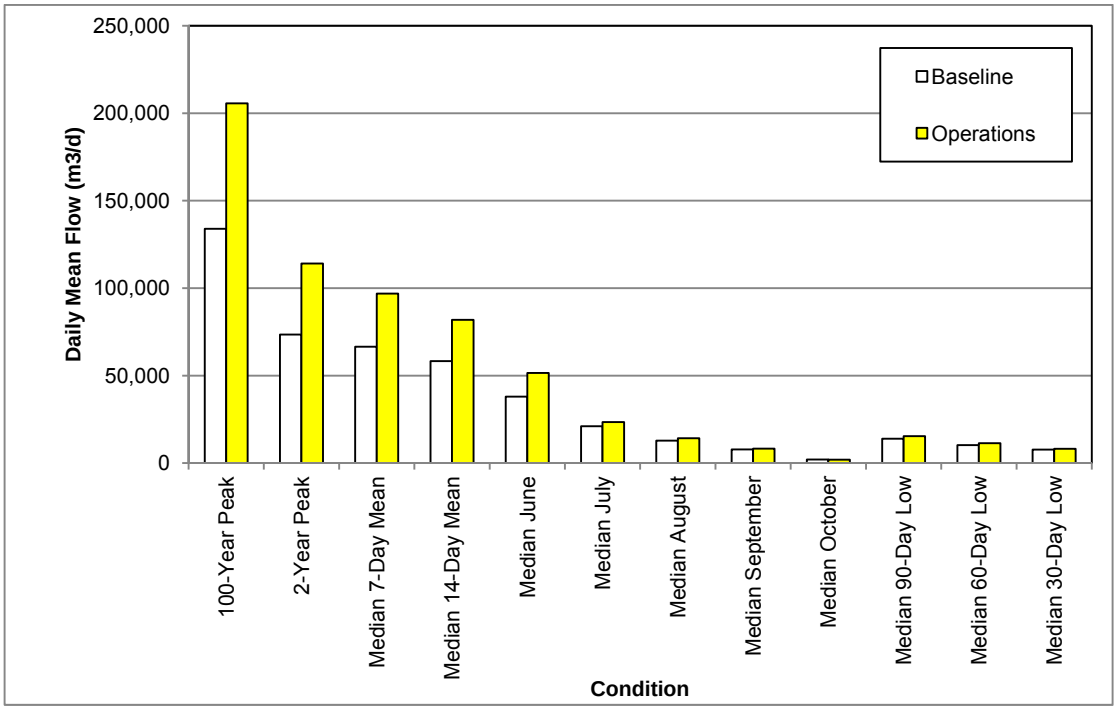

Table A-17:Mean Daily Outflows at Lake N17-Operations (2011 EIS Update Table 9.7-43)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume [m^3/d]				
			June	July	August	September	October
Wet	100	baseline	66,800	44,200	31,800	36,800	7,720
		operations	88,000	52,900	39,600	47,800	8,340
	10	baseline	54,000	32,400	20,900	17,300	4,100
		operations	72,300	37,300	24,700	20,400	4,210
Median	2	baseline	38,000	21,100	12,800	7,830	2,040
		operations	51,500	23,400	14,200	8,220	1,910
Dry	10	baseline	21,800	12,400	8,050	4,500	1,160
		operations	29,000	13,500	8,550	4,370	963
	100	baseline	8,350	6,980	5,720	3,460	835
		operations	9,180	7,620	5,920	3,270	620

Table A-18:Discharges at Lake N17- Operations (2011 EIS Update Table 9.7-44)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	1.55	115,000	95,800	26,300	30,300	35,000
		operations	2.38	168,000	133,000	30,800	36,500	42,200
	10	baseline	1.28	96,700	82,100	14,300	17,800	22,400
		operations	1.98	141,000	115,000	16,000	20,600	25,700
Median	2	baseline	0.85	66,500	58,300	7,690	10,300	13,900
		operations	1.32	96,900	81,900	8,130	11,400	15,400
Dry	10	baseline	0.42	34,700	32,300	4,340	6,590	9,200
		operations	0.64	50,400	45,200	4,160	6,940	9,990
	100	baseline	0.09	8,900	10,300	3,530	5,780	7,880
		operations	0.1	12,800	13,500	3,240	6,090	8,680

Table A-19:Mean Daily Water Levels at Lake N17-Operations (2011 EIS Update Table 9.7-45)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.762	0.702	0.657	0.677	0.495
		operations	0.806	0.728	0.687	0.713	0.503
	10	baseline	0.731	0.66	0.604	0.582	0.436
		operations	0.775	0.679	0.625	0.601	0.439
Median	2	baseline	0.681	0.606	0.548	0.497	0.379
		operations	0.724	0.618	0.559	0.501	0.375
Dry	10	baseline	0.609	0.544	0.499	0.445	0.339
		operations	0.645	0.554	0.505	0.442	0.327
	100	baseline	0.503	0.485	0.466	0.422	0.317
		operations	0.513	0.494	0.47	0.417	0.299

Table A-20:Water Levels at Lake N17-Operations (2011 EIS Update Tables 9.7-46)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	0.876	0.85	0.819	0.633	0.651	0.67
		operations	0.955	0.917	0.875	0.653	0.676	0.696
	10	baseline	0.843	0.821	0.795	0.56	0.585	0.613
		operations	0.92	0.885	0.85	0.573	0.603	0.63
Median	2	baseline	0.778	0.762	0.742	0.495	0.525	0.557
		operations	0.849	0.821	0.794	0.5	0.535	0.569
Dry	10	baseline	0.675	0.669	0.659	0.441	0.48	0.513
		operations	0.735	0.721	0.705	0.438	0.485	0.521
	100	baseline	0.491	0.51	0.525	0.423	0.467	0.497
		operations	0.51	0.548	0.554	0.416	0.472	0.507

Figure A-11: Effects on Lake N16 Discharges during Operations (2011 EIS Update Tables 9.7-47 9.7-48)

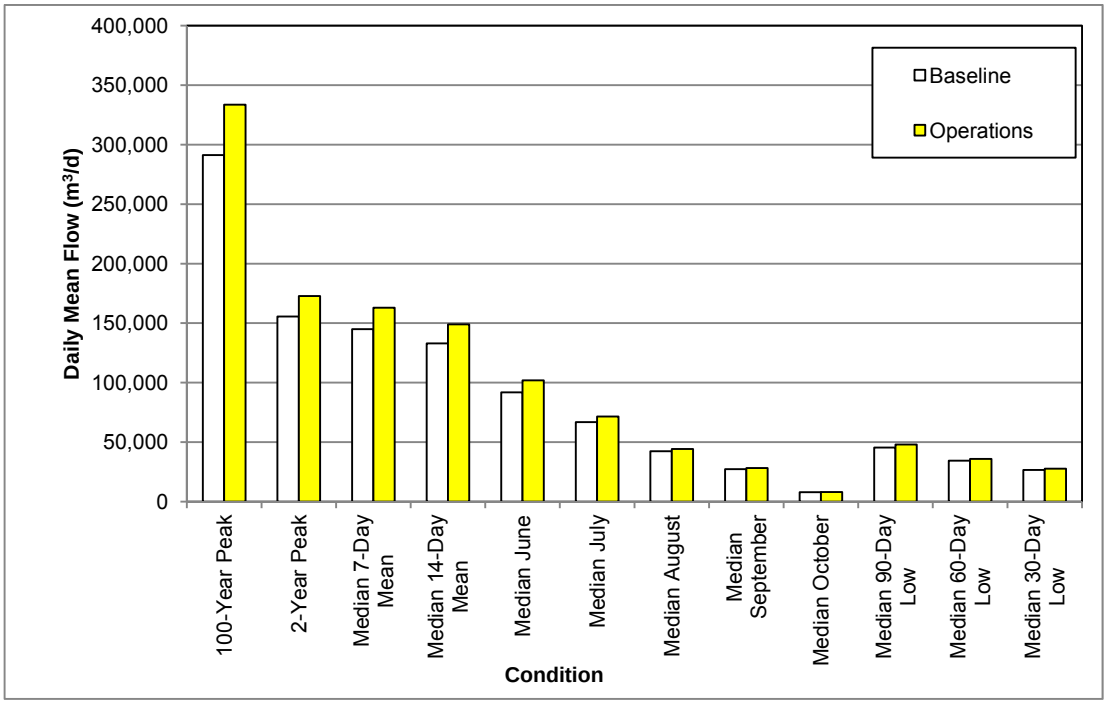

Figure A-12: Effects on Lake N16 Outlet Water Levels during Operations (2011 EIS Update Tables 9.7-49, 9.7-50)

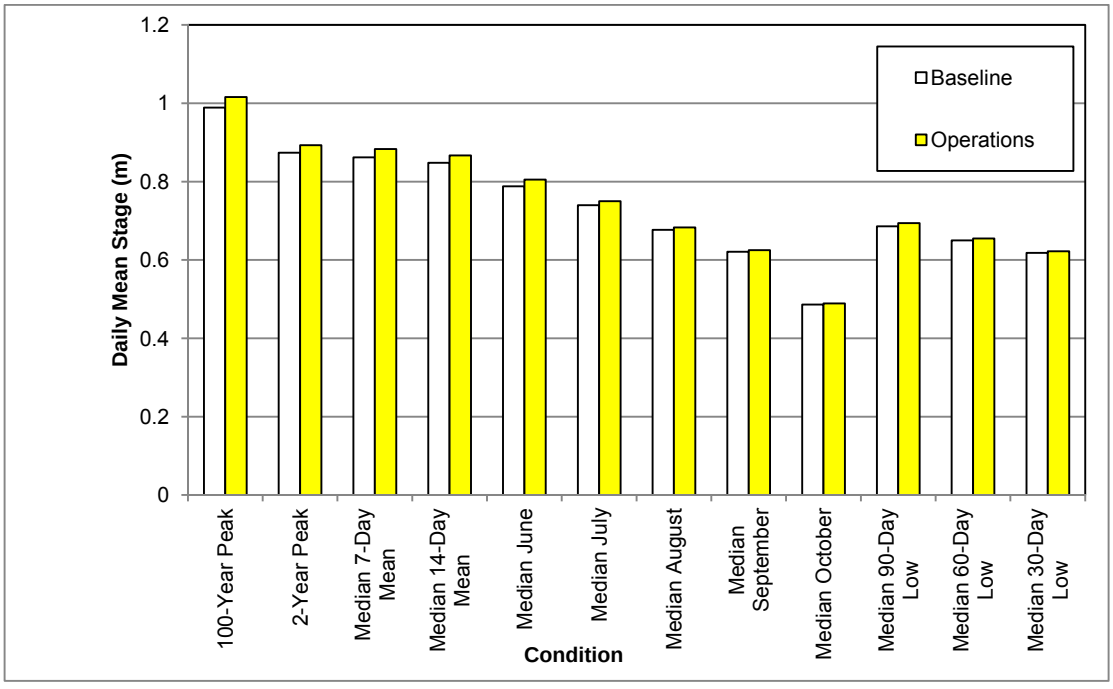

Table A-21:Mean Daily Outflows at Lake N16 - Operations (2011 EIS Update Table 9.7-47)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume (m^3/d)				
			June	July	August	September	October
Wet	100	baseline	171,000	127,000	92,300	93,600	23,800
		operations	190,000	138,000	98,700	101,000	25,400
	10	baseline	134,000	97,800	64,700	51,400	14,100
		operations	149,000	105,000	68,500	54,400	14,700
Median	2	baseline	91,900	66,900	42,400	27,300	7,910
		operations	102,000	71,600	44,300	28,300	8,140
Dry	10	baseline	53,200	40,900	28,200	17,000	4,960
		operations	57,800	43,400	29,300	17,500	5,060
	100	baseline	23,900	22,600	20,500	13,200	3,740
		operations	24,600	23,900	21,300	13,600	3,820

Table A-22:Discharges at Lake N16 - Operations (2011 EIS Update Table 9.7-48)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	3.37	257,000	228,000	79,300	89,800	100,000
		operations	3.86	295,000	258,000	84,700	96,100	108,000
	10	baseline	2.71	212,000	190,000	45,800	55,800	69,400
		operations	3.07	242,000	215,000	48,200	58,800	73,900
Median	2	baseline	1.8	145,000	133,000	26,700	34,500	45,500
		operations	2	163,000	149,000	27,700	36,000	48,000
Dry	10	baseline	0.94	78,200	74,600	16,700	23,300	30,500
		operations	1	84,500	81,300	17,200	24,200	32,100
	100	baseline	0.31	26,400	29,000	14,300	20,700	25,500
		operations	0.3	25,100	28,500	14,600	21,400	26,900

Table A-23:Mean Daily Water Levels at Lake N16-Operations (2011 EIS Update Table 9.7-49)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.891	0.84	0.789	0.791	0.604
		operations	0.91	0.854	0.799	0.803	0.612
	10	baseline	0.849	0.798	0.736	0.703	0.545
		operations	0.867	0.809	0.744	0.711	0.549
Median	2	baseline	0.788	0.74	0.677	0.621	0.486
		operations	0.805	0.75	0.683	0.625	0.489
Dry	10	baseline	0.708	0.672	0.624	0.565	0.443
		operations	0.719	0.68	0.629	0.568	0.445
	100	baseline	0.604	0.598	0.586	0.538	0.419
		operations	0.608	0.604	0.591	0.541	0.421

Table A-24:Water Levels at Lake N16-Operations (2011 EIS Update Tables 9.7-50)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	0.989	0.965	0.943	0.766	0.785	0.801
		operations	1.016	0.992	0.966	0.776	0.795	0.814
	10	baseline	0.948	0.929	0.91	0.687	0.714	0.746
		operations	0.971	0.954	0.932	0.694	0.722	0.755
Median	2	baseline	0.874	0.862	0.848	0.618	0.65	0.686
		operations	0.893	0.883	0.867	0.622	0.655	0.694
Dry	10	baseline	0.769	0.764	0.757	0.563	0.601	0.634
		operations	0.779	0.775	0.769	0.566	0.606	0.641
	100	baseline	0.619	0.616	0.628	0.546	0.588	0.612
		operations	0.612	0.61	0.626	0.548	0.591	0.619

Figure A-13: Effects on Lake N11 Discharges during Construction, Operations, and Closure (2011 EIS Update Tables 9.7-13, 9.7-14, 9.7-51, 9.7-52, 9.7-77, 9.7-78)

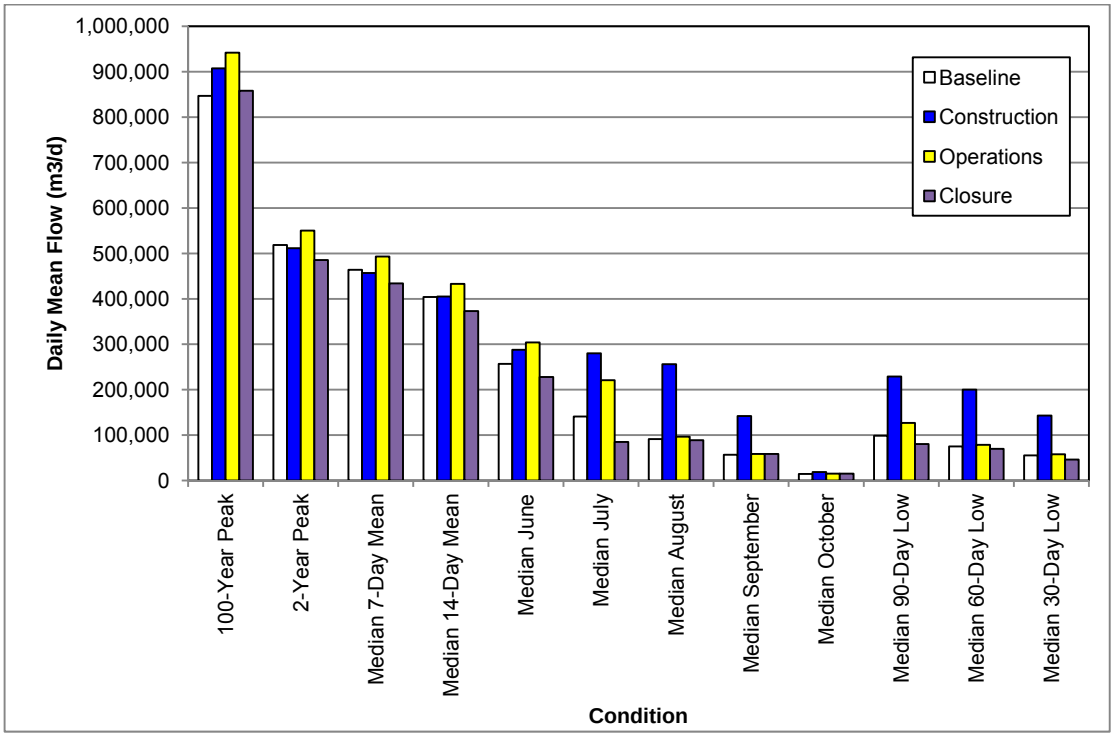

Figure A-14: Effects on Lake N11 Outlet Water Levels During Construction, Operations, and Closure (2011 EIS Update Tables 9.7-15,9.7-16, 9.7-53, 9.7-54, 9.7-79, 9.7-80)

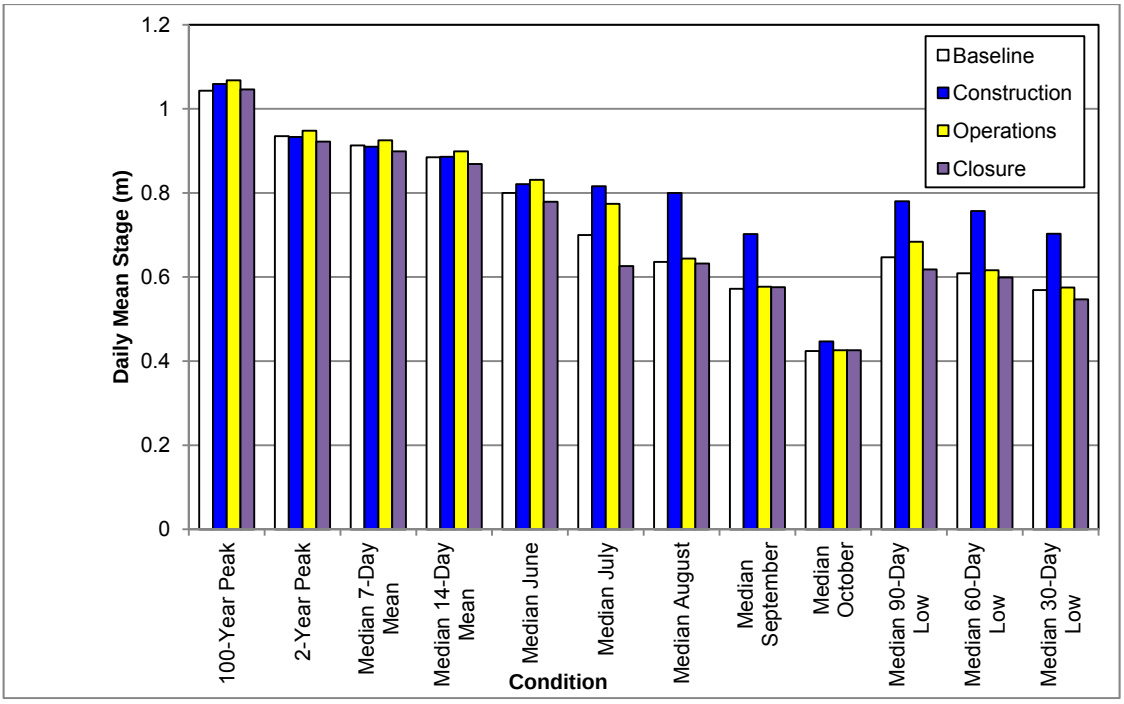

Table A-25: Mean Daily Outflows at Lake N11–Construction, Operations and Closure (2011 EIS Update Table 9.7-13, 9.7-51, 9.7-77)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume [m^3/d]				
			June	July	August	September	October
Wet	100	baseline	443,000	293,000	221,000	258,000	50,700
		construction	478,000	373,000	332,000	370,000	62,900
		operations	508,000	388,000	243,000	267,000	53,300
		closure	395,000	201,000	221,000	268,000	53,600
	10	baseline	359,000	215,000	147,000	123,000	28,200
		construction	389,000	324,000	294,000	247,000	35,100
		operations	413,000	311,000	158,000	127,000	29,200
		closure	320,000	144,000	146,000	127,000	29,300
Median	2	baseline	257,000	141,000	91,400	56,800	14,700
		construction	288,000	280,000	256,000	142,000	18,600
		operations	304,000	221,000	96,600	58,700	15,100
		closure	228,000	85,100	88,800	58,600	15,100
Dry	10	baseline	155,000	83,600	58,800	33,300	8,740
		construction	196,000	248,000	226,000	71,700	11,200
		operations	202,000	132,000	62,200	34,400	8,880
		closure	138,000	37,400	54,400	34,300	8,890
	100	baseline	71,900	46,900	42,600	25,900	6,400
		construction	126,000	230,000	207,000	32,400	8,380
		operations	123,000	62,600	45,700	26,700	6,510
		closure	65,000	5,180	36,800	26,700	6,520

Table A-26: Discharges at Lake N11– Construction , Operations and Closure (2011 EIS Update Table 9.7-14, 9.7-52, 9.7-78)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	9.8	747,000	630,000	179,000	198,000	215,000
		construction	10.5	805,000	676,000	326,000	331,000	343,000
		operations	10.9	838,000	702,000	196,000	222,000	259,000
		closure	9.93	751,000	600,000	106,000	145,000	175,000
	10	baseline	8.22	630,000	538,000	102,000	125,000	152,000
		construction	8.27	634,000	543,000	239,000	264,000	284,000
		operations	8.86	680,000	580,000	109,000	135,000	189,000
		closure	7.96	607,000	501,000	75,000	106,000	122,000
Median	2	baseline	6	464,000	404,000	55,500	75,000	98,700
		construction	5.92	457,000	405,000	143,000	200,000	229,000
		operations	6.37	493,000	433,000	57,900	78,800	127,000
		closure	5.62	434,000	373,000	46,200	69,700	80,500
Dry	10	baseline	3.36	269,000	240,000	33,900	48,500	64,200
		construction	4.12	321,000	296,000	73,500	152,000	189,000
		operations	3.87	311,000	288,000	34,900	50,700	83,000
		closure	3.38	266,000	237,000	25,100	42,800	54,700
	100	baseline	0.85	85,300	81,700	25,200	36,500	45,200
		construction	3.19	250,000	238,000	43,600	128,000	167,000
		operations	1.82	167,000	172,000	25,900	38,600	57,000
		closure	1.61	132,000	119,000	12,100	26,300	41,200

Table A-27: Mean Daily Water Levels at Lake N11 Outlet – Construction, Operations and Closure (2011 EIS Update Table 9.7-15, 9.7-53, 9.7-79)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.903	0.824	0.774	0.801	0.558
		construction	0.919	0.869	0.847	0.868	0.585
		operations	0.931	0.877	0.791	0.807	0.564
		closure	0.881	0.758	0.774	0.808	0.565
	10	baseline	0.862	0.769	0.707	0.68	0.49
		construction	0.878	0.843	0.825	0.793	0.514
		operations	0.889	0.835	0.718	0.684	0.494
		closure	0.84	0.704	0.706	0.684	0.494
Median	2	baseline	0.8	0.7	0.636	0.572	0.424
		construction	0.821	0.816	0.8	0.702	0.447
		operations	0.831	0.774	0.644	0.577	0.426
		closure	0.779	0.626	0.632	0.576	0.426
Dry	10	baseline	0.715	0.624	0.577	0.508	0.378
		construction	0.754	0.794	0.778	0.603	0.399
		operations	0.759	0.69	0.584	0.512	0.379
		closure	0.697	0.522	0.567	0.512	0.379
	100	baseline	0.603	0.548	0.537	0.481	0.352
		construction	0.683	0.781	0.763	0.505	0.374
		operations	0.68	0.585	0.545	0.484	0.354
		closure	0.59	0.336	0.52	0.484	0.354

Table A-28: Water Levels at Lake N11 – Construction, Operations and Closure (2011 EIS Update Table 9.7-16, 9.7-54, 9.7-80)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	1.043	1.015	0.977	0.739	0.755	0.769
		construction	1.059	1.032	0.992	0.844	0.847	0.853
		operations	1.068	1.041	1.001	0.754	0.775	0.802
		closure	1.046	1.016	0.966	0.657	0.705	0.735
	10	baseline	1.003	0.977	0.943	0.652	0.682	0.712
		construction	1.005	0.978	0.945	0.788	0.805	0.818
		operations	1.02	0.994	0.959	0.662	0.694	0.748
		closure	0.996	0.969	0.928	0.609	0.657	0.678
Median	2	baseline	0.935	0.913	0.885	0.569	0.609	0.647
		construction	0.933	0.91	0.886	0.703	0.757	0.78
		operations	0.948	0.925	0.899	0.575	0.616	0.684
		closure	0.922	0.899	0.869	0.547	0.599	0.618
Dry	10	baseline	0.822	0.809	0.788	0.51	0.553	0.588
		construction	0.861	0.841	0.826	0.606	0.712	0.748
		operations	0.849	0.835	0.821	0.514	0.558	0.623
		closure	0.823	0.807	0.786	0.477	0.537	0.568
	100	baseline	0.606	0.626	0.62	0.478	0.519	0.544
		construction	0.813	0.796	0.787	0.54	0.686	0.727
		operations	0.718	0.727	0.732	0.481	0.525	0.573
		closure	0.698	0.69	0.675	0.406	0.482	0.533

Figure A-15: Effects on Lake N1 Discharges during Construction, Operations and Closure (2011 EIS Update Tables 9.7-17, 9.7-18, 9.7-55, 9.7-56, 9.7-81, 9.7-82

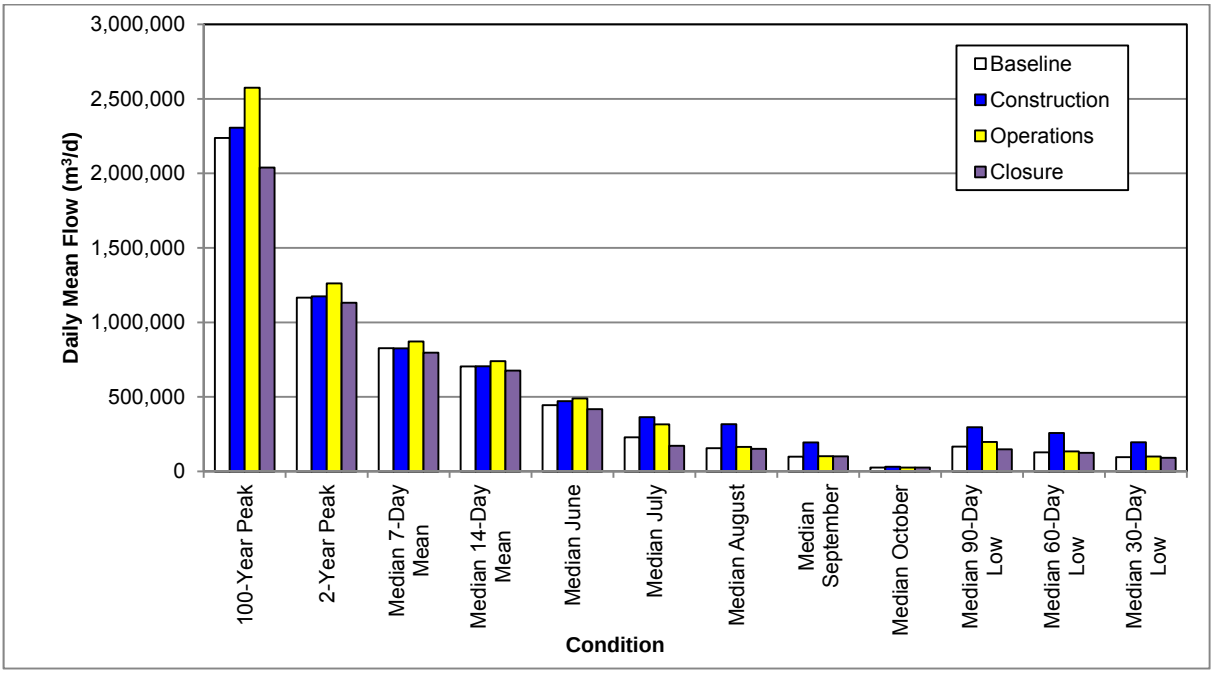

Figure A-16: Effects on Lake N1 Outlet Water Levels during Construction, Operations and Closure (2011 EIS Update Tables 9.7-19, 9.7-20, 9.7-57, 9.7-58, 9.7-84, and 9.7-85)

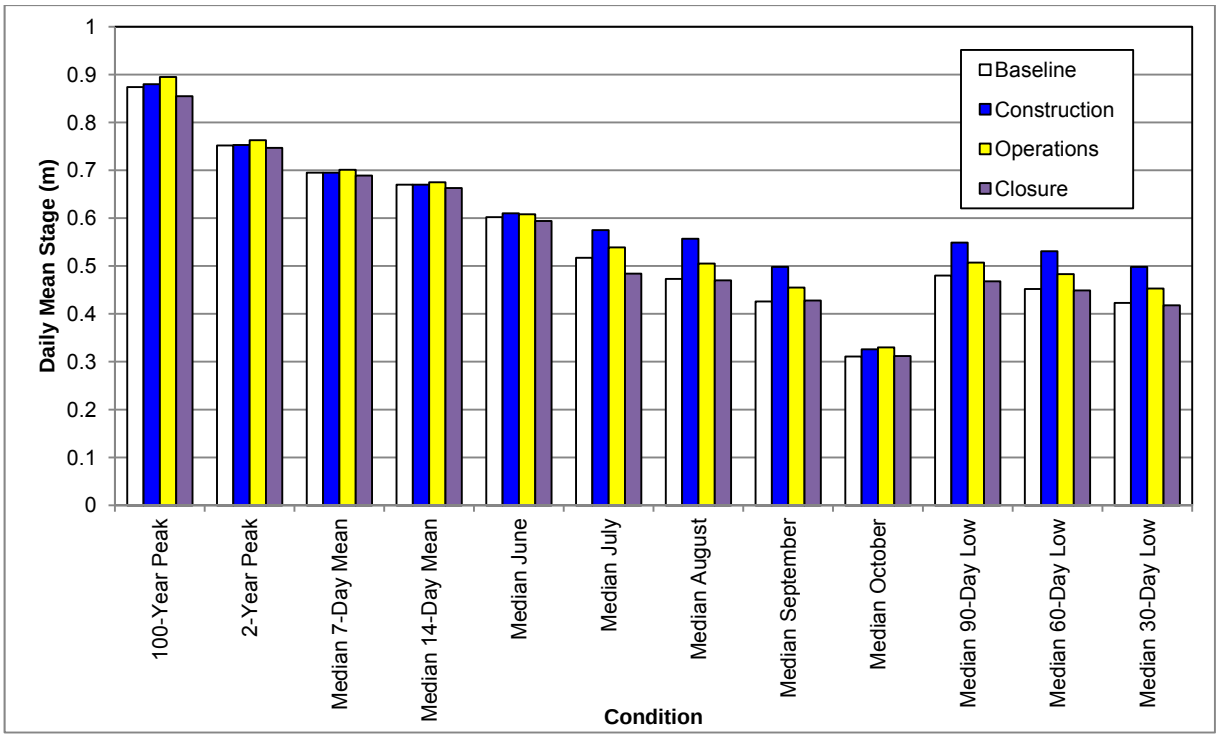

Table A-29: Mean Daily Outflows at Lake N1–Construction, Operations and Closure (2011 EIS Update Table 9.7-17, 9.7-55, 9.7-81)

Condition	Return Period (years)	Snapshot	Monthly Mean Daily Outflow Volume [m^3/d]				
			June	July	August	September	October
Wet	100	baseline	737,000	470,000	370,000	398,000	84,100
		construction	764,000	550,000	499,000	490,000	99,600
		operations	801,000	569,000	401,000	418,000	87,900
		closure	691,000	375,000	375,000	415,000	87,700
	10	baseline	609,000	348,000	248,000	204,000	47,600
		construction	632,000	453,000	396,000	326,000	57,400
		operations	660,000	448,000	265,000	213,000	49,300
		closure	570,000	265,000	247,000	211,000	49,200
Median	2	baseline	444,000	229,000	156,000	99,000	25,100
		construction	471,000	364,000	317,000	194,000	30,900
		operations	489,000	315,000	164,000	102,000	25,700
		closure	417,000	172,000	151,000	101,000	25,600
Dry	10	baseline	270,000	138,000	102,000	56,600	14,600
		construction	312,000	297,000	272,000	111,000	18,400
		operations	319,000	197,000	107,000	58,300	14,900
		closure	259,000	110,000	97,300	57,800	14,800
	100	baseline	121,000	79,300	75,400	41,600	10,300
		construction	184,000	256,000	249,000	66,700	13,300
		operations	183,000	111,000	79,700	43,000	10,500
		closure	127,000	75,100	70,900	42,700	10,500

Table A-30: Discharges at Lake N1– Construction and Operations (2011 EIS Update Table 9.7-18, 9.7-56, 9.7-82)

Condition	Return Period (years)	Snapshot	Peak Daily Q [m^3/s]	7-Day Mean Peak Q [m^3/d]	14-Day Mean Peak Q [m^3/d]	30-Day Low Flow Q [m^3/d]	60-Day Low Flow Q [m^3/d]	90-Day Low Flow Q [m^3/d]
Wet	100	baseline	25.9	1,250,000	1,050,000	285,000	333,000	353,000
		construction	26.7	1,280,000	1,070,000	417,000	462,000	482,000
		operations	29.8	1,350,000	1,110,000	312,000	368,000	404,000
		closure	23.6	1,250,000	1,020,000	229,000	294,000	305,000
	10	baseline	19.9	1,080,000	910,000	171,000	212,000	251,000
		construction	19.9	1,080,000	914,000	304,000	351,000	384,000
		operations	22.1	1,150,000	962,000	183,000	227,000	293,000
		closure	18.6	1,050,000	878,000	149,000	195,000	219,000
Median	2	baseline	13.5	827,000	704,000	95,600	128,000	166,000
		construction	13.6	826,000	705,000	195,000	257,000	296,000
		operations	14.6	872,000	740,000	100,000	134,000	197,000
		closure	13.1	797,000	676,000	90,800	124,000	148,000
Dry	10	baseline	8.2	527,000	441,000	57,200	83,800	109,000
		construction	8.8	561,000	473,000	112,000	195,000	235,000
		operations	8.68	557,000	472,000	59,100	87,500	132,000
		closure	8.27	527,000	443,000	57,700	83,600	102,000
	100	baseline	4.5	242,000	174,000	40,500	63,800	77,100
		construction	5.8	335,000	264,000	59,400	161,000	199,000
		operations	4.84	270,000	211,000	41,600	67,200	95,000
		closure	4.74	294,000	226,000	41,800	64,500	77,500

Table A-31: Mean Daily Water Levels at Lake N1 Outlet – Construction, Operations and Closure (2011 EIS Update Table 9.7-19, 9.7-57, 9.7-83)

Condition	Return Period (years)	Snapshot	Monthly Mean Stage [m]				
			June	July	August	September	October
Wet	100	baseline	0.677	0.61	0.577	0.587	0.411
		construction	0.682	0.633	0.619	0.616	0.427
		operations	0.682	0.627	0.602	0.6	0.419
		closure	0.667	0.579	0.579	0.593	0.415
	10	baseline	0.648	0.569	0.527	0.504	0.36
		construction	0.653	0.605	0.587	0.561	0.376
		operations	0.653	0.588	0.553	0.523	0.373
		closure	0.638	0.535	0.526	0.507	0.363
Median	2	baseline	0.602	0.517	0.473	0.426	0.311
		construction	0.61	0.575	0.557	0.498	0.326
		operations	0.608	0.539	0.505	0.455	0.33
		closure	0.594	0.484	0.47	0.428	0.312
Dry	10	baseline	0.537	0.46	0.429	0.375	0.274
		construction	0.555	0.549	0.538	0.438	0.289
		operations	0.542	0.486	0.47	0.413	0.302
		closure	0.532	0.437	0.425	0.377	0.275
	100	baseline	0.446	0.405	0.4	0.349	0.253
		construction	0.492	0.531	0.527	0.389	0.269
		operations	0.452	0.437	0.45	0.393	0.287
		closure	0.451	0.4	0.395	0.351	0.254

Table A-32: Water Levels at Lake N1 – Construction, Operations and Closure (2011 EIS Update Table 9.7-20, 9.7-58, 9.7-84)

Condition	Return Period (years)	Snapshot	Peak Daily Stage [m]	7-Day Mean Peak Stage [m]	14-Day Mean Peak Stage [m]	30-Day Low Flow Stage [m]	60-Day Low Flow Stage [m]	90-Day Low Flow Stage [m]
Wet	100	baseline	0.874	0.764	0.734	0.544	0.564	0.571
		construction	0.88	0.768	0.737	0.594	0.608	0.614
		operations	0.895	0.773	0.74	0.565	0.587	0.59
		closure	0.855	0.764	0.729	0.517	0.548	0.552
	10	baseline	0.822	0.739	0.71	0.483	0.508	0.528
		construction	0.822	0.739	0.711	0.552	0.571	0.582
		operations	0.837	0.745	0.716	0.508	0.532	0.55
		closure	0.81	0.734	0.705	0.468	0.498	0.512
Median	2	baseline	0.752	0.695	0.67	0.423	0.452	0.48
		construction	0.753	0.695	0.67	0.498	0.531	0.549
		operations	0.763	0.701	0.675	0.453	0.483	0.507
		closure	0.747	0.689	0.663	0.418	0.449	0.468
Dry	10	baseline	0.671	0.626	0.601	0.376	0.41	0.436
		construction	0.682	0.636	0.611	0.439	0.498	0.52
		operations	0.68	0.635	0.609	0.414	0.449	0.469
		closure	0.672	0.626	0.602	0.377	0.41	0.429
	100	baseline	0.584	0.524	0.485	0.347	0.385	0.403
		construction	0.62	0.564	0.534	0.379	0.477	0.501
		operations	0.599	0.546	0.508	0.391	0.432	0.442
		closure	0.591	0.548	0.516	0.35	0.386	0.403