

Type A Water Licence Renewal Application for the Jackfish Lake Generating Station in Yellowknife, NT

**Technical Session
May 2, 2019**



Overview

- Introduction
- Facility Background
- Overview of Operations
 - Cooling Systems Details
 - Operational Details
- Engagement
- Completed Monitoring
- Proposed Monitoring



Introduction

- **Objectives:**
 - Overall: Renew the Type A Water Licence for the Jackfish Lake Generating Station with the Mackenzie Valley Land and Water Board
 - Technical Session: Provide a forum for discussion on technical aspects of the Water Licence Application

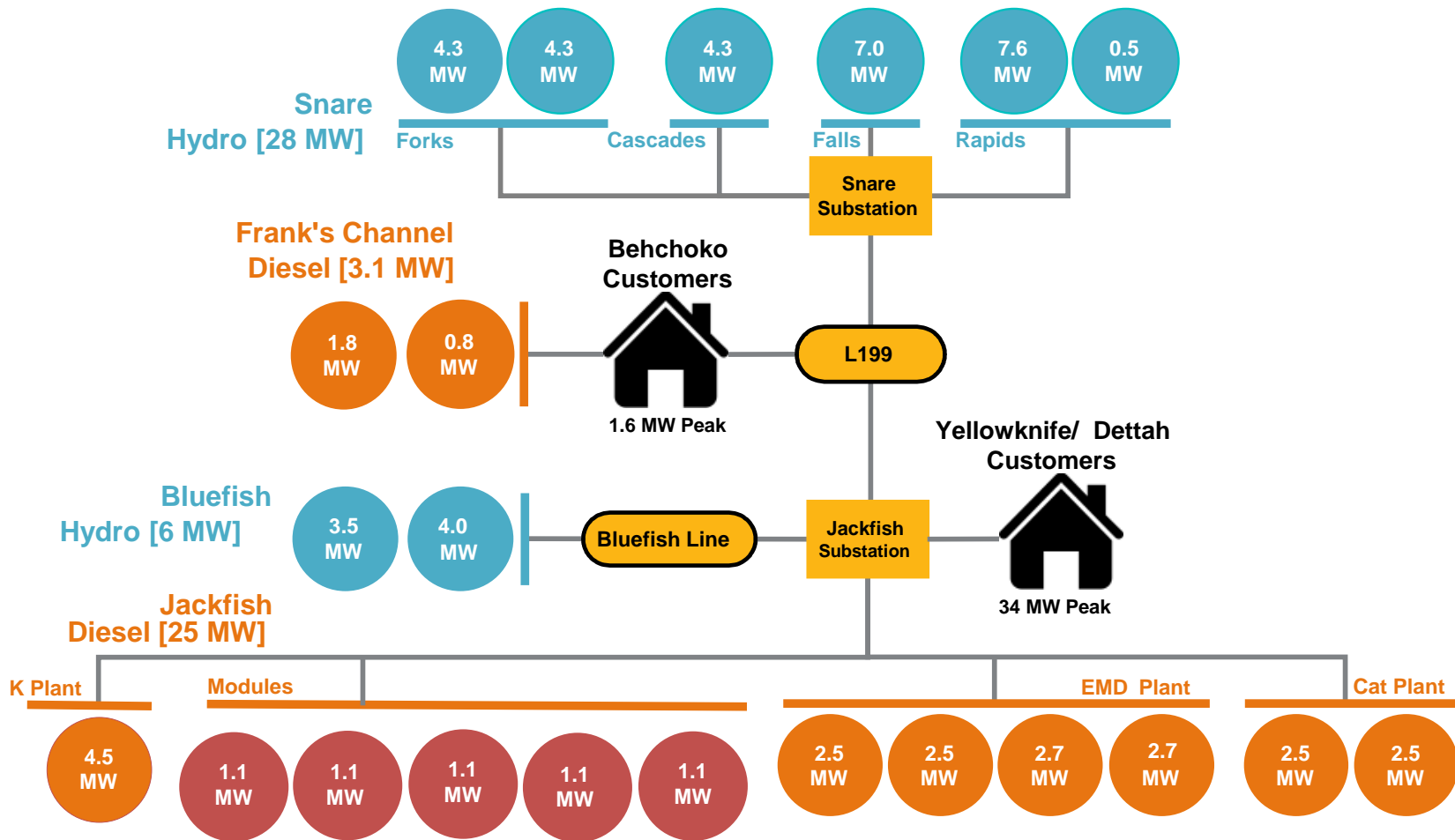


Introduction

- **Colin Steed**- Director, Hydro Division
- **Eileen Hendry**- Manager, System Control
- **Matt Miller**- Senior Environmental Licensing Specialist
- **Tamara Darwish**- Senior Aquatic Biologist (Golder)
- **Zsolt Kovats**- Senior Aquatic Ecologist (Golder)

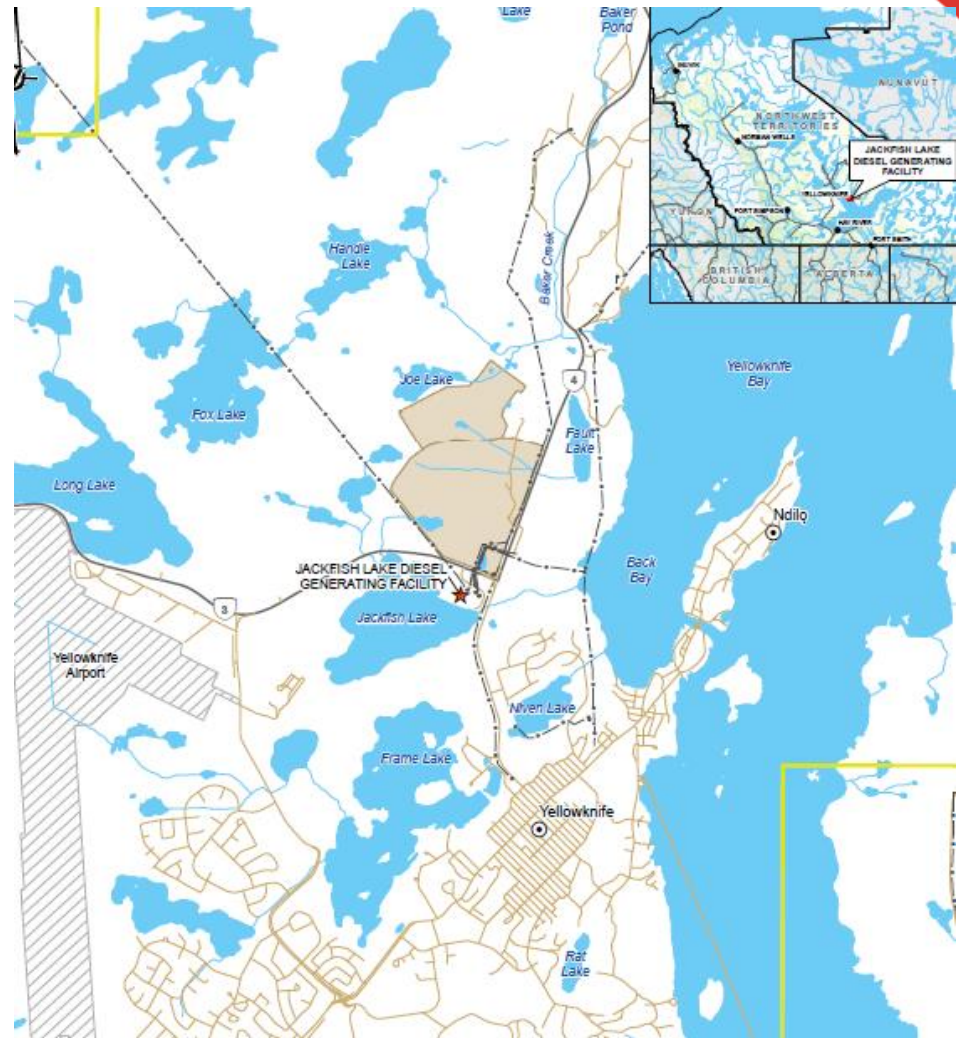


North Slave Power System



Facility Background

- **Jackfish Lake Generating Station**
 - Northeast shore of Jackfish Lake in Yellowknife, NT
- **Backup power for the North Slave Electrical System**
 - Yellowknife, Behchokò, Ndilo, and Dettah



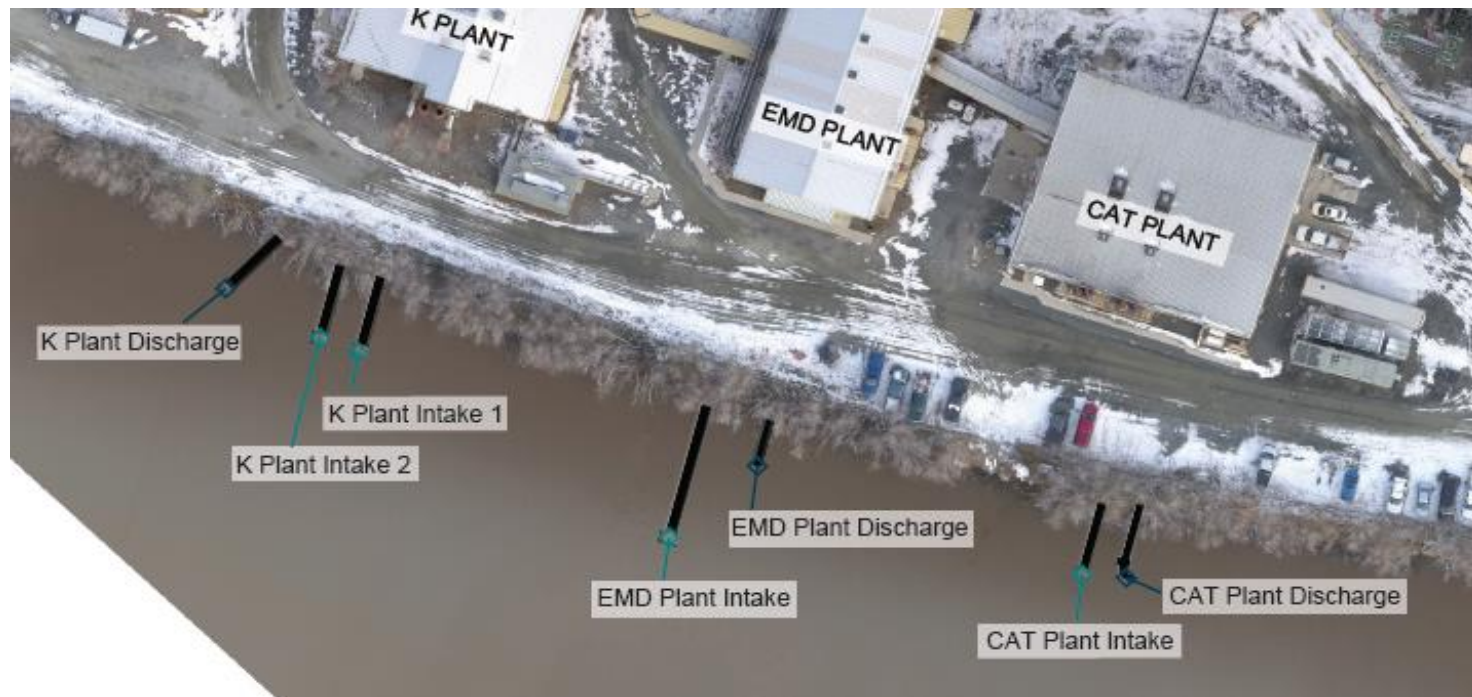
Facility Background

- **Diesel Generation**
 - CAT Plant
 - EMD Plant
 - K Plant
 - Modular Units
- **Cooling system in plants uses water from Jackfish Lake**



Facility Background

- Three plants, each with an intake and discharge
- Water used for cooling only, no additives
- Intakes located at lake bottom, discharge pipe on/near surface



K Plant

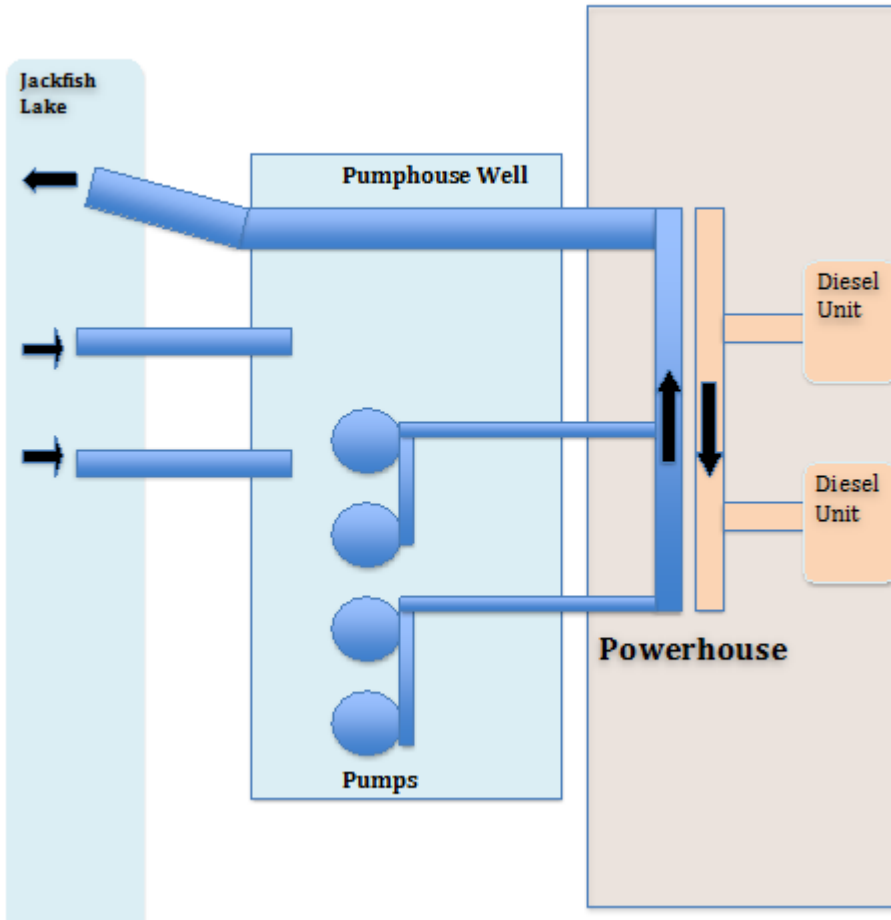
- Built in 1969
- Expanded in 1988
- 2 Mirrlees generators (5000kW each)
- Only one is in service at this time



NWT Archives/James Jerome/N-1987-017-2193

K Plant

K Plant Raw Water Schematic



EMD Plant

- Built in 1974
- Expanded in 1988
- 4 EMD generators (Electro-Motive Division of GM)
- 2 rated at 2500kW each
- 2 rated at 2850kW each



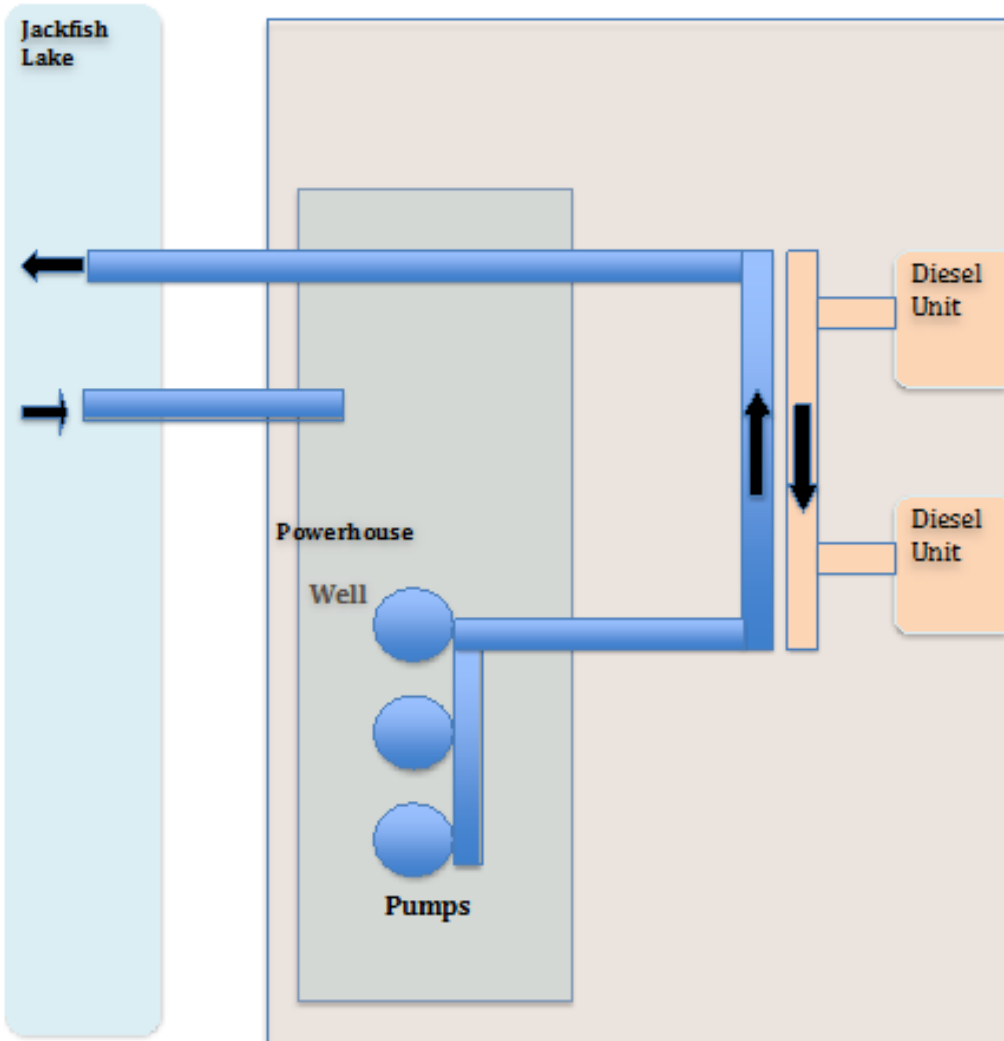
CAT Plant

- Built in 1993
- 2 two Caterpillar 3612 generators
- Rated at 2700kW each



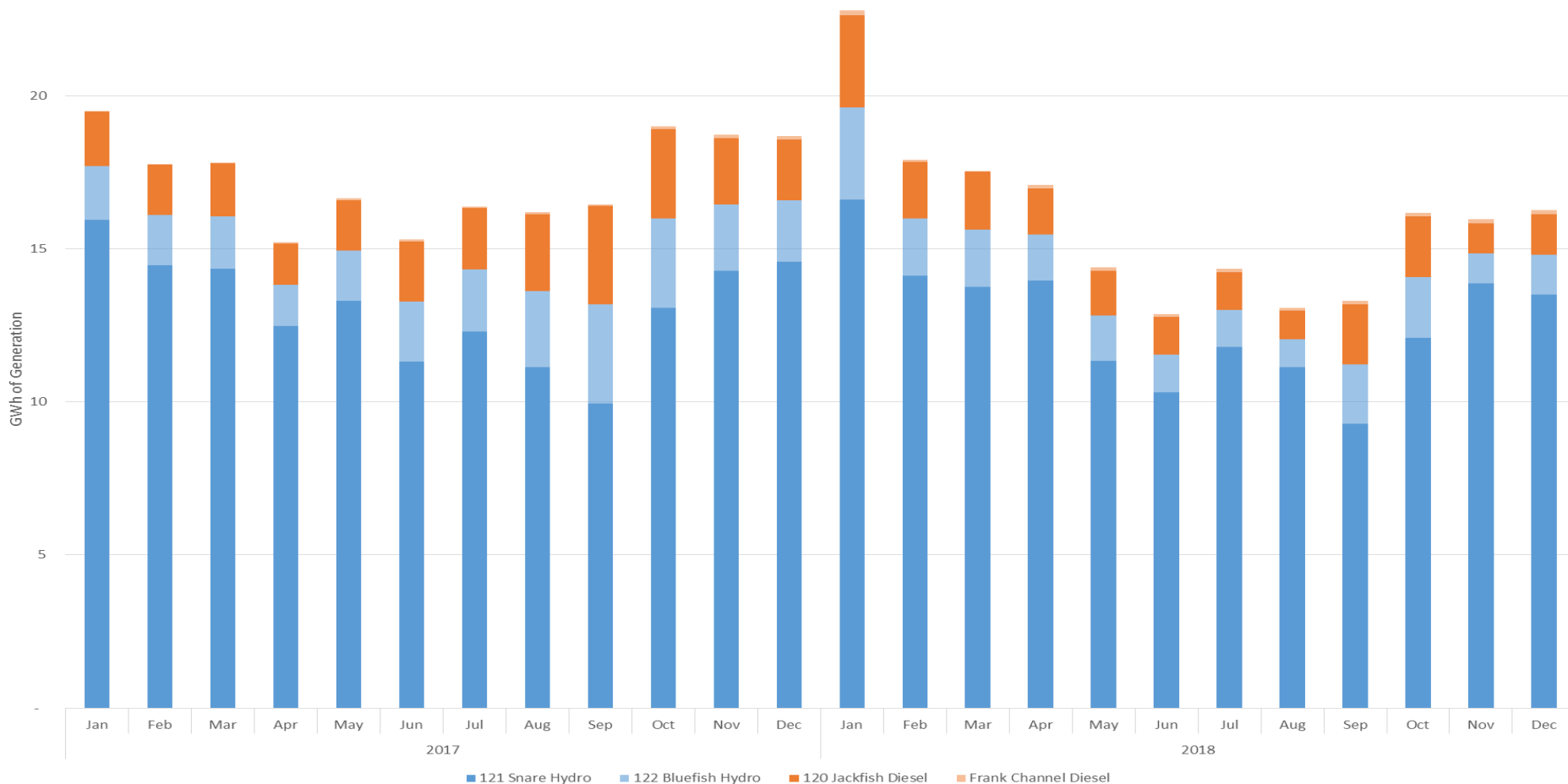
CAT Plant

Cat Plant Raw Water Schematic



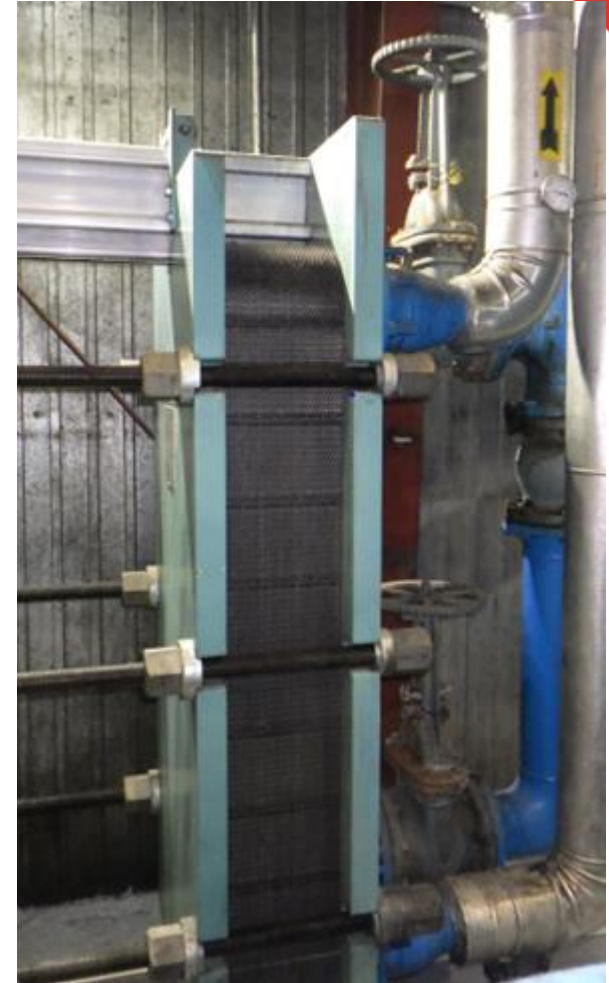
Mitigation

- Operational approach for North Slave Power System is to maximize hydro input and minimize diesel use



Mitigation

- **Heat Recovery Systems**
 - Plate type heat exchangers capture recoverable heat off jacket water for various units
 - Used as needed to heat plants, administration building and warehouse



Engagement

- **NTPC began engaging with stakeholders in November 2018**
- Akaitcho IMA Implementation Office
- City of Yellowknife
- Dene Nation
- Deninu K'ue First Nation
- Fort Resolution Métis Council
- K'atl'odeeche First Nation
- Lutsel K'e Dene First Nation - Wildlife, Lands and Environment
- North Slave Métis Alliance
- Northwest Territory Métis Nation
- Salt River First Nation
- Smith's Landing First Nation
- Tłıchǫ Lands Protection Department
- West Point First Nation
- Yellowknives Dene First Nation

Engagement

- **Notification Letters sent out to all parties listed on previous slide**
- **Follow up correspondence**
 - Phone calls/teleconferences
 - In-person meetings
- **Advertisements**
- **Public Engagement Plan submitted as part of Application**
 - Engagement will continue throughout term of new licence as per Water Licence



2018 Environmental Monitoring

Objectives:

- Collect one year of monitoring data
- Begin to develop an environmental dataset for Jackfish Lake
- Support future monitoring

Monitoring Components:

- Water Temperature and Water Level
- Water Quality
- Phytoplankton
- Benthic Invertebrate Community and Supporting Sediment Quality
- Fish Community and Fish Tissue Chemistry



Monitoring Stations

Water temperature

- 4 intake
- 3 discharge (end of pipe)
- 3 in-lake (5 m from end of pipe)
- 3 in-lake (mid/far field)

Water quality

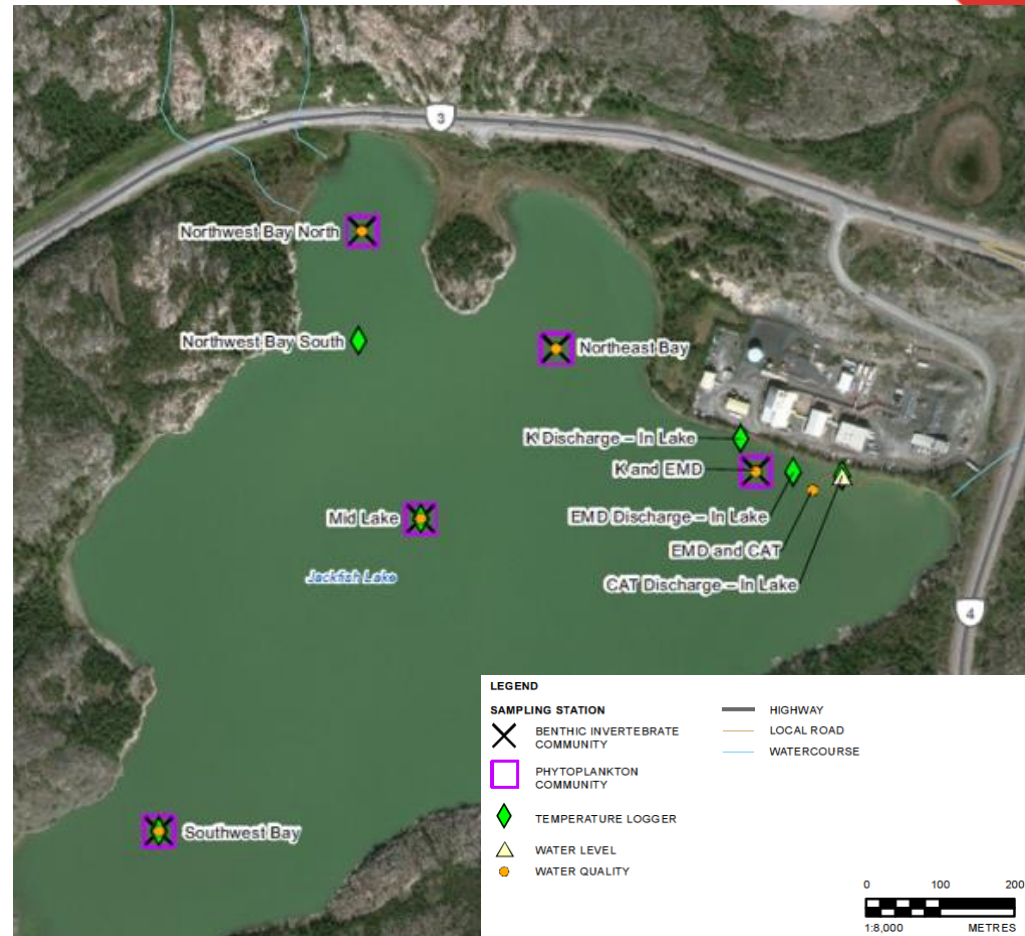
- In-facility – 3 intakes, 2 discharge (CAT and K discharges)
- 2 in-lake near discharges
- 4 in-lake (mid/far field)

Phytoplankton and benthic invertebrates

- 1 in-lake near discharges
- 4 in-lake (mid/far-field)

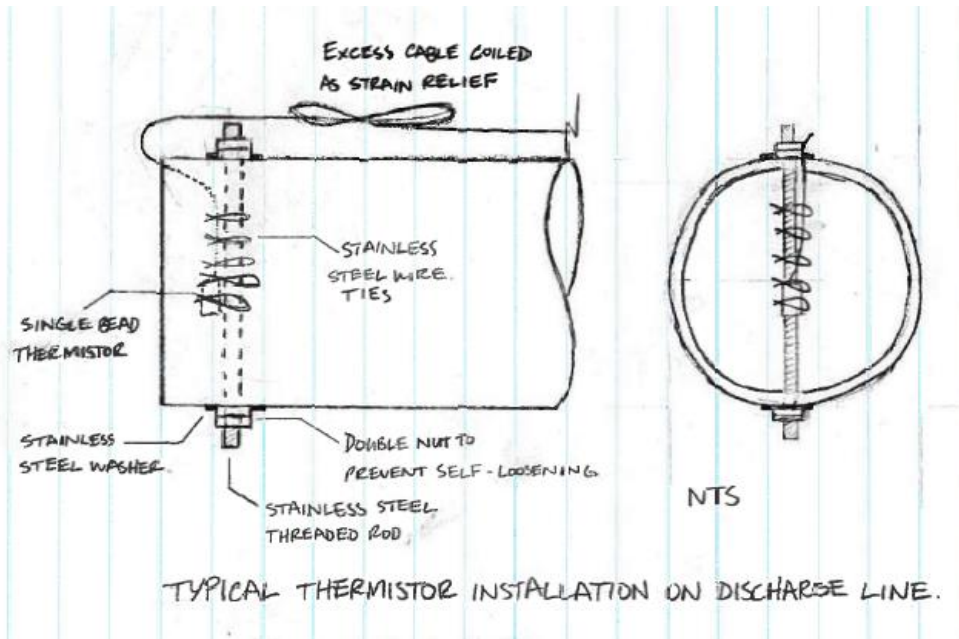
Fish

- Throughout lake

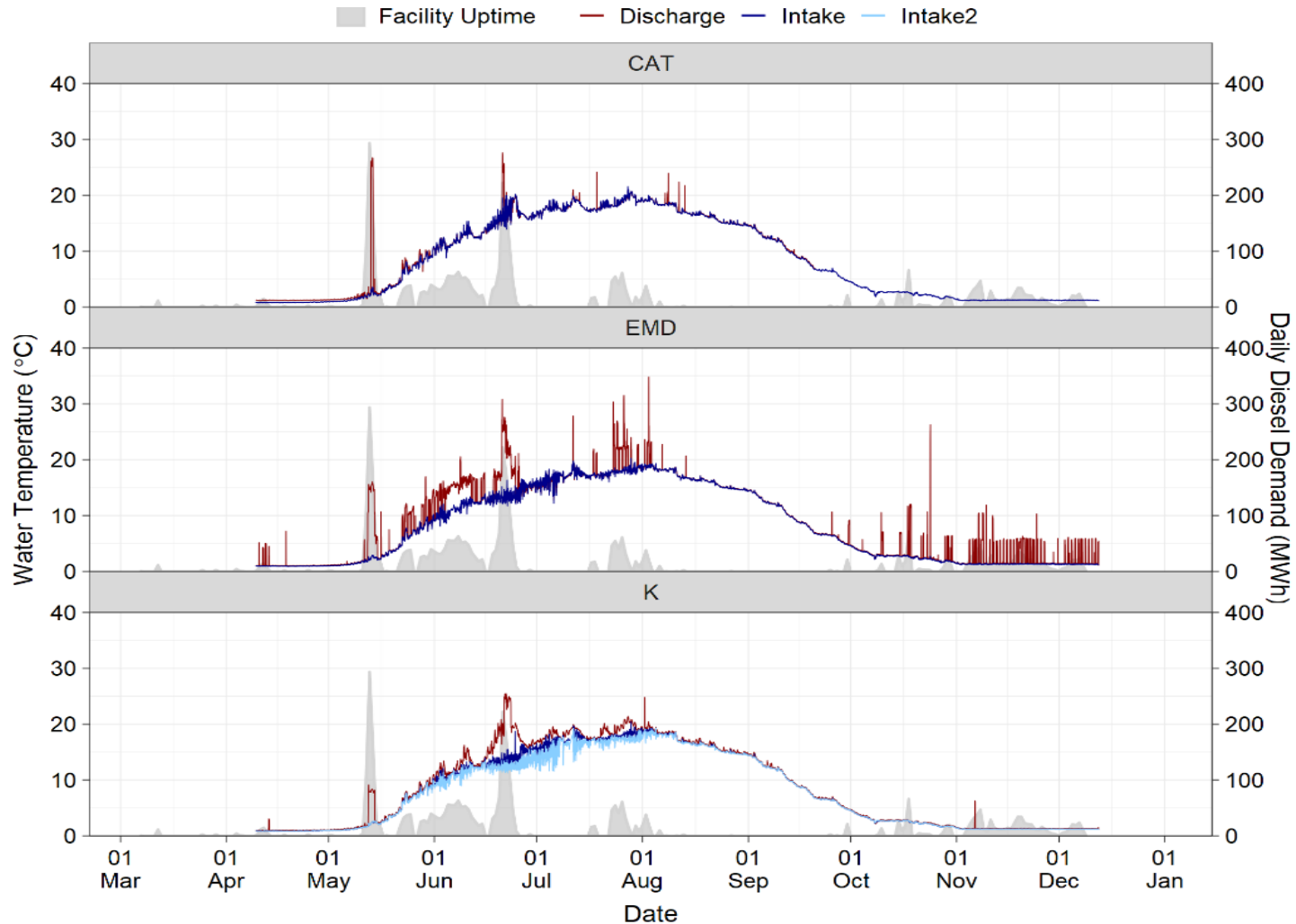


Water Temperature

- Thermistors installed on screens of intakes and at end of pipe at outlets.



Water Temperature



Water Temperature

- In-lake temperatures ranged from $<1^{\circ}\text{C}$ to 23°C
- Summer temperature stratification
- Temperature decreased with distance from discharges
- Mid-lake bottom temperature remained cooler than other areas



Water Quality

- Monitored parameters: field, conventional, major ions, nutrients, metals and organics
- Frequency: 5 times in 2018 (May, Jul, Aug, Sept and Dec)
- Alkaline lake, with hard and generally turbid water.
- Eutrophic lake
- Clear vertical gradients in temperature and dissolved oxygen (DO) concentration during the summer

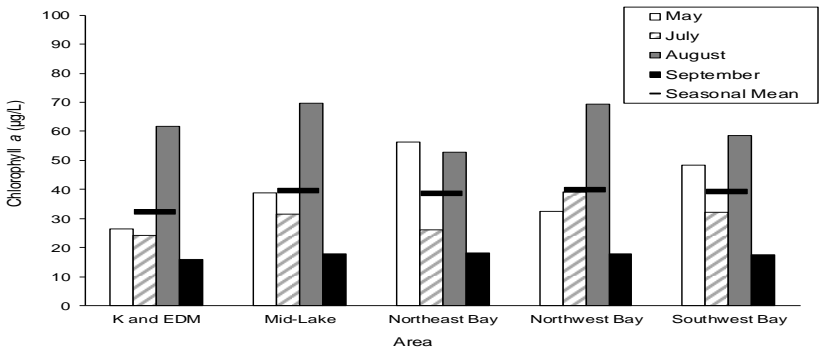
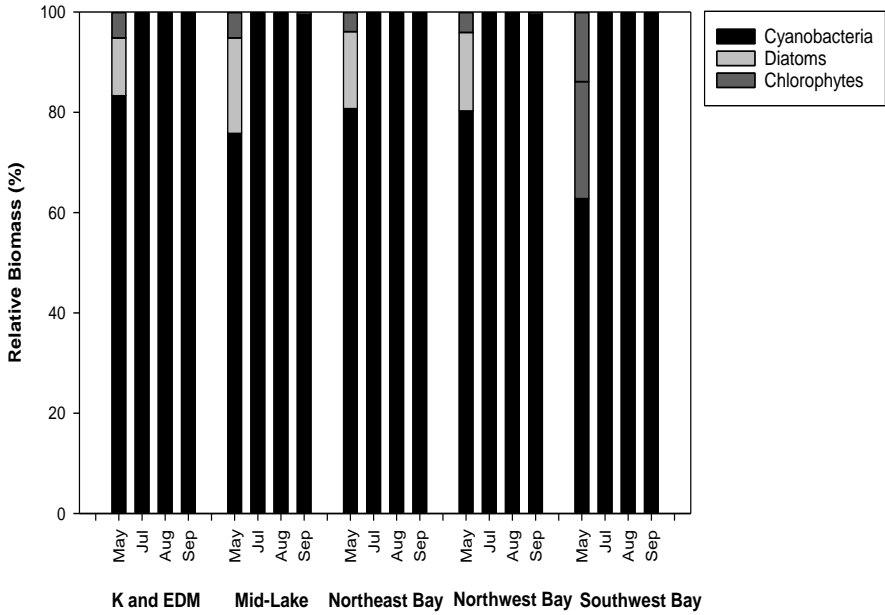
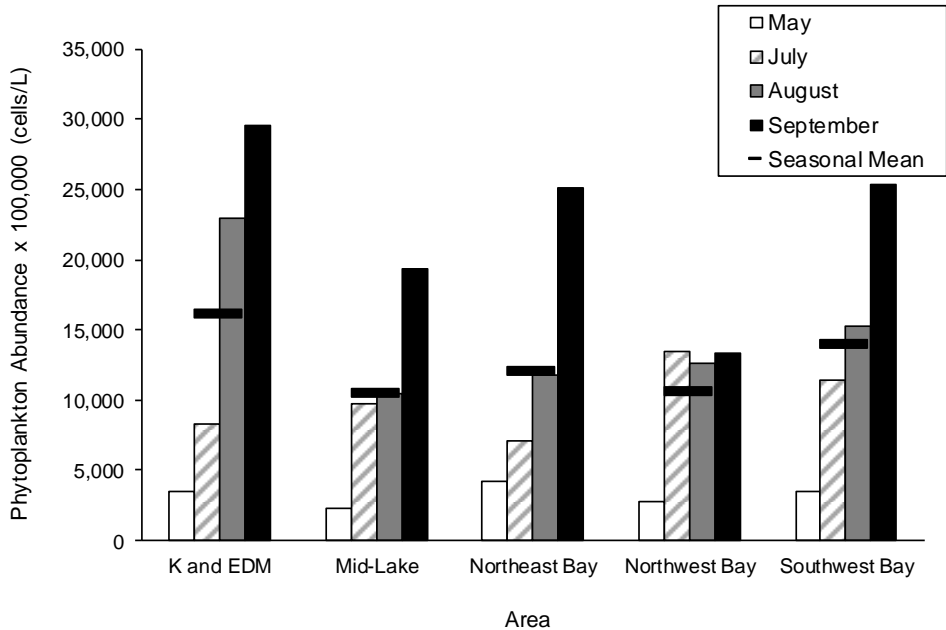


Water Quality

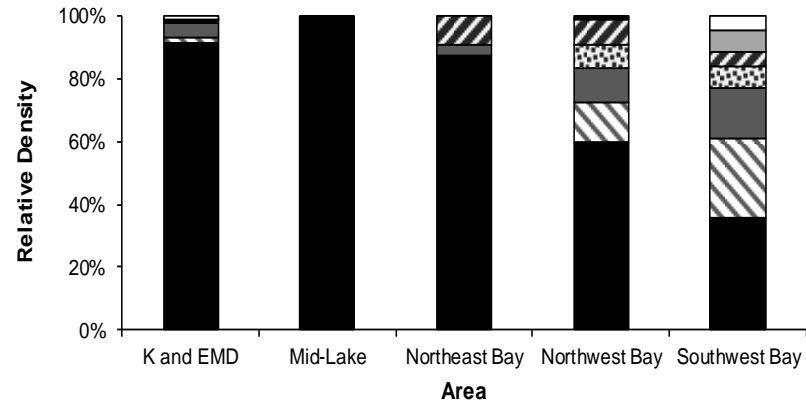
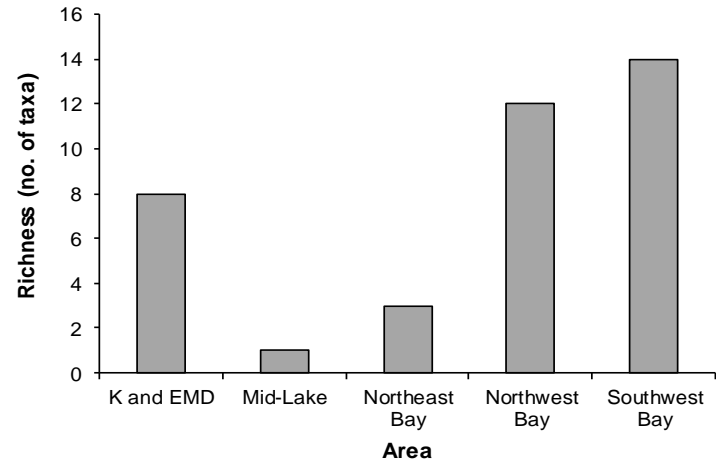
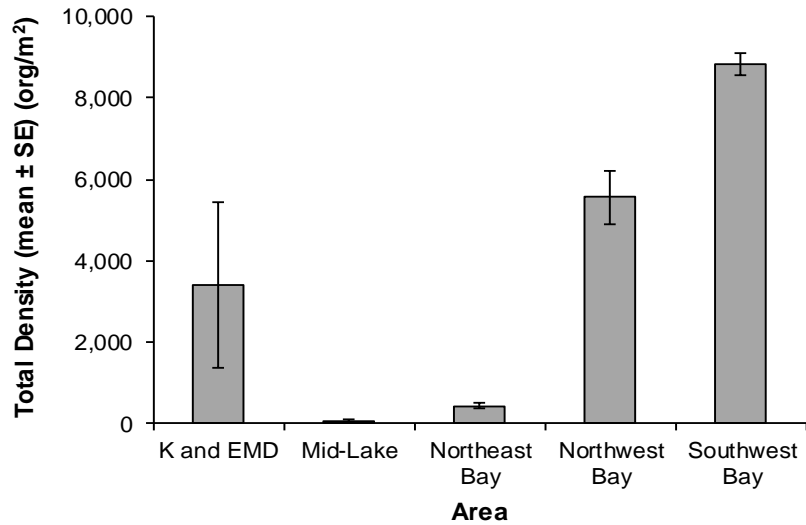
- Concentrations typically met CWQGs for the protection of aquatic life except:
 - summer dissolved oxygen near the bottom of the lake
 - arsenic
- Nitrite, copper, and zinc occasionally above CWQGs
- Whole-lake spatial and or temporal trends in water quality not observed



Phytoplankton



Benthic Invertebrate Community



- Chironomus
- Tanypus
- Procladius
- Other Chironomidae
- Hydracarina
- Oligochaeta
- Other

Fish

Lake Whitefish

- Most abundant
- 14 captures
- Mostly adults, good condition, full stomachs

Northern Pike

- 11 captures
- Adults were slender
- One juvenile capture, suggests reproduction

Trout-Perch

- 4 captures

Fish Tissue

- First known dataset collected for Jackfish Lake fish tissue chemistry
- Mercury concentrations for all fish (7 LKWH and 3 NRPK) were below the CFIA guideline of 0.5 mg/kg ww



Proposed Monitoring

- **On-site monitoring under the Surveillance Network Program (SNP)**
 - Continuous water temperature at CAT, K, and EMD intakes and discharges
 - Continuous flow measurements to report daily, monthly and annual quantities of cooling water circulated
 - Refer to Annex A of proposed Water Licence conditions
- **In-lake monitoring under the Aquatic Effects Monitoring Program (AEMP)**
 - Within ninety (90) days following issuance of the licence, the Licensee shall submit an AEMP Design Plan to the Board for approval

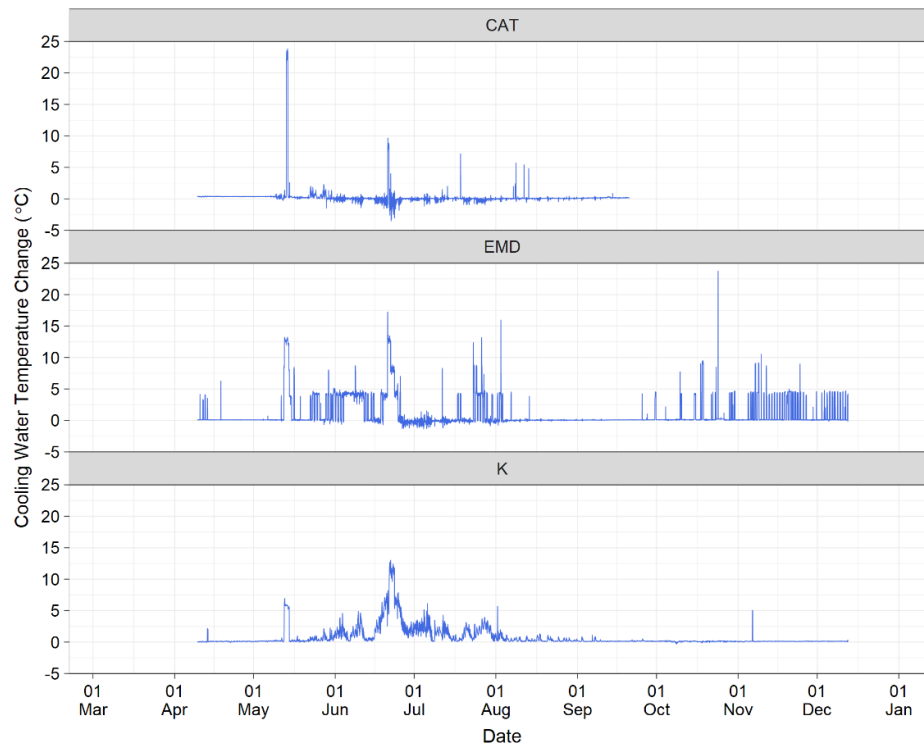


Thank you

Water Quality Management

Water Temperature

- Elevated (spike) temperatures were recorded at end of pipe, relative to the intakes during operating periods
- Temperatures recorded 5 m from end of pipe were below the UILT for large-bodied fish species captured in Jackfish Lake
- Acute thermal impacts to fish populations were not expected to have occurred for the 2018 operating year



Water Quality Management

Water Temperature

- Setting thermal discharge criteria for Jackfish Facility discharges is not recommended
 - acute thermal impacts to fish populations were not expected to have occurred for the 2018 operating year
 - fish have cooler water in the lake available for access
 - fish are present and have likely acclimated to conditions, as the Jackfish Facility has been in operation since the 1960s.
- Temperature dataset was limited and further monitoring is recommended
 - » SNP (intake/discharge temperatures)
 - » AEMP (in-lake temperatures)
- Temperature will continue to be evaluated as further monitoring data are obtained

Water Quality Management

Temperature Tolerances for Fish Species in Jackfish Lake

- Fish species and life stage evaluated according to standard thermal acute benchmarks
 - UILT was not exceeded for large-bodied fish species 5 m from end of pipe.
 - acute thermal impacts to fish populations were not expected to have occurred for the 2018 operating year
- Maximum recorded in lake temperature in 2018 = 23.1°C
- Fish present in Jackfish Lake
- Fish have likely experienced similar temperatures since 1960s



Aquatic Effects Monitoring and General Monitoring

a) Surveillance Network Program (SNP) 00xx-1:

Description:	SNP 00xx-1a,b,c,d – Intakes to the K (2 intakes), EMD (1 intake), and CAT (1 intake) plants
Location:	SNP 00xx-1a - K plant intake 1 SNP 00xx-1b - K plant intake 2 SNP 00xx-1c - EMD plant intake SNP 00xx-1d - CAT plant intake
Sampling Frequency:	Continuous in-situ measurements during periods of discharge to Jackfish Lake
Sampling Parameters:	Water Temperature

b) Surveillance Network Program (SNP) 00xx-2:

Description:	SNP 00xx-2a,b,c - Discharges from the K, EMD and CAT plants, respectively
Location:	SNP 00xx-2a - K plant discharge SNP 00xx-2b - EMD plant discharge SNP 00xx-2c - CAT plant discharge
Sampling Frequency:	Continuous in-situ measurements during periods of discharge to Jackfish Lake
Sampling Parameters:	Water Temperature Flow

Aquatic Effects Monitoring and General Monitoring

- An AEMP will be developed, proposed submission 90 days after issuance of Water Licence
- Acknowledged that new MVLWB Guidelines for AEMP have been issued
- AEMP will be scoped based on scale of project and size of receiving environment
- Will include:
 - plain language summary
 - problem formation
 - study design
 - description of components
 - sampling methods
 - schedule
 - Response Framework

Water Source and Water Quantity

- Water source is Jackfish Lake
- 50,000 m³/day based on full operating capacity
- Jackfish provides backup and peak capacity only
 - required by Public Utilities Board
- Average water usage in 2018 was 16,414 m³/day
 - 2018 reporting includes accurate pump capacities
 - Accurate water usage for past years will be re-submitted to MVLWB



Term

- 20 Year Water Licence term requested
 - Based on stability of operations
 - Current Water Licence term was 25 years
 - Term requested to help keep electricity rates as low as possible for customers by minimizing regulatory costs

