



# Water Management and Reservoir Operating Plan

June, 2022

Northwest Territories Power Corporation  
Snare River Watershed Power Generation  
Facilities

Water Licence No.:  
N1L4-0150 and  
W2014L4-0001

SUBMITTED TO:  
WEK'EEZHII LAND AND WATER BOARD

JUNE 30, 2022



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## LIST OF ABBREVIATIONS

CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CRP	Closure and Reclamation Plan
DSR	Dam Safety Review
ENR	Environment & Natural Resources
EPP	Emergency Preparedness Plan
GNWT	Government of Northwest Territories
GW	Gigawatts
km	Kilometers
kW	Kilowatt
LUP	Land Use Permit
MVLWB	Mackenzie Valley Land and Water Board
MW	Megawatts
NTPC	Northwest Territories Power Corporation
OMS	Operations, Maintenance, and Surveillance
SCP	Spill Contingency Plan
SNP	Surveillance Network Program
WL	Water Licence
WLWB	Wek'eezhii Land and Water Board
WMROP	Water Management and Reservoir Operating Plan

## 1 INTRODUCTION

This 2022 Bi-Annual Report has been prepared for submission by NTPC to WLWB, as part of the requirements of Water Licence No.: N1L4-0150 for Snare River Watershed Power Generation Facilities and Water Licence WL2014-L0001 for the Snare Cascades Power Generation Facility (Hydroelectric Facilities)

The Hydroelectric Facilities (Figure 1-1) are located on the Snare River, approximately 140 km northwest of Yellowknife in Northwest Territories and currently provides electricity to the City of Yellowknife, the settlements of Ndilq, Dettah, Behchokq and to a mining reclamation site.

The Hydroelectric Facilities consists of three generating facilities:

- Snare Rapids Facility (8.0-MW and 500 kW hydroelectric generators),
- Snare Falls Facility (7.4-MW hydroelectric generator),
- Snare Cascades Facility (4.3 MW hydroelectric generator).
- Snare Forks Facility (two 5 MW hydroelectric generators).

All four locations are connected by an all-weather road, and air access is available year-round; personnel and freight are also delivered via aircraft on Big Spruce Lake and an all-weather landing strip located near the Snare Falls Facility.

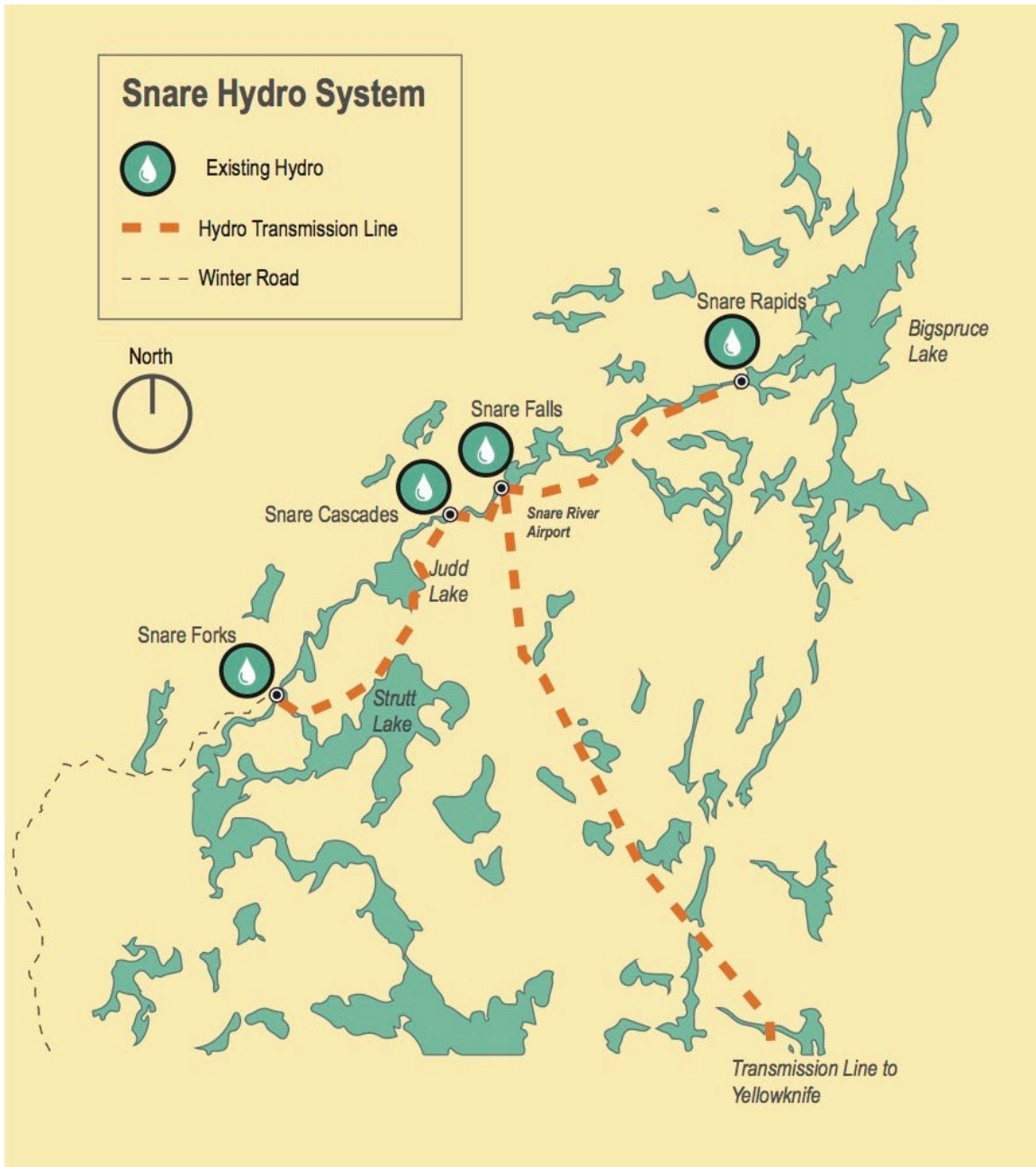


Figure 1-1 Snare River Watershed Hydroelectric Facilities

## 2 COMMENTARY AND OVERVIEW

The annual Snow Survey of the Snare Basin took place at the end of March and suggested a snowpack 70% of average.

The Indin River peaked at 17.7 m<sup>3</sup>/s on June 21 which predicts a Snare River peak at the confluence of the Ghost River of 55.0 m<sup>3</sup>/s near August 2, 2022. This is significantly below average and comparable to inflows of 2015.

With these inflows the water level on Big Spruce Lake will be at a maximum of 728.57 ft. (222.25 m) near the end of January 2023 and a minimum level of 726.2 ft. (221.34 m) in mid-June of 2023.

The 5B reservoir spillway was operated on May 12, 2022 to increase spill in anticipation of spring freshet following the development of the early spring forecast. The updated forecast following the Indin River peak calls for the spillway to be closed on July 6 and reopened only for a two-week period in August to support generation from Snare Falls, Snare Cascades, and Snare Forks during a planned shutdown of the Snare Rapids main generating unit.

NTPC will continue to monitor levels and adjust accordingly if required throughout the summer and fall.

NTPC expects to utilize diesel generation during the coldest winter months for peaking with hydro at full capacity.

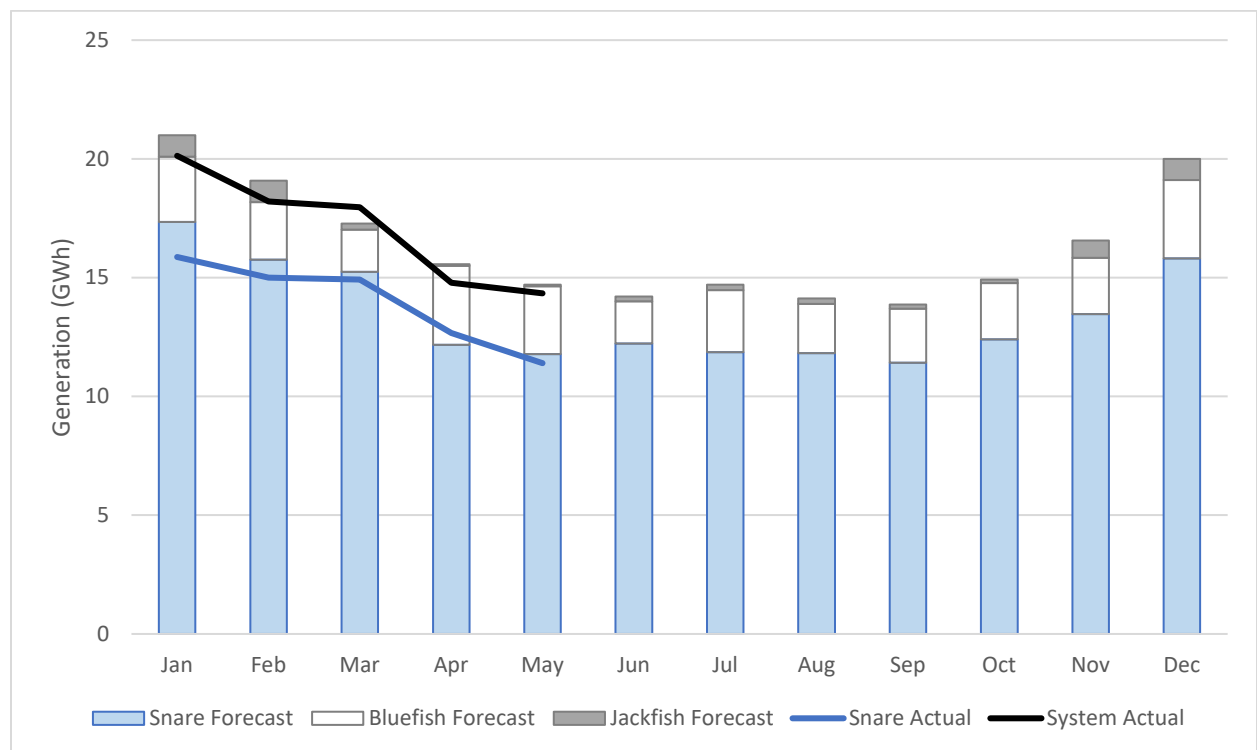
## 3 SYSTEM FORECAST

### 3.1 SYSTEM LOAD

The operational load forecast is developed based on recorded hourly loads from the previous year with a growth factor applied as necessary to align with financial forecasting. For the 2022-23 fiscal year, a growth factor of 1% (1.01) has been applied to actual recorded values from 2021-22 to produce the operational forecast. In 2021-22, the 2019-20 fiscal year was used for reference in development of the operational forecast due to the impacts of COVID-19 closures on observed loads during the 2020 calendar year.

**Table 3-1 Forecast and Actual Power Generation, 2022 Calendar Year**

Month	Snare Hydroelectric Facilities		Bluefish Hydroelectric Facilities		Jackfish Lake Diesel Facilities		System Total	
	Forecast (GWh)	Actual (GWh)	Forecast (GWh)	Actual (GWh)	Forecast (GWh)	Actual (GWh)	Forecast (GWh)	Actual (GWh)
January	17.35	15.87	2.74	4.06	0.90	0.20	20.99	20.13
February	15.75	15.00	2.43	3.13	0.90	0.08	19.08	18.21
March	15.24	14.92	1.78	2.86	0.26	0.18	17.28	17.96
April	12.17	12.67	3.33	2.08	0.07	0.04	15.57	14.79
May	11.78	11.40	2.86	2.93	0.07	0.01	14.71	14.34
June	12.23		1.77		0.20		14.20	
July	11.86		2.62		0.23		14.71	
August	11.82		2.08		0.23		14.13	
September	11.42		2.27		0.18		13.87	
October	12.40		2.37		0.15		14.92	
November	13.46		2.37		0.73		16.56	
December	15.81		3.30		0.89		20.00	



**Figure 3-1 Forecast and Actual Power Generation, 2022 Calendar Year**

## 3.2 FORECAST AND ACTUAL INFLOWS

NTPC uses an empirical model to forecast inflow to the Big Spruce Reservoir. An early forecast is developed in May based on the spring snow survey of the Snare Basin and antecedent conditions from the previous fall. The early forecast is refined and updated after flow on the Indin River peaks in late June to early July.

### 3.2.1 Early Forecast 2022

The 2022 snow survey was conducted between March 30 and April 5, and indicated a Snow Water Equivalent (SWE) of 81.0 mm (70% of average). The early forecast anticipated spring inflows with a peak of 111 m<sup>3</sup>/s, approximately 85% of average.

**Table 3-2 Snow Survey Results, 2022**

Site	Snow Water Equivalent (SWE)		Average to 2018
	SWE (mm)	% of Average	SWE (mm)
-			
Big Spruce Lake	85	81.0	105.0
Ghost Lake	80.5	76.8	104.9
Indin Lake	85	76.3	111.4
Snare Lake	75	65.9	113.8
Winter Lake	65	73.2	88.8
Mattberry Lake	85	85.7	99.2
Castor Lake	85	73.7	115.3
Mesa Lake	85	66.9	127.1
Big Lake	65	53.0	122.6
White Wolf Lake	75	55.8	134.5
Christison Lake	75	65.8	114.0
Compared to Average		70%	

AMEC E&C Services Limited developed the current flow forecasting procedures for the Snare Hydro System. The formula for forecasting the Snare/Ghost peak based on the Snow Survey is:

$$Q_{\max} = -89.84 + 1.702 * SWE + 1.042 * Q_{\text{fall}}$$



**Table 3-3 Early Forecast Inputs and Output**

Abbreviation	Definition	Value for 2022
SWE	Snow Water Equivalent, Snare Basin Snow Survey	81.4 mm
Q <sub>fall</sub>	Snare/Ghost inflow in m <sup>3</sup> /s on Nov. 15	60.2 m <sup>3</sup> /s
Q <sub>max</sub>	Forecast peak inflow for Snare/Ghost in m <sup>3</sup> /s	111.4 m <sup>3</sup> /s

2019 was selected as the template year for the early forecast. 2019 saw a peak inflow of 107 m<sup>3</sup>/s compared to a forecast peak of 111.4 m<sup>3</sup>/s, so the forecast model applied a factor of 1.04 to the 2019 template.

### 3.2.2 June Forecast 2022

Inflow at the Indin River peaked at 17.7 m<sup>3</sup>/s on June 21, 2022. This is only the sixth year a peak below 18 m<sup>3</sup>/s has been recorded at the Indin River since 1978. The Indin River has historically been a reliable indicator of inflow to the Snare River and the Big Spruce Reservoir. The revised forecast based on the Indin River anticipates a peak inflow of 54.2 m<sup>3</sup>/s during the first week of August. The reservoir operating plan for the upcoming six months has been adjusted accordingly.

The formula for forecasting the Snare/Ghost peak based on the Indin peak is:

$$Q_{sg} = -12.0 + 3.74 * Q_{in}$$

The template year selected for the updated forecast is 2015, with a factor of 0.99. The 2015 calendar year saw a peak inflow to the Big Spruce Reservoir of 55 m<sup>3</sup>/s. 2015 also saw a “double peak” in inflows due to a wet fall. This feature is somewhat unusual and may require further adjustment to the forecast model as the summer progresses.

**Table 3-4 Peak Ratio Comparison, Indin River and Snare River below confluence with Ghost River**

Year	Snare/Ghost (m <sup>3</sup> /s)	Indin (m <sup>3</sup> /s)	Peak Ratio
2010	88.2	20	4.41
2011	64.1	22.3	2.87
2012	149	47.5	3.14
2013	93.2	33.6	2.77
2014	41.6	11	3.78
2015	55	17.8	3.09
2016	162	44.1	3.67
2017	141	43.1	3.27
2018	123	32	3.84
2019	107	34.8	3.07
2020	189	31	6.10
2021	305	82.6	3.69
Average	126.51	34.98	3.64

### 3.2.3 Yellowknife and Wekweètì Precipitation

**Table 3-5 Precipitation Recorded by Environment Canada**

Month	Yellowknife		Wekweètì	
	Actual (mm)	Normal (mm)	Actual (mm)	Normal (mm)
-				
December	8.1	16.3	5.1	6.9
January	6.6	14.1	3.6	13.5
February	3.8	12.9	0.9	6.9
March	10.4	13.4	0.2	3.1
April	0.2	10.8	13.3	6.1
May	28	19.1	3.6	9.9
June	6.2	27.0	18.4	17.3
Total (to May)	56.7	86.6	26.7	46.24

### 3.3 RESERVOIR OPERATING PLAN

**Table 3-6 Forecast and Actual Inflow and Outflow, Snare River and Big Spruce Reservoir**

Month	Inflow		Outflow		Average Reservoir Level	
	Forecast (m <sup>3</sup> /s)	Actual (m <sup>3</sup> /s)	Forecast (m <sup>3</sup> /s)	Actual (m <sup>3</sup> /s)	Forecast (m)	Actual (m)
January	45.4	43.78	50.8	49.9	222.10	221.93
February	36.7	35.2	50.8	49.3	222.00	221.69
March	30.5	27.5	47.6	43.3	221.80	221.32
April	21.4	21.4	34.1	39.8	221.02	220.94
May	24.4	21.34	36.3	46.5	220.63	220.56
June	32.1	27.44	35.9	34.5	220.15	220.10
July	49.1		34.3		220.10	
August	50.4		33.9		220.48	
September	48.2		32.6		220.82	
October	50		32.1		221.15	
November	53.8		37.4		221.50	
December	54.5		41.5		221.82	

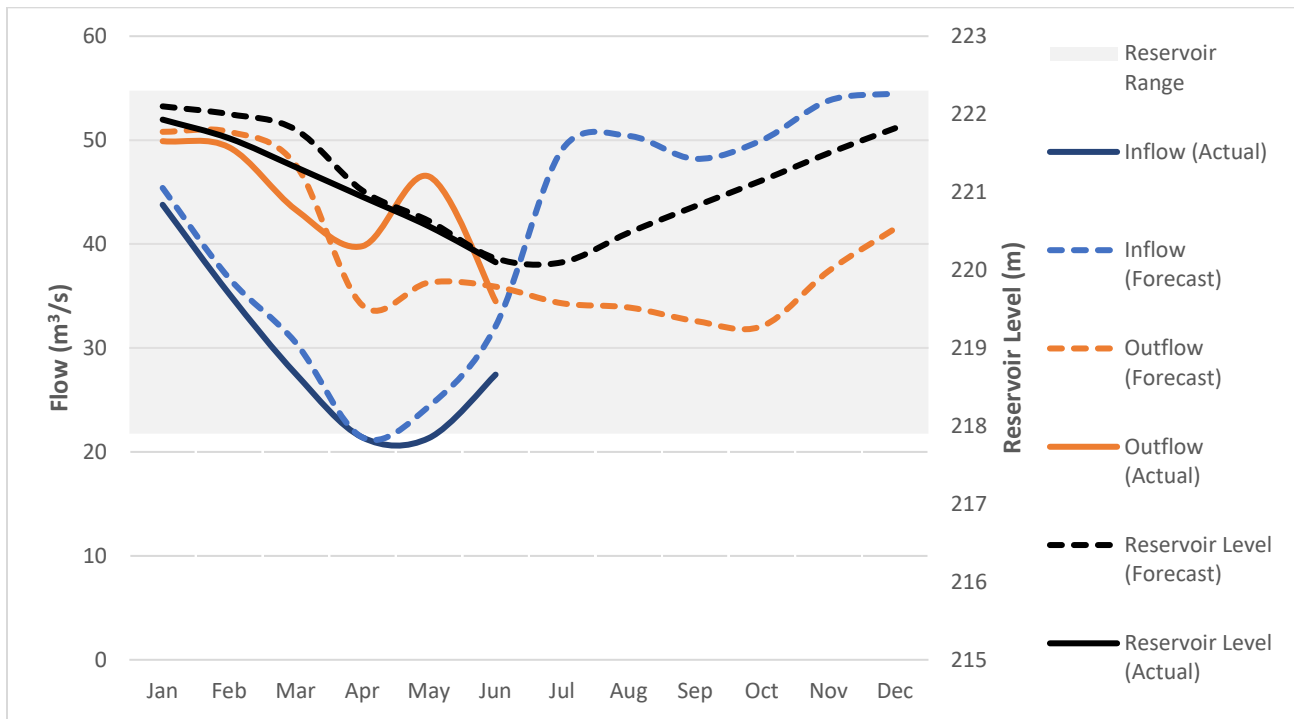


Figure 3-2 Big Spruce Reservoir Operating Plan 2022

## CLOSURE

This Water Management and Reservoir Operating Plan was prepared by the Northwest Territories Power Corporation to meet the requirements of Water Licence N1L4-0150 and WL2014L4-0001.

Respectfully submitted,

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