

## **Appendix V5-1D**

Hope Bay Belt Project: 2009 Hydrology Baseline Report



Hope Bay Mining Limited



# Hope Bay Belt Project: 2009 Hydrology Baseline Report



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# 2009 Hydrology Baseline Report, Hope Bay Belt Project

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**Prepared for:**



Hope Bay Mining Ltd.

**Prepared by:**



Rescan™ Environmental Services Ltd.  
Vancouver, British Columbia

HOPE BAY BELT PROJECT  
**2009 HYDROLOGY BASELINE REPORT**

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## **Executive Summary**

## Executive Summary

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Environmental baseline studies were conducted by Rescan Environmental Services Ltd. (Rescan) in 2009, on behalf of Newmont Mining Corporation (Newmont), for the Hope Bay Belt Project. The Hope Bay Belt Property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound. The nearest communities are Omingmaktok (75 km to the southwest of the property), Cambridge Bay, and Kingaok (Bathurst Inlet; 160 km to the southwest of the property).

The environmental baseline program conducted in 2009 was based on the plan to develop multiple deposits in the belt. The 2009 program was also based on Newmont's priorities as of early 2009, which included regulatory compliance with the existing Doris North Project permits and licences. Baseline work was primarily focused on the north end of the belt in 2009.

This report presents the findings of the 2009 hydrology baseline study. The primary objective of the 2009 hydrology monitoring was to collect additional hydrometric data relevant to the planned project to support permitting and project design. This report presents the methods used to collect and analyze hydrometric data for 2009 as well as a comparison of the results to on-site historical data and regional data.

A network of 13 lake and stream stations was operated during 2009. Eleven automated hydrometric stations were installed before or during freshet in 2009. Two hydrometric stations at Doris and Tail lakes were installed prior to 2009. The monitoring program commenced in mid June and continued through to late September when the majority of the stations were demobilized for the winter.

The estimated average runoff for the open-water season ranged from 95 to 168 mm across the Study Area. Estimated annual runoff was higher in the Windy-Glenn Watersheds (149 mm) than in the Doris-Roberts Watersheds (105 mm). Estimated runoff in the Koignuk Watershed and Reference-A Watershed was 134 mm and 88 mm, respectively.

The 2009 estimated runoff for Doris Outflow was 99 mm which agrees well with runoff values previously estimated for the Doris Watershed. This characterizes 2009 as an average year in terms of runoff.

Annual peak flows in the Project area occurred during the freshet period in late-June to early-July, driven by snowmelt. Observed instantaneous peak flows for the watersheds in the Study area ranged from 0.13 m<sup>3</sup>/s at Tail Outflow to 133 m<sup>3</sup>/s at the Koignuk River near its discharge point into Hope Bay. Similarly, instantaneous peak unit yields ranged from 17 L/s/km<sup>2</sup> at Patch Outflow to 45 L/s/km<sup>2</sup> at the Koignuk River.

Changes in lake water levels recorded from June 16 to September 21 ranged from 0.14 m to 0.35 m at Tail Lake and Doris Lake, respectively.

Tidal fluctuations were measured by an automated hydrometric station installed near the jetty at Roberts Bay from late July to early September. The tides in Roberts Bay were always microtidal (<2 m tidal range) and diurnal (one high tide and low tide per day) with larger tidal ranges (0.4 - 0.5 m) occurring during spring tides than during the neap tidal cycle (0.2 - 0.3 m). A strong storm surge was noted during early September.

## Acknowledgements

## Acknowledgements

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This report was prepared for Newmont Mining Corporation by Rescan Environmental Services Ltd. The 2009 hydrology fieldwork was conducted by Rescan scientists Greg Norton (M.Sc.), Xavier Pinto (M.Sc.), Katsky Venter (M.Sc.), and Tolga Olcay (M.Sc.). Field work assistance was provided by Wynter Kulliktana, Janet Kadlun, and Clarence Klengenberg. The report was written by Greg Norton, Jason Rempel (M.Sc.), and Xavier Pinto, and reviewed by Deborah Muggli (Ph.D., M.Sc., R.P.Bio.).

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HOPE BAY BELT PROJECT  
**2009 HYDROLOGY BASELINE REPORT**

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## **Table of Contents**

# HOPE BAY BELT PROJECT:

# 2009 Hydrology Baseline Report

## Table of Contents

---

|                                                 |      |
|-------------------------------------------------|------|
| Executive Summary .....                         | i    |
| Acknowledgements .....                          | iii  |
| Table of Contents .....                         | v    |
| List of Appendices.....                         | vi   |
| List of Figures.....                            | vi   |
| List of Tables .....                            | vii  |
| List of Plates .....                            | viii |
| 1. Introduction .....                           | 1-1  |
| 2. Hydrological Setting.....                    | 2-1  |
| 2.1 Arctic Hydrology.....                       | 2-1  |
| 2.2 Study Area Watersheds.....                  | 2-3  |
| 2.3 Available Hydrological Data .....           | 2-3  |
| 2.3.1 Historical Site Data .....                | 2-3  |
| 2.3.2 Regional Data .....                       | 2-5  |
| 3. 2009 Field Data Collection .....             | 3-1  |
| 3.1 Objectives .....                            | 3-1  |
| 3.2 Methods .....                               | 3-1  |
| 3.2.1 Monitoring Network .....                  | 3-1  |
| 3.2.2 Manual Flow Measurements.....             | 3-2  |
| 3.2.2.1 Winter Under Ice Flow Measurements..... | 3-7  |
| 3.2.3 Stage-Discharge Rating Curves.....        | 3-7  |
| 3.2.4 Annual Hydrographs.....                   | 3-7  |
| 3.2.5 Tidal Level.....                          | 3-8  |
| 3.3 Results.....                                | 3-8  |
| 3.3.1 Manual Flow Measurements.....             | 3-8  |
| 3.3.1.1 Winter Under Ice Flow Measurements..... | 3-10 |
| 3.3.2 Rating Curves .....                       | 3-10 |
| 3.3.3 Stage Data .....                          | 3-11 |
| 3.3.4 Lake Levels .....                         | 3-12 |
| 3.3.5 Hydrographs.....                          | 3-12 |
| 3.3.6 Tidal Level.....                          | 3-19 |
| 3.3.7 Important Hydrologic Variables.....       | 3-19 |

## 2009 HYDROLOGY BASELINE REPORT

|         |                                                                      |      |
|---------|----------------------------------------------------------------------|------|
| 3.3.7.1 | Calculated Average Runoff.....                                       | 3-19 |
| 3.3.7.2 | Monthly Runoff Distribution.....                                     | 3-19 |
| 3.3.7.3 | Peak and Low Flows .....                                             | 3-25 |
| 4.      | Historical Site Data and Regional Analysis.....                      | 4-1  |
| 4.1     | Comparison of 2009 Data with Regional and Historical site Data ..... | 4-1  |
| 4.2     | review of Previous Regional Analysis .....                           | 4-1  |
| 4.3     | Applicability .....                                                  | 4-14 |
|         | References.....                                                      | 4-1  |

### **List of Appendices**

Appendix 1. Manual Flow Measurements

Appendix 2. Rating Curves

Appendix 3. Survey Control Points

Appendix 4. Lake Water Levels

Appendix 5. Hydrographs

### **List of Figures**

| <b>FIGURE</b>                                                                                                      | <b>PAGE</b> |
|--------------------------------------------------------------------------------------------------------------------|-------------|
| Figure 1-1. Hope Bay Belt Project Location .....                                                                   | 1-2         |
| Figure 1-2. Site Layout Options Considered for 2009 Baseline Program.....                                          | 1-3         |
| Figure 2.1-1. Theoretical Typical Annual Flow Hydrograph for a Small Northern Watershed .....                      | 2-2         |
| Figure 2.3-1. WSC Hydrometric stations near the Study Area.....                                                    | 2-6         |
| Figure 3.2-1. 2009 Hydrometric Monitoring Stations for Doris/Madrid Area, Hope Bay Belt Study Area .....           | 3-3         |
| Figure 3.3-1. Irregularities in the Recorded Water Level Data Caused by Ice Jamming in the Koignuk River .....     | 3-13        |
| Figure 3.3-2. Recorded Lake Water Levels in the Study Area .....                                                   | 3-14        |
| Figure 3.3-3. Recorded Lake Water Levels in the Study Area (with graphics).....                                    | 3-15        |
| Figure 3.3-4. 2009 Annual Flow Hydrographs .....                                                                   | 3-16        |
| Figure 3.3-5. 2009 Annual Hydrographs.....                                                                         | 3-17        |
| Figure 3.3-6. 2009 Open-water Season Unit Yield Hydrographs.....                                                   | 3-18        |
| Figure 3.3-7. Relation Developed to Estimate Flows at Roberts-Hydro Based on Calculated Flows at Doris-Hydro ..... | 3-20        |
| Figure 3.3-8. Tidal Fluctuations at Roberts Bay July to September 2009.....                                        | 3-21        |

|                                                                                                    |      |
|----------------------------------------------------------------------------------------------------|------|
| Figure 3.3-9. 2009 Monthly Distribution of Annual Runoff in the Watersheds in the Study Area ..... | 3-23 |
| Figure 3.3-10. 2009 Monthly Distribution of Annual Runoff in the Watersheds in the Study Area..... | 3-24 |
| Figure 4.1-1. Historical Hydrographs for Doris Outflow .....                                       | 4-2  |
| Figure 4.1-2. Historical Hydrographs for Tail Outflow.....                                         | 4-3  |
| Figure 4.1-3. Historical Hydrographs for Ogama Outflow .....                                       | 4-4  |
| Figure 4.1-4. Historical Hydrographs for Roberts Outflow .....                                     | 4-5  |
| Figure 4.1-5. Historical Hydrographs for Patch Outflow .....                                       | 4-6  |
| Figure 4.1-6. Historical Hydrographs for PO Outflow.....                                           | 4-7  |
| Figure 4.1-7. Historical Hydrographs for Windy Outflow.....                                        | 4-8  |
| Figure 4.1-8. Historical Hydrographs for Glenn Outflow.....                                        | 4-9  |
| Figure 4.1-9. Historical Hydrographs for Koignuk River .....                                       | 4-10 |
| Figure 4.2-1. Correlation of Weekly Runoff between Ellice River and Doris Outflow .....            | 4-12 |
| Figure 4.2-2. Relation Between Watershed Area and Peak Flows with Different Return Periods .....   | 4-15 |
| Figure 4.2-3. Relation Between Watershed Area and Low Flows with Different Return Periods .....    | 4-16 |

### **List of Tables**

| <b>TABLE</b>                                                                                              | <b>PAGE</b> |
|-----------------------------------------------------------------------------------------------------------|-------------|
| Table 2.3-1. Summary of Available Historic On-site Data Collected by Automated Hydrometric Stations ..... | 2-5         |
| Table 2.3-2. Regional Water Survey of Canada (WSC) stations Relevant to the Study Area.....               | 2-5         |
| Table 3.2-1. 2009 Automated Hydrometric Monitoring Stations.....                                          | 3-1         |
| Table 3.2-2. 2009 Period of Operation for Hydrometric Monitoring Stations.....                            | 3-2         |
| Table 3.3-1. Summary of 2009 Manual Flow Measurements.....                                                | 3-9         |
| Table 3.3-2. Winter Flows and Ice Thickness Measurements at the Koignuk River .....                       | 3-11        |
| Table 3.3-3. Summary of 2009 Stage-Discharge Rating Equations.....                                        | 3-11        |
| Table 3.3-4. Recorded Lake Water Levels for the 2009 Open-water Season .....                              | 3-12        |
| Table 3.3-5. 2009 Annual Runoff and Mean Annual Flow.....                                                 | 3-22        |
| Table 3.3-6. 2009 Monthly Runoff Distribution (mm).....                                                   | 3-22        |
| Table 3.3-7. 2009 Monthly Runoff Distribution (%).....                                                    | 3-22        |
| Table 3.3-8. Mean Flow for the Open-water Season (m <sup>3</sup> /s).....                                 | 3-25        |
| Table 3.3-9. 2009 Annual Peak Flow and Yield .....                                                        | 3-25        |

## 2009 HYDROLOGY BASELINE REPORT

|                                                                                                                     |      |
|---------------------------------------------------------------------------------------------------------------------|------|
| Table 3.3-10. Daily Minimum Flows (July – September 2009).....                                                      | 3-26 |
| Table 4.2-1. Return Period Estimates of Annual Runoff from AMEC (2003).....                                         | 4-11 |
| Table 4.2-2. Estimates of Mean Monthly Runoff from AMEC (2003).....                                                 | 4-11 |
| Table 4.2-3. Summary of Annual Runoff Return Period Estimates for Lakes in the Study Area from Golder (2009).....   | 4-13 |
| Table 4.2-4. Summary of Peak Daily Flow Return Period Estimates for Lakes in the Study Area from Golder (2009)..... | 4-13 |
| Table 4.2-5. Summary of 7-Day Low-Flow Return Period Estimates for Lakes in the Study Area from Golder (2009).....  | 4-13 |
| Table 4.2-6. Peak and Low Flow Estimates for Koignuk River and Reference-A Watershed .....                          | 4-14 |

### **List of Plates**

| <b>PLATE</b>                                                           | <b>PAGE</b> |
|------------------------------------------------------------------------|-------------|
| Plate 2.2-1. Koignuk River facing south.....                           | 2-4         |
| Plate 2.2-2. Ogama Lake with Hope Bay in the background.....           | 2-4         |
| Plate 3.2-1. Photographs Illustrating Hydrometric Station Design ..... | 3-5         |

# 1. Introduction

# 1. Introduction

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The Hope Bay Belt Property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound (Figure 1-1). The nearest communities are Omingmaktok (75 km to the southwest of the property), Cambridge Bay, and Kingaok (Bathurst Inlet; 160 km to the southwest of the property).

The property consists of a greenstone belt running in a north/south direction, approximately 80 km long, with three main gold deposit areas. The Doris and Madrid deposits are located in the northern portion of the belt, and the Boston deposit is located in the southern end. The northern portion of the property consists of several watershed systems that drain into Roberts Bay, and a large river (Koignuk River) that drains into Hope Bay. Watersheds in the southern portion of the belt ultimately drain into the upper Koignuk, which drains into Hope Bay.

Newmont Mining Corporation (Newmont) acquired the property in 2008, and initially decided to consider the property as a whole to evaluate various options for responsible, long-term development of the belt. However, as of the fall of 2009, Newmont has decided to proceed with developing the already-permitted Doris North Project, which consists of a two year underground gold mine in the north end of the belt.

The environmental baseline program conducted in 2009 was based on the plan to develop multiple deposits in the belt, as indicated in Figure 1-2. The 2009 program was also based on Newmont's priorities as of early 2009, which included regulatory compliance with the existing Doris North Project permits and licences. Baseline programs for ecosystem mapping, vegetation, soils, and socio-community were deferred to 2010. Baseline work was primarily focused on the north end of the belt in 2009.

Results from the 2009 environmental baseline program are being reported in a series of reports, as follows:

- o 2009 Hydrology Baseline Report;
- o 2009 Meteorology Baseline Report;
- o 2009 Freshwater Baseline Report;
- o 2009 Freshwater Fish and Fish Habitat Baseline Report;
- o 2009 Marine Baseline Report;
- o 2009 Marine Fish and Fish Habitat Baseline Report.

In addition, baseline information obtained during 2009 was used to generate various compliance reports as specified in the Doris North Project Certificate (e.g., the Wildlife Monitoring and Mitigation Program Report), the Doris North Type A Water Licence, and the Doris North Roberts Bay Jetty Fisheries Authorization. Archaeology work was also conducted in 2009 and is being reported separately.



Figure 1-1

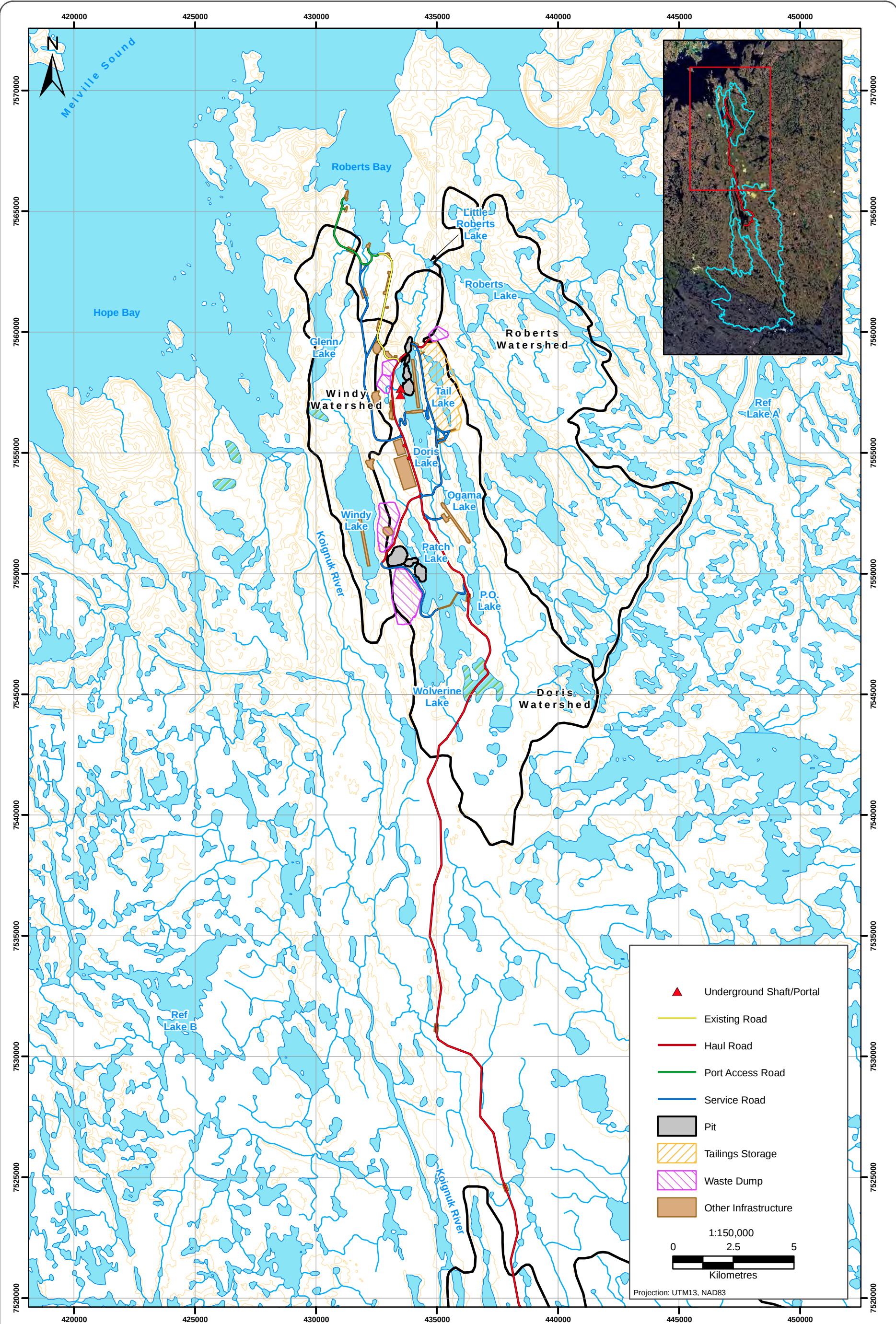


Figure 1-2



Site Layout Options Considered for 2009 Baseline Program

Figure 1-2



This report presents the results from the hydrology portion of the 2009 environmental baseline program. Preliminary estimates of key hydrological parameters (e.g., mean annual runoff and flow, and extreme flows) that describe hydrological conditions within the Study Area are prepared and compared against historical datasets for the Study Area as well as long-term hydrological datasets for rivers close to the project site. These estimates can be used for environmental impact assessment and to assist in engineering design. The main body of this report is divided into three sections, including:

- o description of the hydrological setting of the project site;
- o summary of 2009 field data collection and on-site monitoring program; and
- o analysis of available on-site historical and regional hydrological datasets and comparison to derived key hydrological parameters.

## 2. Hydrological Setting

## 2. Hydrological Setting

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### 2.1 ARCTIC HYDROLOGY

The Hope Bay Study Area lies within the permafrost zone of the Canadian Arctic. This region is composed of vegetated tundra slopes dotted with lakes and wetland fens. Hydrologic processes are dominated by snow accumulation and melt, surface runoff, stream flow and lake hydrology. The annual flow hydrograph is controlled by long cold winters and short summers. Most of the annual runoff occurs during freshet and is derived from the melting snow pack. Late August and September precipitation events can also produce moderate runoff. Following freshet, a period of low flows typically extends through July and August. Due to the presence of permafrost, there is no groundwater support for smaller streams although there may be interaction between groundwater systems and larger rivers and/or lakes through taliks or openings in the permafrost. As a result, baseflow in streams is low and supported only by flow through the shallow upper active layer of the soil profile, the only part of the soil profile that melts in the summer months.

The hydrological year for the region is defined by freeze-up, which typically occurs in October for the Study Area. In small watersheds, like many of those in the Study Area, streams typically freeze to their bottom with zero flow during winter. Some larger rivers maintain flow year round, likely due to either groundwater discharge from taliks or flow from upstream lakes, where turbulent flow maintains ice free zones at the lake outlets. Water is stored in the snowpack during winter and is released in the spring freshet.

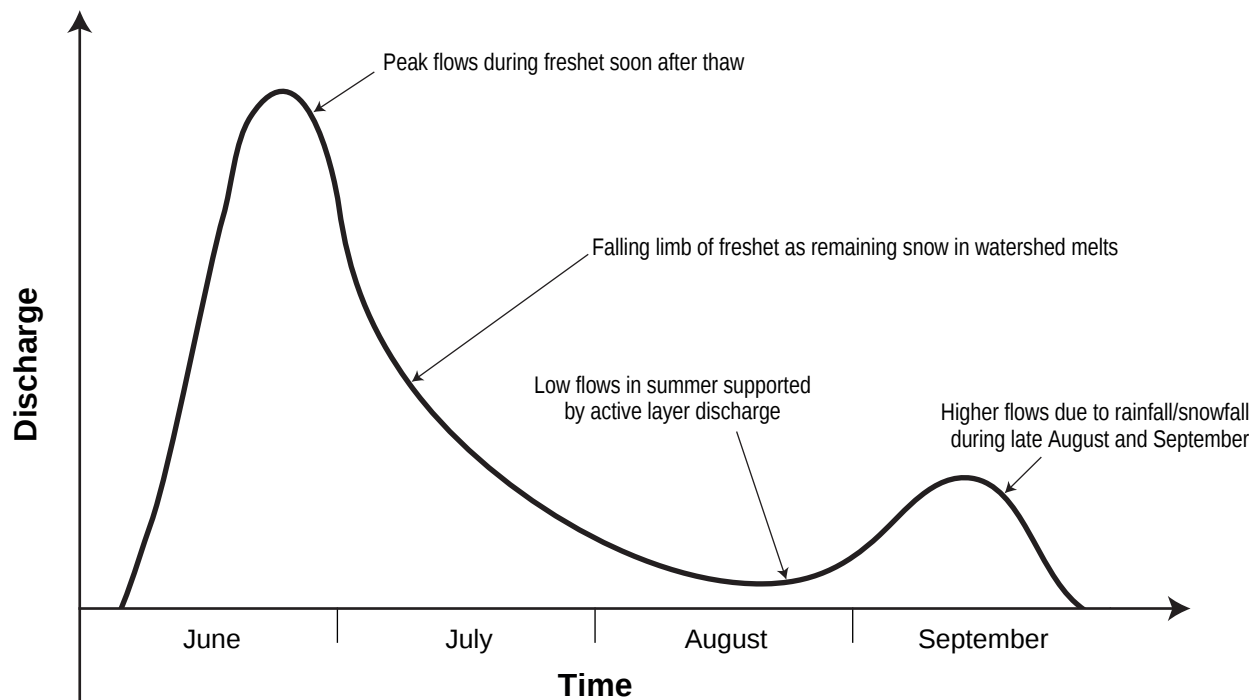
A conceptual hydrograph showing typical annual discharge patterns for small watersheds is shown in Figure 2.1-1. This figure shows a steep peak during freshet and a second peak in late August through September. The shapes of hydrographs and the responses of streams to both spring snowmelt and precipitation are strongly correlated to basin size. Smaller watersheds respond more rapidly to inputs than larger watersheds. The magnitude and timing of runoff events vary with watershed size and precipitation.

In very small basins the freshet can be as short as a few days and will often occur immediately after ice break-up. Flow in these basins may cease after freshet until the late summer rains begin. For rivers draining larger basins, the freshet peak may be delayed after ice break-up compared to smaller drainages as snowmelt from upper portions of the watershed is routed through the system.

Smaller watersheds can also have more dramatic responses to precipitation. In larger watersheds, the presence of lakes creates significant attenuation of water and diminishes the magnitude of peak flows. The attenuation of flows in lakes also reduces risks of flooding in the area due to lower downstream peak flows.

The overall shape of the annual flow hydrograph for Arctic watersheds is relatively easy to predict. However, predicting the volume of freshet or the size of the peak flow during freshet is much more difficult. This is due to a number of factors that influence freshet runoff, including:

- o *Amount of snowpack available to be melted in spring.* Snowpack is dependent on the amount of snowfall during the previous winter and the amount of snow remaining in each watershed in May or June. Snow can be lost or redistributed due to sublimation, melting, or wind.



Note: Approximate scale only

- o *Rate of temperature rise in spring.* This can greatly affect peak flow rates as a rapid increase in temperature after the snowpack has saturated can produce high melt rates. Also there can be differential melt rates on north and south facing slopes which may affect the size of the contributing area to the melt.
- o *Timing of opening of stream channels linking lakes.* In the Study Area, snowmelt from hillslopes surrounding lakes can occur before the stream channel draining the lake becomes ice free. In this case, meltwater can be stored in the lake and then released once the channel is open to flow.
- o *Soil moisture conditions and lake levels at the end of the previous summer.* If there was a dry summer during the previous year, lake levels could have been lowered and a soil moisture deficit could have developed within the hillslopes surrounding the lakes. As a result, a portion of the annual runoff will recharge the lakes and soil moisture and not be transmitted from the watershed as stream flow.

The amount of runoff during summer and fall is controlled by the relative impact of rainfall and evaporation. Open-water evaporation rates in summer often exceed total rainfall such that soil moisture deficits build up in the shallow active layer of the soil. Studies of hillslope processes in northern watersheds (e.g., Quinton and Marsh, 1998) have shown that summer rainfall may produce little or no runoff from hillslopes in the permafrost zone. In this case, stream flow increases only due to rain falling directly onto lake surfaces or when there is high intensity or lower intensity/higher duration rainfall.

## 2.2 STUDY AREA WATERSHEDS

The Study Area is coastal lowland characterized by extensive chains of lakes and low relief. The drainage basins are generally long and narrow and predominantly oriented along a north-south axis. Drainage basins are relatively flat, with a large percentage of lake area and high ridges along basin boundaries formed by rock outcrops. The local topography ranges from sea level at Roberts Bay to 158 m at the summit of Doris mesa, 3 km inland (Plates 2.2-1 and 2.2-2).

The Study Area included four main drainages (Figure 3.2-1): Koignuk (2937 km<sup>2</sup>), Windy-Glenn (48 km<sup>2</sup>), Doris-Roberts (194 km<sup>2</sup>), and Reference-A (27 km<sup>2</sup>). The Koignuk River Watershed drains north into Hope Bay. The Windy-Glenn Watershed is located east of the Koignuk River and flows north into Roberts Bay via Glenn Lake. The Doris-Roberts Watershed is located east of the Windy-Glenn Watershed, the outlet stream of Doris Lake flows north into Roberts Bay of Melville Sound via Little Roberts Lake. The Reference-A Lake Watershed is the easternmost basin in the Study Area and it drains northwest into Melville Sound.

## 2.3 AVAILABLE HYDROLOGICAL DATA

### 2.3.1 Historical Site Data

Various hydrology stations have been installed and operated throughout the Hope Bay Belt area since the mid 1990s. Multiple years of data are available for many major lake outflows for the Doris/Madrid area. Fewer years of data are available for the Boston area. Hydrometric monitoring in the area began in 1993 at several sites where flow and water levels were manually recorded. Automated monitoring began in 1995 and this continued to the present, although the number of stations has changed from year to year over that period (Table 2.3-1).



*Plate 2.2-1. Koignuk River facing south.*



*Plate 2.2-2. Ogama Lake with Hope Bay in the background.*

**Table 2.3-1. Summary of Available Historic On-site Data Collected by Automated Hydrometric Stations**

| Monitoring Location           | Coordinates UTM <sup>a</sup><br>(Easting, Northing) |           | Drainage (km <sup>2</sup> ) | Years of Automated Data Collection |
|-------------------------------|-----------------------------------------------------|-----------|-----------------------------|------------------------------------|
| Aimaokatalok Lake and Outflow | 438,892                                             | 7,508,794 | 1241                        | 2006-2008                          |
| Aimaokatalok River            | 441,634                                             | 7,499,360 | 769                         | 2006-2008                          |
| Doris Lake                    | 433,513                                             | 7,558,451 | 93.1                        | 2004-2009                          |
| Doris Lake Outflow            | 434,063                                             | 7,559,507 | 93.1                        | 1996-1998, 2000, 2003-2009         |
| Fickle Duck Lake and Outflow  | 442,699                                             | 7,503,688 | 31.3                        | 2006-2008                          |
| Glenn Lake Outflow            | 430,616                                             | 7,561,906 | 31.6                        | 1996-1998, 2000, 2006-2009         |
| Koignuk River                 | 429,739                                             | 7,554,336 | 3192 <sup>b</sup>           | 2006-2009                          |
| Little Roberts Outflow        | 434,271                                             | 7,563,159 | 198.9                       | 2003-2008                          |
| Ogama Inflow                  | 436,617                                             | 7,550,891 | 64.6                        | 1997                               |
| Ogama Lake and Outflow        | 435,648                                             | 7,555,130 | 72.1                        | 1996-1998, 2006-2009               |
| Patch Lake and Outflow        | 435,993                                             | 7,549,169 | 30                          | 2006-2009                          |
| PO Lake                       | 436,584                                             | 7,551,126 | 34.4                        | 2007-2009                          |
| PO Lake Outflow               | 436,565                                             | 7,550,014 | 64.9                        | 2007-2009                          |
| Roberts Lake and Outflow      | 435,289                                             | 7,562,800 | 97.8                        | 2003-2009                          |
| Stickleback Lake and Outflow  | 442,009                                             | 7,504,121 | 2.8                         | 1998, 2006-2008                    |
| Tail Lake                     | 434,899                                             | 7,558,494 | 4.4                         | 2004-2009                          |
| Tail Lake Outflow             | 434,273                                             | 7,559,147 | 4.4                         | 2000, 2004-2009                    |
| Windy Lake and Outflow        | 431,507                                             | 7,555,043 | 13.9                        | 2006-2009                          |
| Wolverine Lake and Outflow    | 435,222                                             | 7,545,888 | 1.97                        | 2006-2009                          |

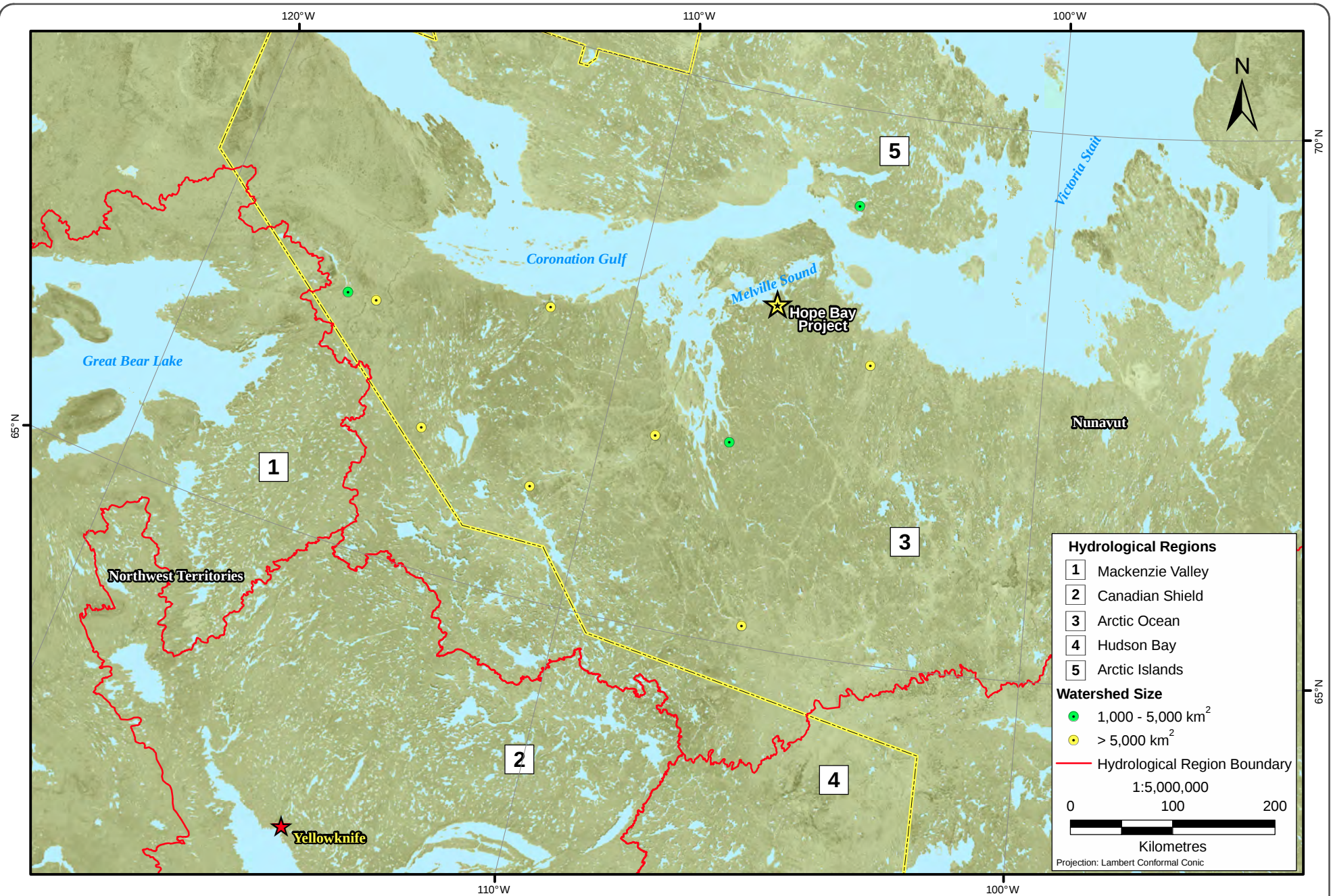
<sup>a</sup> - UTM Zone 13W, NAD83<sup>b</sup> - Value reported by Golder. Value reported by Rescan is 2,937 km<sup>2</sup>

### 2.3.2 Regional Data

Table 2.3-2 and Figure 2.3-1 present the locations of regional hydrometric stations operated by the Water Survey of Canada (WSC). Data from these stations was used to supplement the on-site data collected for 2009 in order to calculate annual runoff estimates for the Koignuk River.

**Table 2.3-2. Regional Water Survey of Canada (WSC) stations Relevant to the Study Area**

| Station Name                                    | Station Number | Location    |              | Drainage Area<br>(km <sup>2</sup> ) | Period of Record |
|-------------------------------------------------|----------------|-------------|--------------|-------------------------------------|------------------|
| Burnside River near the mouth                   | 10QC001        | 66°43'30" N | 108°48'42" W | 16,800                              | 1976-present     |
| Tree River near the mouth                       | 10QA001        | 67°38'6" N  | 111°54'9" W  | 5,810                               | 1968-present     |
| Freshwater Creek near Cambridge Bay             | 10TF001        | 69°7'52" N  | 104°59'26" W | 1,490                               | 1970-present     |
| Ellice River near the mouth                     | 10QD001        | 67°42'30" N | 104°08'21" W | 16,900                              | 1971-present     |
| Back River below Beechy Lake                    | 10RA001        | 65°11'14" N | 106°5'9" W   | 19,600                              | 1978-present     |
| Contwoyto Lake at Lupin Mine                    | 10QC003        | 65°46'37" N | 111°13'1" W  | not provided                        | 1991-present     |
| Fairy Lake River near outlet of Napaktulik Lake | 10PC005        | 66°15'7" N  | 113°59'7" W  | 6,442                               | 1993-present     |
| Coppermine River above Copper Creek             | 10PC004        | 67°13'44" N | 115°53'12" W | 46,200                              | 1987-2008        |
| Kendall River near outlet of Dismal Lakes       | 10PC001        | 67°12'31" N | 116°34'20" W | 2,790                               | 1969-present     |
| Gordon River near the mouth                     | 10QC002        | 66°48'36" N | 107°6'4" W   | 1,530                               | 1977-1994        |



### **3. 2009 Field Data Collection**

## 3. 2009 Field Data Collection

### 3.1 OBJECTIVES

Hydrological monitoring has been conducted to varying degrees within the Study Area since the mid 1990s. The primary objective of the 2009 monitoring program was to collect additional hydrometric data relevant to the planned project to support permitting and project design.

### 3.2 METHODS

#### 3.2.1 Monitoring Network

A network of thirteen lake and stream stations was operated during 2009. Eleven automated hydrometric stations were installed before or during freshet in 2009. Two hydrometric stations at Doris and Tail lakes were installed prior to 2009 (Table 3.2-1, Figure 3.2-1).

**Table 3.2-1. 2009 Automated Hydrometric Monitoring Stations**

| Station                                | Location                         | UTM Coordinates <sup>a</sup><br>(Easting, Northing) |           | Drainage Area<br>(km2) | Monitoring Type    |
|----------------------------------------|----------------------------------|-----------------------------------------------------|-----------|------------------------|--------------------|
| <b><i>Doris-Roberts Watersheds</i></b> |                                  |                                                     |           |                        |                    |
| Doris-Hydro                            | Doris Lake outflow               | 434,059                                             | 7,559,504 | 95                     | stream water level |
| Doris-Lake <sup>b</sup>                | Doris Lake                       | 433,512                                             | 7,558,452 | 95                     | lake water level   |
| Ogama-Hydro                            | Ogama Lake outflow               | 435,501                                             | 7,555,173 | 75                     | stream water level |
| Patch-Hydro                            | Patch Lake outflow               | 436,062                                             | 7,549,169 | 32                     | lake water level   |
| PO-Hydro                               | PO Lake outflow                  | 436,549                                             | 7,550,584 | 68                     | lake water level   |
| Roberts-Hydro                          | Roberts Lake outflow             | 435,310                                             | 7,562,560 | 98                     | lake water level   |
| Tail-Hydro                             | Tail Lake outflow                | 434,300                                             | 7,559,158 | 4                      | stream water level |
| Tail-Lake <sup>b</sup>                 | Tail Lake                        | 434,899                                             | 7,558,494 | 4                      | lake water level   |
| Wolverine-Hydro                        | Wolverine Lake outflow           | 43,4802                                             | 7,545,443 | 3                      | lake water level   |
| <b><i>Windy-Glenn Watersheds</i></b>   |                                  |                                                     |           |                        |                    |
| Windy-Hydro                            | Windy Lake outflow               | 431,481                                             | 7,555,089 | 14                     | lake water level   |
| Glenn-Hydro                            | Glenn Lake outflow               | 430,616                                             | 7,561,906 | 33                     | lake water level   |
| <b><i>Koignuk Watershed</i></b>        |                                  |                                                     |           |                        |                    |
| Koignuk-Hydro                          | Koignuk River                    | 429,731                                             | 7,554,332 | 2937                   | stream water level |
| <b><i>Reference-A Watershed</i></b>    |                                  |                                                     |           |                        |                    |
| Reference A-Hydro                      | Reference Lake outflow           | 448,494                                             | 7,561,212 | 27                     | lake water level   |
| <b><i>Tidal Gauge <sup>c</sup></i></b> |                                  |                                                     |           |                        |                    |
| Roberts Bay - Hydro                    | Roberts Bay, near proposed jetty | 432,209                                             | 7,563,364 | n/a                    | ocean water level  |

<sup>a</sup> - NAD 83, Zone 13 W

<sup>b</sup> - Station previously installed by Golder in 2004

<sup>c</sup> - for more details refer to section 3.2-5

n/a – not applicable

Each station installed in 2009 consisted of a 0-5 psi vented Instrumentation Northwest Inc. Aquistar PT-2X Smartsensor® that combines a pressure transducer and datalogger in one small diameter unit. The pressure transducers recorded water level at ten minute intervals. Each pressure transducer and cabling were inserted into a flexible aluminum conduit with one end of the conduit attached to a piece of angle iron. In rocky substrates, the angle iron was placed directly on the lake or stream bed

whereas in fine-grained substrates, the angle iron was attached to a wooden frame to spread the weight evenly and prevent the assembly from sinking into the substrate. At the outflow of Ogama Lake, the angle iron was anchored to ½ inch diameter pieces of reinforced bar which were drilled into bedrock and fixed in place with rock epoxy. A standard 1 m WSC staff gauge graduated to 0.01 m was also installed to allow for visual measurements of stage. The end connector of the pressure transducer/datalogger was housed in an aluminum waterproof box situated above the high water mark. Pressure transducers were installed as deep as possible to allow for monitoring of low lake and stream levels. Illustrations of station design are provided in Plate 3.2-1.

On shore benchmarks were established as survey control points at each lake and stream level station. During the installation of the stations the elevation of the pressure transducer and water level were surveyed using an automatic level. Surveys were also conducted at each station during subsequent site visits later in the summer (June/July) as a check against pressure transducers readings, to determine if there had been any drift in the readings.

The monitoring period for the stations installed in the spring of 2009 commenced in mid-June and continued through to late-September when the majority of the stations were demobilized for the winter (Table 3.2-2). The majority of the monitoring stations were demobilized at the end of the open-water period as freezing conditions can cause damage to the pressure transducer during the winter. Further, outlet channels completely freeze during the winter and flow levels reach zero. All stations were demobilized with the exception of Doris Lake and Tail Lake stations, which had monitoring instrumentation in water deep enough to prevent ice damage to the pressure transducer and therefore remained in operation as of late-September.

**Table 3.2-2. 2009 Period of Operation for Hydrometric Monitoring Stations**

| Station           | Period of Operation                 | Notes                                                                                                                                   |
|-------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Doris-Hydro       | June 18 to September 21             | Station was operated partially through 2004 at a temporary location before it was permanently installed at its current location in 2005 |
| Doris-Lake        | January 1 to August 28 <sup>a</sup> |                                                                                                                                         |
| Glenn-Hydro       | June 16 to September 21             | Station found vandalized during site visit in September 22.                                                                             |
| Koignuk-Hydro     | June 16 to September 23             |                                                                                                                                         |
| Ogama-Hydro       | June 17 to September 24             |                                                                                                                                         |
| Patch-Hydro       | June 18 to September 24             |                                                                                                                                         |
| PO-Hydro          | June 17 to September 23             |                                                                                                                                         |
| Reference A-Hydro | June 18 to September 23             |                                                                                                                                         |
| Roberts Bay-Hydro | July 28 to September 22             |                                                                                                                                         |
| Roberts-Hydro     | June 17 to July 30                  |                                                                                                                                         |
| Tail-Hydro        | June 17 to September 21             |                                                                                                                                         |
| Tail-Lake         | January 1 to August 28 <sup>a</sup> |                                                                                                                                         |
| Windy-Hydro       | June 16 to September 24             | Station was damaged by wildlife on July 28. Manual lake level readings taken on August 24 and September 24.                             |
| Wolverine-Hydro   | June 21 to July 28                  |                                                                                                                                         |

<sup>a</sup> - Station operated through the 2008-2009 winter and remained in operation as of site visit on August 28, 2009.

### 3.2.2 Manual Flow Measurements

Manual flow measurements during the open-water season were conducted during site visits in June, July, August, and September. The timing of the site visits was designed to capture the full range of flows that would be experienced at each monitoring station.

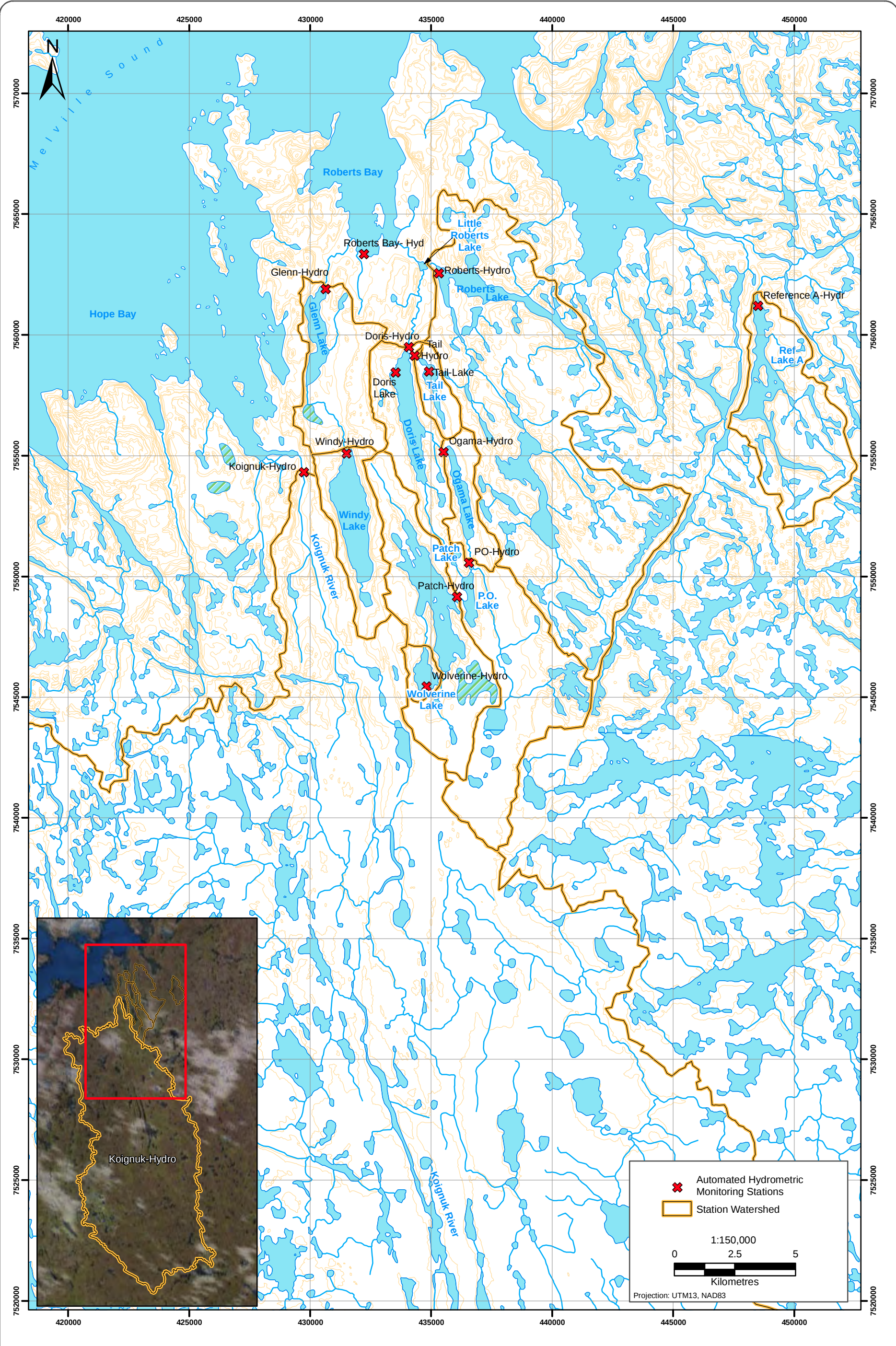


Figure 3.2-1



2009 Hydrometric Monitoring Stations for Doris/Madrid Area,  
Hope Bay Belt Project

Figure 3.2-1





*Plate 3.2-1. Photographs Illustrating Hydrometric Station Design*

*(continued)*



*Plate 3.2-1. Photographs Illustrating Hydrometric Station Design (completed)*

At lake outlets, manual flow measurements were obtained by the velocity-area method using a Swoffer 2100 handheld velocity meter (Swoffer Instruments Inc.). Standard WSC methodologies for manual flow measurements were adopted (Terzi, 1981). Typically, channel wetted width was measured and equally divided into segments so that 20 to 30 vertical measurements were taken across the width of the channel with the aim of having each measurement interval accounting for less

than 10% of the total discharge. At each vertical, velocities were measured at 60% of depth from the surface when the depth of flow was <0.75 m and at 20% and 80% of depth from the surface when the depth of flow was >0.75 m. In most cases two replicate discharge measurements were conducted at each site in order to estimate the precision of the method. The average of the two measurements was taken to be the actual flow. The value of the two measurements provided the range of error associated with the actual flow.

During the open-water season, flow conditions at the Koignuk River were too dangerous to allow field personnel to safely wade and measure discharge with a handheld current velocity meter. Therefore, discharge was measured at this site by means of a StreamPro (Teledyne RD Instruments) acoustic Doppler current profiler (ADCP) following standard methodology (Rehmel et al. 2003, WSC 2004). The ADCP unit was towed from a boat across the river and measurements of velocity depth and position were collected as the boat traversed the measuring section. A single crossing, or transect, of the stream resulted in one measurement of discharge. At least four valid transects were collected during each site visit to reduce the effects of turbulence, directional bias, or other random errors. Transects were considered as valid if they were within 5% of the observed average. The average discharge from the multiple transects was taken to be the actual discharge for the river. The range of individual measurements was used as the error associated with the average discharge.

#### 3.2.2.1 *Winter Under Ice Flow Measurements*

In May 2009 a 6-inch diameter ice auger was used to drill a hole through the surface ice at different locations on the Koignuk River (near its discharge point into Hope Bay) and on the Spyder River (approximately 20 km South of Boston Camp) and flow was measured by means of a Marsh-McBirney handheld velocity meter (Hach Company).

### 3.2.3 **Stage-Discharge Rating Curves**

Manual flow measurements obtained during 2009 were used to generate stage-discharge rating curves (rating curves) for each station. Rating curves are used to convert water level data (stage) recorded by the automated hydrometric stations into a continuous stream flow time-series. The quality of a rating curve depends on the number and accuracy of the individual data points used to generate the curve as well as hydraulic characteristics of the monitoring location. Although a minimum of three points can be used to generate a rating curve, each point adds increased robustness at varying flows. Flow measurements at the higher end of the flow range are especially important as they help in confining the high end of the rating curve. This is important as high flows often require extrapolation beyond the range of the observed data used to generate the rating curve and the rating relationship can change from low flow periods to high flow periods, depending on channel geometry.

### 3.2.4 **Annual Hydrographs**

For the operational period of each station, flows were calculated by applying the generated rating curves to the recorded stage data. In some cases, where recorded stage data were unreliable, flows were estimated from nearby stations when possible. Prior to recorded stage data, rising limbs of the hydrographs were estimated using manual flows measured before station installation and assuming a logarithmic growth function. After the removal of pressure transducers in the fall, hydrograph recession limbs were estimated assuming a linear decay function. Other functions were considered (e.g., logarithmic, polynomial) however the linear function was the most conservative and consistent with results obtained by Rescan in other Arctic locations (e.g., Ekati Diamond Mine).

For all lake stations, it was assumed that the lake outlet streams ceased to flow following a prolonged period of sub-zero temperatures. From previous monitoring years, it was estimated that flows from Tail Lake and Doris Lake ceased following 74 and 252 negative degree (Celsius) days (Golder 2009). This assumption was applied to the 2009 observed mean air temperatures from the Doris meteorological station to provide a date of zero flow of October 15 for Tail Lake and October 31 for Doris Lake. Because Tail Lake encompasses the smallest catchment area compared to the other catchments among the Doris-Roberts, Windy-Glenn, and Reference-A Watersheds it was assumed to stop flowing at an earlier date: October 15. All other gauged lakes were assumed to cease to flow on the same estimated date as Doris Lake.

Due to its larger size compared to the rest of the watersheds in the Study Area the Koignuk River (2,937 km<sup>2</sup>) was assumed to stop flowing at a later date, on December 1. An examination of daily flow data (2005-2008) from the similarly sized WSC station at Kendall River (2,790 km<sup>2</sup>) showed that the river stopped flowing around mid- to late-November. The Koignuk Watershed is relatively larger than the Kendall Watershed and is also located farther north, having therefore a climate more influenced by its proximity to the ocean. Thus, the assumption of December 1 as the date when flow ceases at the Koignuk is reasonable.

### 3.2.5 Tidal Level

Tidal levels were recorded by an automated hydrometric station (tidal gauge) installed near the jetty at Roberts Bay on July 2009 (Figure 3.2-1 and Table 3.2-1). The station consisted of a Solinst M-10 Levellogger pressure transducer/data logger combination. The Levellogger was attached to a float and anchored to the ocean bottom and recorded water levels every 10 minutes. A Solinst Barologger was installed on shore and recorded atmospheric pressure to correct the Levellogger absolute pressure readings.

The elevation of the tidal gauge at Roberts Bay relative to a geodetic benchmark was surveyed using a total station prior to station demobilization.

The tidal gauge operated from July 28 to September 22 when the station was demobilized to prevent winter freeze up.

## 3.3 RESULTS

### 3.3.1 Manual Flow Measurements

Manual flow measurements were collected during the freshet period at each hydrometric station with additional measurements conducted in July, August, and September 2009 (Table 3.3-1 and Appendix 1). Between five and eight flow measurements were made at each station, with the exception of Wolverine-Hydro, for a total of 69 measurements.

Surface flows were not measured at Wolverine-Hydro because there was no defined outlet channel. Negligible amounts of flow were observed spread over a relatively wide area (approximately 40 m wide) on the north end of the lake. Flow was estimated at <10 L/s on a 50 cm wide rivulet located amid the marshes. On the south east end of the lake smaller flows were also spread over a marsh-like feature although they could not be measured.

Care was taken during the 2009 field season to collect multiple measurements during the freshet period and to capture a range of different flow conditions. Freshet peak flows were successfully captured at the majority of the monitoring stations. However, there is some degree of uncertainty as to whether the maximum measured flow at PO-Hydro (2 m<sup>3</sup>/s on June 11) was the actual peak flow or whether the maximum flow for the open-water season occurred previous to the site visit in June 11.

**Table 3.3-1. Summary of 2009 Manual Flow Measurements**

| Station       | Date   | Pressure Transducer Stage<br>(m, referenced to arbitrary datum) | Flow (m <sup>3</sup> /s) | Measuring Technique            |
|---------------|--------|-----------------------------------------------------------------|--------------------------|--------------------------------|
| Doris-Hydro   | 11-Jun | a                                                               | 0.02                     | Velocity-Area (Swoffer)        |
|               | 14-Jun | a                                                               | 0.01                     | Velocity-Area (Swoffer)        |
|               | 18-Jun | 99.00                                                           | 1.48                     | Velocity-Area (Swoffer)        |
|               | 20-Jun | 99.04                                                           | 1.92                     | Velocity-Area (Swoffer)        |
|               | 23-Jun | 99.07                                                           | 2.17                     | Velocity-Area (Swoffer)        |
|               | 23-Jul | 98.93                                                           | 0.89                     | Velocity-Area (Swoffer)        |
|               | 28-Jul | 98.90                                                           | 0.76                     | Velocity-Area (Swoffer)        |
|               | 21-Sep | 98.82                                                           | 0.58                     | Velocity-Area (Swoffer)        |
| Glenn-Hydro   | 11-Jun | a                                                               | 0.01                     | Velocity-Area (Swoffer)        |
|               | 14-Jun | a                                                               | 0.01                     | Velocity-Area (Swoffer)        |
|               | 16-Jun | 98.67                                                           | 0.02                     | Velocity-Area (Swoffer)        |
|               | 22-Jun | 98.69                                                           | 0.97                     | Velocity-Area (Swoffer)        |
|               | 24-Jun | 98.67                                                           | 0.87                     | Velocity-Area (Swoffer)        |
|               | 23-Jul | 98.56                                                           | 0.37                     | Velocity-Area (Swoffer)        |
|               | 26-Jul | 98.57                                                           | 0.42                     | Velocity-Area (Swoffer)        |
| Koignuk-Hydro | 5-May  | a                                                               | 0                        | Velocity-Area (Marsh-McBirney) |
|               | 23-May | a                                                               | 0                        | Velocity-Area (Marsh-McBirney) |
|               | 19-Jun | 98.67                                                           | 80.29                    | Velocity-Area (ADCP)*          |
|               | 21-Jun | 98.77                                                           | 94.92                    | Velocity-Area (ADCP)           |
|               | 24-Jun | 99.10                                                           | 125.08                   | Velocity-Area (ADCP)           |
|               | 23-Jul | 97.93                                                           | 31.32                    | Velocity-Area (ADCP)           |
|               | 27-Jul | 97.83                                                           | 24.26                    | Velocity-Area (ADCP)           |
| Ogama-Hydro   | 11-Jun | a                                                               | 0.90                     | Velocity-Area (Swoffer)        |
|               | 14-Jun | a                                                               | 1.88                     | Velocity-Area (Swoffer)        |
|               | 17-Jun | 98.75                                                           | 1.92                     | Velocity-Area (Swoffer)        |
|               | 23-Jun | 98.74                                                           | 2.02                     | Velocity-Area (Swoffer)        |
|               | 25-Jun | 98.72                                                           | 1.81                     | Velocity-Area (Swoffer)        |
|               | 22-Jul | 98.54                                                           | 0.57                     | Velocity-Area (Swoffer)        |
|               | 26-Jul | 98.51                                                           | 0.55                     | Velocity-Area (Swoffer)        |
| Patch-Hydro   | 11-Jun | a                                                               | 0                        | Visual estimation <sup>b</sup> |
|               | 18-Jun | 99.07                                                           | 0.28                     | Velocity-Area (Swoffer)        |
|               | 21-Jun | 99.10                                                           | 0.46                     | Velocity-Area (Swoffer)        |
|               | 23-Jun | 99.11                                                           | 0.50                     | Velocity-Area (Swoffer)        |
|               | 24-Jul | 99.09                                                           | 0.38                     | Velocity-Area (Swoffer)        |
|               | 28-Jul | 99.08                                                           | 0.32                     | Velocity-Area (Swoffer)        |
|               | 24-Sep | 99.00                                                           | 0.21                     | Velocity-Area (Swoffer)        |
| PO-Hydro      | 11-Jun | a                                                               | 2.01                     | Velocity-Area (Swoffer)        |
|               | 15-Jun | a                                                               | 1.67                     | Velocity-Area (Swoffer)        |
|               | 18-Jun | 99.57                                                           | 1.82                     | Velocity-Area (Swoffer)        |
|               | 21-Jun | 99.58                                                           | 1.91                     | Velocity-Area (Swoffer)        |
|               | 24-Jun | 99.55                                                           | 1.46                     | Velocity-Area (Swoffer)        |
|               | 24-Jul | 99.41                                                           | 0.48                     | Velocity-Area (Swoffer)        |
|               | 28-Jul | 99.39                                                           | 0.41                     | Velocity-Area (Swoffer)        |

(continued)

**Table 3.3-1. Summary of 2009 Manual Flow Measurements (completed)**

| Station           | Date   | Pressure Transducer Stage<br>(m, referenced to arbitrary datum) | Flow (m <sup>3</sup> /s) | Measuring Technique            |
|-------------------|--------|-----------------------------------------------------------------|--------------------------|--------------------------------|
| Reference A Hydro | 12-Jun | a                                                               | 0.03                     | Velocity-Area (Swoffer)        |
|                   | 15-Jun | a                                                               | 0.10                     | Velocity-Area (Swoffer)        |
|                   | 18-Jun | 99.30                                                           | 0.21                     | Velocity-Area (Swoffer)        |
|                   | 22-Jun | 99.39                                                           | 0.39                     | Velocity-Area (Swoffer)        |
|                   | 25-Jun | 99.42                                                           | 0.44                     | Velocity-Area (Swoffer)        |
|                   | 24-Jul | 99.39                                                           | 0.31                     | Velocity-Area (Swoffer)        |
|                   | 28-Jul | 99.38                                                           | 0.24                     | Velocity-Area (Swoffer)        |
|                   | 23-Sep | 99.34                                                           | 0.14                     | Velocity-Area (Swoffer)        |
| Roberts-Hydro     | 11-Jun | a                                                               | 0                        | Visual estimation <sup>b</sup> |
|                   | 15-Jun | a                                                               | 0.41                     | Velocity-Area (Swoffer)        |
|                   | 17-Jun | 99.26                                                           | 1.45                     | Velocity-Area (Swoffer)        |
|                   | 22-Jun | 99.31                                                           | 2.76                     | Velocity-Area (Swoffer)        |
|                   | 25-Jun | 99.31                                                           | 2.48                     | Velocity-Area (Swoffer)        |
|                   | 23-Jul | 99.14                                                           | 0.88                     | Velocity-Area (Swoffer)        |
|                   | 26-Jul | 99.14                                                           | 0.79                     | Velocity-Area (Swoffer)        |
| Spyder River      | 5-May  | a                                                               | 0                        | Velocity-Area (Marsh-McBirney) |
| Tail-Hydro        | 11-Jun | a                                                               | 0.09                     | Velocity-Area (Swoffer)        |
|                   | 14-Jun | a                                                               | 0.09                     | Velocity-Area (Swoffer)        |
|                   | 17-Jun | 97.96                                                           | 0.10                     | Velocity-Area (Swoffer)        |
|                   | 20-Jun | 97.97                                                           | 0.12                     | Velocity-Area (Swoffer)        |
|                   | 23-Jun | 97.96                                                           | 0.10                     | Velocity-Area (Swoffer)        |
|                   | 26-Jul | 97.90                                                           | 0.03                     | Velocity-Area (Swoffer)        |
|                   | 28-Aug | 97.88                                                           | 0.02                     | Velocity-Area (Swoffer)        |
| Windy-Hydro       | 11-Jun | a                                                               | 0.37                     | Velocity-Area (Swoffer)        |
|                   | 14-Jun | a                                                               | 0.21                     | Velocity-Area (Swoffer)        |
|                   | 16-Jun | 98.53                                                           | 0.26                     | Velocity-Area (Swoffer)        |
|                   | 22-Jun | 98.56                                                           | 0.38                     | Velocity-Area (Swoffer)        |
|                   | 24-Jun | 98.56                                                           | 0.28                     | Velocity-Area (Swoffer)        |
|                   | 22-Jul | 98.54                                                           | 0.23                     | Velocity-Area (Swoffer)        |
|                   | 26-Jul | 98.54                                                           | 0.24                     | Velocity-Area (Swoffer)        |
|                   | 24-Sep | 98.49                                                           | 0.16                     | Velocity-Area (Swoffer)        |

\* - Flows measured by means of an acoustic Doppler current profiler

a - Station not installed

<sup>b</sup>- Outflow channel observed to be frozen, having zero flow

### 3.3.1.1 Winter Under Ice Flow Measurements

All streams in the study area cease to flow over the winter period. Assessment of winter flows in the area in May 2009 discovered that the Koignuk River does not flow year round. Ice thickness was assessed at different locations and no under-ice flows were measured (Table 3.3-2). It was assumed that under-ice water only existed in isolated pools separated by frozen sections of river.

### 3.3.2 Rating Curves

Rating curves for each station are summarized in Table 3.3.3 and provided in Appendix 2. Survey control points at each lake and stream level station are provided in Appendix 3.

**Table 3.3-2. Winter Flows and Ice Thickness Measurements at the Koignuk River**

| Site                      | UTM Coordinates <sup>a</sup> |           | Date Sampled | Ice Thickness (m) | Bottom Depth (m) | Flow (m <sup>3</sup> /s) |
|---------------------------|------------------------------|-----------|--------------|-------------------|------------------|--------------------------|
|                           | Easting                      | Northing  |              |                   |                  |                          |
| Koignuk River Downstream  | 429,553                      | 7,554,936 | May 5        | 1.70              | 2.7              | 0                        |
| Koignuk River Midstream   | 430,490                      | 7,549,055 | May 23       | 1.80              | 2.9              | 0                        |
| Koignuk River Upstream    | 431,940                      | 7,545,536 | May 5        | 1.85              | 3.7              | 0                        |
| Spyder River, Reference 1 | 450,285                      | 7,487,174 | May 5        | 1.55              | 1.9              | 0                        |
| Spyder River, Reference 2 | 450,285                      | 7,478,179 | May 5        | 1.55              | 2.1              | 0                        |

<sup>a</sup>- NAD 83, Zone 13W**Table 3.3-3. Summary of 2009 Stage-Discharge Rating Equations**

| Station           | Rating Equation<br>$Q = C(h-a)^b$ | $r^2$ | Number of Flow Measurements<br>Used in Curve |
|-------------------|-----------------------------------|-------|----------------------------------------------|
| Doris-Hydro       |                                   |       |                                              |
| <i>low stage</i>  | $Q = 2.81(h-98.60)^{1.05}$        | 0.98  | 3                                            |
| <i>high stage</i> | $Q = 14.60(h-98.60)^{2.49}$       | 0.99  | 4                                            |
| Glenn-Hydro       | $Q = 7.74(h-98.17)^{3.21}$        | 0.99  | 4                                            |
| Koignuk-Hydro     | $Q = 0.57(h-95.28)^{4.05}$        | 0.99  | 5                                            |
| Ogama-Hydro       | $Q = 1.12(h-97.64)^{5.78}$        | 0.99  | 5                                            |
| Patch-Hydro       | $Q = 4.64(h-98.69)^{2.71}$        | 0.81  | 6                                            |
| PO-Hydro          | $Q = 13.43(h-98.93)^{4.54}$       | 0.99  | 5                                            |
| Reference A-Hydro | $Q = 15.74(h-99.25)^{1.98}$       | 0.95  | 5                                            |
| Roberts-Hydro     | $Q = 2.01(h-98.28)^{6.14}$        | 0.95  | 5                                            |
| Tail-Hydro        | $Q = 217.69(h-97.63)^{6.92}$      | 0.99  | 5                                            |
| Windy-Hydro       | $Q = 7.25(h-97.99)^{5.62}$        | 0.86  | 6                                            |

At Doris-Hydro a two-stage (high and low) rating curve was found to have better fit to the observed data than a single stage curve and was used to generate a hydrograph for this station. Low flows were well confined by the outlet channel. However, overbank flow during freshet period resulted in a shift in the slope of the rating curve at higher stages.

### 3.3.3 Stage Data

The majority of the automated hydrometric stations collected good quality useable water level data throughout the monitoring period. However, incomplete water level data were recorded at two stations (Roberts-Hydro and Wolverine-Hydro) during the 2009 monitoring period.

At Roberts-Hydro the station was found vandalized during a site visit on September 22. The period of useable water level data for this station extends from June 17 to July 30.

The Wolverine-Hydro station was damaged by wildlife. The period of useable continuous data for this station extends from June 21 to July 28. Continuous water level data were supplemented at Wolverine-Hydro by point measurements of lake water levels relative to established survey control points on August 24 and September 24.

An ice jam on the Koignuk River resulted in spurious water level data between June 19 and June 20 at Koignuk-Hydro (Figure 3.3-1). The ice jam occurred at the channel constriction where the Koignuk River discharges into Hope Bay and resulted in a 1.7 m spike in the recorded water level. Data recorded during this event were not used for discharge calculations.

### 3.3.4 Lake Levels

Lake levels were recorded at Doris, Glenn, Patch, PO, Reference-A, Roberts, Tail, Windy, and Wolverine lakes. The mean lake level variation for lakes in the Study Area was 0.22 m, ranging from 0.14 m at Tail Lake to 0.35 m at Doris Lake (Table 3.3-4). Lake water levels decreased after freshet until late-August when they were recharged from precipitation events. Lake levels are presented in Figures 3.3-2 and 3.3-3 and in tabular form in Appendix 4.

**Table 3.3-4. Recorded Lake Water Levels for the 2009 Open-water Season**

| Lake               | Min water level (m) | Max water level (m) | Water level change (m) | Lake Area (km <sup>2</sup> ) |
|--------------------|---------------------|---------------------|------------------------|------------------------------|
| Doris <sup>a</sup> | 5.68                | 6.03                | 0.35                   | 3.4                          |
| Tail <sup>a</sup>  | 4.95                | 5.09                | 0.14                   | 0.8                          |
| Glenn              | 98.46               | 98.72               | 0.26                   | 2.3                          |
| Patch              | 98.97               | 99.15               | 0.18                   | 5.7                          |
| PO                 | 99.37               | 99.58               | 0.22                   | 0.8                          |
| Reference-A        | 99.29               | 99.45               | 0.16                   | 3.9                          |
| Roberts            | 99.12               | 99.32               | 0.20                   | 3.6                          |
| Windy              | 98.41               | 98.64               | 0.23                   | 5.3                          |
| Wolverine          | 98.62               | 98.87               | 0.25                   | 1.0                          |

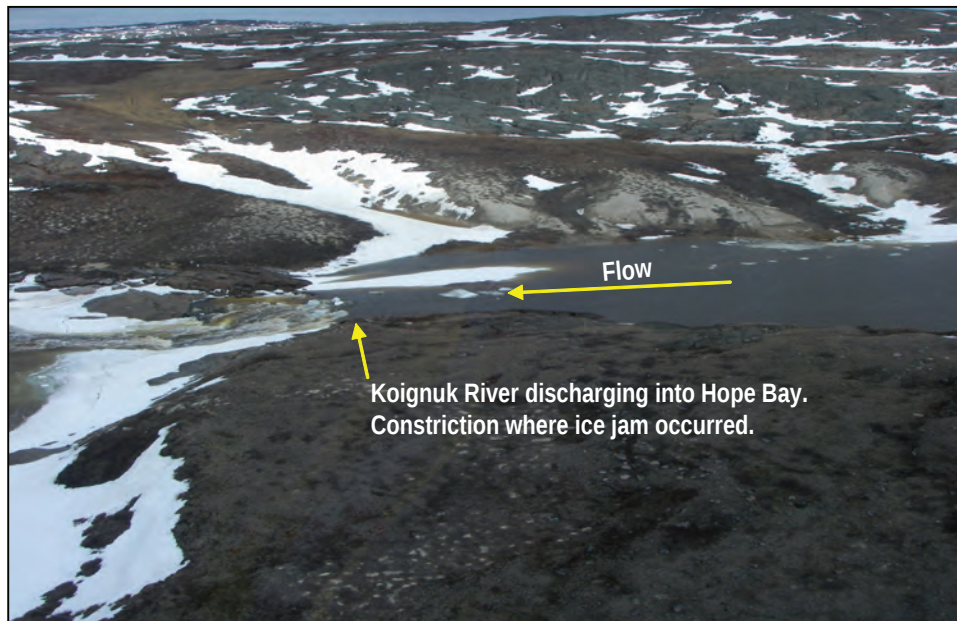
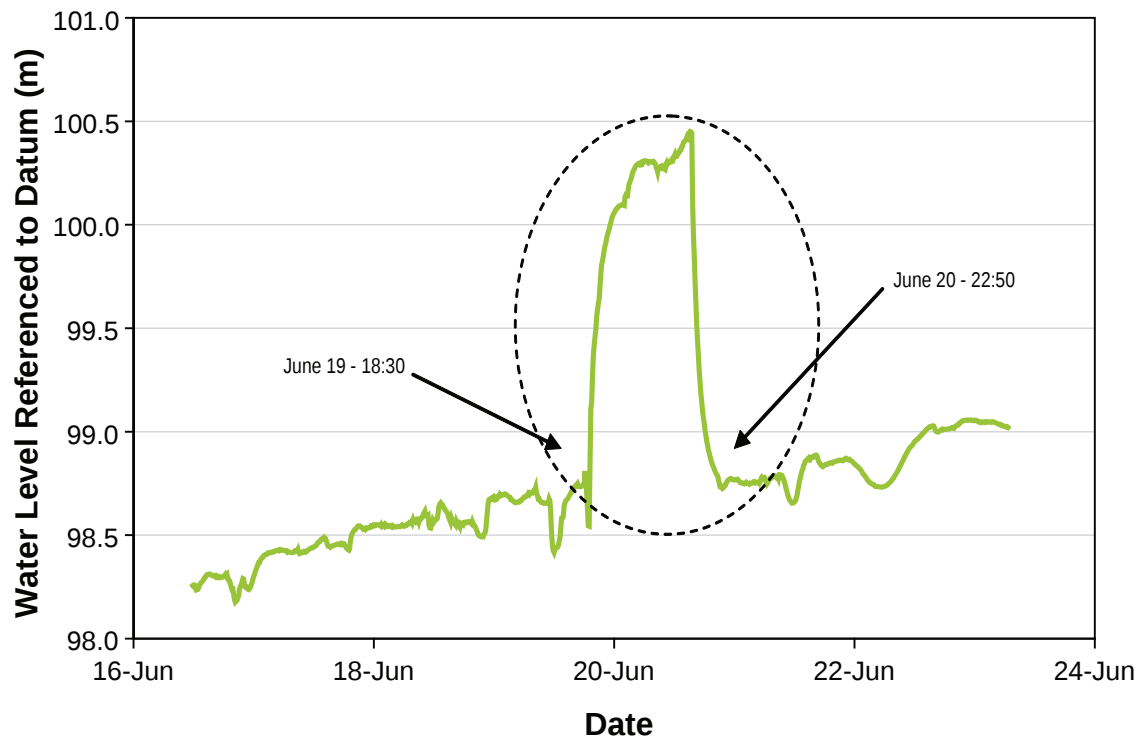
<sup>a</sup> - water levels referenced to pressure transducer

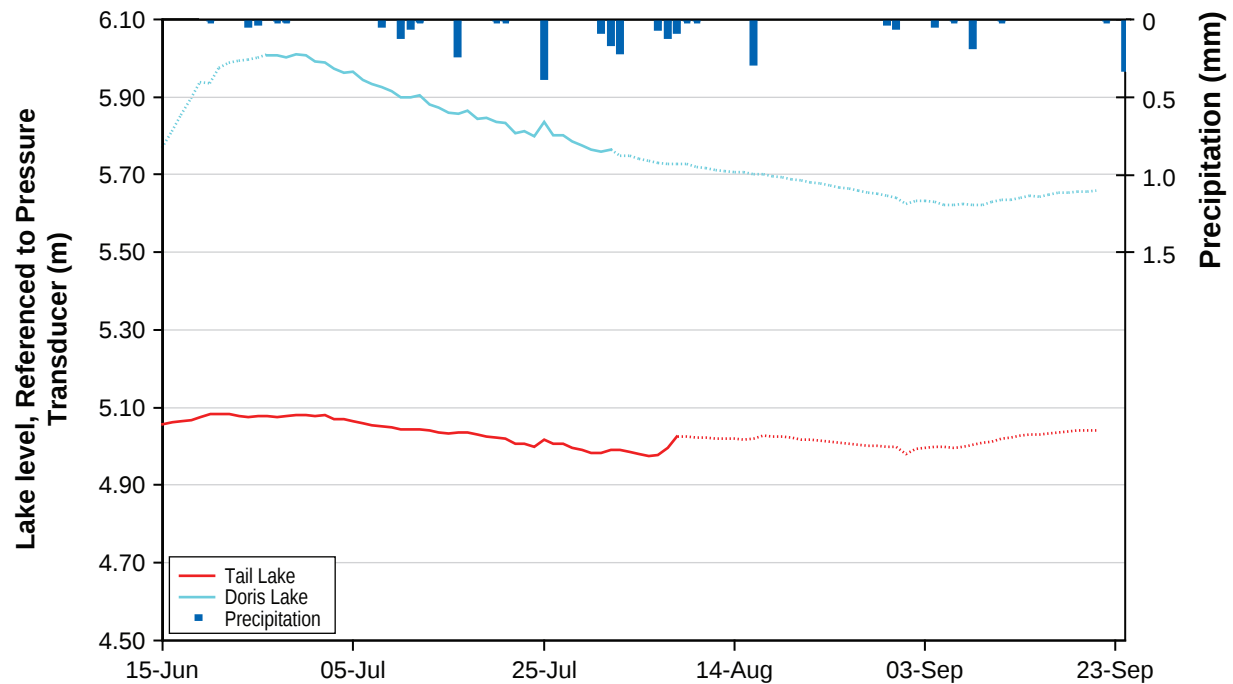
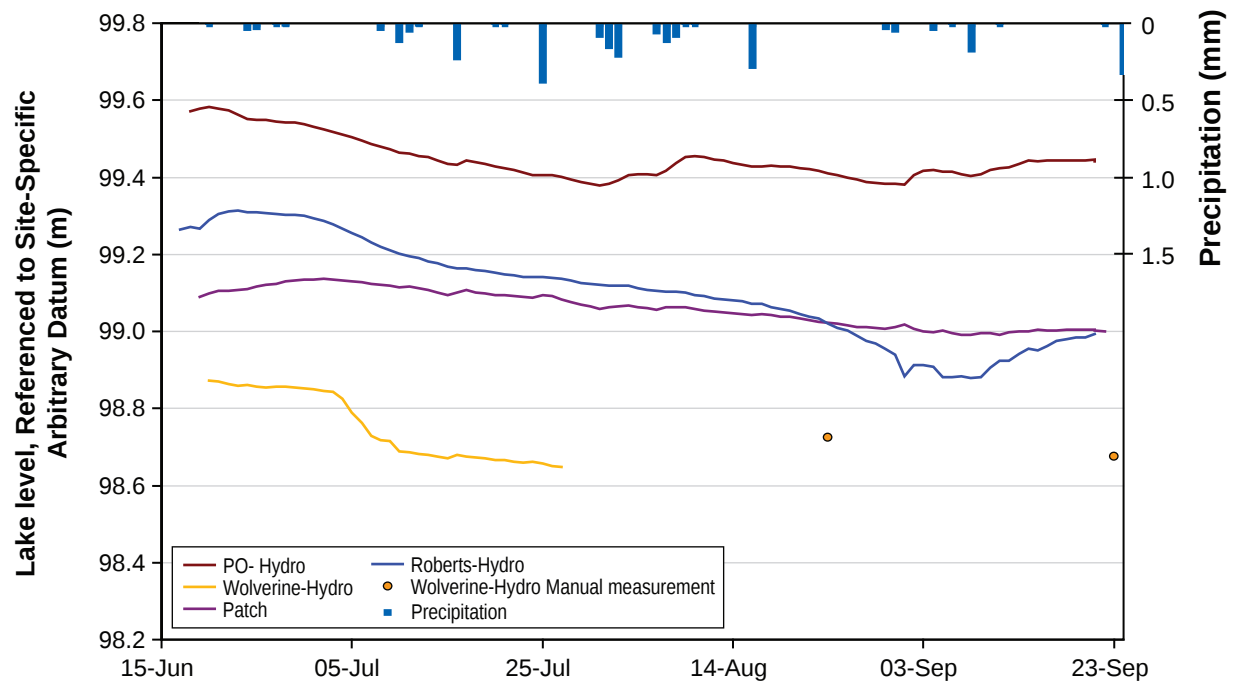
In some cases, when recorded stage data were unavailable, stage records were estimated using records from nearby stations. This was required at Doris Lake between June 15 and June 25, due to a transducer malfunction, and after August 2. From June 15 to June 18 average daily stage data were estimated using a linear function. From June 19 to June 25 and after August 2, average daily stage data were estimated based on calculated average daily stage data at Doris-Hydro using a relationship developed between the two stations for a period of concurrent observations (from June 26 to August 1). At Tail Lake average daily stage data were estimated after August 8 based on calculated average daily stage data at Tail-Hydro using a relationship developed between the two stations for a period of concurrent observations (from June 18 to July 20).

### 3.3.5 Hydrographs

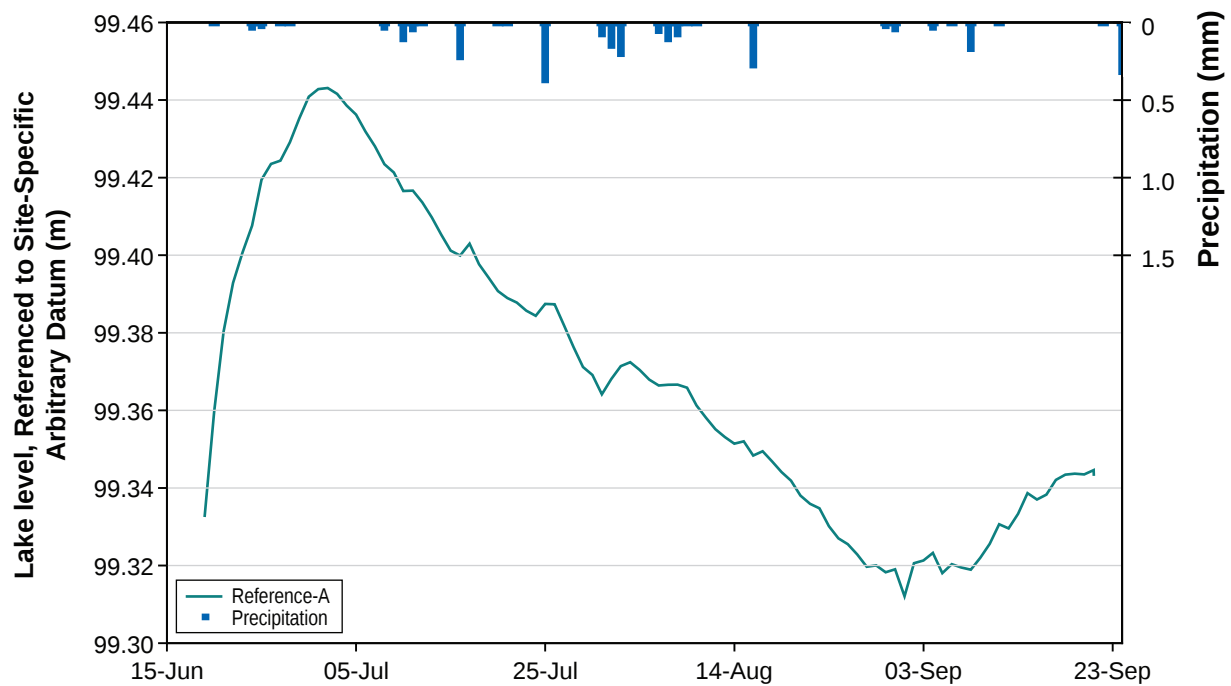
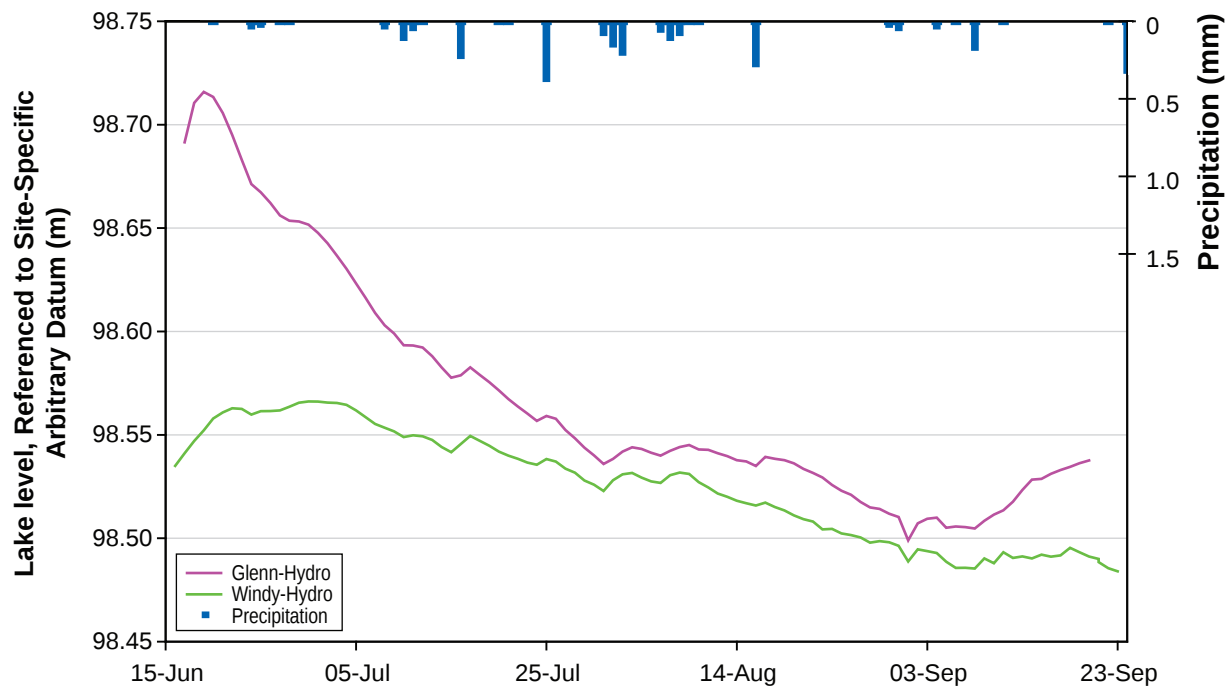
Hydrographs were generated for the three stream level stations (Doris-Hydro, Tail-Hydro, and Koignuk-Hydro) as well as for the outflow of seven of the eight lake level monitoring stations. These are individually presented in Appendix 5. Due to the lack of well defined flows a rating curve could not be generated for Wolverine-Hydro, thus a hydrograph was not generated for this station.

Annual hydrographs are presented as mean daily flow (m<sup>3</sup>/s; Figures 3.3-4 and 3.3-5) and as mean daily unit yield (L/s/km<sup>2</sup>; Figure 3.3-6) for the open-water season (June 1 to October 31). Unit yield is a measure of flow normalized to watershed area that allows direct comparison of the hydrological response of watersheds with varying watershed areas.

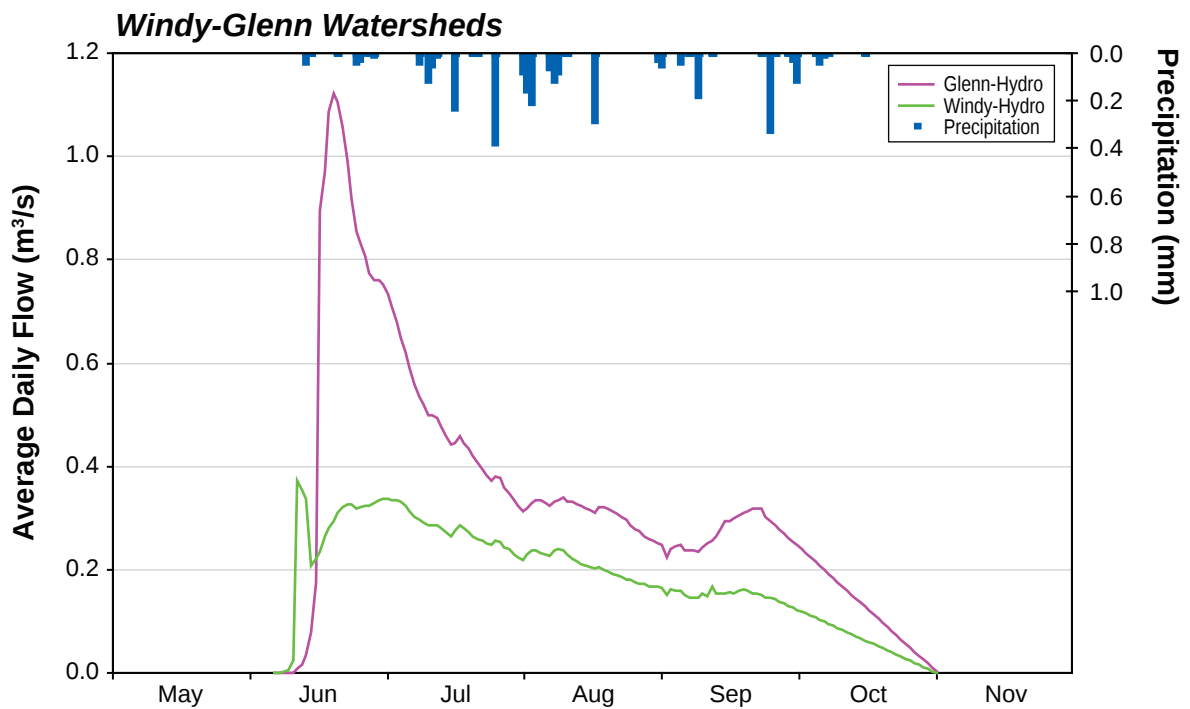
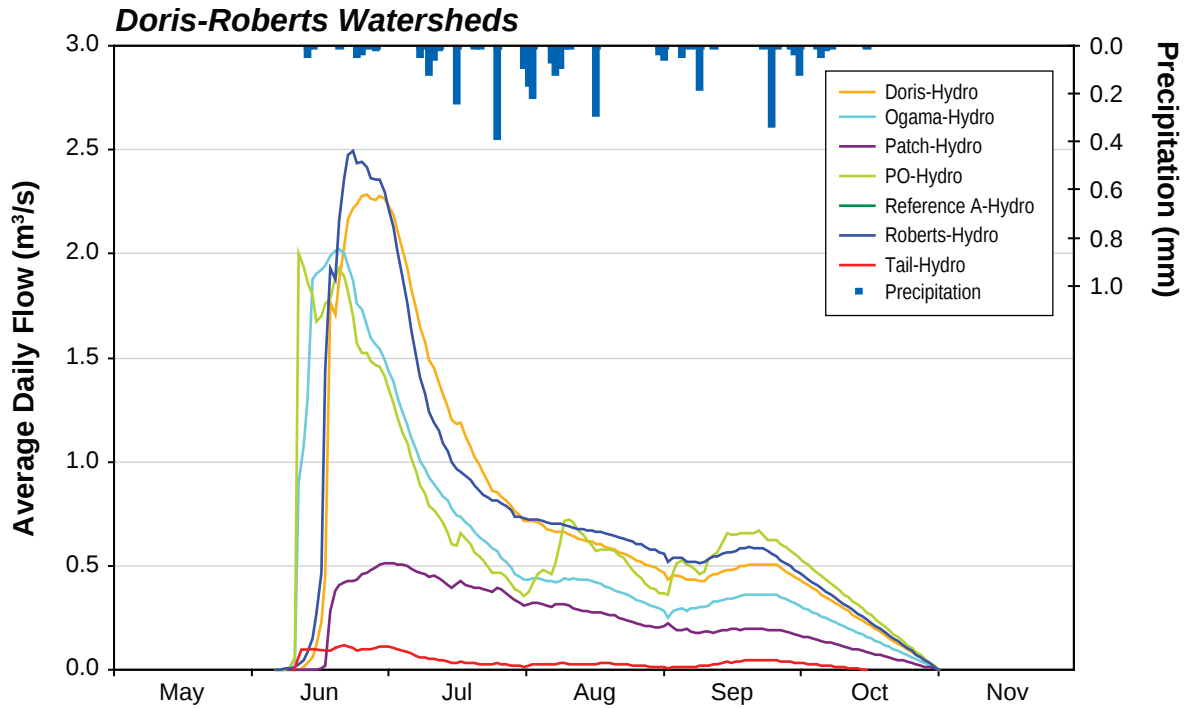




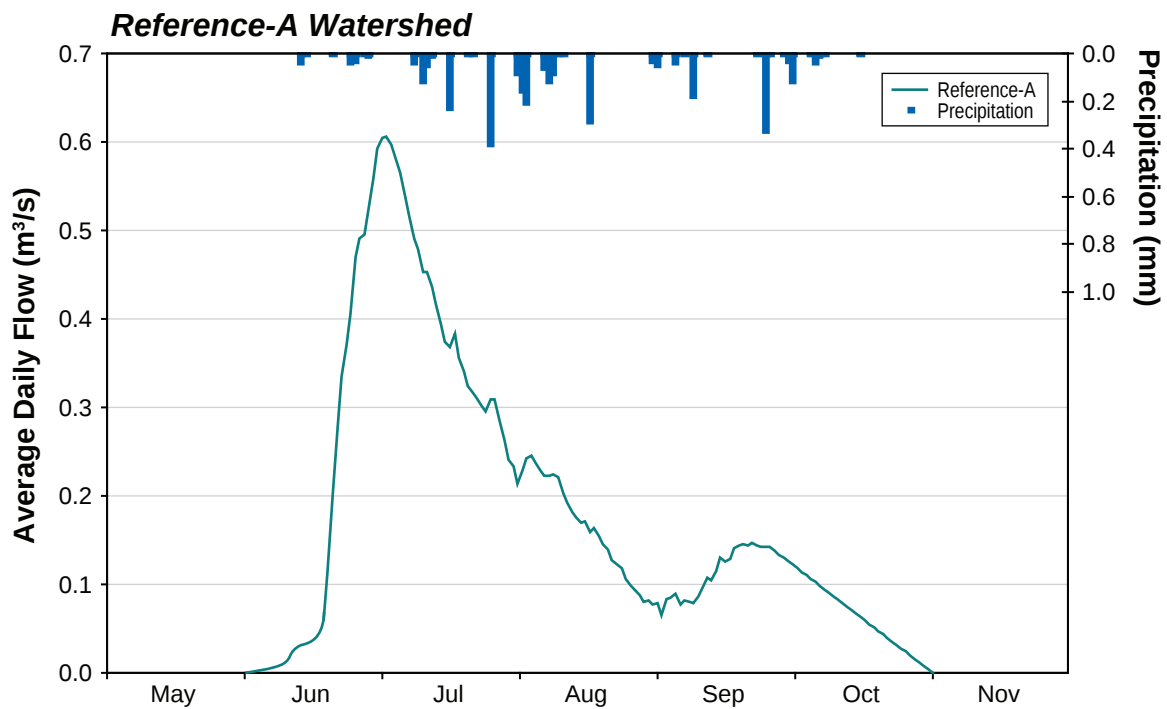
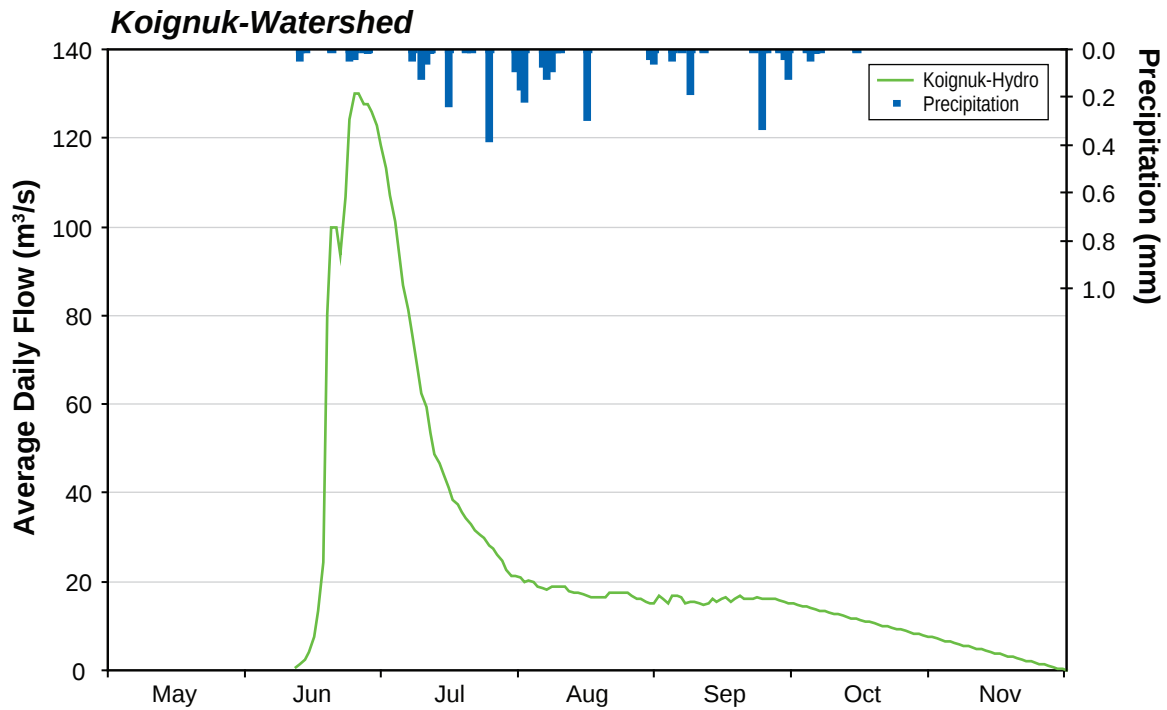
Notes: Precipitation data from Doris Met meteorological station.  
Dashed lines indicate stage values were estimated.



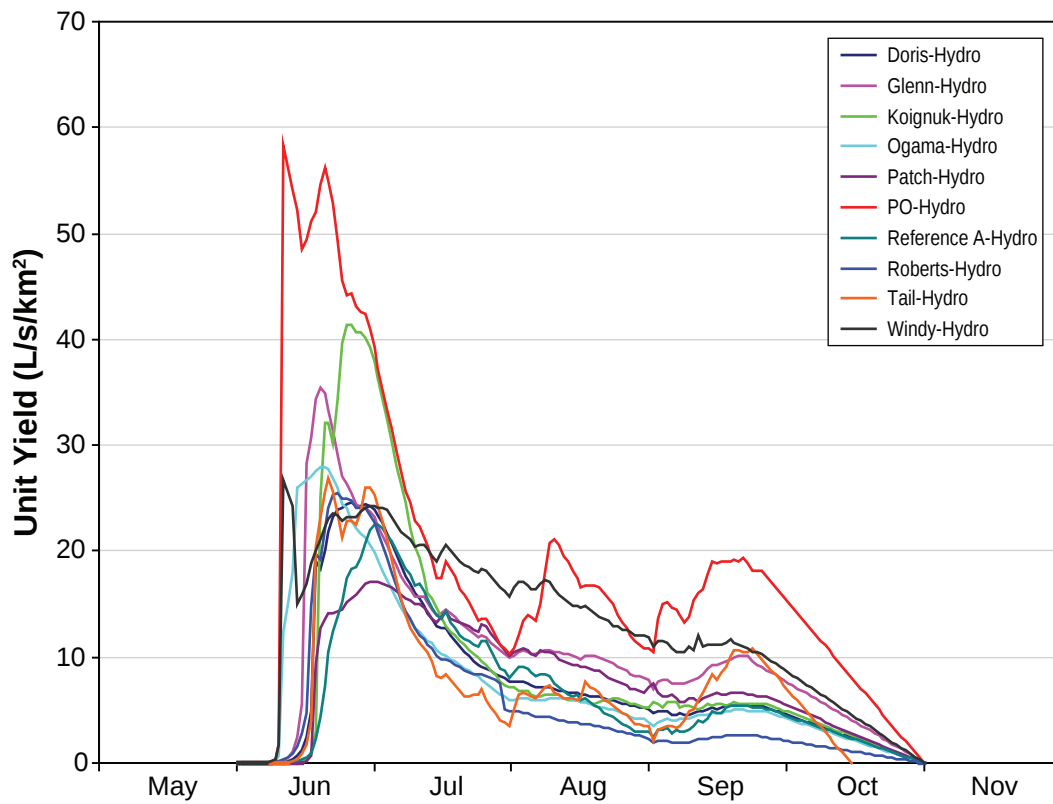
Note: Precipitation data from Doris Met meteorological station.



Note: Average daily precipitation values from Doris Met meteorological station.



Note: Average daily precipitation values from Doris Met meteorological station.



The onset of the spring freshet occurred in early June throughout the watersheds in the Study Area. Annual peak flows occurred in mid-June to early July in all watersheds as a result of inputs of water from melting snow (between June 11 and July 2, 2009). On average the freshet peak occurred approximately two weeks after streams began to flow. Flows steadily decreased throughout the Study Area from early July to late August. Flows increased through the first week of September due to increased rainfall and remained elevated until late September.

At Roberts-Hydro stage recorded stage data were unavailable after July 30. In this case, average daily flow data were estimated based on calculated average daily flow data at Doris-Hydro using a relationship developed between the two stations for a period of concurrent observations (from June 24 to July 29) (Figure 3.3-7).

### 3.3.6 Tidal Level

The deployment of the tidal gauge showed the two main tidal cycles in Roberts Bay: 1) the fortnightly spring-neap cycle and 2) the daily diurnal high-low tidal cycle (Figure 3.3-8). Overall, the tides in Roberts Bay were microtidal (<2 m tidal range) and were generally diurnal with one daily high tide and low tide, respectively. There were only small differences between the daily tidal ranges of the spring and neap cycles as the spring tidal (new and full moon period) range exceeded 0.4 m while neap tidal ranges (1<sup>st</sup> and 3<sup>rd</sup> quarter moons) were typically between 0.2 m and 0.3 m.

The appearance of a major storm system coincided with a spring tide cycle in early September. This resulted in elevated water levels in Roberts Bay due to the accompanying storm surge and the elevated daily tidal heights typical of spring tides (Figure 3.3-8).

### 3.3.7 Important Hydrologic Variables

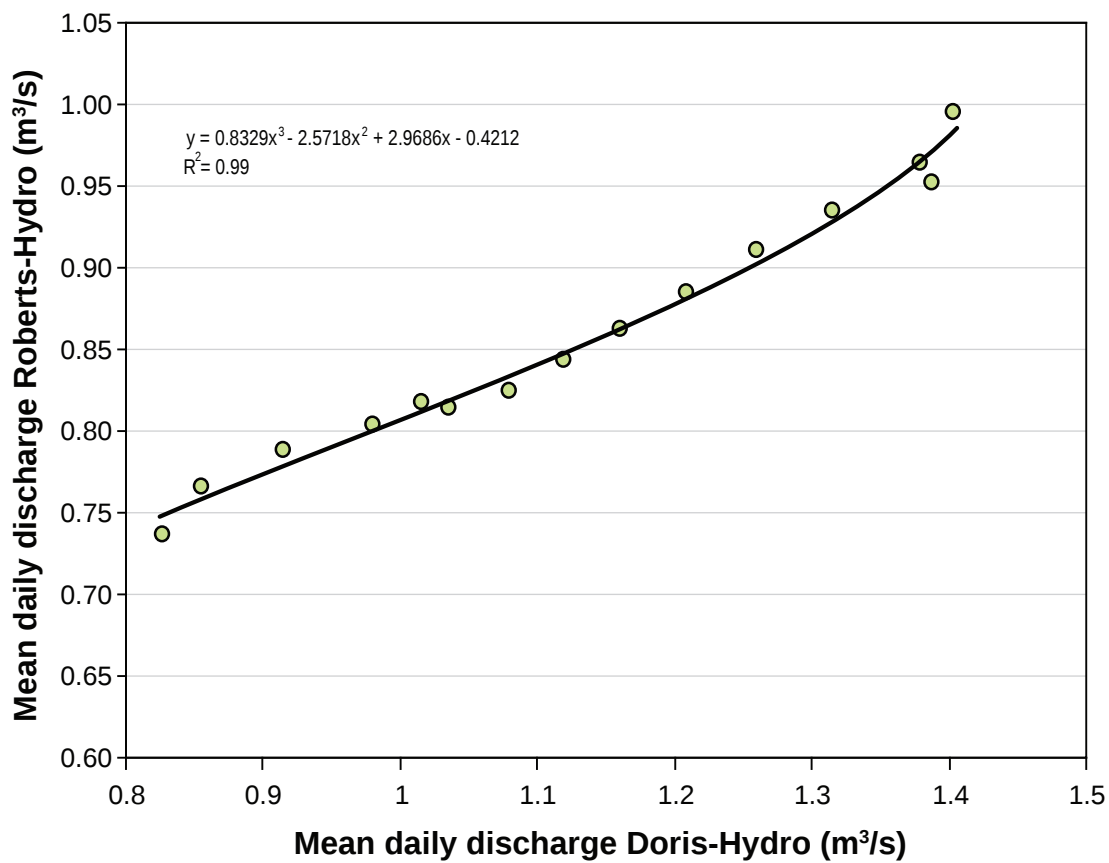
#### 3.3.7.1 Calculated Average Runoff

Calculated runoff (Table 3.3-5) (over the open-water season) represents the total hydrologic response of a watershed to driving factors such as precipitation and air temperature. The calculated average runoff from gauged watersheds in the Study Area for the period of record in 2009 was 99 mm, ranging from 78 mm at Ogama-Hydro to 139 mm at Windy-Hydro. It is important to note that Roberts-Hydro was not included in the average calculation because the period of record for this station was limited to approximately six weeks (June 18 to July 29). Average calculated runoff was higher in the Windy-Glenn Watersheds (125 mm) than in the Doris-Roberts Watersheds (86 mm). The estimated average runoff for the open-water season from gauged watersheds in the Study Area was 116 mm; ranging from 95 to 168 mm at Patch-A-Hydro and Windy-Hydro, respectively.

#### 3.3.7.2 Monthly Runoff Distribution

The monthly distribution of runoff is similar among the gauged catchments in the Study Area (Tables 3.3-6 and 3.3-7, and Figures 3.3-9 and 3.3-10). Maximum monthly runoff occurred during July in the majority of the watersheds, except for Ogama-Hydro, Tail-Hydro, and PO-Hydro where it occurred during June.

The mean flow over the open-water season (June 1 to October 15 for Tail Lake and June 1 to December 1 for Koignuk River) ranged from 0.04 m<sup>3</sup>/s to 25.51 m<sup>3</sup>/s at Tail-Hydro and Koignuk-Hydro, respectively (Table 3.3-8).



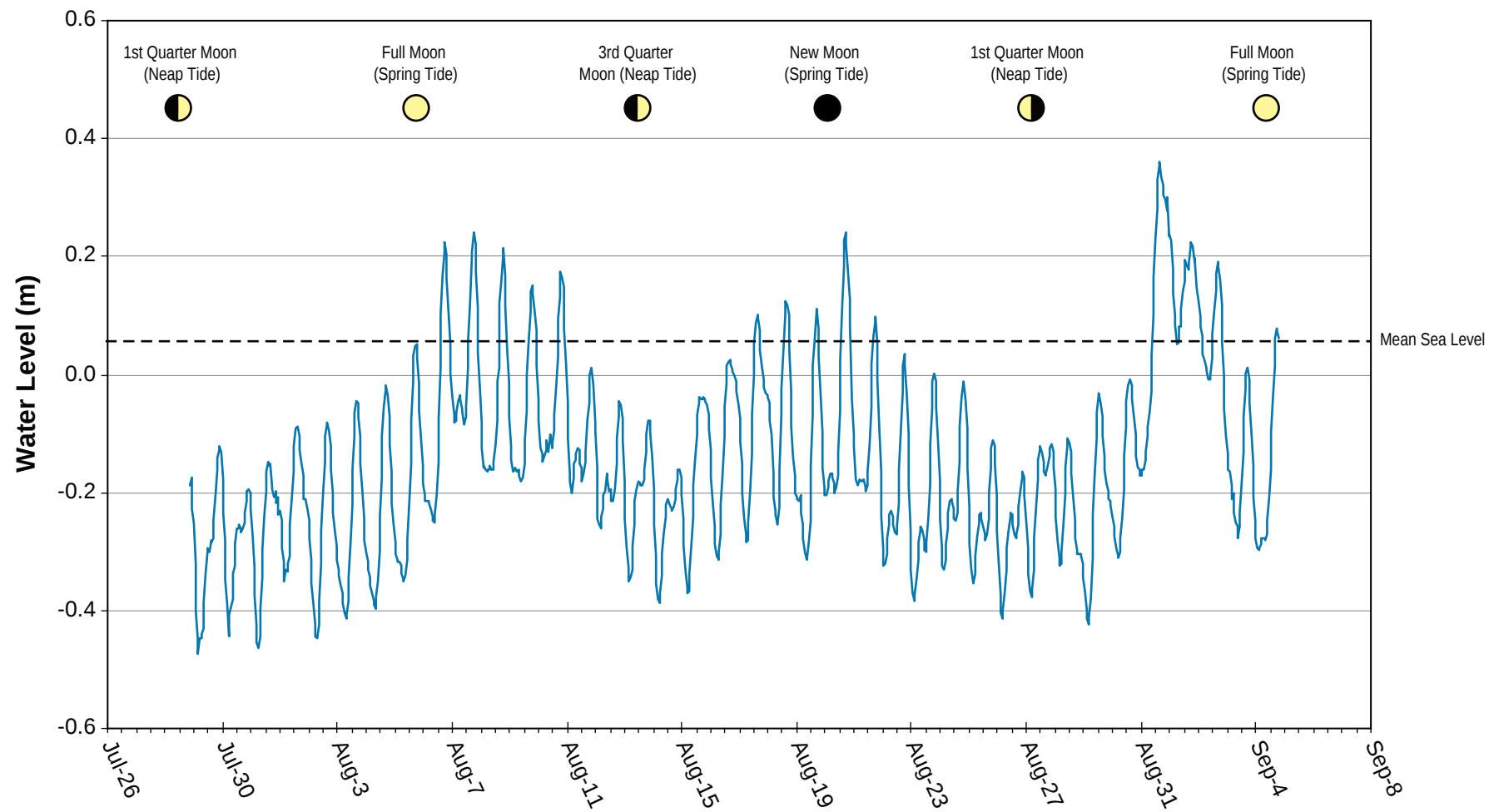


Table 3.3-5. 2009 Annual Runoff and Mean Annual Flow

| Station                         | Watershed Area (km <sup>2</sup> ) | Percent Lake Coverage in Watershed | Calculated Runoff Over 2009 Period of Record (mm) | Estimated Annual Runoff (mm) | Mean Annual Flow (m <sup>3</sup> /s) |
|---------------------------------|-----------------------------------|------------------------------------|---------------------------------------------------|------------------------------|--------------------------------------|
| <b>Doris-Roberts Watersheds</b> |                                   |                                    |                                                   |                              |                                      |
| Doris-Hydro                     | 95                                | 20                                 | 87 (18-Jun to 20 Sept)                            | 99                           | 0.29                                 |
| Ogama-Hydro                     | 75                                | 19                                 | 78 (18-Jun to 23-Sept)                            | 99                           | 0.23                                 |
| Patch-Hydro                     | 32                                | 27                                 | 85 (18-Jun to 24-Sept)                            | 95                           | 0.10                                 |
| PO-Hydro                        | 68                                | 19                                 | 95 (17-Jun to 23-Sept)                            | 125                          | 0.27                                 |
| Roberts-Hydro                   | 98                                | 17                                 | 57 (18-Jun to 29-Jul)*                            | 98                           | 0.31                                 |
| Tail-Hydro                      | 4                                 | 19                                 | 86 (18-Jun to 21-Sept)                            | 109                          | 0.01                                 |
| <b>Windy-Glenn Watersheds</b>   |                                   |                                    |                                                   |                              |                                      |
| Windy-Hydro                     | 14                                | 39                                 | 139 (16-Jun to 24-Sept)                           | 168                          | 0.07                                 |
| Glenn-Hydro                     | 33                                | 25                                 | 110 (17-Jun to 21-Sept)                           | 130                          | 0.14                                 |
| <b>Koignuk Watershed</b>        |                                   |                                    |                                                   |                              |                                      |
| Koignuk-Hydro                   | 2937                              | 18                                 | 116 (21-Jun to 24-Sept)                           | 137                          | 12.46                                |
| <b>Reference-A Watershed</b>    |                                   |                                    |                                                   |                              |                                      |
| Reference A-Hydro               | 27                                | 22                                 | 89 (18-Jun to 23-Sept)                            | 97                           | 0.08                                 |
| <b>Mean</b>                     |                                   |                                    | <b>99</b>                                         | <b>116</b>                   |                                      |

\* Not included in the observed mean annual calculation

Table 3.3-6. 2009 Monthly Runoff Distribution (mm)

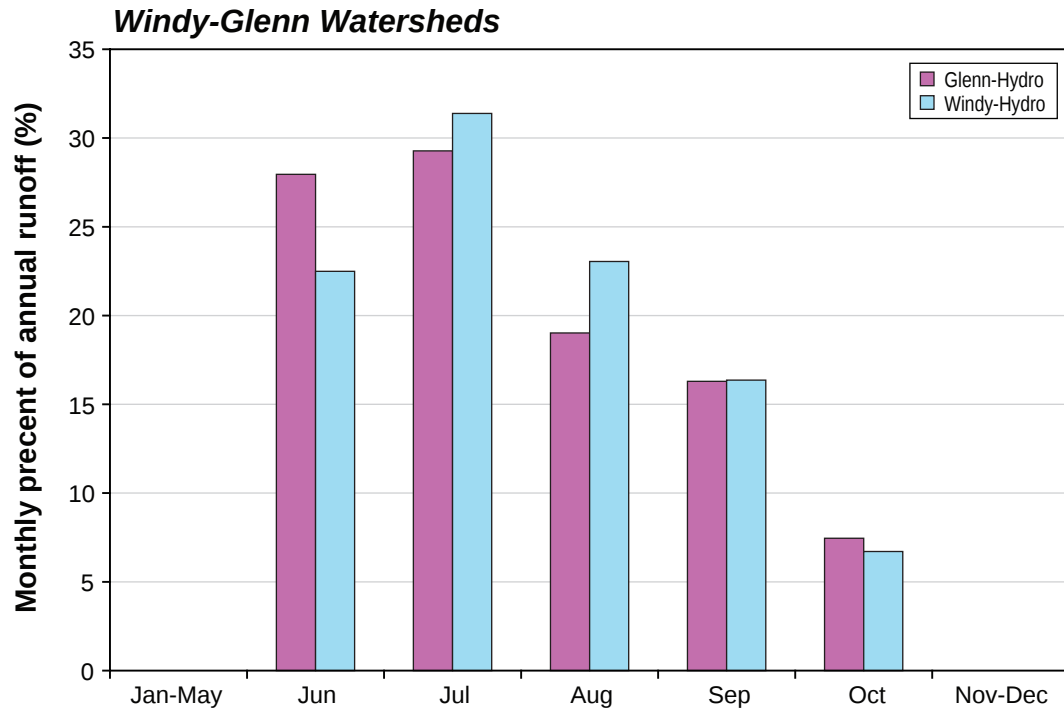
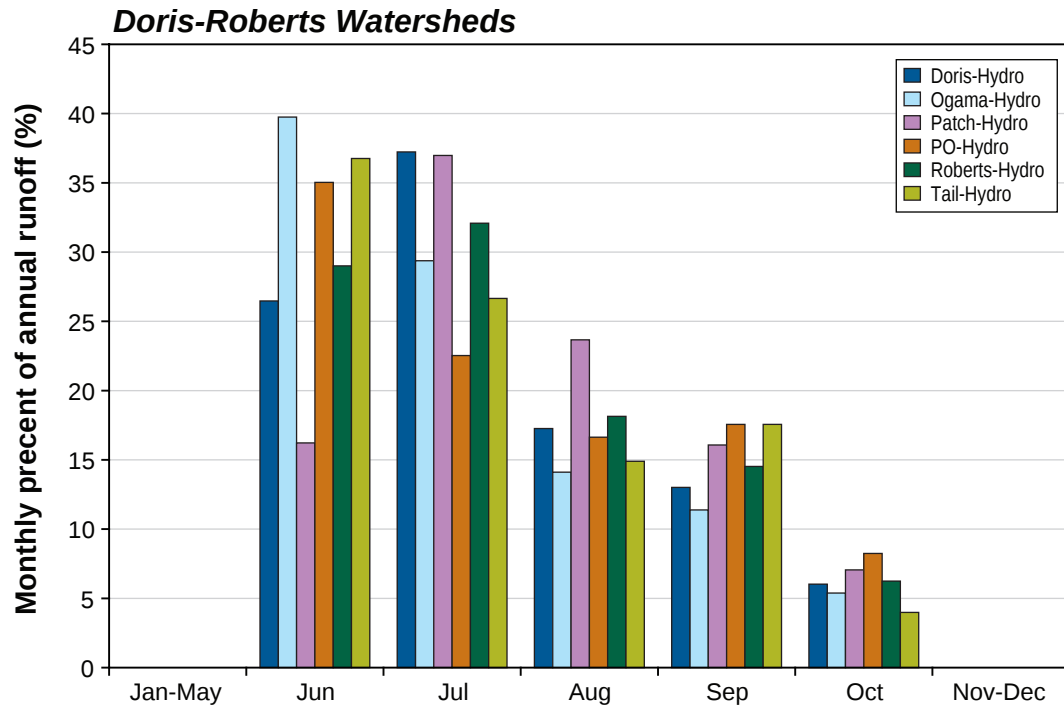
| Station                         | Jan-May | Jun | Jul | Aug | Sep | Oct | Nov-Dec |
|---------------------------------|---------|-----|-----|-----|-----|-----|---------|
| <b>Doris-Roberts Watersheds</b> |         |     |     |     |     |     |         |
| Doris-Hydro                     | 0       | 26  | 37  | 17  | 13  | 6   | 0       |
| Ogama-Hydro                     | 0       | 39  | 29  | 14  | 11  | 5   | 0       |
| Patch-Hydro                     | 0       | 15  | 35  | 22  | 15  | 7   | 0       |
| PO-Hydro                        | 0       | 44  | 28  | 21  | 22  | 10  | 0       |
| Roberts-Hydro                   | 0       | 28  | 32  | 18  | 14  | 6   | 0       |
| Tail-Hydro                      | 0       | 40  | 29  | 16  | 19  | 5   | 0       |
| <b>Windy-Glenn Watersheds</b>   |         |     |     |     |     |     |         |
| Windy-Hydro                     | 0       | 38  | 53  | 39  | 27  | 11  | 0       |
| Glenn-Hydro                     | 0       | 36  | 38  | 25  | 21  | 10  | 0       |
| <b>Koignuk Watershed</b>        |         |     |     |     |     |     |         |
| Koignuk-Hydro                   | 0       | 42  | 48  | 16  | 14  | 10  | 3       |
| <b>Reference-A Watershed</b>    |         |     |     |     |     |     |         |
| Reference A-Hydro               | 0       | 19  | 47  | 16  | 10  | 6   | 0       |

*Italicized values are based on estimated mean daily flow data.*

Table 3.3-7. 2009 Monthly Runoff Distribution (%)

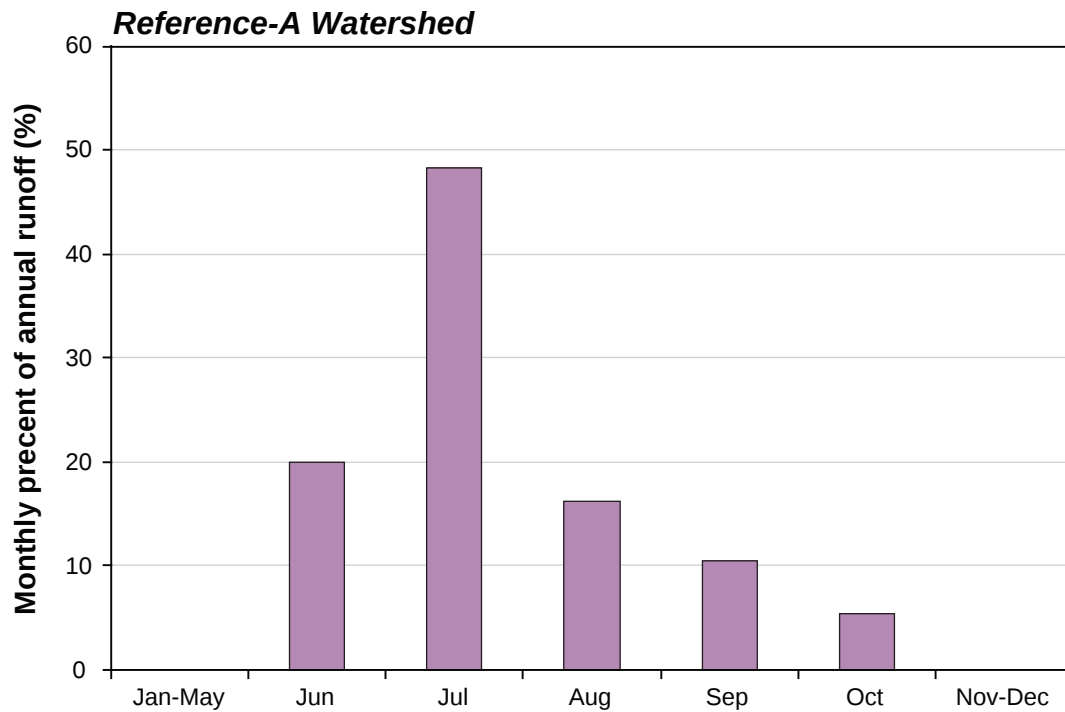
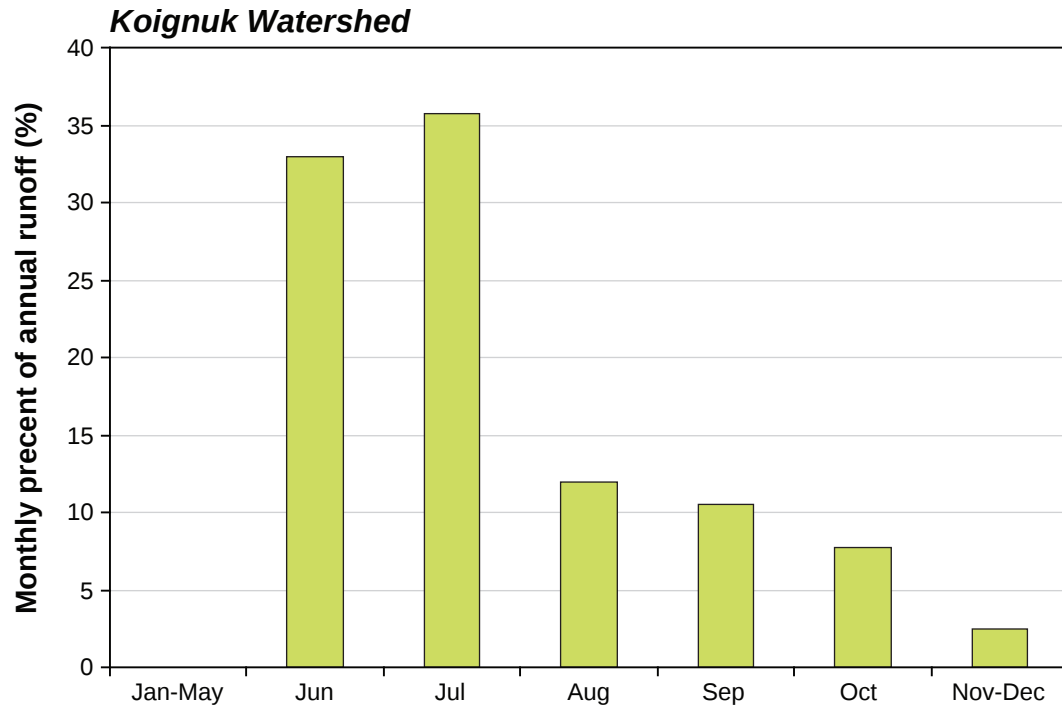
| Station                         | Jan-May | Jun | Jul | Aug | Sep | Oct | Nov-Dec |
|---------------------------------|---------|-----|-----|-----|-----|-----|---------|
| <b>Doris-Roberts Watersheds</b> |         |     |     |     |     |     |         |
| Doris-Hydro                     | 0       | 26  | 37  | 17  | 13  | 6   | 0       |
| Ogama-Hydro                     | 0       | 40  | 29  | 14  | 11  | 5   | 0       |
| Patch-Hydro                     | 0       | 16  | 37  | 24  | 16  | 7   | 0       |
| PO-Hydro                        | 0       | 35  | 23  | 17  | 18  | 8   | 0       |
| Roberts-Hydro                   | 0       | 28  | 32  | 18  | 15  | 6   | 0       |
| Tail-Hydro                      | 0       | 37  | 27  | 15  | 17  | 4   | 0       |
| <b>Windy-Glenn Watersheds</b>   |         |     |     |     |     |     |         |
| Glenn-Hydro                     | 0       | 28  | 29  | 19  | 16  | 7   | 0       |
| Windy-Hydro                     | 0       | 22  | 31  | 23  | 16  | 7   | 0       |
| <b>Koignuk Watershed</b>        |         |     |     |     |     |     |         |
| Koignuk-Hydro                   | 0       | 31  | 36  | 12  | 10  | 8   | 3       |
| <b>Reference-A Watershed</b>    |         |     |     |     |     |     |         |
| Reference A-Hydro               | 0       | 20  | 48  | 16  | 10  | 6   | 0       |

*Italicized values are based on estimated mean daily flow data.*



**Monthly Runoff Distribution (%) for 2009  
Doris-Roberts and Windy-Glenn Watersheds**

Figure 3.3-9



**Monthly Runoff Distribution (%) for 2009  
Koignuk and Reference-A Watersheds**

Figure 3.3-10

**Table 3.3-8. Mean Flow for the Open-water Season (m<sup>3</sup>/s)**

|                                 | Jan-May | Jun   | Jul   | Aug   | Sept  | Oct   | Nov-Dec | Mean (m <sup>3</sup> /s) <sup>a</sup> |
|---------------------------------|---------|-------|-------|-------|-------|-------|---------|---------------------------------------|
| <b>Doris-Roberts Watersheds</b> |         |       |       |       |       |       |         |                                       |
| Doris-Hydro                     | 0       | 0.95  | 1.30  | 0.60  | 0.47  | 0.21  | 0       | 0.71                                  |
| Ogama-Hydro                     | 0       | 1.14  | 0.81  | 0.39  | 0.33  | 0.15  | 0       | 0.56                                  |
| Patch-Hydro                     | 0       | 0.19  | 0.42  | 0.27  | 0.19  | 0.08  | 0       | 0.23                                  |
| PO-Hydro                        | 0       | 1.14  | 0.71  | 0.52  | 0.57  | 0.26  | 0       | 0.64                                  |
| Roberts-Hydro                   | 0       | 1.05  | 1.16  | 0.66  | 0.54  | 0.23  | 0       | 0.73                                  |
| Tail-Hydro                      | 0       | 0.07  | 0.05  | 0.03  | 0.03  | 0.01  | 0       | 0.04                                  |
| <b>Windy-Glenn Watersheds</b>   |         |       |       |       |       |       |         |                                       |
| Windy-Hydro                     | 0       | 0.21  | 0.28  | 0.20  | 0.15  | 0.06  | 0       | 0.18                                  |
| Glenn-Hydro                     | 0       | 0.47  | 0.47  | 0.31  | 0.27  | 0.12  | 0       | 0.33                                  |
| <b>Koignuk Watershed</b>        |         |       |       |       |       |       |         |                                       |
| Koignuk-Hydro                   | 0       | 51.28 | 53.07 | 17.64 | 15.93 | 11.32 | 3.82, 0 | 25.51                                 |
| <b>Reference-A Watershed</b>    |         |       |       |       |       |       |         |                                       |
| Reference A-Hydro               | 0       | 0.20  | 0.47  | 0.16  | 0.11  | 0.06  | 0       | 0.20                                  |

<sup>a</sup> - calculated from June to November for Koignuk-Hydro and from June to October for all the other stations

### 3.3.7.3 Peak and Low Flows

Observed instantaneous peak flows for the watersheds in the Study Area ranged from 0.13 m<sup>3</sup>/s at Tail-Hydro to 133 m<sup>3</sup>/s at Koignuk-Hydro. Similarly, instantaneous peak unit yields ranged from 17.07 L/s/km<sup>2</sup> at Patch-Hydro to 45.33 L/s/km<sup>2</sup> at Koignuk-Hydro (Table 3.3-9).

**Table 3.3-9. 2009 Annual Peak Flow and Yield**

| Station                         | Peak Flow (m³/s) |        | Date      | Peak Unit Yield (L/s/km²) |       |
|---------------------------------|------------------|--------|-----------|---------------------------|-------|
|                                 | Instantaneous    | Daily  |           | Instantaneous             | Daily |
| <b>Doris-Roberts Watersheds</b> |                  |        |           |                           |       |
| Doris-Hydro                     | 2.39             | 2.29   | (28-June) | 25.24                     | 24.17 |
| Ogama-Hydro                     | 2.26             | 2.02   | (19-June) | 30.20                     | 26.96 |
| Patch-Hydro                     | 0.55             | 0.51   | (17-July) | 17.07                     | 15.93 |
| PO-Hydro                        | 1.95             | 1.93   | (20-June) | 28.78                     | 28.59 |
| Roberts-Hydro                   | 2.55             | 2.49   | (22-June) | 26.03                     | 25.47 |
| Tail-Hydro                      | 0.13             | 0.12   | (21-June) | 29.64                     | 27.43 |
| <b>Windy-Glenn Watersheds</b>   |                  |        |           |                           |       |
| Windy-Hydro                     | 0.36             | 0.34   | (30-June) | 25.76                     | 23.91 |
| Glenn-Hydro                     | 1.15             | 1.12   | (19-June) | 34.41                     | 33.59 |
| <b>Koignuk Watershed</b>        |                  |        |           |                           |       |
| Koignuk-Hydro                   | 133              | 130.10 | (24-June) | 45.33                     | 44.30 |
| <b>Reference Watershed</b>      |                  |        |           |                           |       |
| Reference A-Hydro               | 0.85             | 0.78   | (1-July)  | 31.11                     | 28.59 |

Low flows in the Arctic occur at two different times of year depending on the size of the river and its catchment. Smaller streams reach their lowest flows in the open-water season in summer or early fall and then produce zero flow throughout the winter. Larger rivers may produce flow year round and reach their lowest flows during late winter (e.g., March or April). The observed low flows at the ten Hope Bay hydrometric stations occurred in early September in most watersheds, except at PO-Hydro where it occurred in July 31 (Table 3.3-10). Minimum flows ranged from 0.009 m<sup>3</sup>/s at Tail-Hydro to 14.621 m<sup>3</sup>/s at Koignuk-Hydro. The daily minimum flows over the monitoring period for various monitoring locations are presented in (Table 3.3-10).

**Table 3.3-10. Daily Minimum Flows (July – September 2009)**

| Station                                | Observed (m³/s) |                | Watershed Area (km²) | % Lake coverage in watershed |
|----------------------------------------|-----------------|----------------|----------------------|------------------------------|
| <b><i>Doris-Roberts Watersheds</i></b> |                 |                |                      |                              |
| Doris-Hydro                            | 0.428           | (September 8)  | 94.6                 | 20                           |
| Ogama-Hydro                            | 0.248           | (September 1)  | 74.9                 | 19                           |
| Patch-Hydro                            | 00.175          | (September 7)  | 32.2                 | 27                           |
| PO-Hydro                               | 0.355           | (July 31)      | 67.6                 | 19                           |
| Roberts-Hydro                          | 0.515           | (September 8)  | 97.9                 | 17                           |
| Tail-Hydro                             | 0.009           | (September 1)  | 4.2                  | 19                           |
| <b><i>Windy-Glenn Watersheds</i></b>   |                 |                |                      |                              |
| Windy-Hydro                            | 0.45            | (September 8)  | 33                   | 39                           |
| Glenn-Hydro                            | 0.223           | (September 1)  | 14                   | 25                           |
| <b><i>Koignuk Watersheds</i></b>       |                 |                |                      |                              |
| Koignuk-Hydro                          | 14.621          | (September 11) | 2937                 | 18                           |
| <b><i>Reference-A Watershed</i></b>    |                 |                |                      |                              |
| Reference A-Hydro                      | 0.0060          | (September 1)  | 27.2                 | 22                           |

## **4. Historical Site Data and Regional Analysis**

## **4. Historical Site Data and Regional Analysis**

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### **4.1 COMPARISON OF 2009 DATA WITH REGIONAL AND HISTORICAL SITE DATA**

The Hope Bay Project is located within the Arctic Tundra climate region of Canada, based on the Canadian Climate Regions (MSC, 2009). General climatic conditions for the region in 2009 were as follows:

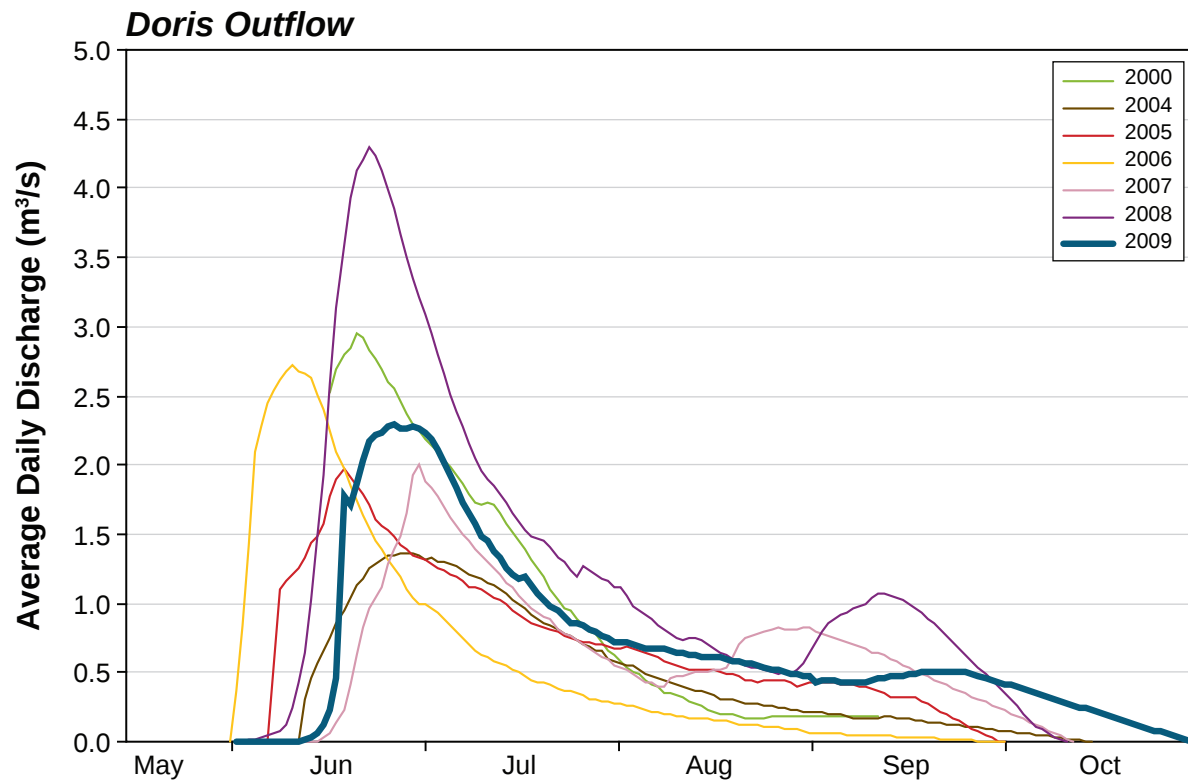
- o Winter 2008/09 was 2°C warmer than the long-term average (rank 10/62), with 14% higher precipitation than average (rank 25/62).
- o Spring temperatures were equivalent to the long-term average (rank 31/62), with 19% higher precipitation than average (rank 16/62).
- o Summer temperatures were 0.9°C above average (rank 18/62), with 4.6% less precipitation than average (rank 48/62).

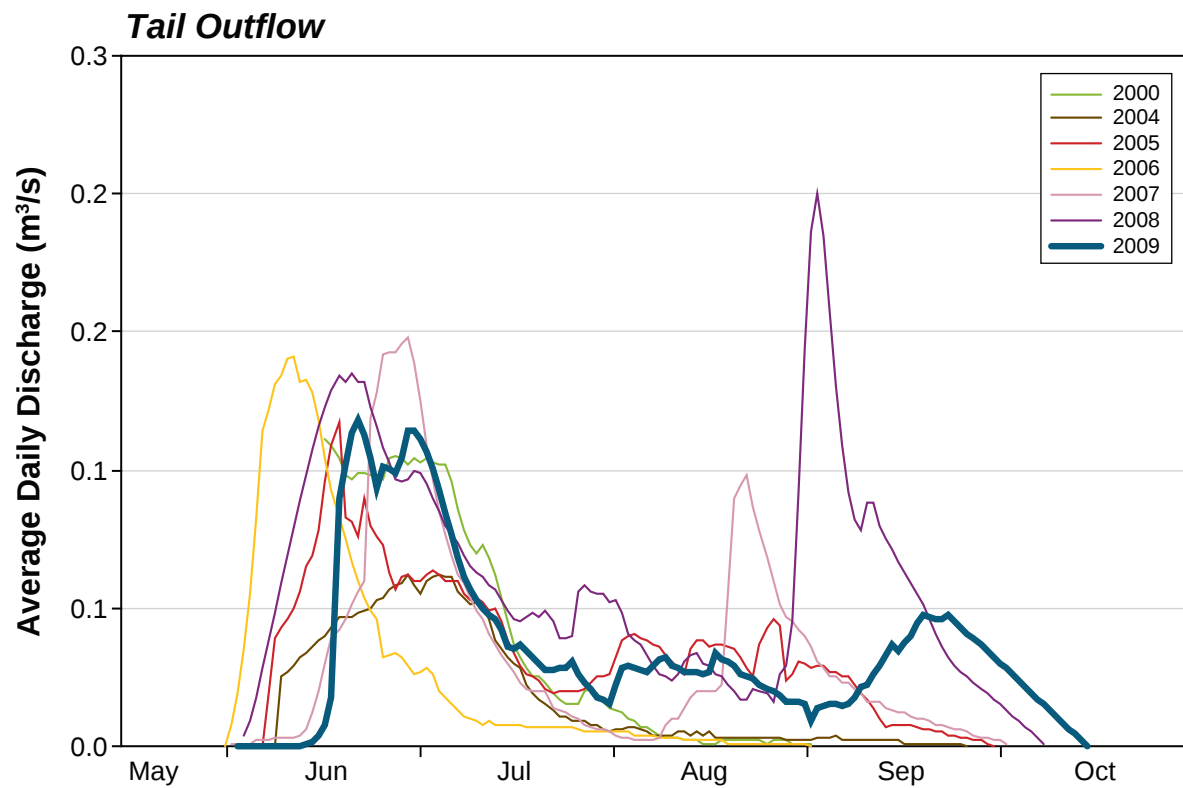
At the time this report was prepared 2009 provisional data for the WSC station at Kendall River were available for analysis. Additional Real Time hydrometric data were available from WSC for a number of stations in the area (e.g., Freshwater Creek, Tree River, and Ellice River); however, the results available are not reliable without additional screening and quality control by WSC technicians. The calculated runoff for the 2009 open-water season at Kendall River was 179 mm. Based on a runoff frequency analysis using historical data for this station (28 years of data; 1970-1990 and 2002-2008), 2009 would be characterized as slightly wetter than average, having a return period of 1 in 5 years.

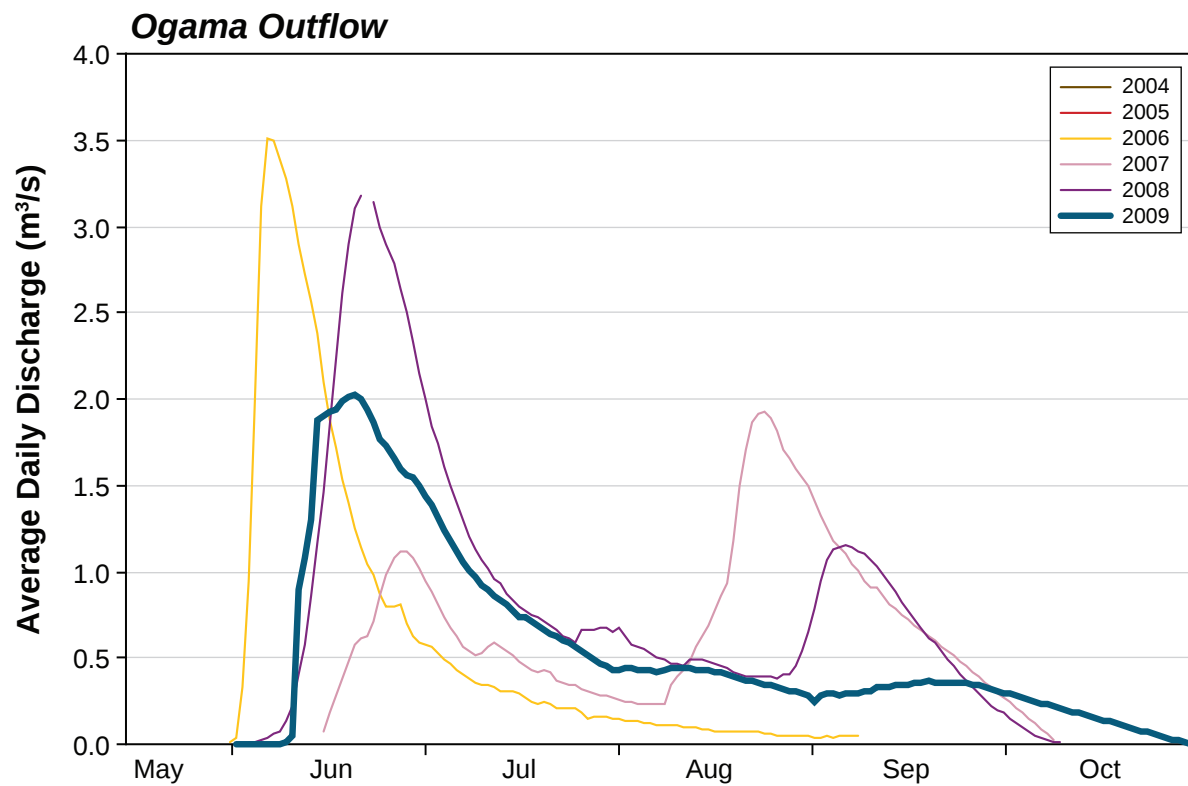
Figures 4.1-1 to 4.1-9 show the 2009 hydrographs for site-specific gauges along with available historical data. In general, 2009 appears to reflect average conditions, which is consistent with the general climatic conditions described above. The timing of the freshet peak was also quite typical, with flow beginning in the second week of June, and peaking around the 19<sup>th</sup> to 21<sup>st</sup>. Peak flow rates were commonly about half the magnitude of the 2008 hydrograph, which generally produced the flows of record at these sites. With the drier than average summer, there were no significant secondary peak flows in the hydrographs from to late summer rain events, which are commonly observed in other years (especially 2008).

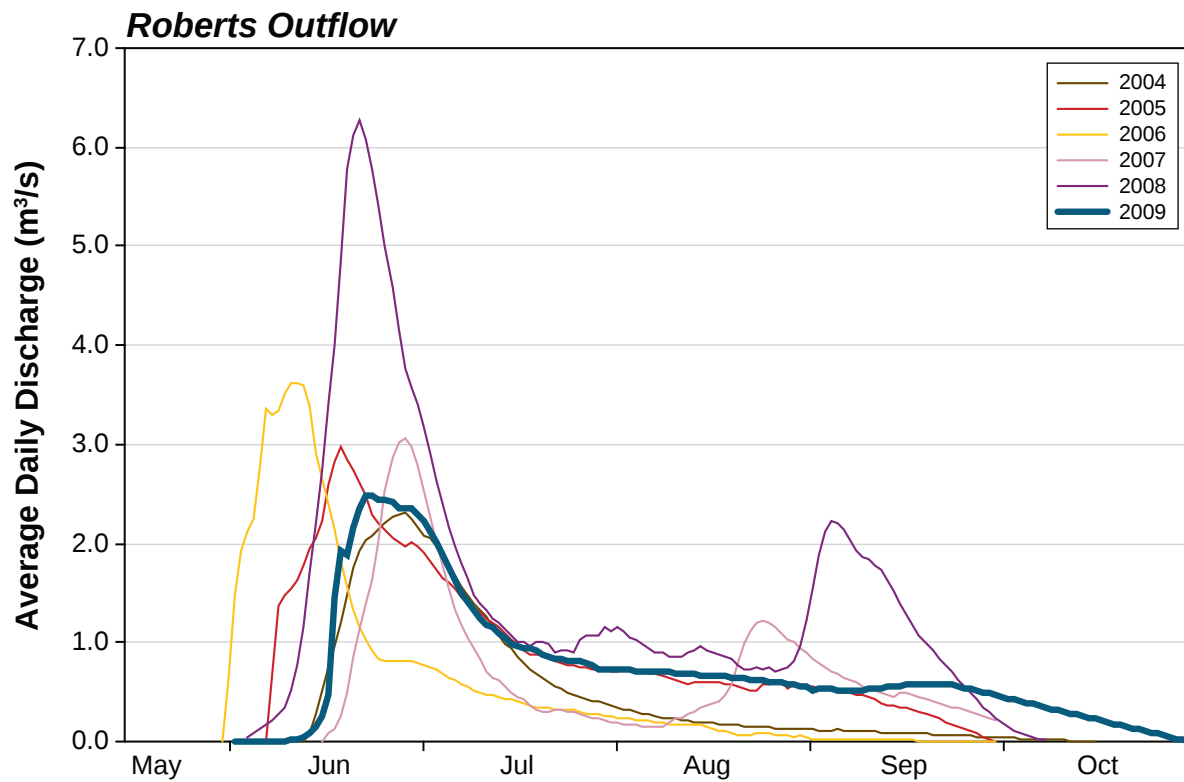
### **4.2 REVIEW OF PREVIOUS REGIONAL ANALYSIS**

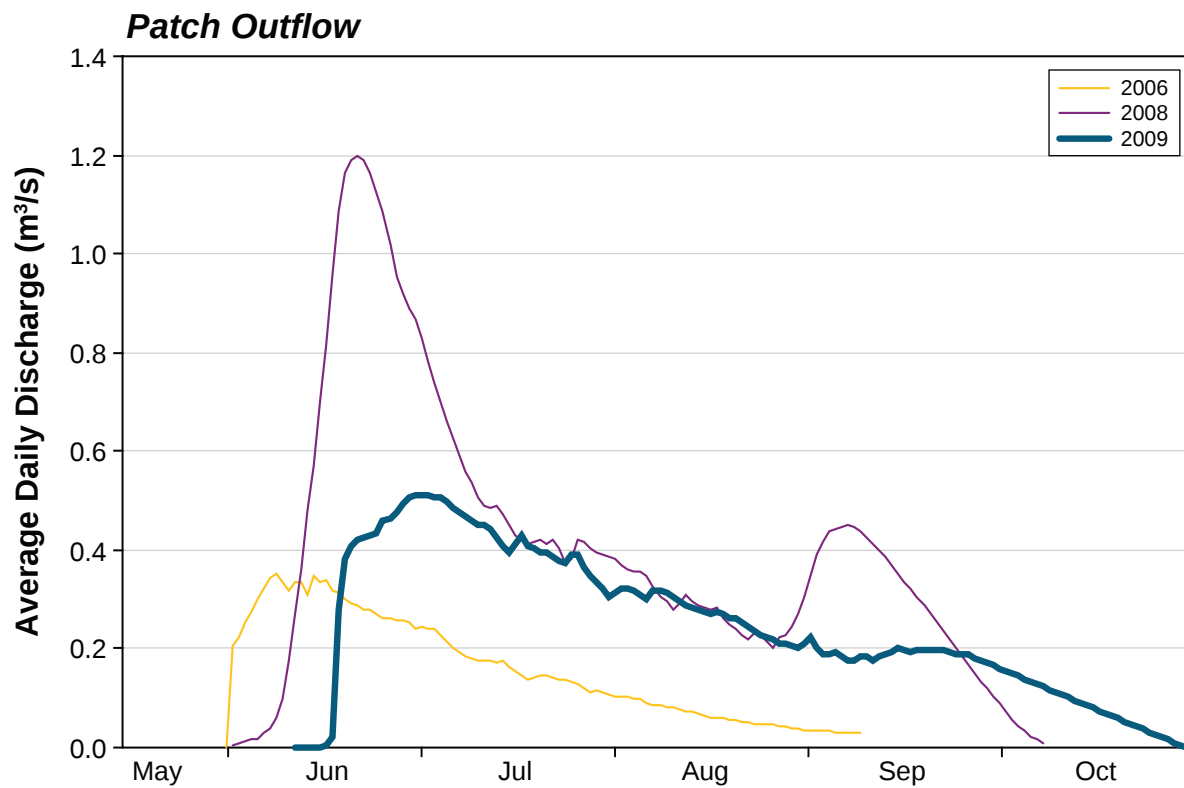
In order to undertake a hydrological assessment for mine site development, for engineering design and for the environmental assessment process, there is a need for estimates of a number of key hydrological parameters, such as average annual runoff, average and extreme flow rates, and low flows. In order to make robust estimates of these parameters, long-term flow records (i.e., at least 10 years) are required. When there is not sufficient data from on-site gauges for this purpose, estimates are generally derived through analysis of regional long-term datasets. An initial regional analysis to derive estimates of annual and monthly runoff for the site was completed in 2003 (AMEC, 2003). A synthetic long-term record was developed for the Doris Outflow station by developing a regression equation between observed flows at Doris with the observed flows for the corresponding period at the WSC station Ellice River (10QD001). A synthetic record was also developed for Tail Outflow by developing a second regression equation between observed flows at Tail and observed flows at Doris. Finally, runoff characteristics for Little Roberts Lake Outflow were assumed to be the same as those for Doris. Frequency analysis was completed on the synthetic records to develop return period estimates for annual runoff (Table 4.2-1), and average monthly flow (Table 4.2-2).

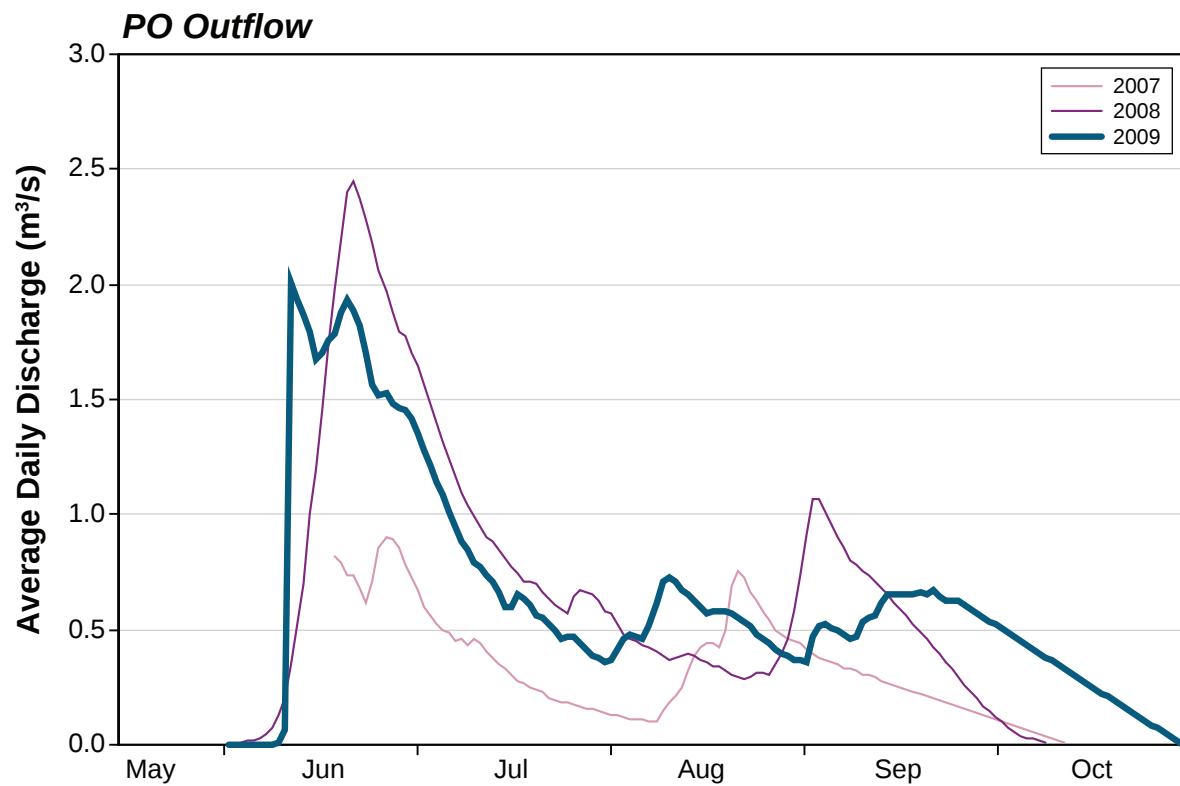


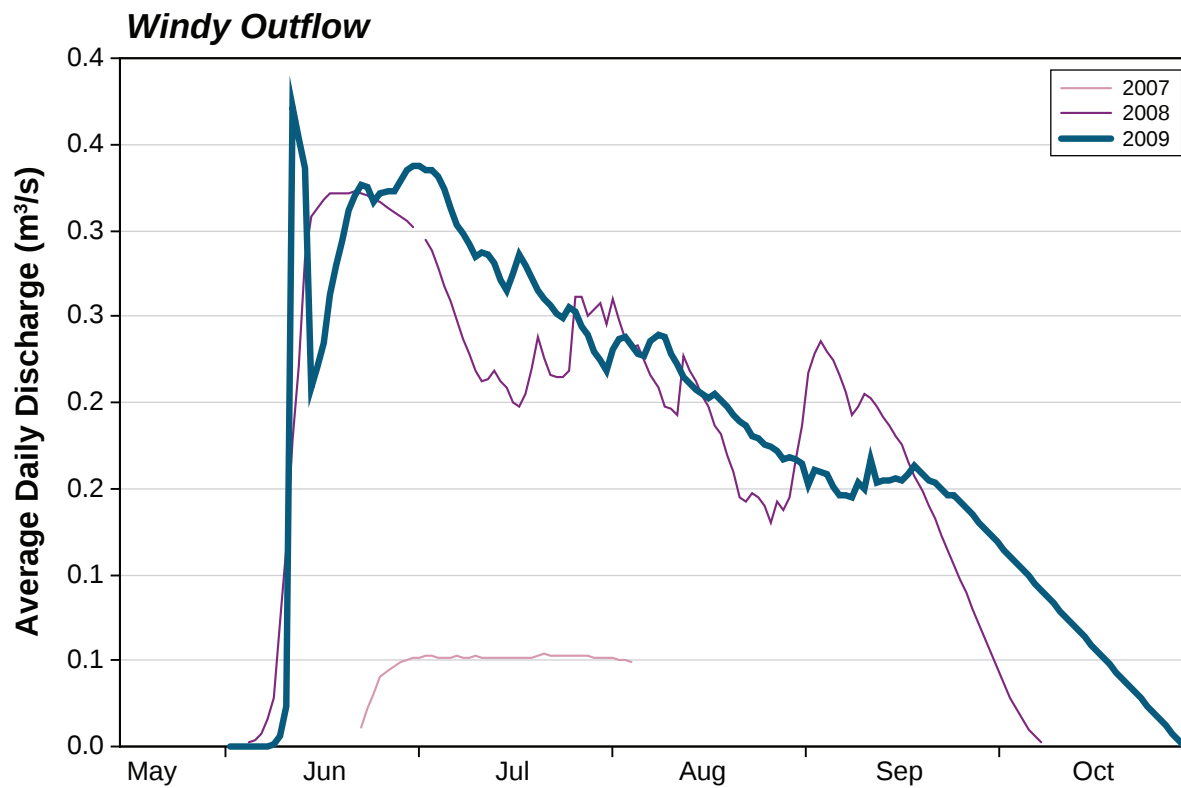


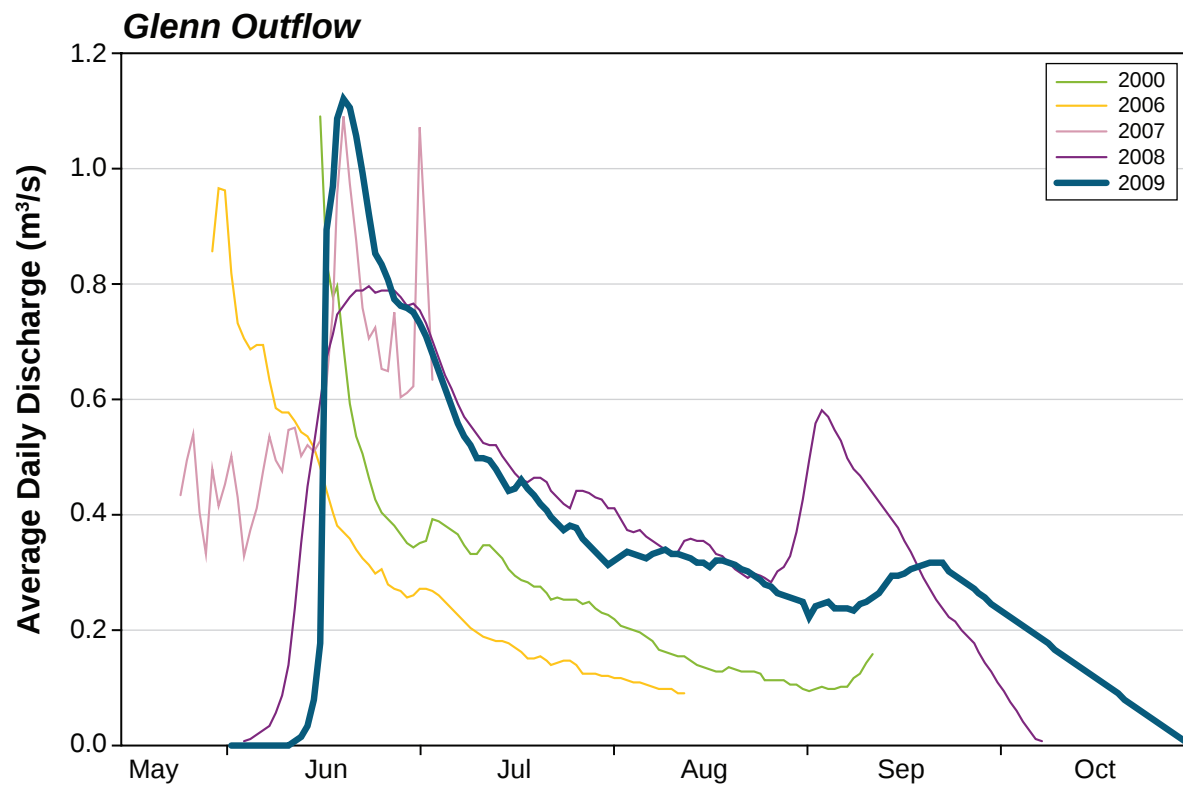


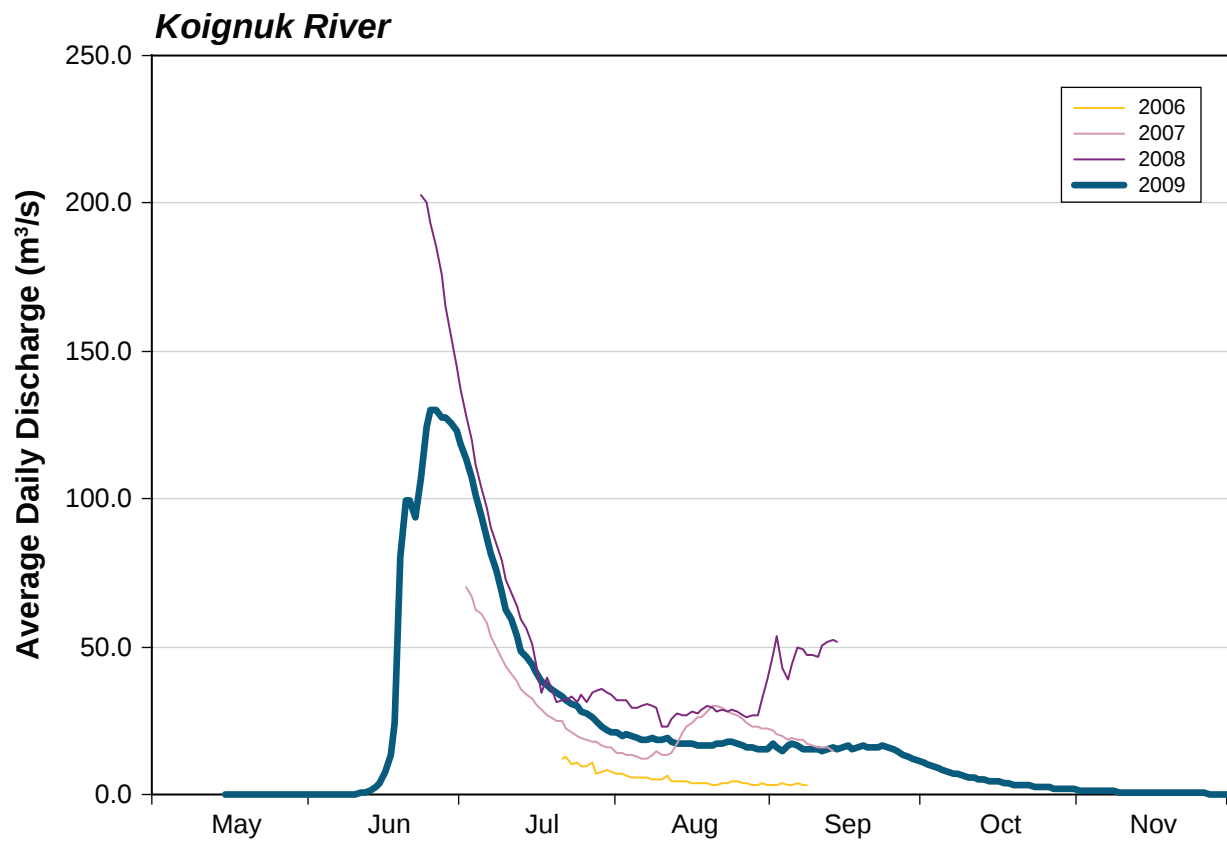












**Table 4.2-1. Return Period Estimates of Annual Runoff from AMEC (2003)**

| Stream                 | Estimated Annual Runoff (mm) |             |               |             |              |
|------------------------|------------------------------|-------------|---------------|-------------|--------------|
|                        | 1:100 Yr Dry                 | 1:10 Yr Dry | 1:2 Yr (Mean) | 1:10 Yr Wet | 1:100 Yr Wet |
| Doris Outflow          | 88.1                         | 97.0        | 134           | 188         | 309          |
| Tail Outflow           | 63.8                         | 74.1        | 111           | 159         | 246          |
| Little Roberts Outflow | 88.1                         | 97.0        | 134           | 188         | 309          |

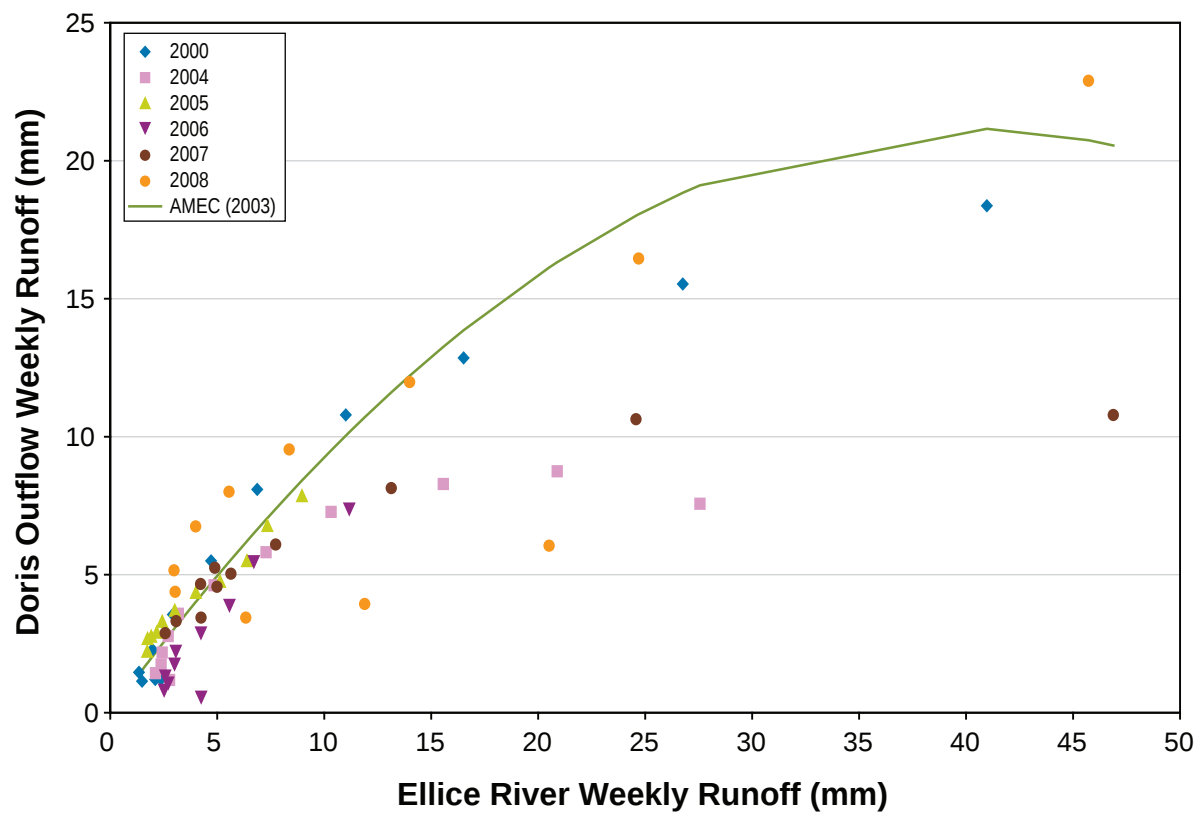
**Table 4.2-2. Estimates of Mean Monthly Runoff from AMEC (2003)**

| Month     | Doris Outflow |             | Tail Outflow |             | Little Roberts Outflow |             |
|-----------|---------------|-------------|--------------|-------------|------------------------|-------------|
|           | Runoff (mm)   | % of Annual | Runoff (mm)  | % of Annual | Runoff (mm)            | % of Annual |
| June      | 57.4          | 43          | 60.0         | 54          | 57.4                   | 43          |
| July      | 35.6          | 27          | 28.3         | 26          | 35.6                   | 27          |
| August    | 15.0          | 11          | 8.8          | 8           | 15.0                   | 11          |
| September | 19.2          | 14          | 11.0         | 10          | 19.2                   | 14          |
| October   | 6.7           | 5           | 2.9          | 2           | 6.7                    | 5           |
| Annual    | 134           | 100         | 111          | 100         | 134                    | 100         |

There are sparse hydrological data available for the Canadian Arctic, especially on small watersheds. The 2003 regional analysis used Ellice River as an analogue because it was the nearest long-term station to the Study Area with data that overlapped with the on-site data to derive the regression. However, it is important to note that Ellice River has a watershed area of 16,900 km<sup>2</sup>, and that results from this gauge were applied to watersheds ranging from 4 to 200 km<sup>2</sup>.

The 2003 regional analysis methodology was repeated for Doris Outflow using available data from 2000 to 2008 (Figure 4.2-1). The results indicate that there is high variability, and that the regression relationship is not constant from one year to the next. Some of this variability is likely due to differences in weather between the two watersheds. For example, the 2008 data show a secondary peak for Ellice River that was not observed at Doris Outflow. It is not clear what physically controls the variability, however, two general groups can be observed in the data: years 2000, 2005 and 2008; and years 2004, 2006, and 2007. The 2003 regression fits well with the first group, which predicts higher runoff at Doris for the same observed flow at Ellice. Applying this regression over the long-term record will result in over-estimated annual runoff results.

Following a number of years of additional on-site data collection, a more detailed water balance model was completed in 2008 for 10 lakes in the Study Area (Golder, 2009). The water balance model was set up on a daily time step for the period 1948 to 2008, using a synthetic precipitation record derived for the Study Area based on long-term climate records from Cambridge Bay. The basic water balance for each lake outflow considered rainfall and snowmelt runoff, direct precipitation to the lake surface, inflow from upstream watersheds, changes in lake storage, lake evaporation and outflow to downstream watersheds. The model was calibrated using runoff coefficients from land surfaces, stage-discharge rating curves at lake outflows, and simple temperature based models for snowmelt, spring ice melt and winter freeze-up in lake outflow channels. The calibrated model was used to generate a daily time series for each lake outflow, and frequency analyses were performed to characterize key discharge parameters (Tables 4.2-3 to 4.2-5).



**Correlation of Weekly Runoff  
between Ellice River and Doris Outflow**

Figure 4.2-1

**Table 4.2-3. Summary of Annual Runoff Return Period Estimates for Lakes in the Study Area from Golder (2009)**

| Station Id             | Annual Runoff (mm) |    |    |    |    |      |     |     |     |     |     |
|------------------------|--------------------|----|----|----|----|------|-----|-----|-----|-----|-----|
|                        | Dry                |    |    |    |    | Mean | Wet |     |     |     |     |
|                        | 100                | 50 | 20 | 10 | 5  | 2    | 5   | 10  | 20  | 50  | 100 |
| Wolverine Outflow      | 19                 | 24 | 33 | 42 | 53 | 77   | 107 | 126 | 144 | 166 | 182 |
| Patch Outflow          | 35                 | 40 | 48 | 56 | 66 | 87   | 114 | 131 | 148 | 168 | 182 |
| PO Outflow             | 54                 | 59 | 66 | 74 | 84 | 105  | 131 | 147 | 162 | 181 | 194 |
| Ogama Outflow          | 52                 | 57 | 65 | 72 | 82 | 103  | 129 | 146 | 161 | 179 | 193 |
| Tail Outflow           | 25                 | 30 | 37 | 44 | 53 | 72   | 96  | 111 | 124 | 141 | 153 |
| Doris Outflow          | 47                 | 52 | 60 | 68 | 77 | 99   | 125 | 141 | 157 | 176 | 189 |
| Roberts Outflow        | 39                 | 44 | 52 | 60 | 70 | 92   | 119 | 136 | 152 | 171 | 185 |
| Little Roberts Outflow | 44                 | 49 | 57 | 64 | 74 | 96   | 122 | 138 | 154 | 172 | 186 |
| Windy Outflow          | 19                 | 23 | 31 | 39 | 50 | 73   | 104 | 124 | 144 | 169 | 188 |
| Glenn Outflow          | 41                 | 45 | 51 | 58 | 67 | 86   | 111 | 128 | 143 | 164 | 179 |

**Table 4.2-4. Summary of Peak Daily Flow Return Period Estimates for Lakes in the Study Area from Golder (2009)**

| Station Id             | Peak Daily Flow (m <sup>3</sup> /s) |       |       |       |       |       |
|------------------------|-------------------------------------|-------|-------|-------|-------|-------|
|                        | Return Period (years)               |       |       |       |       |       |
|                        | 2                                   | 5     | 10    | 20    | 50    | 100   |
| Wolverine Outflow      | 0.056                               | 0.084 | 0.104 | 0.126 | 0.157 | 0.183 |
| Patch Outflow          | 0.693                               | 0.995 | 1.22  | 1.45  | 1.78  | 2.06  |
| PO Outflow             | 1.29                                | 1.74  | 2.04  | 2.34  | 2.74  | 3.04  |
| Ogama Outflow          | 1.41                                | 1.88  | 2.18  | 2.48  | 2.85  | 3.12  |
| Tail Outflow           | 0.122                               | 0.171 | 0.211 | 0.256 | 0.326 | 0.389 |
| Doris Outflow          | 1.68                                | 2.21  | 2.55  | 2.87  | 3.27  | 3.56  |
| Roberts Outflow        | 2.13                                | 3     | 3.64  | 4.3   | 5.22  | 5.97  |
| Little Roberts Outflow | 3.82                                | 5.18  | 6.07  | 6.94  | 8.05  | 8.89  |
| Windy Outflow          | 0.304                               | 0.48  | 0.621 | 0.776 | 1.01  | 1.22  |
| Glenn Outflow          | 0.484                               | 0.687 | 0.839 | 1     | 1.23  | 1.43  |

**Table 4.2-5. Summary of 7-Day Low-Flow Return Period Estimates for Lakes in the Study Area from Golder (2009)**

| Station Id             | August 7-day Low Flow (m <sup>3</sup> /s) |       |       |       |       |       |
|------------------------|-------------------------------------------|-------|-------|-------|-------|-------|
|                        | Return Period (years)                     |       |       |       |       |       |
|                        | 2                                         | 5     | 10    | 20    | 50    | 100   |
| Wolverine Outflow      | 0.012                                     | 0.006 | 0.005 | 0.004 | 0.003 | 0.002 |
| Patch Outflow          | 0.138                                     | 0.085 | 0.068 | 0.056 | 0.046 | 0.041 |
| PO Outflow             | 0.464                                     | 0.331 | 0.281 | 0.246 | 0.213 | 0.194 |
| Ogama Outflow          | 0.502                                     | 0.352 | 0.295 | 0.255 | 0.218 | 0.196 |
| Tail Outflow           | 0.007                                     | 0.001 | 0.001 | 0     | 0     | 0     |
| Doris Outflow          | 0.579                                     | 0.381 | 0.308 | 0.257 | 0.21  | 0.183 |
| Roberts Outflow        | 0.459                                     | 0.284 | 0.227 | 0.189 | 0.155 | 0.137 |
| Little Roberts Outflow | 1.093                                     | 0.702 | 0.567 | 0.475 | 0.391 | 0.343 |
| Windy Outflow          | 0.039                                     | 0.02  | 0.014 | 0.011 | 0.008 | 0.007 |
| Glenn Outflow          | 0.204                                     | 0.147 | 0.124 | 0.108 | 0.093 | 0.085 |

The model estimates predict a mean annual runoff for Doris Outflow of 99 mm, compared to 134 mm from the 2003 regional analysis. The 2009 calculated runoff for this station was 99 mm, equivalent to the model estimate. Comparatively, this would equate to 1-in-10 year dry conditions based on the return period estimates made in 2003. Given the general climatic conditions described above for the Arctic Tundra climate region, it would be expected that 2009 was near, or slightly wetter than average, suggesting the water balance model estimates to be more accurate.

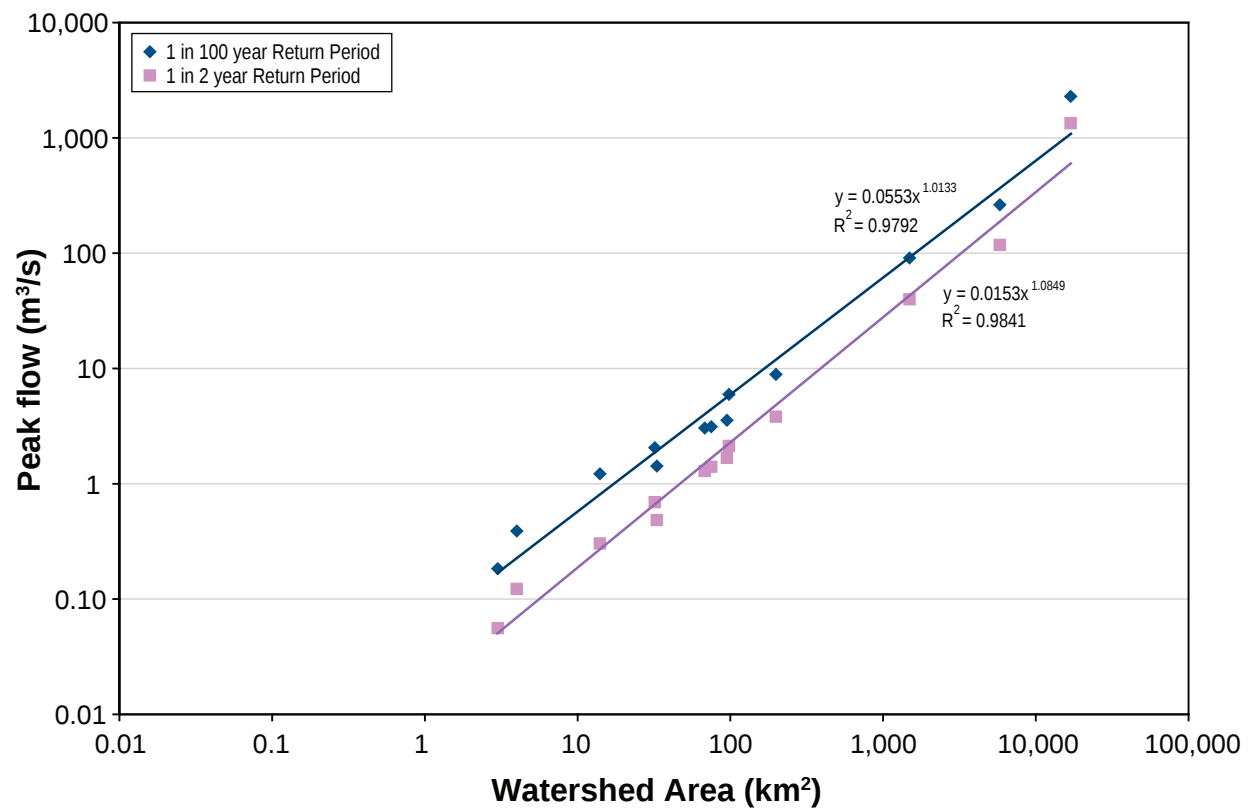
### 4.3 APPLICABILITY

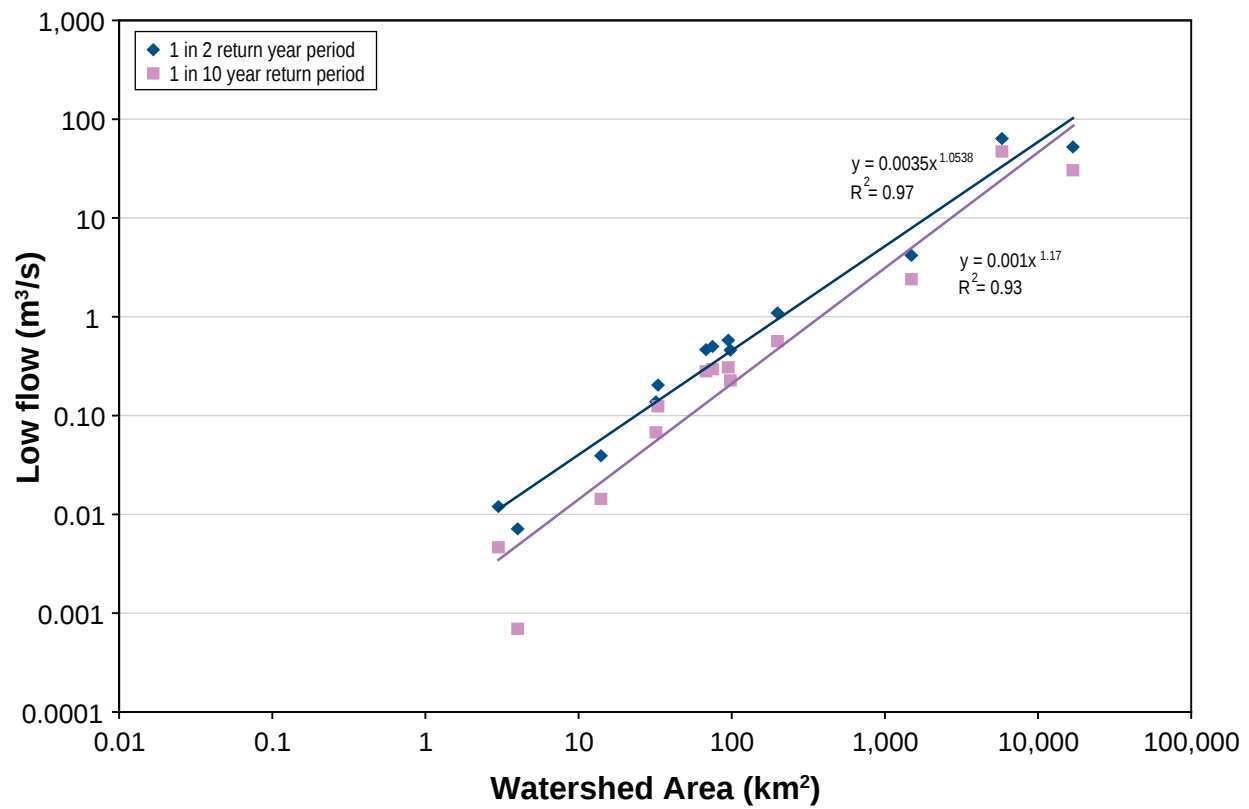
Results of the more detailed water balance model appear to provide good estimates of annual runoff for the Study Area. Site specific estimates were generated for 10 watersheds. In general, the results from Little Roberts Lake can be used to describe average conditions for some catchments in the Study Area (i.e., Doris, Ogama, Patch, PO, and Tail lakes), as results for the smaller sites are nested within this watershed.

Peak and low flow results from the water balance model as well as data from three long-term WSC station (Freshwater Creek (1,490 km<sup>2</sup>), Tree River (5,810 km<sup>2</sup>), and Ellice River (16,900 km<sup>2</sup>) were plotted against watershed area to derive generalized prediction equations for the Study Area (Figures 4.2-2 and 4.2-3). The equations from these plots can be used to estimate peak and low flows for any watershed area of interest. For example, Table 4.2-6 summarizes estimates for the Koignuk River and Reference-A at the location of the hydrometric stations. The 1-in-100 year peak flow is shown, as this is a common design parameter for sizing of ditches, diversion channels, or stream crossings. The average and 1-in-10 year 7-day low flows are shown as they are common indices for water use planning. The low flow provides an estimate of the normal baseflow conditions during the open-water season, which is important to the sustained health of a stream's aquatic community.

**Table 4.2-6. Peak and Low Flow Estimates for Koignuk River and Reference-A Watershed**

| <b>Watershed</b> | <b>Watershed Area<br/>(km<sup>2</sup>)</b> | <b>Average Annual<br/>Peak Flow (m<sup>3</sup>/s)</b> | <b>1-in-100 Year<br/>Peak Flow (m<sup>3</sup>/s)</b> | <b>Average Annual<br/>7-day August<br/>Low Flow (m<sup>3</sup>/s)</b> | <b>1-in-10 Year<br/>7-day August<br/>Low Flow (m<sup>3</sup>/s)</b> |
|------------------|--------------------------------------------|-------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------|
| Koignuk River    | 2,937                                      | 88.5                                                  | 181                                                  | 15.8                                                                  | 4.5                                                                 |
| Reference-A      | 27                                         | 0.546                                                 | 1.56                                                 | 0.11                                                                  | 0.03                                                                |





## References

## References

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## **Appendix 1**

### Manual Flow Measurements

# Manual Flow Measurements at Windy-Hydro in 2009

|                                |                              |        |                                |                              |        |
|--------------------------------|------------------------------|--------|--------------------------------|------------------------------|--------|
| Date Monitored:                | 11-Jun-09                    |        | Date Monitored:                | 11-Jun-09                    |        |
| Time (24 hr):                  | 15:55                        | Run: 1 | Time (24 hr):                  | 15:55                        | Run: 2 |
| Personnel:                     | Xavier Pinto, Katsky Venter  |        | Personnel:                     | Xavier Pinto, Katsky Venter  |        |
| Method:                        | Velocity - area with Swoffer |        | Method:                        | Velocity - area with Swoffer |        |
| Staff Gauge (m):               |                              |        | Staff Gauge (m):               |                              |        |
| Pressure Transducer (m):       |                              |        | Pressure Transducer (m):       |                              |        |
| Discharge (m <sup>3</sup> /s): | 0.374                        |        | Discharge (m <sup>3</sup> /s): | 0.370                        |        |

| Notes | Station (m) | Depth (cm) | Velocity (m/s) | Q (m <sup>3</sup> /s) | % of Total | Notes     | Station (m) | Depth (cm) | Velocity (m/s) | Q (m <sup>3</sup> /s) | % of Total |
|-------|-------------|------------|----------------|-----------------------|------------|-----------|-------------|------------|----------------|-----------------------|------------|
|       | 1           | 0          | 0              | 0                     | 0          |           | 3.6         | 0          | 0              | 0                     | 0          |
|       | 1.15        | 10         | 0              | 0                     | 0          |           | 3.5         | 23         | 0              | 0                     | 0          |
|       | 1.3         | 14         | 0.14           | 0.00294               | 1          | left bank | 3.35        | 25         | 0.19           | 0.00713               | 2          |
|       | 1.45        | 17         | 0.19           | 0.00485               | 1          |           | 3.2         | 35         | 0.37           | 0.0194                | 5          |
|       | 1.6         | 24         | 0.27           | 0.0097                | 3          |           | 3.05        | 58         | 0.54           | 0.0470                | 13         |
|       | 1.75        | 28         | 0.32           | 0.0134                | 4          |           | 2.9         | 58         | 0.5            | 0.0435                | 12         |
|       | 1.9         | 36         | 0.37           | 0.0200                | 5          |           | 2.75        | 58         | 0.44           | 0.0383                | 10         |
|       | 2.05        | 49         | 0.45           | 0.0331                | 9          |           | 2.6         | 59         | 0.42           | 0.0372                | 10         |
|       | 2.2         | 53         | 0.35           | 0.0278                | 7          |           | 2.45        | 59         | 0.43           | 0.0381                | 10         |
|       | 2.35        | 57         | 0.39           | 0.0333                | 9          |           | 2.3         | 59         | 0.42           | 0.0372                | 10         |
|       | 2.5         | 58         | 0.42           | 0.0365                | 10         |           | 2.15        | 52         | 0.41           | 0.0320                | 9          |
|       | 2.65        | 58         | 0.46           | 0.0400                | 11         |           | 2           | 50         | 0.4            | 0.0300                | 8          |
|       | 2.8         | 58         | 0.46           | 0.0400                | 11         |           | 1.85        | 30         | 0.33           | 0.0149                | 4          |
|       | 2.95        | 57         | 0.56           | 0.0479                | 13         |           | 1.7         | 27         | 0.31           | 0.0126                | 3          |
|       | 3.1         | 54         | 0.51           | 0.0413                | 11         |           | 1.55        | 23         | 0.23           | 0.00794               | 2          |
|       | 3.25        | 30         | 0.49           | 0.0221                | 6          |           | 1.4         | 15         | 0.14           | 0.00315               | 1          |
|       | 3.4         | 23         | 0.03           | 0.00104               | 0          |           | 1.25        | 13         | 0.07           | 0.00137               | 0          |
|       | 3.55        | 21         | 0              | 0                     | 0          |           | 1.1         | 9          | 0              | 0                     | 0          |
|       | 3.6         | 0          | 0              | 0                     | 0          |           | 1           | 0          | 0              | 0                     | 0          |

|                                |                              |        |                                |                              |        |
|--------------------------------|------------------------------|--------|--------------------------------|------------------------------|--------|
| Date Monitored:                | 14-Jun-09                    |        | Date Monitored:                | 14-Jun-09                    |        |
| Time (24 hr):                  | 17:25                        | Run: 1 | Time (24 hr):                  | 17:25                        | Run: 2 |
| Personnel:                     | Xavier Pinto, Katsky Venter  |        | Personnel:                     | Xavier Pinto, Katsky Venter  |        |
| Method:                        | Velocity - area with Swoffer |        | Method:                        | Velocity - area with Swoffer |        |
| Staff Gauge (m):               |                              |        | Staff Gauge (m):               |                              |        |
| Pressure Transducer (m):       |                              |        | Pressure Transducer (m):       |                              |        |
| Discharge (m <sup>3</sup> /s): | 0.204                        |        | Discharge (m <sup>3</sup> /s): | 0.214                        |        |

| Notes | Station (m) | Depth (cm) | Velocity (m/s) | Q (m <sup>3</sup> /s) | % of Total | Notes     | Station (m) | Depth (cm) | Velocity (m/s) | Q (m <sup>3</sup> /s) | % of Total |
|-------|-------------|------------|----------------|-----------------------|------------|-----------|-------------|------------|----------------|-----------------------|------------|
|       | 5.2         | 0          | 0              | 0                     | 0          |           | 7.2         | 0          | 0              | 0                     | 0          |
|       | 5.25        | 4          | 0              | 0                     | 0          |           | 7.07        | 43         | 0.04           | 0.00198               | 1          |
|       | 5.3         | 5          | 0              | 0                     | 0          | left bank | 6.97        | 46         | 0.22           | 0.0101                | 5          |
|       | 5.35        | 8          | 0              | 0                     | 0          |           | 6.87        | 49         | 0.42           | 0.0206                | 10         |
|       | 5.4         | 10         | 0.01           | 0.0000500             | 0          |           | 6.77        | 51         | 0.46           | 0.0235                | 11         |
|       | 5.45        | 12         | 0.05           | 0.000300              | 0          |           | 6.67        | 48         | 0.44           | 0.0211                | 10         |
|       | 5.5         | 13         | 0.1            | 0.000650              | 0          |           | 6.57        | 47         | 0.41           | 0.0193                | 9          |
|       | 5.55        | 17         | 0.24           | 0.00204               | 1          |           | 6.47        | 47         | 0.42           | 0.0197                | 9          |
|       | 5.6         | 21         | 0.27           | 0.00284               | 1          |           | 6.37        | 46         | 0.3            | 0.0138                | 6          |
|       | 5.65        | 21         | 0.28           | 0.00294               | 1          |           | 6.27        | 47         | 0.35           | 0.0165                | 8          |
|       | 5.7         | 25         | 0.31           | 0.00387               | 2          |           | 6.17        | 45         | 0.26           | 0.0117                | 5          |
|       | 5.75        | 25         | 0.31           | 0.00387               | 2          |           | 6.07        | 45         | 0.26           | 0.0117                | 5          |
|       | 5.8         | 30         | 0.28           | 0.00420               | 2          |           | 5.97        | 43         | 0.34           | 0.0146                | 7          |
|       | 5.85        | 32         | 0.25           | 0.00400               | 2          |           | 5.87        | 34         | 0.27           | 0.00918               | 4          |
|       | 5.9         | 33         | 0.27           | 0.00446               | 2          |           | 5.77        | 30         | 0.3            | 0.00900               | 4          |
|       | 5.95        | 39         | 0.29           | 0.00565               | 3          |           | 5.67        | 22         | 0.3            | 0.00660               | 3          |
|       | 6           | 45         | 0.21           | 0.00472               | 2          |           | 5.57        | 17         | 0.21           | 0.00357               | 2          |
|       | 6.05        | 46         | 0.28           | 0.00644               | 3          |           | 5.47        | 12         | 0.09           | 0.00108               | 1          |
|       | 6.1         | 45         | 0.28           | 0.00630               | 3          |           | 5.37        | 10         | 0              | 0                     | 0          |
|       | 6.15        | 45         | 0.31           | 0.00698               | 3          |           | 5.27        | 7          | 0              | 0                     | 0          |
|       | 6.2         | 46         | 0.29           | 0.00667               | 3          |           | 5.2         | 0          | 0              | 0                     | 0          |
|       | 6.25        | 48         | 0.29           | 0.00696               | 3          |           |             |            |                |                       |            |
|       | 6.3         | 47         | 0.3            | 0.00705               | 3          |           |             |            |                |                       |            |
|       | 6.35        | 46         | 0.33           | 0.00759               | 4          |           |             |            |                |                       |            |
|       | 6.4         | 47         | 0.32           | 0.00752               | 4          |           |             |            |                |                       |            |
|       | 6.45        | 48         | 0.39           | 0.00936               | 5          |           |             |            |                |                       |            |
|       | 6.5         | 50         | 0.4            | 0.0100                | 5          |           |             |            |                |                       |            |
|       | 6.55        | 50         | 0.37           | 0.00925               | 5          |           |             |            |                |                       |            |
|       | 6.6         | 48         | 0.41           | 0.0148                | 7          |           |             |            |                |                       |            |
|       | 6.7         | 50         | 0.45           | 0.0225                | 11         |           |             |            |                |                       |            |
|       | 6.8         | 51         | 0.43           | 0.0219                | 11         |           |             |            |                |                       |            |
|       | 6.9         | 48         | 0.28           | 0.0134                | 7          |           |             |            |                |                       |            |
|       | 7           | 44         | 0.15           | 0.00660               | 3          |           |             |            |                |                       |            |
|       | 7.1         | 22         | 0.03           | 0.000660              | 0          |           |             |            |                |                       |            |
|       | 7.2         | 14         | 0              | 0                     | 0          |           |             |            |                |                       |            |

|                                |                              |        |                                |                              |        |
|--------------------------------|------------------------------|--------|--------------------------------|------------------------------|--------|
| Date Monitored:                | 16-Jun-09                    | Run: 1 | Date Monitored:                | 16-Jun-09                    | Run: 2 |
| Time (24 hr):                  | 7:34                         |        | Time (24 hr):                  | 7:34                         |        |
| Personnel:                     | Xavier Pinto, Greg Norton    |        | Personnel:                     | Xavier Pinto, Greg Norton    |        |
| Method:                        | Velocity - area with Swoffer |        | Method:                        | Velocity - area with Swoffer |        |
| Staff Gauge (m):               |                              |        | Staff Gauge (m):               |                              |        |
| Pressure Transducer (m):       | 98.533                       |        | Pressure Transducer (m):       | 98.533                       |        |
| Discharge (m <sup>3</sup> /s): | 0.272                        |        | Discharge (m <sup>3</sup> /s): | 0.252                        |        |

| Notes | Station<br>(m) | Depth<br>(cm) | Velocity<br>(m/s) | Q<br>(m <sup>3</sup> /s) | % of Total | Notes     | Station<br>(m) | Depth<br>(cm) | Velocity<br>(m/s) | Q<br>(m <sup>3</sup> /s) | % of Total |
|-------|----------------|---------------|-------------------|--------------------------|------------|-----------|----------------|---------------|-------------------|--------------------------|------------|
|       | 0.8            | 0             | 0.00              | 0                        | 0          |           | 4.5            | 0             | 0.00              | 0                        | 0          |
|       | 1              | 11            | 0.00              | 0                        | 0          |           | 4.3            | 18            | 0.03              | 0.00104                  | 0          |
|       | 1.2            | 15            | 0.00              | 0                        | 0          |           | 4.1            | 19            | 0.07              | 0.00276                  | 1          |
|       | 1.4            | 17            | 0.00              | 0                        | 0          | left bank | 3.9            | 25.5          | 0.15              | 0.00740                  | 3          |
|       | 1.6            | 26            | 0.12              | 0.00603                  | 2          |           | 3.7            | 31            | 0.16              | 0.00989                  | 4          |
|       | 1.8            | 27            | 0.25              | 0.01332                  | 5          |           | 3.5            | 31            | 0.26              | 0.0162                   | 6          |
|       | 2              | 31            | 0.29              | 0.0180                   | 7          |           | 3.3            | 34            | 0.30              | 0.0207                   | 8          |
|       | 2.2            | 35.5          | 0.44              | 0.0309                   | 11         |           | 3.1            | 35            | 0.32              | 0.0223                   | 9          |
|       | 2.4            | 39            | 0.45              | 0.0351                   | 13         |           | 2.9            | 37.5          | 0.32              | 0.0239                   | 9          |
|       | 2.6            | 45            | 0.39              | 0.0353                   | 13         |           | 2.7            | 41            | 0.39              | 0.0321                   | 13         |
|       | 2.8            | 40            | 0.41              | 0.0325                   | 12         |           | 2.5            | 42            | 0.36              | 0.0305                   | 12         |
|       | 3              | 39            | 0.28              | 0.0215                   | 8          |           | 2.3            | 37            | 0.42              | 0.0311                   | 12         |
|       | 3.2            | 35            | 0.30              | 0.0213                   | 8          |           | 2.1            | 35            | 0.41              | 0.0284                   | 11         |
|       | 3.4            | 32            | 0.26              | 0.0167                   | 6          |           | 1.9            | 30            | 0.32              | 0.0191                   | 8          |
|       | 3.6            | 34            | 0.25              | 0.0168                   | 6          |           | 1.7            | 26            | 0.13              | 0.00679                  | 3          |
|       | 3.8            | 41            | 0.20              | 0.0167                   | 6          |           | 1.5            | 23            | 0.00              | 0                        | 0          |
|       | 4              | 32            | 0.07              | 0.00464                  | 2          |           | 1.3            | 0             | 0.00              | 0                        | 0          |
|       | 4.2            | 20            | 0.06              | 0.00290                  | 1          |           | 0.8            | 0             | 0.00              | 0                        | 0          |
|       | 4.5            | 0             | 0                 | 0                        | 0          |           |                |               |                   |                          |            |

|                                |                              |        |                                |                              |        |
|--------------------------------|------------------------------|--------|--------------------------------|------------------------------|--------|
| Date Monitored:                | 22-Jun-09                    | Run: 1 | Date Monitored:                | 22-Jun-09                    | Run: 2 |
| Time (24 hr):                  | 17:39                        |        | Time (24 hr):                  | 17:39                        |        |
| Personnel:                     | Xavier Pinto, Greg Norton    |        | Personnel:                     | Xavier Pinto, Greg Norton    |        |
| Method:                        | Velocity - area with Swoffer |        | Method:                        | Velocity - area with Swoffer |        |
| Staff Gauge (m):               |                              |        | Staff Gauge (m):               |                              |        |
| Pressure Transducer (m):       | 98.562                       |        | Pressure Transducer (m):       | 98.562                       |        |
| Discharge (m <sup>3</sup> /s): | 0.369                        |        | Discharge (m <sup>3</sup> /s): | 0.388                        |        |

| Notes      | Station<br>(m) | Depth<br>(cm) | Velocity<br>(m/s) | Q<br>(m <sup>3</sup> /s) | % of Total | Notes      | Station<br>(m) | Depth<br>(cm) | Velocity<br>(m/s) | Q<br>(m <sup>3</sup> /s) | % of Total |
|------------|----------------|---------------|-------------------|--------------------------|------------|------------|----------------|---------------|-------------------|--------------------------|------------|
| left bank  | 0.4            | 0             | 0.00              | 0                        | 0          | right bank | 3.85           | 0             | 0.00              | 0                        | 0          |
|            | 1.8            | 20            | 0.00              | 0                        | 0          |            | 3.75           | 11            | 0.03              | 0.000393                 | 0          |
|            | 2              | 23            | 0.13              | 0.00518                  | 1          |            | 3.6            | 19            | 0.30              | 0.00856                  | 2          |
|            | 2.15           | 26            | 0.09              | 0.00335                  | 1          |            | 3.45           | 20            | 0.23              | 0.00686                  | 2          |
|            | 2.3            | 25            | 0.14              | 0.00536                  | 1          |            | 3.3            | 24            | 0.43              | 0.0129                   | 3          |
|            | 2.45           | 32            | 0.57              | 0.0229                   | 6          |            | 3.2            | 40            | 0.44              | 0.0177                   | 5          |
|            | 2.55           | 52            | 0.79              | 0.0409                   | 11         |            | 3.1            | 46            | 0.67              | 0.0309                   | 8          |
|            | 2.65           | 50            | 0.97              | 0.0486                   | 13         |            | 3              | 55            | 0.87              | 0.0480                   | 12         |
|            | 2.75           | 50            | 0.97              | 0.0486                   | 13         |            | 2.9            | 54            | 0.93              | 0.0502                   | 13         |
|            | 2.85           | 53            | 0.96              | 0.0508                   | 14         |            | 2.8            | 51            | 0.99              | 0.0503                   | 13         |
|            | 2.95           | 54            | 0.87              | 0.0471                   | 13         |            | 2.7            | 50            | 0.94              | 0.0472                   | 12         |
|            | 3.05           | 50            | 0.91              | 0.0457                   | 12         |            | 2.6            | 52            | 0.63              | 0.0327                   | 8          |
|            | 3.15           | 45            | 0.36              | 0.0161                   | 4          |            | 2.5            | 51            | 0.83              | 0.0529                   | 14         |
|            | 3.25           | 27            | 0.51              | 0.0174                   | 5          |            | 2.35           | 30            | 0.27              | 0.0143                   | 4          |
|            | 3.4            | 20            | 0.23              | 0.00686                  | 2          |            | 2.15           | 25            | 0.19              | 0.00813                  | 2          |
|            | 3.55           | 20            | 0.23              | 0.00686                  | 2          |            | 2              | 22            | 0.19              | 0.00716                  | 2          |
|            | 3.7            | 15            | 0.14              | 0.00322                  | 1          |            | 1.8            | 20            | 0.00              | 0                        | 0          |
| right bank | 3.85           | 0             | 0.00              | 0                        | 0          | left bank  | 0.4            | 0             | 0.00              | 0                        | 0          |

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|--------------------------|--|---------------------------------|--|--------|--|
| Date Monitored:          |  | 22-Jul-09                       |  | Run: 1 |  |
| Time (24 hr):            |  | 15:04                           |  |        |  |
| Personnel:               |  | Xavier Pinto, Wynter Kullikтана |  |        |  |
| Method:                  |  | Velocity - area with Swoffer    |  |        |  |
| Staff Gauge (m):         |  |                                 |  |        |  |
| Pressure Transducer (m): |  | 98.541                          |  |        |  |
| Discharge (m³/s):        |  | 0.227                           |  |        |  |
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|--------------------------------|---------------------------------|--------|
| Date Monitored:                | 26-Jul-09                       | Run: 1 |
| Time (24 hr):                  | 15:09                           |        |
| Personnel:                     | Xavier Pinto, Wynter Kulliktana |        |
| Method:                        | Velocity - area with Swoffer    |        |
| Staff Gauge (m):               |                                 |        |
| Pressure Transducer (m):       | 98.535                          |        |
| Discharge (m <sup>3</sup> /s): | 0.236                           |        |

| Notes      | Station<br>(m) | Depth<br>(cm) | Velocity<br>(m/s) | Q<br>(m <sup>3</sup> /s) | % of Total |
|------------|----------------|---------------|-------------------|--------------------------|------------|
| right bank | 1.1            | 0             | 0                 | 0                        | 0          |
|            | 1.15           | 20            | 0.15              | 0.00150                  | 1          |
|            | 1.2            | 20            | 0.22              | 0.00330                  | 1          |
|            | 1.3            | 38            | 0.46              | 0.0131                   | 6          |
|            | 1.35           | 40            | 0.57              | 0.0114                   | 5          |
|            | 1.4            | 42            | 0.56              | 0.0118                   | 5          |
|            | 1.45           | 43            | 0.61              | 0.0131                   | 6          |
|            | 1.5            | 44            | 0.6               | 0.0132                   | 6          |
|            | 1.55           | 44            | 0.6               | 0.0132                   | 6          |
|            | 1.6            | 43            | 0.63              | 0.0135                   | 6          |
|            | 1.65           | 42            | 0.55              | 0.0116                   | 5          |
|            | 1.7            | 43            | 0.6               | 0.0129                   | 5          |
|            | 1.75           | 44            | 0.57              | 0.0125                   | 5          |
|            | 1.8            | 44            | 0.54              | 0.0119                   | 5          |
|            | 1.85           | 44            | 0.56              | 0.0123                   | 5          |
|            | 1.9            | 44            | 0.46              | 0.0101                   | 4          |
|            | 1.95           | 44            | 0.45              | 0.00990                  | 4          |
|            | 2              | 45            | 0.46              | 0.0104                   | 4          |
|            | 2.05           | 45            | 0.4               | 0.00900                  | 4          |
|            | 2.1            | 44            | 0.41              | 0.00902                  | 4          |
|            | 2.15           | 42            | 0.35              | 0.00735                  | 3          |
|            | 2.2            | 41            | 0.31              | 0.00953                  | 4          |
|            | 2.3            | 29            | 0.24              | 0.00696                  | 3          |
|            | 2.4            | 21            | 0.2               | 0.00420                  | 2          |
|            | 2.5            | 20            | 0.13              | 0.00260                  | 1          |
|            | 2.6            | 16            | 0.05              | 0.00120                  | 1          |
| left bank  | 2.8            | 0             | 0                 | 0                        | 0          |

|                                |                                          |        |
|--------------------------------|------------------------------------------|--------|
| Date Monitored:                | 24-Sep-09                                | Run: 1 |
| Time (24 hr):                  | 17:12                                    |        |
| Personnel:                     | Xavier Pinto-Swoffer; Tolga Olcay- Notes |        |
| Method:                        | Velocity - area with Swoffer             |        |
| Staff Gauge (m):               |                                          |        |
| Pressure Transducer (m):       | 98.489                                   |        |
| Discharge (m <sup>3</sup> /s): | 0.157                                    |        |

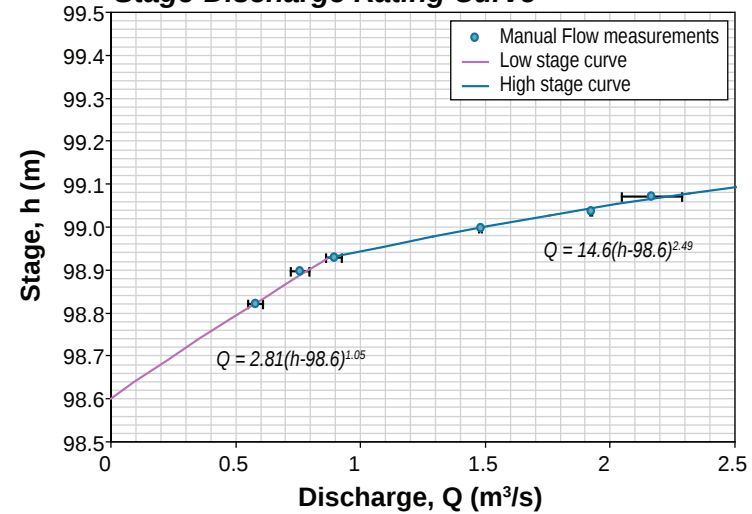
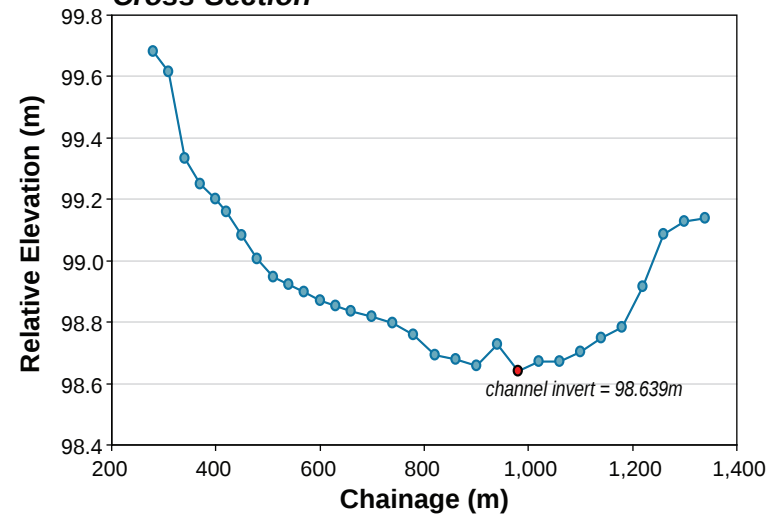
| Notes      | Station<br>(m) | Depth<br>(cm) | Velocity<br>(m/s) | Q<br>(m <sup>3</sup> /s) | % of Total |
|------------|----------------|---------------|-------------------|--------------------------|------------|
| right bank | 6.4            | 0             | 0.00              | 0                        | 0          |
|            | 6.5            | 10            | 0.00              | 0                        | 0          |
|            | 6.6            | 12            | 0.00              | 0                        | 0          |
|            | 6.7            | 16            | 0.14              | 0.00227                  | 1          |
|            | 6.8            | 19            | 0.23              | 0.00432                  | 3          |
|            | 6.9            | 22            | 0.20              | 0.00437                  | 3          |
|            | 7              | 37            | 0.24              | 0.00893                  | 6          |
|            | 7.1            | 36            | 0.47              | 0.0169                   | 11         |
|            | 7.2            | 34            | 0.71              | 0.0181                   | 12         |
|            | 7.25           | 32            | 0.72              | 0.0116                   | 7          |
|            | 7.3            | 31            | 0.64              | 0.00991                  | 6          |
|            | 7.35           | 30            | 0.71              | 0.0107                   | 7          |
|            | 7.4            | 30            | 0.61              | 0.00916                  | 6          |
|            | 7.45           | 26            | 0.58              | 0.00757                  | 5          |
|            | 7.5            | 27            | 0.48              | 0.00652                  | 4          |
|            | 7.55           | 26            | 0.40              | 0.00517                  | 3          |
|            | 7.6            | 28            | 0.37              | 0.00775                  | 5          |
|            | 7.7            | 26            | 0.26              | 0.00665                  | 4          |
|            | 7.8            | 28            | 0.30              | 0.00835                  | 5          |
|            | 7.9            | 24            | 0.33              | 0.00588                  | 4          |
|            | 7.95           | 23            | 0.31              | 0.00359                  | 2          |
|            | 8              | 25            | 0.37              | 0.00462                  | 3          |
|            | 8.05           | 28            | 0.34              | 0.00226                  | 1          |
|            | 8.1            | 28            | 0.26              | 0.00179                  | 1          |
|            | 8.2            | 23            | 0.03              | 0.000362                 | 0          |
| left bank  | 8.3            | 18            | 0.01              | 0.000146                 | 0          |
|            | 8.4            | 0             | 0                 | 0                        | 0          |

## **Appendix 2**

### Rating Curves



Lake outlet, facing upstream (S)

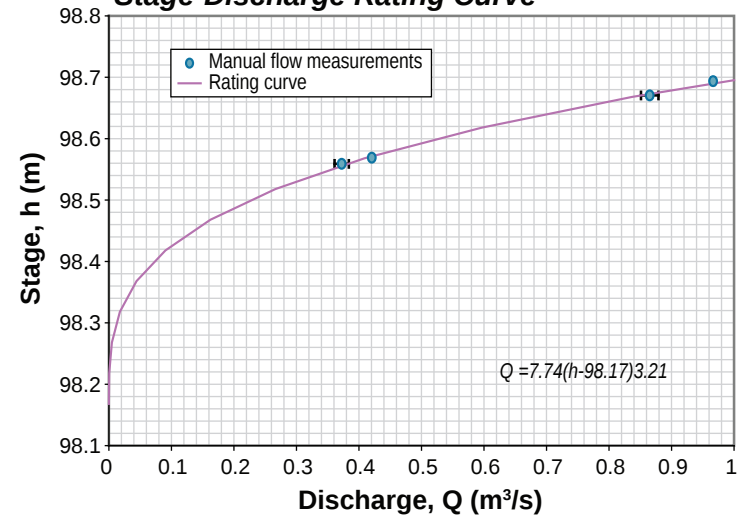
**Stage-Discharge Rating Curve****Cross-Section**

Note: Stage and elevations are referenced to arbitrary datum.

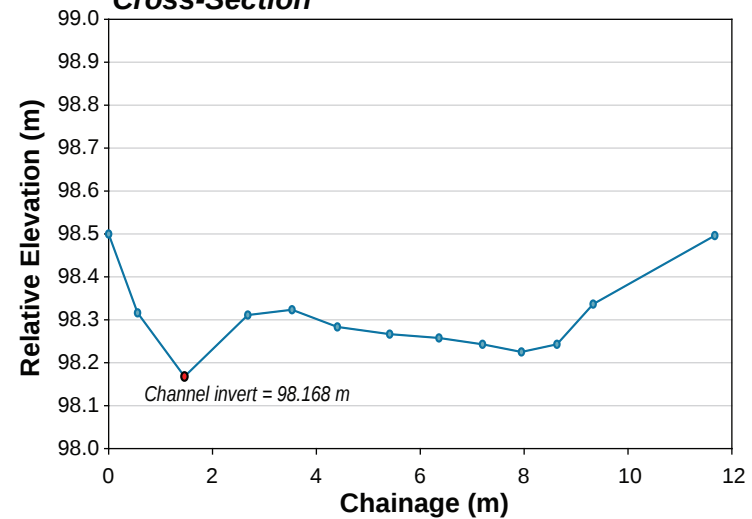


Lake Outlet facing upstream (SW)

### Stage-Discharge Rating Curve



### Cross-Section



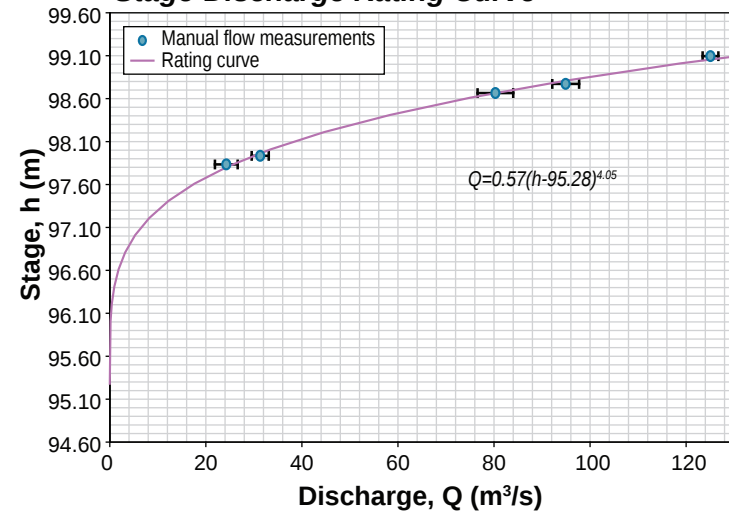
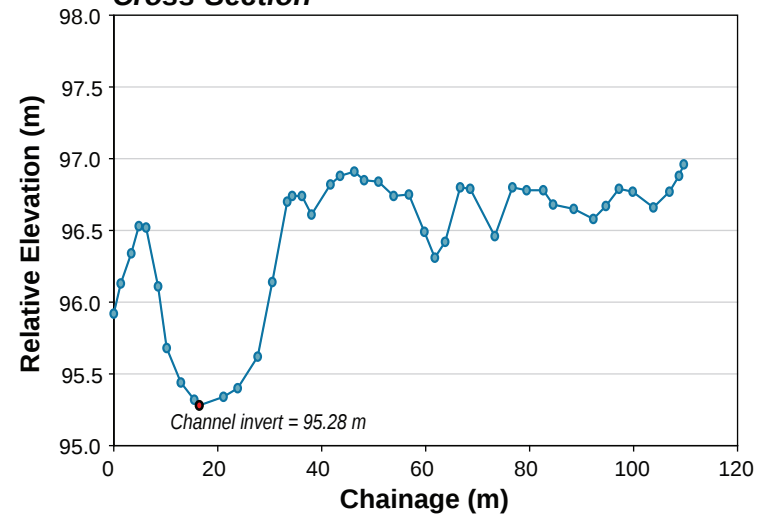
Note: Stage and elevations are referenced to arbitrary datum.



Facing upstream (SW) from the station



Cross-section right at the station

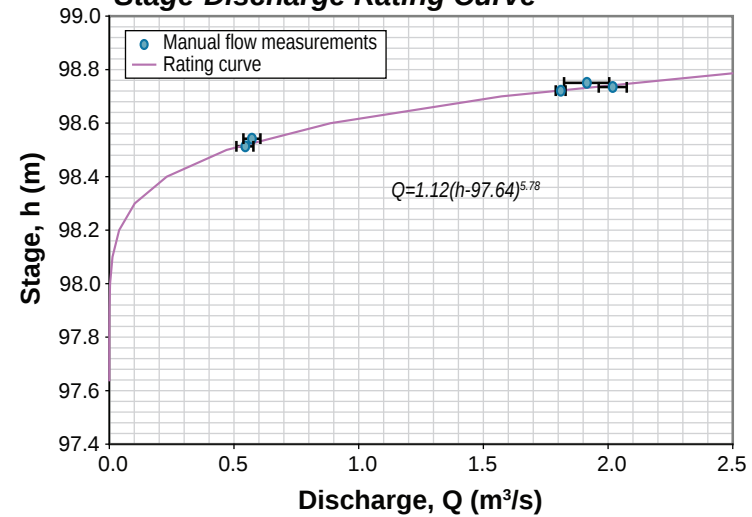
**Stage-Discharge Rating Curve****Cross-Section**

Note: Stage and elevations are referenced to arbitrary datum.

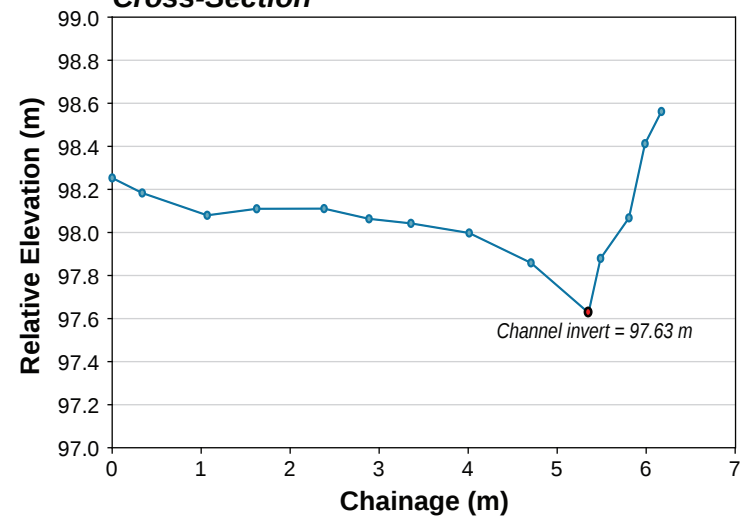


Cross section at the station, facing upstream (SE)

### Stage-Discharge Rating Curve



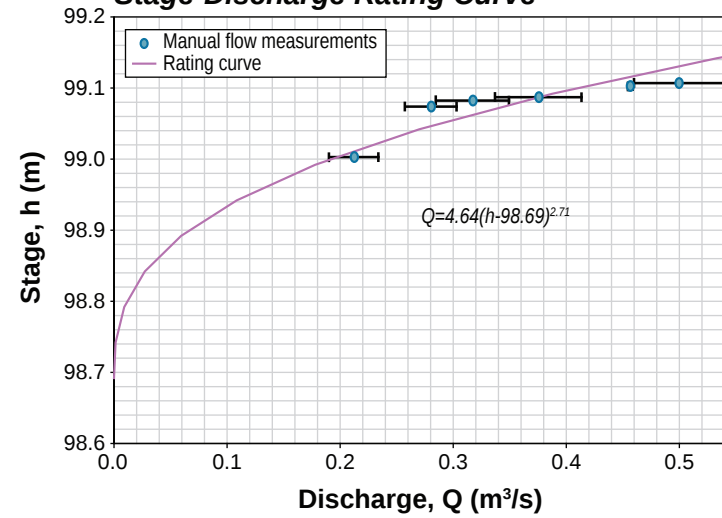
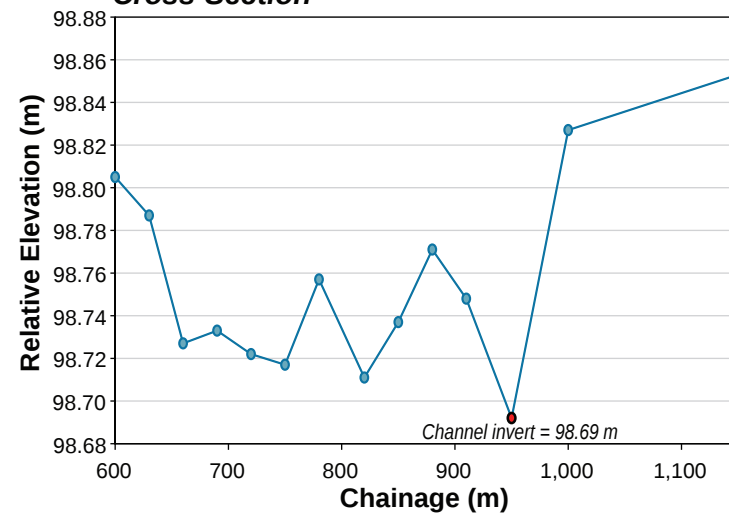
### Cross-Section



Note: Stage and elevations are referenced to arbitrary datum.



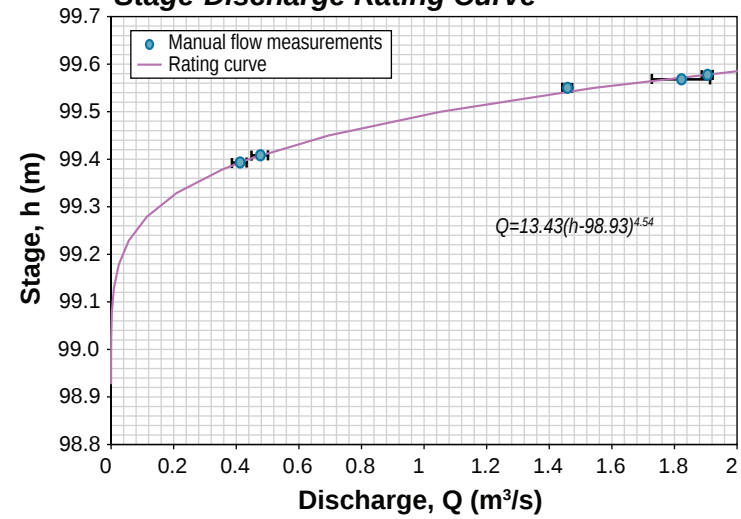
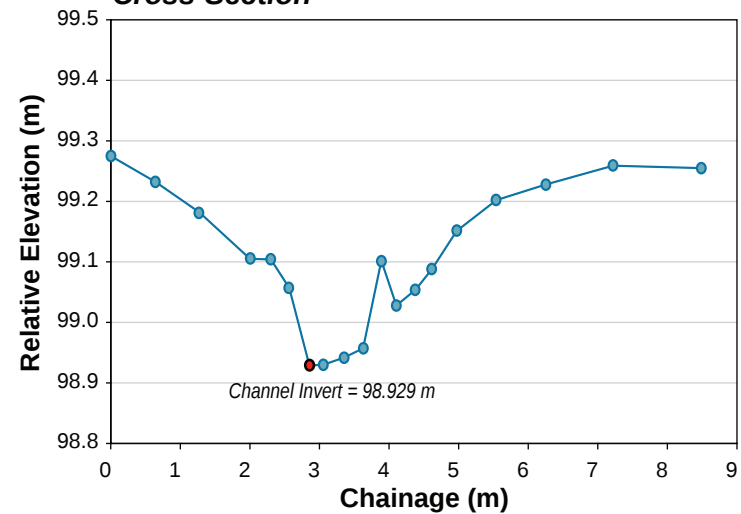
Lake outlet facing upstream (W)

**Stage-Discharge Rating Curve****Cross-Section**

Note: Stage and elevations are referenced to arbitrary datum.



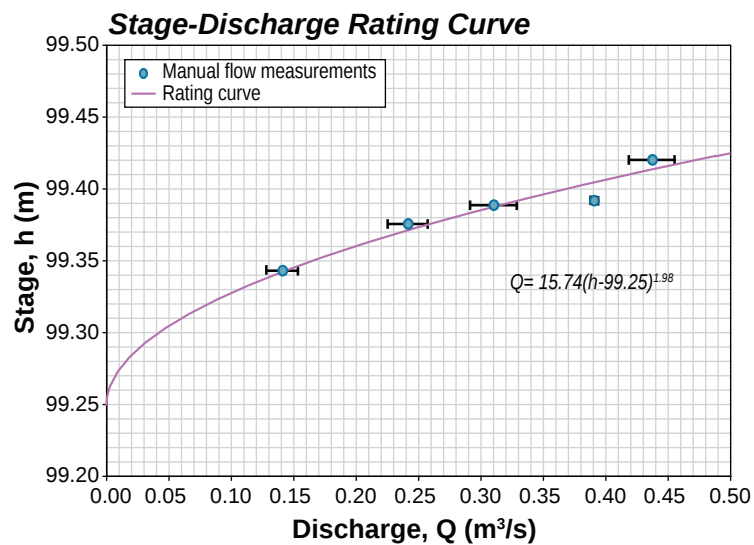
Lake outlet facing upstream (S)

**Stage-Discharge Rating Curve****Cross-Section**

Note: Stage and elevations are referenced to arbitrary datum.



Lake outlet facing upstream (S)



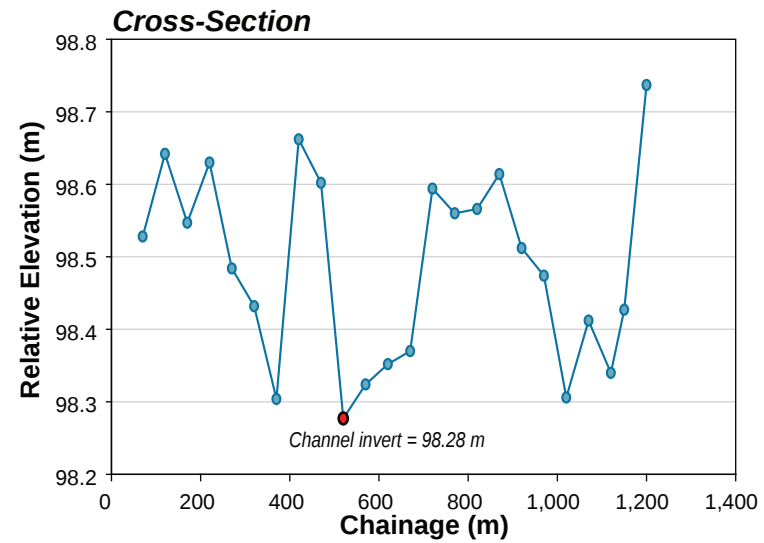
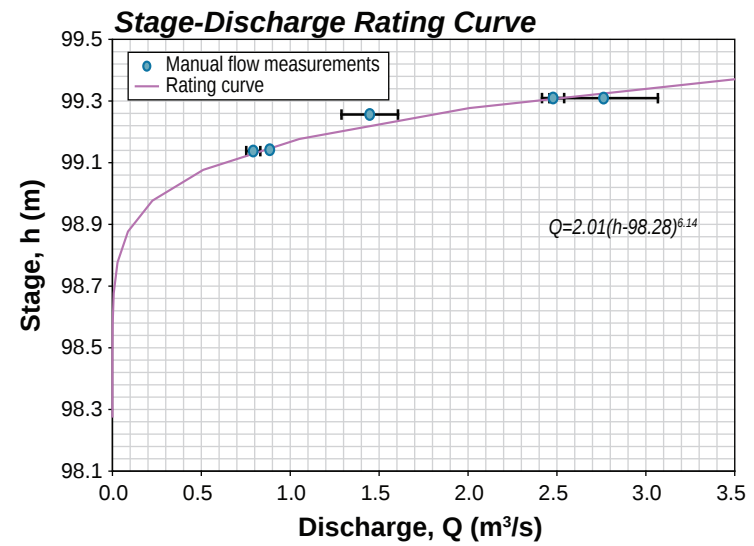
### Cross-Section

No cross-section available

Note: Stage and elevations are referenced to arbitrary datum.



Lake outlet facing upstream (E)

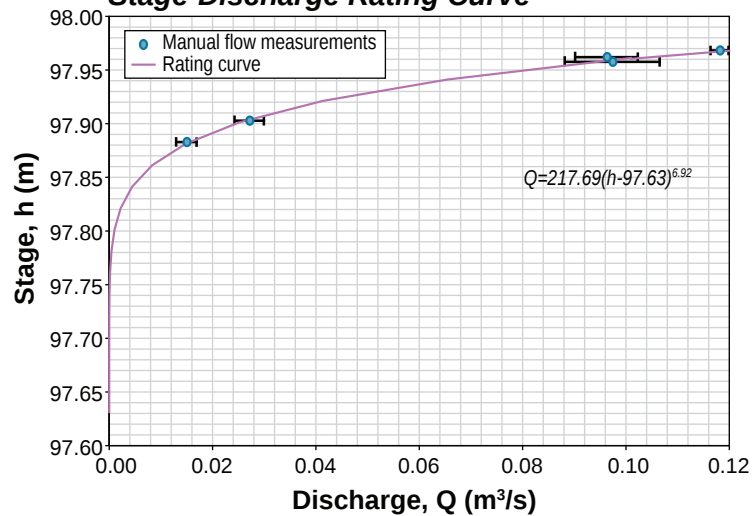


Note: Stage and elevations are referenced to arbitrary datum.



Lake outlet facing upstream (SE)

### Stage-Discharge Rating Curve



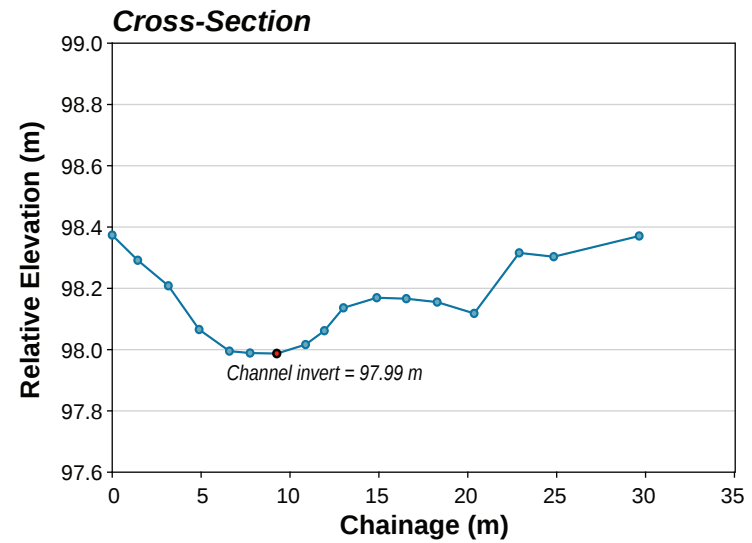
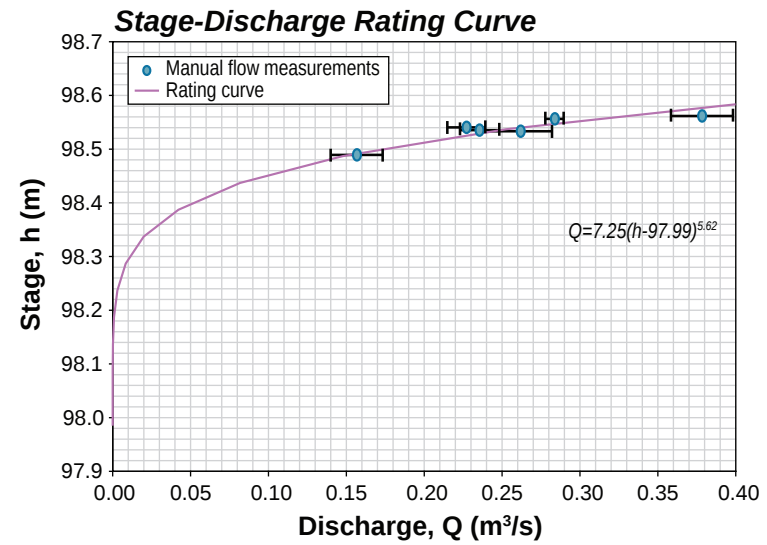
### Cross-Section

No cross-section available

Note: Stage and elevations are referenced to arbitrary datum.



Lake outlet facing upstream (S)



Note: Stage and elevations are referenced to arbitrary datum.

## **Appendix 3**

### Survey Control Points

**Summary of Survey Control Points used at the Hydrometric Stations**

| Station ID             | Survey Point        | Elevation (m) | Date      | Notes                                 |
|------------------------|---------------------|---------------|-----------|---------------------------------------|
| <i>Doris-Hydro</i>     | Benchmark 59        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 58        | 100.617       |           |                                       |
|                        | Pressure transducer | 98.054        | 20-Jun-09 |                                       |
| <i>Ogama-Hydro</i>     | Benchmark 41        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 42        | 100.100       |           |                                       |
|                        | Pressure transducer | 97.999        | 23-Jun-09 |                                       |
| <i>Patch-Hydro</i>     | Benchmark 53        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 52        | 99.567        |           |                                       |
|                        | Benchmark 54        | 99.309        |           |                                       |
|                        | Pressure transducer | 98.522        | 21-Jun-09 | Temporary install                     |
|                        | Pressure transducer | 98.297        | 21-Jun-09 | Final install after moving transducer |
| <i>PO-Hydro</i>        | Benchmark 40        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 39        | 100.313       |           |                                       |
|                        | Benchmark 38        | 99.818        |           |                                       |
|                        | Pressure transducer | 98.613        | 28-Jul-09 |                                       |
| <i>Roberts-Hydro</i>   | Benchmark 50        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 64        | 99.745        |           |                                       |
|                        | Benchmark 49        | 99.868        |           |                                       |
|                        | Pressure transducer | 98.012        | 22-Jun-09 | Temporary install                     |
|                        | Pressure transducer | 98.004        | 26-Jul-09 | Final install after moving transducer |
| <i>Tail-Hydro</i>      | Benchmark Golder    | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 43        | 99.300        |           |                                       |
|                        | Pressure transducer | 97.661        | 23-Jun-09 |                                       |
| <i>Wolverine-Hydro</i> | Benchmark 61        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 60        | 98.874        |           |                                       |
|                        | Pressure transducer | 97.788        | 21-Jun-09 |                                       |
| <i>Windy-Hydro</i>     | Benchmark 44        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 45        | 99.116        |           |                                       |
|                        | Pressure transducer | 98.125        | 24-Jun-09 | Temporary install                     |
|                        | Pressure transducer | 97.996        | 24-Jun-09 | Final install after moving transducer |
| <i>Glenn-Hydro</i>     | Benchmark 3         | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 2         | 99.032        |           |                                       |
|                        | Benchmark 1         | 98.670        |           |                                       |
|                        | Pressure transducer | 97.572        | 16-Jun-09 | Temporary install                     |
|                        | Pressure transducer | 97.124        | 22-Jun-09 | Final install after moving transducer |
| <i>Koignuk-Hydro</i>   | Benchmark 68        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 67        | 100.155       |           |                                       |
|                        | Benchmark 66        | 98.900        |           |                                       |
|                        | Pressure transducer | 97.415        | 16-Jun-09 | Temporary install                     |
|                        | Pressure transducer | 96.864        | 19-Jun-09 | Final install after moving transducer |
|                        | Pressure transducer | 96.309        | 27-Jul-09 | Transducer relocated to deeper water  |
| <i>Reference-Hydro</i> | Benchmark 56        | 100.000       |           | arbitrary elevation                   |
|                        | Benchmark 57        | 100.375       |           |                                       |
|                        | Benchmark 55        | 99.952        |           |                                       |
|                        | Pressure transducer | 98.731        | 22-Jun-09 | Temporary install                     |
|                        | Pressure transducer | 98.463        | 22-Jun-09 | Final install after moving transducer |

## **Appendix 4**

### Lake Water Levels

### Summary of Daily Mean Water Level (m) at Doris Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 5.993           | 1-Sep  | 5.620           | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 5.988           | 2-Sep  | 5.630           | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 5.972           | 3-Sep  | 5.632           | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 5.963           | 4-Sep  | 5.630           | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 5.966           | 5-Sep  | 5.620           | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 5.943           | 6-Sep  | 5.620           | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 5.934           | 7-Sep  | 5.620           | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 5.926           | 8-Sep  | 5.620           | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 5.916           | 9-Sep  | 5.620           | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 5.900           | 10-Sep | 5.630           | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 5.898           | 11-Sep | 5.640           | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 5.905           | 12-Sep | 5.640           | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 5.880           | 13-Sep | 5.640           | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 5.874           | 14-Sep | 5.650           | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 5.861           | 15-Sep | 5.645           | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 5.857           | 16-Sep | 5.650           | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 5.866           | 17-Sep | 5.650           | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 5.845           | 18-Sep | 5.650           | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 5.847           | 19-Sep | 5.660           | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 5.837           | 20-Sep | 5.660           | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 5.832           | 21-Sep | 5.660           | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 5.806           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 5.811           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 5.800           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 5.835           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 5.803           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May | 2.465           | 27-Jul | 5.801           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May | 1.610           | 28-Jul | 5.786           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May | 1.867           | 29-Jul | 5.774           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May | 4.588           | 30-Jul | 5.764           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May | 5.133           | 31-Jul | 5.759           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  | 5.498           | 1-Aug  | 5.764           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  | 5.486           | 2-Aug  | 5.749           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  | 5.539           | 3-Aug  | 5.748           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  | 5.582           | 4-Aug  | 5.741           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  | 5.555           | 5-Aug  | 5.735           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  | 5.506           | 6-Aug  | 5.730           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  | 5.452           | 7-Aug  | 5.729           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  | 5.389           | 8-Aug  | 5.728           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  | 5.517           | 9-Aug  | 5.727           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun | 5.517           | 10-Aug | 5.720           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun | 5.517           | 11-Aug | 5.717           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun | 5.517           | 12-Aug | 5.712           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun | 5.517           | 13-Aug | 5.710           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun | 5.517           | 14-Aug | 5.708           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun | 5.517           | 15-Aug | 5.706           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun | 5.517           | 16-Aug | 5.701           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun | 5.517           | 17-Aug | 5.701           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun | 5.517           | 18-Aug | 5.696           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 5.517           | 19-Aug | 5.693           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 5.517           | 20-Aug | 5.689           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 5.517           | 21-Aug | 5.685           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 5.517           | 22-Aug | 5.681           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 5.517           | 23-Aug | 5.678           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 5.517           | 24-Aug | 5.672           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 5.517           | 25-Aug | 5.667           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 6.008           | 26-Aug | 5.664           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 6.006           | 27-Aug | 5.658           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 6.003           | 28-Aug | 5.650           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 6.011           | 29-Aug | 5.650           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 6.006           | 30-Aug | 5.640           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 5.640           |        |                 |        |                 |

Note: Estimated values are italicized

### Summary of Daily Mean Water Level (m) at Wolverine Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 98.85           | 1-Sep  |                 | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 98.85           | 2-Sep  |                 | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 98.84           | 3-Sep  |                 | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 98.82           | 4-Sep  |                 | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 98.79           | 5-Sep  |                 | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 98.76           | 6-Sep  |                 | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 98.73           | 7-Sep  |                 | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 98.72           | 8-Sep  |                 | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 98.72           | 9-Sep  |                 | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 98.69           | 10-Sep |                 | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 98.69           | 11-Sep |                 | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 98.68           | 12-Sep |                 | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 98.68           | 13-Sep |                 | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 98.67           | 14-Sep |                 | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 98.67           | 15-Sep |                 | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 98.68           | 16-Sep |                 | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 98.68           | 17-Sep |                 | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 98.67           | 18-Sep |                 | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 98.67           | 19-Sep |                 | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 98.67           | 20-Sep |                 | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 98.67           | 21-Sep |                 | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 98.66           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 98.66           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 98.66           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 98.65           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 98.65           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul |                 | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul |                 | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul |                 | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul |                 | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul |                 | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  |                 | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  |                 | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  |                 | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  |                 | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  |                 | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  |                 | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  |                 | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  |                 | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  |                 | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug |                 | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug |                 | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug |                 | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug |                 | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug |                 | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug |                 | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun |                 | 16-Aug |                 | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun |                 | 17-Aug |                 | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun |                 | 18-Aug |                 | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun |                 | 19-Aug |                 | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 98.87           | 20-Aug |                 | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 98.87           | 21-Aug |                 | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 98.86           | 22-Aug |                 | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 98.86           | 23-Aug |                 | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 98.86           | 24-Aug |                 | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 98.86           | 25-Aug |                 | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 98.85           | 26-Aug |                 | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 98.86           | 27-Aug |                 | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 98.86           | 28-Aug |                 | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 98.85           | 29-Aug |                 | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 98.85           | 30-Aug |                 | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug |                 |        |                 |        |                 |

### Summary of Daily Mean Water Level (m) at Tail Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  | 4.972           | 1-Mar  | 4.980           | 1-May  | 4.989           | 1-Jul  | 5.078           | 1-Sep  | 4.980           | 1-Nov  |                 |
| 2-Jan  | 4.970           | 2-Mar  | 4.979           | 2-May  | 4.988           | 2-Jul  | 5.081           | 2-Sep  | 4.995           | 2-Nov  |                 |
| 3-Jan  | 4.972           | 3-Mar  | 4.978           | 3-May  | 4.989           | 3-Jul  | 5.071           | 3-Sep  | 4.997           | 3-Nov  |                 |
| 4-Jan  | 4.975           | 4-Mar  | 4.982           | 4-May  | 4.990           | 4-Jul  | 5.071           | 4-Sep  | 4.999           | 4-Nov  |                 |
| 5-Jan  | 4.975           | 5-Mar  | 4.984           | 5-May  | 4.990           | 5-Jul  | 5.065           | 5-Sep  | 4.999           | 5-Nov  |                 |
| 6-Jan  | 4.975           | 6-Mar  | 4.984           | 6-May  | 4.990           | 6-Jul  | 5.059           | 6-Sep  | 4.998           | 6-Nov  |                 |
| 7-Jan  | 4.974           | 7-Mar  | 4.984           | 7-May  | 4.989           | 7-Jul  | 5.054           | 7-Sep  | 5.000           | 7-Nov  |                 |
| 8-Jan  | 4.975           | 8-Mar  | 4.986           | 8-May  | 4.989           | 8-Jul  | 5.051           | 8-Sep  | 5.004           | 8-Nov  |                 |
| 9-Jan  | 4.976           | 9-Mar  | 4.984           | 9-May  | 4.989           | 9-Jul  | 5.049           | 9-Sep  | 5.011           | 9-Nov  |                 |
| 10-Jan | 4.974           | 10-Mar | 4.984           | 10-May | 4.988           | 10-Jul | 5.044           | 10-Sep | 5.013           | 10-Nov |                 |
| 11-Jan | 4.976           | 11-Mar | 4.984           | 11-May | 4.988           | 11-Jul | 5.045           | 11-Sep | 5.019           | 11-Nov |                 |
| 12-Jan | 4.976           | 12-Mar | 4.984           | 12-May | 4.989           | 12-Jul | 5.043           | 12-Sep | 5.023           | 12-Nov |                 |
| 13-Jan | 4.976           | 13-Mar | 4.984           | 13-May | 4.988           | 13-Jul | 5.040           | 13-Sep | 5.027           | 13-Nov |                 |
| 14-Jan | 4.976           | 14-Mar | 4.984           | 14-May | 4.987           | 14-Jul | 5.037           | 14-Sep | 5.032           | 14-Nov |                 |
| 15-Jan | 4.974           | 15-Mar | 4.984           | 15-May | 4.987           | 15-Jul | 5.033           | 15-Sep | 5.029           | 15-Nov |                 |
| 16-Jan | 4.974           | 16-Mar | 4.983           | 16-May | 4.987           | 16-Jul | 5.035           | 16-Sep | 5.033           | 16-Nov |                 |
| 17-Jan | 4.974           | 17-Mar | 4.983           | 17-May | 4.987           | 17-Jul | 5.036           | 17-Sep | 5.035           | 17-Nov |                 |
| 18-Jan | 4.971           | 18-Mar | 4.982           | 18-May | 4.986           | 18-Jul | 5.031           | 18-Sep | 5.040           | 18-Nov |                 |
| 19-Jan | 4.970           | 19-Mar | 4.982           | 19-May | 4.985           | 19-Jul | 5.025           | 19-Sep | 5.042           | 19-Nov |                 |
| 20-Jan | 4.974           | 20-Mar | 4.982           | 20-May | 4.985           | 20-Jul | 5.022           | 20-Sep | 5.042           | 20-Nov |                 |
| 21-Jan | 4.977           | 21-Mar | 4.981           | 21-May | 4.984           | 21-Jul | 5.020           | 21-Sep | 5.040           | 21-Nov |                 |
| 22-Jan | 4.978           | 22-Mar | 4.983           | 22-May | 4.983           | 22-Jul | 5.007           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan | 4.977           | 23-Mar | 4.983           | 23-May | 4.984           | 23-Jul | 5.008           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan | 4.977           | 24-Mar | 4.983           | 24-May | 4.985           | 24-Jul | 5.000           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan | 4.977           | 25-Mar | 4.983           | 25-May | 4.985           | 25-Jul | 5.017           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan | 4.976           | 26-Mar | 4.982           | 26-May | 4.984           | 26-Jul | 5.008           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan | 4.972           | 27-Mar | 4.981           | 27-May | 4.984           | 27-Jul | 5.006           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan | 4.970           | 28-Mar | 4.980           | 28-May | 4.983           | 28-Jul | 4.997           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan | 4.970           | 29-Mar | 4.982           | 29-May | 4.983           | 29-Jul | 4.992           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan | 4.970           | 30-Mar | 4.983           | 30-May | 4.983           | 30-Jul | 4.984           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan | 4.975           | 31-Mar | 4.984           | 31-May | 4.983           | 31-Jul | 4.983           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  | 4.977           | 1-Apr  | 4.985           | 1-Jun  | 4.983           | 1-Aug  | 4.991           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  | 4.976           | 2-Apr  | 4.984           | 2-Jun  | 4.984           | 2-Aug  | 4.992           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  | 4.976           | 3-Apr  | 4.985           | 3-Jun  | 4.985           | 3-Aug  | 4.986           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  | 4.973           | 4-Apr  | 4.985           | 4-Jun  | 4.986           | 4-Aug  | 4.980           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  | 4.972           | 5-Apr  | 4.985           | 5-Jun  | 4.986           | 5-Aug  | 4.976           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  | 4.972           | 6-Apr  | 4.983           | 6-Jun  | 4.988           | 6-Aug  | 4.978           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  | 4.971           | 7-Apr  | 4.984           | 7-Jun  | 4.993           | 7-Aug  | 4.995           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  | 4.970           | 8-Apr  | 4.985           | 8-Jun  | 5.008           | 8-Aug  | 5.026           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  | 4.970           | 9-Apr  | 4.985           | 9-Jun  | 5.031           | 9-Aug  | 5.027           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb | 4.972           | 10-Apr | 4.983           | 10-Jun | 5.049           | 10-Aug | 5.023           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb | 4.976           | 11-Apr | 4.983           | 11-Jun | 5.053           | 11-Aug | 5.022           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb | 4.976           | 12-Apr | 4.984           | 12-Jun | 5.052           | 12-Aug | 5.020           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb | 4.978           | 13-Apr | 4.986           | 13-Jun | 5.050           | 13-Aug | 5.019           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb | 4.977           | 14-Apr | 4.983           | 14-Jun | 5.053           | 14-Aug | 5.020           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb | 4.976           | 15-Apr | 4.985           | 15-Jun | 5.057           | 15-Aug | 5.019           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb | 4.977           | 16-Apr | 4.987           | 16-Jun | 5.062           | 16-Aug | 5.019           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb | 4.978           | 17-Apr | 4.988           | 17-Jun | 5.065           | 17-Aug | 5.028           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb | 4.978           | 18-Apr | 4.990           | 18-Jun | 5.069           | 18-Aug | 5.026           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb | 4.979           | 19-Apr | 4.990           | 19-Jun | 5.076           | 19-Aug | 5.025           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb | 4.980           | 20-Apr | 4.991           | 20-Jun | 5.082           | 20-Aug | 5.023           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb | 4.981           | 21-Apr | 4.992           | 21-Jun | 5.084           | 21-Aug | 5.019           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb | 4.981           | 22-Apr | 4.991           | 22-Jun | 5.083           | 22-Aug | 5.018           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb | 4.981           | 23-Apr | 4.991           | 23-Jun | 5.079           | 23-Aug | 5.016           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb | 4.981           | 24-Apr | 4.992           | 24-Jun | 5.075           | 24-Aug | 5.013           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb | 4.981           | 25-Apr | 4.990           | 25-Jun | 5.079           | 25-Aug | 5.011           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb | 4.980           | 26-Apr | 4.990           | 26-Jun | 5.078           | 26-Aug | 5.008           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb | 4.980           | 27-Apr | 4.991           | 27-Jun | 5.076           | 27-Aug | 5.005           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb | 4.980           | 28-Apr | 4.989           | 28-Jun | 5.078           | 28-Aug | 5.001           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr | 4.989           | 29-Jun | 5.080           | 29-Aug | 5.000           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr | 4.989           | 30-Jun | 5.081           | 30-Aug | 5.000           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 4.999           |        |                 |        |                 |

Note: Estimated values are italicized

### Summary of Daily Mean Water Level (m) at Roberts Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 99.29           | 1-Sep  | <i>98.91</i>    | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 99.29           | 2-Sep  | <i>98.91</i>    | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 99.28           | 3-Sep  | <i>98.91</i>    | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 99.27           | 4-Sep  | <i>98.88</i>    | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 99.26           | 5-Sep  | <i>98.88</i>    | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 99.24           | 6-Sep  | <i>98.88</i>    | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 99.23           | 7-Sep  | <i>98.88</i>    | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 99.22           | 8-Sep  | <i>98.88</i>    | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 99.21           | 9-Sep  | <i>98.91</i>    | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 99.20           | 10-Sep | <i>98.92</i>    | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 99.19           | 11-Sep | <i>98.92</i>    | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 99.19           | 12-Sep | <i>98.94</i>    | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 99.18           | 13-Sep | <i>98.96</i>    | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 99.18           | 14-Sep | <i>98.95</i>    | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 99.17           | 15-Sep | <i>98.96</i>    | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 99.16           | 16-Sep | <i>98.98</i>    | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 99.16           | 17-Sep | <i>98.98</i>    | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 99.16           | 18-Sep | <i>98.98</i>    | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 99.16           | 19-Sep | <i>98.98</i>    | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 99.15           | 20-Sep | <i>98.99</i>    | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 99.15           | 21-Sep |                 | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 99.15           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 99.14           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 99.14           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 99.14           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 99.14           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul | 99.13           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul | 99.13           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul | 99.12           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul | <i>99.12</i>    | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul | <i>99.12</i>    | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  | <i>99.12</i>    | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  | <i>99.12</i>    | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  | <i>99.11</i>    | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  | <i>99.11</i>    | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  | <i>99.10</i>    | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  | <i>99.10</i>    | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  | <i>99.10</i>    | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  | <i>99.10</i>    | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  | <i>99.09</i>    | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug | <i>99.09</i>    | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug | <i>99.09</i>    | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug | <i>99.08</i>    | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug | <i>99.08</i>    | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug | <i>99.08</i>    | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug | <i>99.07</i>    | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun |                 | 16-Aug | <i>99.07</i>    | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun | 99.26           | 17-Aug | <i>99.06</i>    | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun | 99.27           | 18-Aug | <i>99.06</i>    | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 99.27           | 19-Aug | <i>99.05</i>    | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 99.29           | 20-Aug | <i>99.04</i>    | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 99.30           | 21-Aug | <i>99.04</i>    | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 99.31           | 22-Aug | <i>99.03</i>    | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 99.31           | 23-Aug | <i>99.02</i>    | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 99.31           | 24-Aug | <i>99.01</i>    | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 99.31           | 25-Aug | <i>99.00</i>    | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 99.31           | 26-Aug | <i>98.99</i>    | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 99.30           | 27-Aug | <i>98.97</i>    | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 99.30           | 28-Aug | <i>98.97</i>    | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 99.30           | 29-Aug | <i>98.96</i>    | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 99.30           | 30-Aug | <i>98.94</i>    | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | <i>98.88</i>    |        |                 |        |                 |

Note: Estimated values are italicized

### Summary of Daily Mean Water Level (m) at Windy Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 98.57           | 1-Sep  | 98.49           | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 98.57           | 2-Sep  | 98.49           | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 98.57           | 3-Sep  | 98.49           | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 98.56           | 4-Sep  | 98.49           | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 98.56           | 5-Sep  | 98.49           | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 98.56           | 6-Sep  | 98.49           | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 98.56           | 7-Sep  | 98.49           | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 98.55           | 8-Sep  | 98.49           | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 98.55           | 9-Sep  | 98.49           | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 98.55           | 10-Sep | 98.49           | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 98.55           | 11-Sep | 98.49           | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 98.55           | 12-Sep | 98.49           | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 98.55           | 13-Sep | 98.49           | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 98.54           | 14-Sep | 98.49           | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 98.54           | 15-Sep | 98.49           | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 98.55           | 16-Sep | 98.49           | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 98.55           | 17-Sep | 98.50           | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 98.55           | 18-Sep | 98.49           | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 98.54           | 19-Sep | 98.49           | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 98.54           | 20-Sep | 98.49           | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 98.54           | 21-Sep | 98.49           | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 98.54           | 22-Sep | 98.49           | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 98.54           | 23-Sep | 98.48           | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 98.54           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 98.54           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 98.53           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul | 98.53           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul | 98.53           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul | 98.53           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul | 98.52           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul | 98.53           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  | 98.53           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  | 98.53           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  | 98.53           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  | 98.53           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  | 98.53           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  | 98.53           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  | 98.53           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  | 98.53           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  | 98.53           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug | 98.52           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug | 98.52           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug | 98.52           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug | 98.52           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug | 98.52           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug | 98.52           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun | 98.54           | 16-Aug | 98.52           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun | 98.54           | 17-Aug | 98.52           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun | 98.55           | 18-Aug | 98.51           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 98.55           | 19-Aug | 98.51           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 98.56           | 20-Aug | 98.51           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 98.56           | 21-Aug | 98.51           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 98.56           | 22-Aug | 98.50           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 98.56           | 23-Aug | 98.50           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 98.56           | 24-Aug | 98.50           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 98.56           | 25-Aug | 98.50           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 98.56           | 26-Aug | 98.50           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 98.56           | 27-Aug | 98.50           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 98.56           | 28-Aug | 98.50           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 98.57           | 29-Aug | 98.50           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 98.57           | 30-Aug | 98.50           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 98.49           |        |                 |        |                 |

### Summary of Daily Mean Water Level (m) at Reference-A Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 99.44           | 1-Sep  | 99.32           | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 99.44           | 2-Sep  | 99.32           | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 99.44           | 3-Sep  | 99.32           | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 99.44           | 4-Sep  | 99.32           | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 99.44           | 5-Sep  | 99.32           | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 99.43           | 6-Sep  | 99.32           | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 99.43           | 7-Sep  | 99.32           | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 99.42           | 8-Sep  | 99.32           | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 99.42           | 9-Sep  | 99.33           | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 99.42           | 10-Sep | 99.33           | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 99.42           | 11-Sep | 99.33           | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 99.41           | 12-Sep | 99.33           | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 99.41           | 13-Sep | 99.34           | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 99.41           | 14-Sep | 99.34           | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 99.40           | 15-Sep | 99.34           | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 99.40           | 16-Sep | 99.34           | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 99.40           | 17-Sep | 99.34           | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 99.40           | 18-Sep | 99.34           | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 99.39           | 19-Sep | 99.34           | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 99.39           | 20-Sep | 99.34           | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 99.39           | 21-Sep | 99.34           | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 99.39           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 99.39           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 99.39           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 99.39           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 99.38           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul | 99.38           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul | 99.37           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul | 99.37           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul | 99.36           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul | 99.37           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  | 99.37           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  | 99.37           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  | 99.37           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  | 99.37           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  | 99.37           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  | 99.37           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  | 99.37           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  | 99.37           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  | 99.36           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug | 99.36           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug | 99.36           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug | 99.35           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug | 99.35           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug | 99.35           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug | 99.35           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun |                 | 16-Aug | 99.35           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun |                 | 17-Aug | 99.35           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun |                 | 18-Aug | 99.34           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 99.33           | 19-Aug | 99.34           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 99.36           | 20-Aug | 99.34           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 99.38           | 21-Aug | 99.34           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 99.39           | 22-Aug | 99.33           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 99.40           | 23-Aug | 99.33           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 99.41           | 24-Aug | 99.33           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 99.42           | 25-Aug | 99.33           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 99.42           | 26-Aug | 99.32           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 99.42           | 27-Aug | 99.32           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 99.43           | 28-Aug | 99.32           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 99.44           | 29-Aug | 99.32           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 99.44           | 30-Aug | 99.32           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 99.31           |        |                 |        |                 |

### Summary of Daily Mean Water Level (m) at PO Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 99.53           | 1-Sep  | 99.41           | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 99.52           | 2-Sep  | 99.42           | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 99.52           | 3-Sep  | 99.42           | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 99.51           | 4-Sep  | 99.41           | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 99.50           | 5-Sep  | 99.41           | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 99.50           | 6-Sep  | 99.41           | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 99.49           | 7-Sep  | 99.40           | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 99.48           | 8-Sep  | 99.41           | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 99.47           | 9-Sep  | 99.42           | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 99.46           | 10-Sep | 99.42           | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 99.46           | 11-Sep | 99.43           | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 99.46           | 12-Sep | 99.44           | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 99.45           | 13-Sep | 99.44           | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 99.44           | 14-Sep | 99.44           | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 99.43           | 15-Sep | 99.44           | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 99.43           | 16-Sep | 99.44           | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 99.44           | 17-Sep | 99.44           | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 99.44           | 18-Sep | 99.44           | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 99.43           | 19-Sep | 99.44           | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 99.43           | 20-Sep | 99.45           | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 99.42           | 21-Sep | 99.44           | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 99.42           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 99.41           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 99.53           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 99.52           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 99.52           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul | 99.51           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul | 99.50           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul | 99.50           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul | 99.49           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul | 99.48           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  | 99.47           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  | 99.46           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  | 99.46           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  | 99.46           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  | 99.45           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  | 99.44           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  | 99.43           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  | 99.43           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  | 99.44           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug | 99.44           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug | 99.43           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug | 99.43           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug | 99.42           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug | 99.42           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug | 99.41           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun |                 | 16-Aug | 99.43           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun |                 | 17-Aug | 99.43           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun | 99.57           | 18-Aug | 99.43           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 99.58           | 19-Aug | 99.43           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 99.58           | 20-Aug | 99.42           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 99.58           | 21-Aug | 99.42           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 99.57           | 22-Aug | 99.42           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 99.56           | 23-Aug | 99.41           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 99.55           | 24-Aug | 99.40           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 99.55           | 25-Aug | 99.40           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 99.55           | 26-Aug | 99.39           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 99.54           | 27-Aug | 99.39           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 99.54           | 28-Aug | 99.39           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 99.54           | 29-Aug | 99.38           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 99.54           | 30-Aug | 99.38           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 99.38           |        |                 |        |                 |

### Summary of Daily Mean Water Level (m) at Patch Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 99.14           | 1-Sep  | 99.01           | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 99.14           | 2-Sep  | 99.00           | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 99.13           | 3-Sep  | 99.00           | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 99.13           | 4-Sep  | 99.00           | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 99.13           | 5-Sep  | 98.99           | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 99.13           | 6-Sep  | 98.99           | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 99.12           | 7-Sep  | 98.99           | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 99.12           | 8-Sep  | 98.99           | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 99.12           | 9-Sep  | 99.00           | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 99.11           | 10-Sep | 98.99           | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 99.12           | 11-Sep | 99.00           | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 99.11           | 12-Sep | 99.00           | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 99.11           | 13-Sep | 99.00           | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 99.10           | 14-Sep | 99.01           | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 99.10           | 15-Sep | 99.00           | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 99.10           | 16-Sep | 99.00           | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 99.11           | 17-Sep | 99.00           | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 99.10           | 18-Sep | 99.01           | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 99.10           | 19-Sep | 99.00           | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 99.10           | 20-Sep | 99.00           | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 99.09           | 21-Sep | 99.00           | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 99.09           | 22-Sep | 99.00           | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 99.09           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 99.09           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 99.09           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 99.08           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul | 99.08           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul | 99.07           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul | 99.06           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul | 99.06           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul | 99.06           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  | 99.09           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  | 99.09           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  | 99.08           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  | 99.08           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  | 99.07           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  | 99.06           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  | 99.06           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  | 99.06           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  | 99.06           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug | 99.05           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug | 99.05           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug | 99.05           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug | 99.05           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug | 99.04           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug | 99.04           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun |                 | 16-Aug | 99.04           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun |                 | 17-Aug | 99.04           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun |                 | 18-Aug | 99.04           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 99.09           | 19-Aug | 99.04           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 99.10           | 20-Aug | 99.03           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 99.10           | 21-Aug | 99.03           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 99.11           | 22-Aug | 99.02           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 99.11           | 23-Aug | 99.02           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 99.11           | 24-Aug | 99.02           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 99.12           | 25-Aug | 99.02           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 99.12           | 26-Aug | 99.01           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 99.12           | 27-Aug | 99.01           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 99.13           | 28-Aug | 99.01           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 99.13           | 29-Aug | 99.01           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 99.14           | 30-Aug | 99.01           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 99.02           |        |                 |        |                 |

### Summary of Daily Mean Water Level (m) at Glenn Lake

| Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) | Date   | Water Level (m) |
|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
| 1-Jan  |                 | 1-Mar  |                 | 1-May  |                 | 1-Jul  | 98.65           | 1-Sep  | 98.51           | 1-Nov  |                 |
| 2-Jan  |                 | 2-Mar  |                 | 2-May  |                 | 2-Jul  | 98.64           | 2-Sep  | 98.51           | 2-Nov  |                 |
| 3-Jan  |                 | 3-Mar  |                 | 3-May  |                 | 3-Jul  | 98.64           | 3-Sep  | 98.51           | 3-Nov  |                 |
| 4-Jan  |                 | 4-Mar  |                 | 4-May  |                 | 4-Jul  | 98.63           | 4-Sep  | 98.51           | 4-Nov  |                 |
| 5-Jan  |                 | 5-Mar  |                 | 5-May  |                 | 5-Jul  | 98.62           | 5-Sep  | 98.51           | 5-Nov  |                 |
| 6-Jan  |                 | 6-Mar  |                 | 6-May  |                 | 6-Jul  | 98.62           | 6-Sep  | 98.51           | 6-Nov  |                 |
| 7-Jan  |                 | 7-Mar  |                 | 7-May  |                 | 7-Jul  | 98.61           | 7-Sep  | 98.50           | 7-Nov  |                 |
| 8-Jan  |                 | 8-Mar  |                 | 8-May  |                 | 8-Jul  | 98.60           | 8-Sep  | 98.51           | 8-Nov  |                 |
| 9-Jan  |                 | 9-Mar  |                 | 9-May  |                 | 9-Jul  | 98.60           | 9-Sep  | 98.51           | 9-Nov  |                 |
| 10-Jan |                 | 10-Mar |                 | 10-May |                 | 10-Jul | 98.59           | 10-Sep | 98.51           | 10-Nov |                 |
| 11-Jan |                 | 11-Mar |                 | 11-May |                 | 11-Jul | 98.59           | 11-Sep | 98.52           | 11-Nov |                 |
| 12-Jan |                 | 12-Mar |                 | 12-May |                 | 12-Jul | 98.59           | 12-Sep | 98.52           | 12-Nov |                 |
| 13-Jan |                 | 13-Mar |                 | 13-May |                 | 13-Jul | 98.59           | 13-Sep | 98.53           | 13-Nov |                 |
| 14-Jan |                 | 14-Mar |                 | 14-May |                 | 14-Jul | 98.58           | 14-Sep | 98.53           | 14-Nov |                 |
| 15-Jan |                 | 15-Mar |                 | 15-May |                 | 15-Jul | 98.58           | 15-Sep | 98.53           | 15-Nov |                 |
| 16-Jan |                 | 16-Mar |                 | 16-May |                 | 16-Jul | 98.58           | 16-Sep | 98.53           | 16-Nov |                 |
| 17-Jan |                 | 17-Mar |                 | 17-May |                 | 17-Jul | 98.58           | 17-Sep | 98.53           | 17-Nov |                 |
| 18-Jan |                 | 18-Mar |                 | 18-May |                 | 18-Jul | 98.58           | 18-Sep | 98.54           | 18-Nov |                 |
| 19-Jan |                 | 19-Mar |                 | 19-May |                 | 19-Jul | 98.58           | 19-Sep | 98.50           | 19-Nov |                 |
| 20-Jan |                 | 20-Mar |                 | 20-May |                 | 20-Jul | 98.57           | 20-Sep |                 | 20-Nov |                 |
| 21-Jan |                 | 21-Mar |                 | 21-May |                 | 21-Jul | 98.57           | 21-Sep |                 | 21-Nov |                 |
| 22-Jan |                 | 22-Mar |                 | 22-May |                 | 22-Jul | 98.56           | 22-Sep |                 | 22-Nov |                 |
| 23-Jan |                 | 23-Mar |                 | 23-May |                 | 23-Jul | 98.56           | 23-Sep |                 | 23-Nov |                 |
| 24-Jan |                 | 24-Mar |                 | 24-May |                 | 24-Jul | 98.56           | 24-Sep |                 | 24-Nov |                 |
| 25-Jan |                 | 25-Mar |                 | 25-May |                 | 25-Jul | 98.56           | 25-Sep |                 | 25-Nov |                 |
| 26-Jan |                 | 26-Mar |                 | 26-May |                 | 26-Jul | 98.56           | 26-Sep |                 | 26-Nov |                 |
| 27-Jan |                 | 27-Mar |                 | 27-May |                 | 27-Jul | 98.55           | 27-Sep |                 | 27-Nov |                 |
| 28-Jan |                 | 28-Mar |                 | 28-May |                 | 28-Jul | 98.55           | 28-Sep |                 | 28-Nov |                 |
| 29-Jan |                 | 29-Mar |                 | 29-May |                 | 29-Jul | 98.54           | 29-Sep |                 | 29-Nov |                 |
| 30-Jan |                 | 30-Mar |                 | 30-May |                 | 30-Jul | 98.54           | 30-Sep |                 | 30-Nov |                 |
| 31-Jan |                 | 31-Mar |                 | 31-May |                 | 31-Jul | 98.54           | 1-Oct  |                 | 1-Dec  |                 |
| 1-Feb  |                 | 1-Apr  |                 | 1-Jun  |                 | 1-Aug  | 98.54           | 2-Oct  |                 | 2-Dec  |                 |
| 2-Feb  |                 | 2-Apr  |                 | 2-Jun  |                 | 2-Aug  | 98.54           | 3-Oct  |                 | 3-Dec  |                 |
| 3-Feb  |                 | 3-Apr  |                 | 3-Jun  |                 | 3-Aug  | 98.54           | 4-Oct  |                 | 4-Dec  |                 |
| 4-Feb  |                 | 4-Apr  |                 | 4-Jun  |                 | 4-Aug  | 98.54           | 5-Oct  |                 | 5-Dec  |                 |
| 5-Feb  |                 | 5-Apr  |                 | 5-Jun  |                 | 5-Aug  | 98.54           | 6-Oct  |                 | 6-Dec  |                 |
| 6-Feb  |                 | 6-Apr  |                 | 6-Jun  |                 | 6-Aug  | 98.54           | 7-Oct  |                 | 7-Dec  |                 |
| 7-Feb  |                 | 7-Apr  |                 | 7-Jun  |                 | 7-Aug  | 98.54           | 8-Oct  |                 | 8-Dec  |                 |
| 8-Feb  |                 | 8-Apr  |                 | 8-Jun  |                 | 8-Aug  | 98.54           | 9-Oct  |                 | 9-Dec  |                 |
| 9-Feb  |                 | 9-Apr  |                 | 9-Jun  |                 | 9-Aug  | 98.55           | 10-Oct |                 | 10-Dec |                 |
| 10-Feb |                 | 10-Apr |                 | 10-Jun |                 | 10-Aug | 98.54           | 11-Oct |                 | 11-Dec |                 |
| 11-Feb |                 | 11-Apr |                 | 11-Jun |                 | 11-Aug | 98.54           | 12-Oct |                 | 12-Dec |                 |
| 12-Feb |                 | 12-Apr |                 | 12-Jun |                 | 12-Aug | 98.54           | 13-Oct |                 | 13-Dec |                 |
| 13-Feb |                 | 13-Apr |                 | 13-Jun |                 | 13-Aug | 98.54           | 14-Oct |                 | 14-Dec |                 |
| 14-Feb |                 | 14-Apr |                 | 14-Jun |                 | 14-Aug | 98.54           | 15-Oct |                 | 15-Dec |                 |
| 15-Feb |                 | 15-Apr |                 | 15-Jun |                 | 15-Aug | 98.54           | 16-Oct |                 | 16-Dec |                 |
| 16-Feb |                 | 16-Apr |                 | 16-Jun |                 | 16-Aug | 98.53           | 17-Oct |                 | 17-Dec |                 |
| 17-Feb |                 | 17-Apr |                 | 17-Jun | 98.69           | 17-Aug | 98.54           | 18-Oct |                 | 18-Dec |                 |
| 18-Feb |                 | 18-Apr |                 | 18-Jun | 98.71           | 18-Aug | 98.54           | 19-Oct |                 | 19-Dec |                 |
| 19-Feb |                 | 19-Apr |                 | 19-Jun | 98.72           | 19-Aug | 98.54           | 20-Oct |                 | 20-Dec |                 |
| 20-Feb |                 | 20-Apr |                 | 20-Jun | 98.71           | 20-Aug | 98.54           | 21-Oct |                 | 21-Dec |                 |
| 21-Feb |                 | 21-Apr |                 | 21-Jun | 98.71           | 21-Aug | 98.53           | 22-Oct |                 | 22-Dec |                 |
| 22-Feb |                 | 22-Apr |                 | 22-Jun | 98.70           | 22-Aug | 98.53           | 23-Oct |                 | 23-Dec |                 |
| 23-Feb |                 | 23-Apr |                 | 23-Jun | 98.68           | 23-Aug | 98.53           | 24-Oct |                 | 24-Dec |                 |
| 24-Feb |                 | 24-Apr |                 | 24-Jun | 98.67           | 24-Aug | 98.53           | 25-Oct |                 | 25-Dec |                 |
| 25-Feb |                 | 25-Apr |                 | 25-Jun | 98.67           | 25-Aug | 98.52           | 26-Oct |                 | 26-Dec |                 |
| 26-Feb |                 | 26-Apr |                 | 26-Jun | 98.66           | 26-Aug | 98.52           | 27-Oct |                 | 27-Dec |                 |
| 27-Feb |                 | 27-Apr |                 | 27-Jun | 98.66           | 27-Aug | 98.52           | 28-Oct |                 | 28-Dec |                 |
| 28-Feb |                 | 28-Apr |                 | 28-Jun | 98.65           | 28-Aug | 98.51           | 29-Oct |                 | 29-Dec |                 |
|        |                 | 29-Apr |                 | 29-Jun | 98.65           | 29-Aug | 98.51           | 30-Oct |                 | 30-Dec |                 |
|        |                 | 30-Apr |                 | 30-Jun | 98.65           | 30-Aug | 98.51           | 31-Oct |                 | 31-Dec |                 |
|        |                 |        |                 |        |                 | 31-Aug | 98.51           |        |                 |        |                 |

## **Appendix 5**

### Hydrographs

### Summary of Daily Mean Flow (m<sup>3</sup>/s) at Doris-Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 2.23                        | 1-Sep  | 0.432                       |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 2.18                        | 2-Sep  | 0.451                       |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 2.11                        | 3-Sep  | 0.450                       |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 2.02                        | 4-Sep  | 0.448                       |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 1.93                        | 5-Sep  | 0.430                       |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 1.83                        | 6-Sep  | 0.431                       |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 1.73                        | 7-Sep  | 0.431                       |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 1.65                        | 8-Sep  | 0.428                       |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 1.57                        | 9-Sep  | 0.430                       |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 1.49                        | 10-Sep | 0.445                       |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 1.45                        | 11-Sep | 0.457                       |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 1.38                        | 12-Sep | 0.458                       |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 1.32                        | 13-Sep | 0.470                       |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 1.26                        | 14-Sep | 0.481                       |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 1.20                        | 15-Sep | 0.48                        |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 1.18                        | 16-Sep | 0.49                        |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 1.19                        | 17-Sep | 0.50                        |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 1.12                        | 18-Sep | 0.499                       |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 1.07                        | 19-Sep | 0.505                       |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 1.03                        | 20-Sep | 0.503                       |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.98                        | 21-Sep | 0.503                       |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.94                        | 22-Sep | 0.503                       |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.90                        | 23-Sep | 0.503                       |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.86                        | 24-Sep | 0.503                       |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.85                        | 25-Sep | 0.503                       |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.84                        | 26-Sep | 0.489                       |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.81                        | 27-Sep | 0.475                       |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.79                        | 28-Sep | 0.461                       |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.76                        | 29-Sep | 0.45                        |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.74                        | 30-Sep | 0.43                        |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.72                        | 1-Oct  | 0.42                        |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0                           | 1-Aug  | 0.71                        | 2-Oct  | 0.41                        |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0                           | 2-Aug  | 0.710                       | 3-Oct  | 0.39                        |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0                           | 3-Aug  | 0.71                        | 4-Oct  | 0.38                        |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0                           | 4-Aug  | 0.69                        | 5-Oct  | 0.36                        |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0                           | 5-Aug  | 0.68                        | 6-Oct  | 0.34                        |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0                           | 6-Aug  | 0.67                        | 7-Oct  | 0.336                       |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0                           | 7-Aug  | 0.67                        | 8-Oct  | 0.322                       |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0                           | 8-Aug  | 0.67                        | 9-Oct  | 0.308                       |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0                           | 9-Aug  | 0.66                        | 10-Oct | 0.294                       |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0                           | 10-Aug | 0.65                        | 11-Oct | 0.280                       |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0.002                       | 11-Aug | 0.640                       | 12-Oct | 0.266                       |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0.015                       | 12-Aug | 0.63                        | 13-Oct | 0.252                       |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0.03                        | 13-Aug | 0.62                        | 14-Oct | 0.238                       |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.059                       | 14-Aug | 0.62                        | 15-Oct | 0.224                       |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.117                       | 15-Aug | 0.62                        | 16-Oct | 0.210                       |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0.231                       | 16-Aug | 0.604                       | 17-Oct | 0.196                       |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 0.455                       | 17-Aug | 0.604                       | 18-Oct | 0.182                       |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 1.77                        | 18-Aug | 0.592                       | 19-Oct | 0.167                       |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 1.71                        | 19-Aug | 0.586                       | 20-Oct | 0.154                       |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 1.87                        | 20-Aug | 0.577                       | 21-Oct | 0.139                       |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 2.04                        | 21-Aug | 0.567                       | 22-Oct | 0.126                       |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 2.17                        | 22-Aug | 0.559                       | 23-Oct | 0.111                       |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 2.22                        | 23-Aug | 0.55                        | 24-Oct | 0.090                       |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 2.24                        | 24-Aug | 0.54                        | 25-Oct | 0.084                       |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 2.28                        | 25-Aug | 0.53                        | 26-Oct | 0.069                       |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 2.29                        | 26-Aug | 0.52                        | 27-Oct | 0.056                       |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 2.26                        | 27-Aug | 0.50                        | 28-Oct | 0.042                       |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 2.26                        | 28-Aug | 0.49                        | 29-Oct | 0.028                       |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 2.28                        | 29-Aug | 0.49                        | 30-Oct | 0.014                       |
|        |                             | 30-Apr |                             | 30-Jun | 2.26                        | 30-Aug | 0.48                        | 31-Oct | 0.000                       |
|        |                             |        |                             |        |                             | 31-Aug | 0.468                       |        |                             |

Note: Estimated values are italicized

### Summary of Daily Mean Flow (m<sup>3</sup>/s) at Glenn-Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 0.73                        | 1-Sep  | 0.223                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 0.71                        | 2-Sep  | 0.241                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 0.68                        | 3-Sep  | 0.246                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 0.65                        | 4-Sep  | 0.247                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 0.62                        | 5-Sep  | 0.236                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 0.59                        | 6-Sep  | 0.238                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 0.56                        | 7-Sep  | 0.236                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 0.54                        | 8-Sep  | 0.235                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.52                        | 9-Sep  | 0.244                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.50                        | 10-Sep | 0.251                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.50                        | 11-Sep | 0.255                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.49                        | 12-Sep | 0.265                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.48                        | 13-Sep | 0.28                        | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.46                        | 14-Sep | 0.293                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.44                        | 15-Sep | 0.294                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.45                        | 16-Sep | 0.299                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.46                        | 17-Sep | 0.305                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.45                        | 18-Sep | 0.309                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.43                        | 19-Sep | 0.314                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.42                        | 20-Sep | 0.317                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.41                        | 21-Sep | 0.317                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.39                        | 22-Sep | 0.318                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.38                        | 23-Sep | 0.302                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.37                        | 24-Sep | 0.294                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.38                        | 25-Sep | 0.286                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.38                        | 26-Sep | 0.278                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.36                        | 27-Sep | 0.27                        | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.35                        | 28-Sep | 0.262                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.33                        | 29-Sep | 0.254                       | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.32                        | 30-Sep | 0.246                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.31                        | 1-Oct  | 0.239                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0.00                        | 1-Aug  | 0.32                        | 2-Oct  | 0.231                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0.00                        | 2-Aug  | 0.33                        | 3-Oct  | 0.223                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0.00                        | 3-Aug  | 0.34                        | 4-Oct  | 0.215                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0.00                        | 4-Aug  | 0.33                        | 5-Oct  | 0.207                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0.00                        | 5-Aug  | 0.33                        | 6-Oct  | 0.199                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0.00                        | 6-Aug  | 0.32                        | 7-Oct  | 0.192                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0.00                        | 7-Aug  | 0.33                        | 8-Oct  | 0.184                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0.00                        | 8-Aug  | 0.34                        | 9-Oct  | 0.176                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0.00                        | 9-Aug  | 0.34                        | 10-Oct | 0.17                        | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0.00                        | 10-Aug | 0.33                        | 11-Oct | 0.16                        | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0.01                        | 11-Aug | 0.33                        | 12-Oct | 0.152                       | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0.02                        | 12-Aug | 0.33                        | 13-Oct | 0.144                       | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0.03                        | 13-Aug | 0.32                        | 14-Oct | 0.136                       | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.08                        | 14-Aug | 0.32                        | 15-Oct | 0.128                       | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.18                        | 15-Aug | 0.32                        | 16-Oct | 0.121                       | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0.90                        | 16-Aug | 0.31                        | 17-Oct | 0.113                       | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 0.97                        | 17-Aug | 0.32                        | 18-Oct | 0.105                       | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 1.09                        | 18-Aug | 0.32                        | 19-Oct | 0.096                       | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 1.12                        | 19-Aug | 0.32                        | 20-Oct | 0.089                       | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 1.11                        | 20-Aug | 0.31                        | 21-Oct | 0.081                       | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 1.06                        | 21-Aug | 0.31                        | 22-Oct | 0.073                       | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 0.99                        | 22-Aug | 0.30                        | 23-Oct | 0.07                        | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 0.92                        | 23-Aug | 0.30                        | 24-Oct | 0.057                       | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 0.85                        | 24-Aug | 0.29                        | 25-Oct | 0.049                       | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 0.83                        | 25-Aug | 0.28                        | 26-Oct | 0.042                       | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 0.81                        | 26-Aug | 0.27                        | 27-Oct | 0.034                       | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 0.77                        | 27-Aug | 0.27                        | 28-Oct | 0.026                       | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 0.76                        | 28-Aug | 0.26                        | 29-Oct | 0.018                       | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 0.76                        | 29-Aug | 0.26                        | 30-Oct | 0.009                       | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 0.75                        | 30-Aug | 0.25                        | 31-Oct | 0.002                       | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.25                        |        |                             |        |                             |

Note: Estimated values are italicized

### Summary of Daily Mean Flow (m<sup>3</sup>/s) at TGN-H1

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 121.0                       | 1-Sep  | 18.60                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 116.0                       | 2-Sep  | 17.82                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 110.0                       | 3-Sep  | 16.50                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 104.0                       | 4-Sep  | 18.40                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 96.9                        | 5-Sep  | 18.60                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 89.6                        | 6-Sep  | 18.20                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 84.0                        | 7-Sep  | 16.70                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 78.5                        | 8-Sep  | 17.20                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 71.00                       | 9-Sep  | 17.20                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 65.50                       | 10-Sep | 16.80                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 62.10                       | 11-Sep | 16.20                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 56.40                       | 12-Sep | 16.80                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 51.40                       | 13-Sep | 17.80                       | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 49.50                       | 14-Sep | 17.10                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 46.80                       | 15-Sep | 17.80                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 43.90                       | 16-Sep | 17.90                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 40.90                       | 17-Sep | 17.20                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 39.80                       | 18-Sep | 17.60                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 38.20                       | 19-Sep | 18.30                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 36.90                       | 20-Sep | 17.80                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 35.50                       | 21-Sep | 17.60                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 34.00                       | 22-Sep | 17.70                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 32.90                       | 23-Sep | 18.00                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 31.90                       | 24-Sep | 17.90                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 30.50                       | 25-Sep | 17.90                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 29.60                       | 26-Sep | 17.90                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 28.10                       | 27-Sep | 17.30                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 26.90                       | 28-Sep | 16.90                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 24.80                       | 29-Sep | 16.4                        | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 23.20                       | 30-Sep | 15.80                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 23.00                       | 1-Oct  | 15.30                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0.0                         | 1-Aug  | 22.90                       | 2-Oct  | 14.80                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0.0                         | 2-Aug  | 21.60                       | 3-Oct  | 14.30                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0.0                         | 3-Aug  | 21.90                       | 4-Oct  | 13.80                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0.0                         | 4-Aug  | 21.60                       | 5-Oct  | 13.30                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0.0                         | 5-Aug  | 20.80                       | 6-Oct  | 12.80                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0.0                         | 6-Aug  | 20.30                       | 7-Oct  | 12.20                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0.0                         | 7-Aug  | 20.00                       | 8-Oct  | 11.80                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0.0                         | 8-Aug  | 20.70                       | 9-Oct  | 11.30                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0.0                         | 9-Aug  | 20.60                       | 10-Oct | 10.70                       | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0.0                         | 10-Aug | 21.00                       | 11-Oct | 10.20                       | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0.0                         | 11-Aug | 20.70                       | 12-Oct | 9.71                        | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0.0                         | 12-Aug | 19.60                       | 13-Oct | 9.20                        | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0.0                         | 13-Aug | 20.00                       | 14-Oct | 8.69                        | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.1                         | 14-Aug | 19.00                       | 15-Oct | 8.18                        | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.4                         | 15-Aug | 18.80                       | 16-Oct | 7.67                        | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 1.1                         | 16-Aug | 18.70                       | 17-Oct | 7.16                        | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 3.2                         | 17-Aug | 18.20                       | 18-Oct | 6.65                        | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 9.3                         | 18-Aug | 18.00                       | 19-Oct | 6.14                        | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 80.3                        | 19-Aug | 18.00                       | 20-Oct | 5.62                        | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 102.0                       | 20-Aug | 18.20                       | 21-Oct | 5.11                        | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 102.0                       | 21-Aug | 19.20                       | 22-Oct | 4.60                        | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 96.4                        | 22-Aug | 19.20                       | 23-Oct | 4.09                        | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 109.5                       | 23-Aug | 19.30                       | 24-Oct | 3.58                        | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 126.4                       | 24-Aug | 19.30                       | 25-Oct | 3.07                        | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 132.3                       | 25-Aug | 19.10                       | 26-Oct | 2.56                        | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 132.2                       | 26-Aug | 18.30                       | 27-Oct | 2.05                        | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 130.1                       | 27-Aug | 17.80                       | 28-Oct | 1.53                        | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 129.9                       | 28-Aug | 17.60                       | 29-Oct | 1.02                        | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 128.2                       | 29-Aug | 17.20                       | 30-Oct | 0.51                        | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 125.3                       | 30-Aug | 16.80                       | 31-Oct | 0.00                        | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 16.70                       |        |                             |        |                             |

Note: Estimated values are italicized

### Summary of Daily Mean Flow (m<sup>3</sup>/s) at Ogama - Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 1.44                        | 1-Sep  | 0.25                        | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 1.4                         | 2-Sep  | 0.28                        | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 1.31                        | 3-Sep  | 0.29                        | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 1.24                        | 4-Sep  | 0.30                        | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 1.18                        | 5-Sep  | 0.28                        | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 1.12                        | 6-Sep  | 0.29                        | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 1.06                        | 7-Sep  | 0.30                        | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 1.01                        | 8-Sep  | 0.30                        | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.97                        | 9-Sep  | 0.30                        | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.92                        | 10-Sep | 0.31                        | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.89                        | 11-Sep | 0.33                        | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.86                        | 12-Sep | 0.33                        | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.83                        | 13-Sep | 0.33                        | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.81                        | 14-Sep | 0.34                        | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.77                        | 15-Sep | 0.34                        | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.74                        | 16-Sep | 0.35                        | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.73                        | 17-Sep | 0.35                        | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.71                        | 18-Sep | 0.36                        | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.69                        | 19-Sep | 0.36                        | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.66                        | 20-Sep | 0.36                        | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.64                        | 21-Sep | 0.36                        | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.63                        | 22-Sep | 0.36                        | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.61                        | 23-Sep | 0.358                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.59                        | 24-Sep | 0.358                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.57                        | 25-Sep | 0.358                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.54                        | 26-Sep | 0.348                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.52                        | 27-Sep | 0.338                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.49                        | 28-Sep | 0.33                        | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.46                        | 29-Sep | 0.32                        | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.45                        | 30-Sep | 0.31                        | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.43                        | 1-Oct  | 0.30                        | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0.00                        | 1-Aug  | 0.43                        | 2-Oct  | 0.29                        | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0.00                        | 2-Aug  | 0.44                        | 3-Oct  | 0.28                        | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0.00                        | 3-Aug  | 0.44                        | 4-Oct  | 0.27                        | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0.00                        | 4-Aug  | 0.43                        | 5-Oct  | 0.25                        | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0.00                        | 5-Aug  | 0.43                        | 6-Oct  | 0.25                        | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0.00                        | 6-Aug  | 0.43                        | 7-Oct  | 0.24                        | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0.00                        | 7-Aug  | 0.42                        | 8-Oct  | 0.23                        | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0.00                        | 8-Aug  | 0.43                        | 9-Oct  | 0.22                        | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0.01                        | 9-Aug  | 0.44                        | 10-Oct | 0.21                        | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0.05                        | 10-Aug | 0.44                        | 11-Oct | 0.20                        | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0.90                        | 11-Aug | 0.44                        | 12-Oct | 0.19                        | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 1.08                        | 12-Aug | 0.44                        | 13-Oct | 0.18                        | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 1.30                        | 13-Aug | 0.43                        | 14-Oct | 0.17                        | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 1.88                        | 14-Aug | 0.43                        | 15-Oct | 0.16                        | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 1.90                        | 15-Aug | 0.43                        | 16-Oct | 0.15                        | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 1.92                        | 16-Aug | 0.42                        | 17-Oct | 0.14                        | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 1.94                        | 17-Aug | 0.41                        | 18-Oct | 0.13                        | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 1.99                        | 18-Aug | 0.40                        | 19-Oct | 0.12                        | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 2.01                        | 19-Aug | 0.39                        | 20-Oct | 0.11                        | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 2.02                        | 20-Aug | 0.38                        | 21-Oct | 0.100                       | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 2.00                        | 21-Aug | 0.37                        | 22-Oct | 0.09                        | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 1.94                        | 22-Aug | 0.37                        | 23-Oct | 0.08                        | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 1.87                        | 23-Aug | 0.36                        | 24-Oct | 0.070                       | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 1.76                        | 24-Aug | 0.35                        | 25-Oct | 0.060                       | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 1.73                        | 25-Aug | 0.34                        | 26-Oct | 0.05                        | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 1.65                        | 26-Aug | 0.33                        | 27-Oct | 0.040                       | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 1.59                        | 27-Aug | 0.32                        | 28-Oct | 0.030                       | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 1.56                        | 28-Aug | 0.31                        | 29-Oct | 0.020                       | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 1.54                        | 29-Aug | 0.30                        | 30-Oct | 0.010                       | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 1.49                        | 30-Aug | 0.30                        | 31-Oct | 0.000                       | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.28                        |        |                             |        |                             |

Note: Estimated values are italicized

### Summary of Daily Mean Flow (m<sup>3</sup>/s) at Patch - Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 0.51                        | 1-Sep  | 0.224                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 0.5                         | 2-Sep  | 0.201                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 0.51                        | 3-Sep  | 0.190                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 0.51                        | 4-Sep  | 0.189                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 0.50                        | 5-Sep  | 0.194                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 0.49                        | 6-Sep  | 0.183                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 0.48                        | 7-Sep  | 0.175                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 0.47                        | 8-Sep  | 0.175                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.46                        | 9-Sep  | 0.183                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.45                        | 10-Sep | 0.183                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.45                        | 11-Sep | 0.175                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.44                        | 12-Sep | 0.185                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.43                        | 13-Sep | 0.189                       | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.41                        | 14-Sep | 0.192                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.40                        | 15-Sep | 0.200                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.41                        | 16-Sep | 0.196                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.43                        | 17-Sep | 0.193                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.41                        | 18-Sep | 0.198                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.40                        | 19-Sep | 0.200                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.40                        | 20-Sep | 0.199                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.39                        | 21-Sep | 0.198                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.39                        | 22-Sep | 0.196                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.38                        | 23-Sep | 0.191                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.37                        | 24-Sep | 0.187                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.39                        | 25-Sep | 0.187                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.39                        | 26-Sep | 0.187                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.365                       | 27-Sep | 0.182                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.350                       | 28-Sep | 0.177                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.333                       | 29-Sep | 0.171                       | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.321                       | 30-Sep | 0.166                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.306                       | 1-Oct  | 0.161                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0                           | 1-Aug  | 0.315                       | 2-Oct  | 0.155                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0                           | 2-Aug  | 0.321                       | 3-Oct  | 0.150                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0                           | 3-Aug  | 0.324                       | 4-Oct  | 0.145                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0                           | 4-Aug  | 0.318                       | 5-Oct  | 0.139                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0                           | 5-Aug  | 0.309                       | 6-Oct  | 0.134                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0                           | 6-Aug  | 0.302                       | 7-Oct  | 0.128                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0                           | 7-Aug  | 0.317                       | 8-Oct  | 0.123                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0                           | 8-Aug  | 0.316                       | 9-Oct  | 0.118                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0                           | 9-Aug  | 0.313                       | 10-Oct | 0.112                       | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0                           | 10-Aug | 0.307                       | 11-Oct | 0.107                       | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0                           | 11-Aug | 0.296                       | 12-Oct | 0.102                       | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0                           | 12-Aug | 0.289                       | 13-Oct | 0.096                       | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0                           | 13-Aug | 0.285                       | 14-Oct | 0.091                       | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0                           | 14-Aug | 0.279                       | 15-Oct | 0.086                       | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0                           | 15-Aug | 0.276                       | 16-Oct | 0.080                       | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0                           | 16-Aug | 0.273                       | 17-Oct | 0.075                       | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 0.02                        | 17-Aug | 0.274                       | 18-Oct | 0.070                       | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 0.28                        | 18-Aug | 0.269                       | 19-Oct | 0.064                       | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 0.381                       | 19-Aug | 0.263                       | 20-Oct | 0.059                       | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 0.407                       | 20-Aug | 0.260                       | 21-Oct | 0.054                       | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 0.422                       | 21-Aug | 0.252                       | 22-Oct | 0.048                       | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 0.425                       | 22-Aug | 0.243                       | 23-Oct | 0.043                       | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 0.429                       | 23-Aug | 0.235                       | 24-Oct | 0.037                       | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 0.434                       | 24-Aug | 0.229                       | 25-Oct | 0.032                       | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 0.457                       | 25-Aug | 0.225                       | 26-Oct | 0.027                       | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 0.466                       | 26-Aug | 0.218                       | 27-Oct | 0.021                       | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 0.477                       | 27-Aug | 0.211                       | 28-Oct | 0.016                       | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 0.493                       | 28-Aug | 0.209                       | 29-Oct | 0.011                       | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 0.506                       | 29-Aug | 0.205                       | 30-Oct | 0.005                       | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 0.511                       | 30-Aug | 0.201                       | 31-Oct | 0.000                       | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.212                       |        |                             |        |                             |

Note: Estimated values are italicized

### Summary of Daily Mean Stage (m) at PO - Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 1.35                        | 1-Sep  | 0.362                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 1.3                         | 2-Sep  | 0.469                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 1.21                        | 3-Sep  | 0.515                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 1.14                        | 4-Sep  | 0.525                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 1.09                        | 5-Sep  | 0.504                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 1.02                        | 6-Sep  | 0.501                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 0.95                        | 7-Sep  | 0.479                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 0.89                        | 8-Sep  | 0.457                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.85                        | 9-Sep  | 0.472                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.79                        | 10-Sep | 0.529                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.77                        | 11-Sep | 0.552                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.73                        | 12-Sep | 0.563                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.71                        | 13-Sep | 0.614                       | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.66                        | 14-Sep | 0.655                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.60                        | 15-Sep | 0.650                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.60                        | 16-Sep | 0.653                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.66                        | 17-Sep | 0.654                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.63                        | 18-Sep | 0.654                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.60                        | 19-Sep | 0.659                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.57                        | 20-Sep | 0.654                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.55                        | 21-Sep | 0.668                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.52                        | 22-Sep | 0.648                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.49                        | 23-Sep | 0.624                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.46                        | 24-Sep | 0.624                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.47                        | 25-Sep | 0.624                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.47                        | 26-Sep | 0.607                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.446                       | 27-Sep | 0.590                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.415                       | 28-Sep | 0.572                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.386                       | 29-Sep | 0.555                       | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.373                       | 30-Sep | 0.538                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.355                       | 1-Oct  | 0.520                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0.00                        | 1-Aug  | 0.372                       | 2-Oct  | 0.503                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0.00                        | 2-Aug  | 0.412                       | 3-Oct  | 0.486                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0.00                        | 3-Aug  | 0.460                       | 4-Oct  | 0.468                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0.00                        | 4-Aug  | 0.477                       | 5-Oct  | 0.451                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0.00                        | 5-Aug  | 0.472                       | 6-Oct  | 0.434                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0.00                        | 6-Aug  | 0.463                       | 7-Oct  | 0.416                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0.00                        | 7-Aug  | 0.515                       | 8-Oct  | 0.399                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0.00                        | 8-Aug  | 0.619                       | 9-Oct  | 0.381                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0.01                        | 9-Aug  | 0.713                       | 10-Oct | 0.364                       | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0.06                        | 10-Aug | 0.725                       | 11-Oct | 0.347                       | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 2.01                        | 11-Aug | 0.708                       | 12-Oct | 0.329                       | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 1.93                        | 12-Aug | 0.672                       | 13-Oct | 0.312                       | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 1.86                        | 13-Aug | 0.652                       | 14-Oct | 0.295                       | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 1.80                        | 14-Aug | 0.623                       | 15-Oct | 0.277                       | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 1.67                        | 15-Aug | 0.599                       | 16-Oct | 0.260                       | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 1.70                        | 16-Aug | 0.570                       | 17-Oct | 0.243                       | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 1.76                        | 17-Aug | 0.577                       | 18-Oct | 0.225                       | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 1.79                        | 18-Aug | 0.579                       | 19-Oct | 0.208                       | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 1.88                        | 19-Aug | 0.576                       | 20-Oct | 0.191                       | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 1.93                        | 20-Aug | 0.569                       | 21-Oct | 0.173                       | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 1.89                        | 21-Aug | 0.551                       | 22-Oct | 0.156                       | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 1.82                        | 22-Aug | 0.535                       | 23-Oct | 0.139                       | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 1.70                        | 23-Aug | 0.514                       | 24-Oct | 0.121                       | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 1.57                        | 24-Aug | 0.482                       | 25-Oct | 0.104                       | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 1.52                        | 25-Aug | 0.459                       | 26-Oct | 0.087                       | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 1.53                        | 26-Aug | 0.439                       | 27-Oct | 0.069                       | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 1.48                        | 27-Aug | 0.413                       | 28-Oct | 0.052                       | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 1.47                        | 28-Aug | 0.394                       | 29-Oct | 0.035                       | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 1.46                        | 29-Aug | 0.385                       | 30-Oct | 0.017                       | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 1.41                        | 30-Aug | 0.370                       | 31-Oct | 0.000                       | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.369                       |        |                             |        |                             |

**Note:** As of the most recent visit to the site Oct 2008 the station was still active  
The station could not be accessed after Oct 2008 due to avalanche hazard

### Summary of Daily Mean Stage (m) at Roberts A-Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 2.22                        | 1-Sep  | 0.519                       |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 2.1                         | 2-Sep  | 0.538                       |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 2.01                        | 3-Sep  | 0.537                       |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 1.88                        | 4-Sep  | 0.535                       |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 1.76                        | 5-Sep  | 0.518                       |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 1.63                        | 6-Sep  | 0.518                       |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 1.51                        | 7-Sep  | 0.518                       |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 1.41                        | 8-Sep  | 0.515                       |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 1.32                        | 9-Sep  | 0.517                       |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 1.24                        | 10-Sep | 0.533                       |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 1.19                        | 11-Sep | 0.545                       |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 1.15                        | 12-Sep | 0.546                       |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 1.09                        | 13-Sep | 0.557                       |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 1.05                        | 14-Sep | 0.567                       |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 1.00                        | 15-Sep | 0.564                       |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.96                        | 16-Sep | 0.572                       |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.95                        | 17-Sep | 0.581                       |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.94                        | 18-Sep | 0.584                       |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.91                        | 19-Sep | 0.588                       |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.88                        | 20-Sep | 0.587                       |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.86                        | 21-Sep | 0.587                       |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.84                        | 22-Sep | 0.587                       |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.82                        | 23-Sep | 0.572                       |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.81                        | 24-Sep | 0.557                       |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.82                        | 25-Sep | 0.542                       |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.80                        | 26-Sep | 0.526                       |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.788                       | 27-Sep | 0.512                       |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.765                       | 28-Sep | 0.497                       |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.736                       | 29-Sep | 0.482                       |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.737                       | 30-Sep | 0.467                       |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.726                       | 1-Oct  | 0.452                       |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0                           | 1-Aug  | 0.723                       | 2-Oct  | 0.437                       |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0                           | 2-Aug  | 0.724                       | 3-Oct  | 0.421                       |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0                           | 3-Aug  | 0.722                       | 4-Oct  | 0.406                       |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0                           | 4-Aug  | 0.714                       | 5-Oct  | 0.391                       |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0                           | 5-Aug  | 0.707                       | 6-Oct  | 0.376                       |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0.001                       | 6-Aug  | 0.702                       | 7-Oct  | 0.361                       |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0.003                       | 7-Aug  | 0.700                       | 8-Oct  | 0.346                       |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0.005                       | 8-Aug  | 0.699                       | 9-Oct  | 0.331                       |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0.009                       | 9-Aug  | 0.697                       | 10-Oct | 0.316                       |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0.016                       | 10-Aug | 0.689                       | 11-Oct | 0.301                       |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0.028                       | 11-Aug | 0.685                       | 12-Oct | 0.286                       |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0.0492                      | 12-Aug | 0.678                       | 13-Oct | 0.271                       |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0.086                       | 13-Aug | 0.675                       | 14-Oct | 0.256                       |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.152                       | 14-Aug | 0.672                       | 15-Oct | 0.241                       |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.267                       | 15-Aug | 0.670                       | 16-Oct | 0.226                       |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0.469                       | 16-Aug | 0.663                       | 17-Oct | 0.211                       |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 1.44                        | 17-Aug | 0.663                       | 18-Oct | 0.195                       |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 1.93                        | 18-Aug | 0.654                       | 19-Oct | 0.181                       |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 1.88                        | 19-Aug | 0.651                       | 20-Oct | 0.166                       |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 2.16                        | 20-Aug | 0.644                       | 21-Oct | 0.151                       |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 2.36                        | 21-Aug | 0.640                       | 22-Oct | 0.135                       |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 2.48                        | 22-Aug | 0.631                       | 23-Oct | 0.120                       |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 2.49                        | 23-Aug | 0.626                       | 24-Oct | 0.105                       |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 2.43                        | 24-Aug | 0.616                       | 25-Oct | 0.090                       |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 2.44                        | 25-Aug | 0.607                       | 26-Oct | 0.075                       |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 2.42                        | 26-Aug | 0.601                       | 27-Oct | 0.060                       |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 2.36                        | 27-Aug | 0.591                       | 28-Oct | 0.045                       |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 2.36                        | 28-Aug | 0.581                       | 29-Oct | 0.030                       |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 2.36                        | 29-Aug | 0.577                       | 30-Oct | 0.015                       |
|        |                             | 30-Apr |                             | 30-Jun | 2.29                        | 30-Aug | 0.567                       | 31-Oct | 0.000                       |
|        |                             |        |                             |        |                             | 31-Aug | 0.556                       |        |                             |

### Summary of Daily Mean Stage (m) at Reference A-Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 0.60                        | 1-Sep  | 0.065                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 0.6                         | 2-Sep  | 0.083                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 0.60                        | 3-Sep  | 0.084                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 0.58                        | 4-Sep  | 0.089                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 0.56                        | 5-Sep  | 0.077                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 0.54                        | 6-Sep  | 0.082                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 0.52                        | 7-Sep  | 0.080                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 0.49                        | 8-Sep  | 0.079                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.48                        | 9-Sep  | 0.086                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.45                        | 10-Sep | 0.095                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.45                        | 11-Sep | 0.108                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.44                        | 12-Sep | 0.105                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.42                        | 13-Sep | 0.115                       | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.39                        | 14-Sep | 0.130                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.37                        | 15-Sep | 0.125                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.37                        | 16-Sep | 0.129                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.38                        | 17-Sep | 0.140                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.36                        | 18-Sep | 0.144                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.34                        | 19-Sep | 0.145                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.32                        | 20-Sep | 0.144                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.32                        | 21-Sep | 0.148                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.31                        | 22-Sep | 0.144                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.30                        | 23-Sep | 0.142                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.30                        | 24-Sep | 0.142                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.31                        | 25-Sep | 0.142                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.31                        | 26-Sep | 0.138                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.285                       | 27-Sep | 0.134                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.262                       | 28-Sep | 0.130                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.241                       | 29-Sep | 0.126                       | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.233                       | 30-Sep | 0.122                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.214                       | 1-Oct  | 0.118                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0                           | 1-Aug  | 0.229                       | 2-Oct  | 0.114                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0                           | 2-Aug  | 0.242                       | 3-Oct  | 0.110                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0                           | 3-Aug  | 0.246                       | 4-Oct  | 0.106                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0                           | 4-Aug  | 0.238                       | 5-Oct  | 0.102                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0                           | 5-Aug  | 0.228                       | 6-Oct  | 0.098                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0                           | 6-Aug  | 0.223                       | 7-Oct  | 0.095                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0                           | 7-Aug  | 0.223                       | 8-Oct  | 0.091                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0                           | 8-Aug  | 0.224                       | 9-Oct  | 0.087                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0                           | 9-Aug  | 0.220                       | 10-Oct | 0.083                       | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0                           | 10-Aug | 0.204                       | 11-Oct | 0.079                       | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0                           | 11-Aug | 0.192                       | 12-Oct | 0.075                       | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0                           | 12-Aug | 0.182                       | 13-Oct | 0.071                       | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0                           | 13-Aug | 0.175                       | 14-Oct | 0.067                       | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.01                        | 14-Aug | 0.170                       | 15-Oct | 0.063                       | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.009                       | 15-Aug | 0.172                       | 16-Oct | 0.059                       | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0.014                       | 16-Aug | 0.160                       | 17-Oct | 0.055                       | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 0.023                       | 17-Aug | 0.163                       | 18-Oct | 0.051                       | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 0.0602                      | 18-Aug | 0.155                       | 19-Oct | 0.047                       | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 0.115                       | 19-Aug | 0.146                       | 20-Oct | 0.043                       | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 0.199                       | 20-Aug | 0.139                       | 21-Oct | 0.039                       | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 0.28                        | 21-Aug | 0.128                       | 22-Oct | 0.035                       | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 0.334                       | 22-Aug | 0.122                       | 23-Oct | 0.032                       | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 0.371                       | 23-Aug | 0.119                       | 24-Oct | 0.028                       | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 0.406                       | 24-Aug | 0.106                       | 25-Oct | 0.024                       | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 0.469                       | 25-Aug | 0.098                       | 26-Oct | 0.020                       | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 0.49                        | 26-Aug | 0.095                       | 27-Oct | 0.016                       | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 0.496                       | 27-Aug | 0.088                       | 28-Oct | 0.012                       | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 0.523                       | 28-Aug | 0.081                       | 29-Oct | 0.008                       | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 0.56                        | 29-Aug | 0.081                       | 30-Oct | 0.004                       | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 0.593                       | 30-Aug | 0.077                       | 31-Oct | 0.000                       | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.080                       |        |                             |        |                             |

### Summary of Daily Mean Stage (m) at Tail - Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 0.11                        | 1-Sep  | 0.009                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 0.1                         | 2-Sep  | 0.014                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 0.10                        | 3-Sep  | 0.015                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 0.09                        | 4-Sep  | 0.015                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 0.08                        | 5-Sep  | 0.015                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 0.08                        | 6-Sep  | 0.015                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 0.07                        | 7-Sep  | 0.016                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 0.06                        | 8-Sep  | 0.018                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.06                        | 9-Sep  | 0.021                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.05                        | 10-Sep | 0.022                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.05                        | 11-Sep | 0.026                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.05                        | 12-Sep | 0.029                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.05                        | 13-Sep | 0.033                       | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.04                        | 14-Sep | 0.037                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.04                        | 15-Sep | 0.034                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.04                        | 16-Sep | 0.037                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.04                        | 17-Sep | 0.040                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.03                        | 18-Sep | 0.044                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.03                        | 19-Sep | 0.047                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.03                        | 20-Sep | 0.047                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.03                        | 21-Sep | 0.046                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.03                        | 22-Sep | 0.046                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.03                        | 23-Sep | 0.047                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.03                        | 24-Sep | 0.045                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.03                        | 25-Sep | 0.043                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.03                        | 26-Sep | 0.041                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.023                       | 27-Sep | 0.039                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.021                       | 28-Sep | 0.037                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.018                       | 29-Sep | 0.034                       | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.017                       | 30-Sep | 0.032                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.015                       | 1-Oct  | 0.030                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0                           | 1-Aug  | 0.022                       | 2-Oct  | 0.028                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0                           | 2-Aug  | 0.028                       | 3-Oct  | 0.026                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0                           | 3-Aug  | 0.029                       | 4-Oct  | 0.024                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0                           | 4-Aug  | 0.029                       | 5-Oct  | 0.022                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0                           | 5-Aug  | 0.027                       | 6-Oct  | 0.019                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0                           | 6-Aug  | 0.027                       | 7-Oct  | 0.017                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0                           | 7-Aug  | 0.029                       | 8-Oct  | 0.015                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0                           | 8-Aug  | 0.032                       | 9-Oct  | 0.013                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0                           | 9-Aug  | 0.032                       | 10-Oct | 0.011                       | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0                           | 10-Aug | 0.029                       | 11-Oct | 0.009                       | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0                           | 11-Aug | 0.028                       | 12-Oct | 0.006                       | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0                           | 12-Aug | 0.027                       | 13-Oct | 0.004                       | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0.001                       | 13-Aug | 0.027                       | 14-Oct | 0.002                       | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.002                       | 14-Aug | 0.027                       | 15-Oct | 0.000                       | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.003                       | 15-Aug | 0.026                       | 16-Oct |                             | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0.008                       | 16-Aug | 0.027                       | 17-Oct |                             | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 0.018                       | 17-Aug | 0.034                       | 18-Oct |                             | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 0.08                        | 18-Aug | 0.032                       | 19-Oct |                             | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 0.102                       | 19-Aug | 0.031                       | 20-Oct |                             | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 0.113                       | 20-Aug | 0.029                       | 21-Oct |                             | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 0.118                       | 21-Aug | 0.026                       | 22-Oct |                             | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 0.113                       | 22-Aug | 0.026                       | 23-Oct |                             | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 0.104                       | 23-Aug | 0.024                       | 24-Oct |                             | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 0.094                       | 24-Aug | 0.022                       | 25-Oct |                             | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 0.1                         | 25-Aug | 0.021                       | 26-Oct |                             | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 0.1                         | 26-Aug | 0.020                       | 27-Oct |                             | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 0.09                        | 27-Aug | 0.018                       | 28-Oct |                             | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 0.104                       | 28-Aug | 0.016                       | 29-Oct |                             | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 0.115                       | 29-Aug | 0.016                       | 30-Oct |                             | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 0.114                       | 30-Aug | 0.016                       | 31-Oct |                             | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.015                       |        |                             |        |                             |

### Summary of Daily Mean Stage (m) at Windy - Hydro

| Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) | Date   | Flow<br>(m <sup>3</sup> /s) |
|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|--------|-----------------------------|
| 1-Jan  |                             | 1-Mar  |                             | 1-May  |                             | 1-Jul  | 0.34                        | 1-Sep  | 0.152                       | 1-Nov  |                             |
| 2-Jan  |                             | 2-Mar  |                             | 2-May  |                             | 2-Jul  | 0.3                         | 2-Sep  | 0.161                       | 2-Nov  |                             |
| 3-Jan  |                             | 3-Mar  |                             | 3-May  |                             | 3-Jul  | 0.33                        | 3-Sep  | 0.159                       | 3-Nov  |                             |
| 4-Jan  |                             | 4-Mar  |                             | 4-May  |                             | 4-Jul  | 0.33                        | 4-Sep  | 0.158                       | 4-Nov  |                             |
| 5-Jan  |                             | 5-Mar  |                             | 5-May  |                             | 5-Jul  | 0.32                        | 5-Sep  | 0.151                       | 5-Nov  |                             |
| 6-Jan  |                             | 6-Mar  |                             | 6-May  |                             | 6-Jul  | 0.31                        | 6-Sep  | 0.146                       | 6-Nov  |                             |
| 7-Jan  |                             | 7-Mar  |                             | 7-May  |                             | 7-Jul  | 0.30                        | 7-Sep  | 0.146                       | 7-Nov  |                             |
| 8-Jan  |                             | 8-Mar  |                             | 8-May  |                             | 8-Jul  | 0.30                        | 8-Sep  | 0.145                       | 8-Nov  |                             |
| 9-Jan  |                             | 9-Mar  |                             | 9-May  |                             | 9-Jul  | 0.29                        | 9-Sep  | 0.153                       | 9-Nov  |                             |
| 10-Jan |                             | 10-Mar |                             | 10-May |                             | 10-Jul | 0.28                        | 10-Sep | 0.149                       | 10-Nov |                             |
| 11-Jan |                             | 11-Mar |                             | 11-May |                             | 11-Jul | 0.29                        | 11-Sep | 0.167                       | 11-Nov |                             |
| 12-Jan |                             | 12-Mar |                             | 12-May |                             | 12-Jul | 0.29                        | 12-Sep | 0.154                       | 12-Nov |                             |
| 13-Jan |                             | 13-Mar |                             | 13-May |                             | 13-Jul | 0.28                        | 13-Sep | 0.155                       | 13-Nov |                             |
| 14-Jan |                             | 14-Mar |                             | 14-May |                             | 14-Jul | 0.27                        | 14-Sep | 0.155                       | 14-Nov |                             |
| 15-Jan |                             | 15-Mar |                             | 15-May |                             | 15-Jul | 0.26                        | 15-Sep | 0.156                       | 15-Nov |                             |
| 16-Jan |                             | 16-Mar |                             | 16-May |                             | 16-Jul | 0.28                        | 16-Sep | 0.155                       | 16-Nov |                             |
| 17-Jan |                             | 17-Mar |                             | 17-May |                             | 17-Jul | 0.29                        | 17-Sep | 0.158                       | 17-Nov |                             |
| 18-Jan |                             | 18-Mar |                             | 18-May |                             | 18-Jul | 0.28                        | 18-Sep | 0.163                       | 18-Nov |                             |
| 19-Jan |                             | 19-Mar |                             | 19-May |                             | 19-Jul | 0.27                        | 19-Sep | 0.158                       | 19-Nov |                             |
| 20-Jan |                             | 20-Mar |                             | 20-May |                             | 20-Jul | 0.27                        | 20-Sep | 0.155                       | 20-Nov |                             |
| 21-Jan |                             | 21-Mar |                             | 21-May |                             | 21-Jul | 0.26                        | 21-Sep | 0.153                       | 21-Nov |                             |
| 22-Jan |                             | 22-Mar |                             | 22-May |                             | 22-Jul | 0.26                        | 22-Sep | 0.150                       | 22-Nov |                             |
| 23-Jan |                             | 23-Mar |                             | 23-May |                             | 23-Jul | 0.25                        | 23-Sep | 0.146                       | 23-Nov |                             |
| 24-Jan |                             | 24-Mar |                             | 24-May |                             | 24-Jul | 0.25                        | 24-Sep | 0.146                       | 24-Nov |                             |
| 25-Jan |                             | 25-Mar |                             | 25-May |                             | 25-Jul | 0.26                        | 25-Sep | 0.142                       | 25-Nov |                             |
| 26-Jan |                             | 26-Mar |                             | 26-May |                             | 26-Jul | 0.25                        | 26-Sep | 0.138                       | 26-Nov |                             |
| 27-Jan |                             | 27-Mar |                             | 27-May |                             | 27-Jul | 0.244                       | 27-Sep | 0.134                       | 27-Nov |                             |
| 28-Jan |                             | 28-Mar |                             | 28-May |                             | 28-Jul | 0.239                       | 28-Sep | 0.131                       | 28-Nov |                             |
| 29-Jan |                             | 29-Mar |                             | 29-May |                             | 29-Jul | 0.230                       | 29-Sep | 0.127                       | 29-Nov |                             |
| 30-Jan |                             | 30-Mar |                             | 30-May |                             | 30-Jul | 0.225                       | 30-Sep | 0.123                       | 30-Nov |                             |
| 31-Jan |                             | 31-Mar |                             | 31-May |                             | 31-Jul | 0.218                       | 1-Oct  | 0.119                       | 1-Dec  |                             |
| 1-Feb  |                             | 1-Apr  |                             | 1-Jun  | 0                           | 1-Aug  | 0.230                       | 2-Oct  | 0.115                       | 2-Dec  |                             |
| 2-Feb  |                             | 2-Apr  |                             | 2-Jun  | 0                           | 2-Aug  | 0.237                       | 3-Oct  | 0.111                       | 3-Dec  |                             |
| 3-Feb  |                             | 3-Apr  |                             | 3-Jun  | 0                           | 3-Aug  | 0.239                       | 4-Oct  | 0.107                       | 4-Dec  |                             |
| 4-Feb  |                             | 4-Apr  |                             | 4-Jun  | 0                           | 4-Aug  | 0.233                       | 5-Oct  | 0.103                       | 5-Dec  |                             |
| 5-Feb  |                             | 5-Apr  |                             | 5-Jun  | 0                           | 5-Aug  | 0.229                       | 6-Oct  | 0.099                       | 6-Dec  |                             |
| 6-Feb  |                             | 6-Apr  |                             | 6-Jun  | 0                           | 6-Aug  | 0.227                       | 7-Oct  | 0.095                       | 7-Dec  |                             |
| 7-Feb  |                             | 7-Apr  |                             | 7-Jun  | 0                           | 7-Aug  | 0.236                       | 8-Oct  | 0.091                       | 8-Dec  |                             |
| 8-Feb  |                             | 8-Apr  |                             | 8-Jun  | 0.002                       | 8-Aug  | 0.239                       | 9-Oct  | 0.087                       | 9-Dec  |                             |
| 9-Feb  |                             | 9-Apr  |                             | 9-Jun  | 0.006                       | 9-Aug  | 0.237                       | 10-Oct | 0.083                       | 10-Dec |                             |
| 10-Feb |                             | 10-Apr |                             | 10-Jun | 0.024                       | 10-Aug | 0.228                       | 11-Oct | 0.079                       | 11-Dec |                             |
| 11-Feb |                             | 11-Apr |                             | 11-Jun | 0.372                       | 11-Aug | 0.222                       | 12-Oct | 0.075                       | 12-Dec |                             |
| 12-Feb |                             | 12-Apr |                             | 12-Jun | 0.354                       | 12-Aug | 0.215                       | 13-Oct | 0.071                       | 13-Dec |                             |
| 13-Feb |                             | 13-Apr |                             | 13-Jun | 0.337                       | 13-Aug | 0.212                       | 14-Oct | 0.067                       | 14-Dec |                             |
| 14-Feb |                             | 14-Apr |                             | 14-Jun | 0.209                       | 14-Aug | 0.207                       | 15-Oct | 0.063                       | 15-Dec |                             |
| 15-Feb |                             | 15-Apr |                             | 15-Jun | 0.221                       | 15-Aug | 0.205                       | 16-Oct | 0.059                       | 16-Dec |                             |
| 16-Feb |                             | 16-Apr |                             | 16-Jun | 0.234                       | 16-Aug | 0.203                       | 17-Oct | 0.055                       | 17-Dec |                             |
| 17-Feb |                             | 17-Apr |                             | 17-Jun | 0.263                       | 17-Aug | 0.205                       | 18-Oct | 0.051                       | 18-Dec |                             |
| 18-Feb |                             | 18-Apr |                             | 18-Jun | 0.279                       | 18-Aug | 0.201                       | 19-Oct | 0.047                       | 19-Dec |                             |
| 19-Feb |                             | 19-Apr |                             | 19-Jun | 0.294                       | 19-Aug | 0.197                       | 20-Oct | 0.044                       | 20-Dec |                             |
| 20-Feb |                             | 20-Apr |                             | 20-Jun | 0.311                       | 20-Aug | 0.192                       | 21-Oct | 0.040                       | 21-Dec |                             |
| 21-Feb |                             | 21-Apr |                             | 21-Jun | 0.32                        | 21-Aug | 0.189                       | 22-Oct | 0.036                       | 22-Dec |                             |
| 22-Feb |                             | 22-Apr |                             | 22-Jun | 0.327                       | 22-Aug | 0.186                       | 23-Oct | 0.032                       | 23-Dec |                             |
| 23-Feb |                             | 23-Apr |                             | 23-Jun | 0.326                       | 23-Aug | 0.180                       | 24-Oct | 0.028                       | 24-Dec |                             |
| 24-Feb |                             | 24-Apr |                             | 24-Jun | 0.317                       | 24-Aug | 0.179                       | 25-Oct | 0.024                       | 25-Dec |                             |
| 25-Feb |                             | 25-Apr |                             | 25-Jun | 0.322                       | 25-Aug | 0.175                       | 26-Oct | 0.020                       | 26-Dec |                             |
| 26-Feb |                             | 26-Apr |                             | 26-Jun | 0.322                       | 26-Aug | 0.174                       | 27-Oct | 0.016                       | 27-Dec |                             |
| 27-Feb |                             | 27-Apr |                             | 27-Jun | 0.323                       | 27-Aug | 0.172                       | 28-Oct | 0.012                       | 28-Dec |                             |
| 28-Feb |                             | 28-Apr |                             | 28-Jun | 0.329                       | 28-Aug | 0.167                       | 29-Oct | 0.008                       | 29-Dec |                             |
| 29-Feb |                             | 29-Apr |                             | 29-Jun | 0.335                       | 29-Aug | 0.168                       | 30-Oct | 0.004                       | 30-Dec |                             |
|        |                             | 30-Apr |                             | 30-Jun | 0.337                       | 30-Aug | 0.167                       | 31-Oct | 0.000                       | 31-Dec |                             |
|        |                             |        |                             |        |                             | 31-Aug | 0.164                       |        |                             |        |                             |

