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February 19, 2025

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Jo-Anne Galarneau
Executive Director and Board Secretary

Re: Application to Supply and Install Runner – Unit 2 – Cat Arm Hydroelectric Generating Station

Please find enclosed Newfoundland and Labrador Hydro's ("Hydro") application for the capital expenditures related to the purchase and replacement of a Pelton runner at Unit 2 of the Cat Arm Hydroelectric Generating Station ("Cat Arm"). The runner is at the end of its service life and failure of the runner would have implications for the operation of Cat Arm and its reliability. The description of the project and the associated costs is described in Schedule 1 to the enclosed application. The total cost of the project is $4,949,800, with completion by 2027.

The proposed capital expenditure is necessary to ensure that Hydro can continue to provide service which is safe and adequate, and just and reasonable, as required by Section 37 of the *Public Utilities Act*. Submission of this proposal within Hydro's 2026 Capital Budget Application would delay approval until the end of 2025 or early 2026. In consideration of the recommendations regarding the timeline for replacement made by third party consultants, and in contemplation of current procurement lead times, Hydro determined that a supplementary application was necessary.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Senior Legal Counsel, Regulatory
SAW/mc

Encl.

ecc:

Board of Commissioners of Public Utilities
Jacqui H. Glynn
Board General

Labrador Interconnected Group
Senwung F. Luk, Olthuis Kleer Townshend LLP
Nicholas E. Kennedy, Olthuis Kleer Townshend LLP

Newfoundland Power Inc.
Dominic J. Foley
Douglas W. Wright
Regulatory Email

Island Industrial Customer Group
Paul L. Coxworthy, Stewart McKelvey
Denis J. Fleming, Cox & Palmer
Glen G. Seaborn, Poole Althouse

Consumer Advocate
Dennis M. Browne, KC, Browne Fitzgerald Morgan & Avis
Stephen F. Fitzgerald, KC, Browne Fitzgerald Morgan & Avis
Sarah G. Fitzgerald, Browne Fitzgerald Morgan & Avis
Bernice Bailey, Browne Fitzgerald Morgan & Avis

Supply and Install Runner – Unit 2

Cat Arm Hydroelectric Generating Station

February 19, 2025

An application to the Board of Commissioners of Public Utilities

newfoundland labrador hydro

IN THE MATTER OF the *Electrical Power Control Act, 1994*, SNL 1994, Chapter E-5.1 ("*EPCA*") and the *Public Utilities Act*, RSNL 1990, Chapter P-47 ("*Act*"), and regulations thereunder; and

IN THE MATTER OF an application by Newfoundland and Labrador Hydro ("Hydro") for an approval of capital expenditures for the purchase and installation of a runner at the Cat Arm Hydroelectric Generating Station ("Cat Arm") pursuant to Section 41(3) of the *Act*.

To: The Board of Commissioners of Public Utilities ("Board")

THE APPLICATION OF HYDRO STATES THAT:

A. Background

1. Hydro, a corporation continued and existing under the *Hydro Corporation Act, 2024*, is a public utility within the meaning of the *Act*, and is subject to the provisions of the *EPCA*.

2. Hydro is the primary generator of electricity in Newfoundland and Labrador, utilizing a number of facilities including Cat Arm, located on the Northern Peninsula. Cat Arm was first placed into service in 1985 and has two hydroelectric units producing 67.5 megawatts ("MW") of power each, for a total plant capacity of 135MW. The plant has a total output of 680 gigawatt-hours ("GWh") annually.

3. The two hydroelectric units have identical Pelton turbine designs and installations, whereby high-pressure water is directed through a nozzle assembly, which discharges a water jet stream towards a Pelton runner consisting of 21 buckets.

4. During an annual unit outage in late 2023, Hydro executed field inspections and reviews of turbine components in Cat Arm in consultation with the turbine's original equipment manufacturer ("OEM"). These inspections concluded that the runners on Cat Arm Unit 1 ("Unit 1") and Cat Arm Unit 2 ("Unit 2") are at the end of their life cycle and due to their age and the increase in the pitting of the metallic surfaces of the turbine parts ("cavitation"), should be replaced. As OEM was not on-site for those inspections, Hydro engaged a third-party expert to

conduct on-site inspections during the annual unit outage in 2024. The consultant's inspections confirmed that the runners are at the end of their service lives and require replacement.

5. The consultant recommended replacement of the Unit 1 runner within 12 months, and replacement of the Unit 2 runner by the end of 2026. Hydro currently has one spare Pelton runner in inventory, and will be proceeding with the replacement of the Unit 1 runner as recommended under Hydro's Hydraulic In-Service Failure Program. Hydro is proposing herein to procure and install a replacement runner for Unit 2.

6. Hydro determined that, due to procurement lead times, a supplemental application for the replacement of the Unit 2 runner would be necessary to enable the replacement to be completed by 2027.

7. The need for the Unit 2 runner replacement and the circumstances requiring the application to be filed as a supplemental application are contained in Schedule 1 of this application.

B. Application

8. To ensure the safe and reliable operation of Hydro's generating system, Hydro recommends the purchase and installation of a new Pelton runner on Unit 2.

9. Project execution is expected to take three years. The project description and schedule are detailed in Sections 2.0 and 5.2 of Schedule 1.

10. The estimated capital cost of the project is $4,949,800 with approximately $747,900 in 2025, $2,462,100 in 2026, and $1,739,800 in 2027.

11. Hydro submits that the proposed capital expenditure is necessary to ensure that Hydro can continue to provide service which is safe and adequate and just and reasonable as required by Section 37 of the *Act.*

C. Hydro's Request

12. Hydro requests that the Board make an Order pursuant to Section 41(3) of the *Act* approving the capital expenditures necessary for the purchase and installation of a new Pelton runner at Cat Arm Unit 2 as more particularly described in this application and the attached Schedule 1.

D. Communications

13. Communications with respect to this application should be forwarded to Shirley A. Walsh, Senior Legal Counsel, Regulatory for Hydro.

DATED at St. John's in the province of Newfoundland and Labrador on this 19th day of February 2025.

NEWFOUNDLAND AND LABRADOR HYDRO

Shirley A. Walsh
Counsel for the Applicant
Newfoundland and Labrador Hydro
500 Columbus Drive, P.O. Box 12400
St. John's, NL A1B 4K7
Telephone: (709) 685-4973

Schedule 1

Supply and Install Runner – Unit 2

Cat Arm Hydroelectric Generating Station

Supply and Install Runner – Unit 2

Location: Cat Arm Hydroelectric Generating Station

Investment Classification: Renewal

Asset Category: Hydraulic Plant

Cost: $4,949,800

Executive Summary

The Cat Arm Hydroelectric Generation Station ("Cat Arm") is located on the Northern Peninsula of the island portion of the province and was synchronized in 1985. The generating station houses two identical Pelton Turbine hydroelectric generating units, both rated for a capacity of 67.5 megawatts ("MW"), with a total plant output of 680 gigawatt-hours ("GWh") annually.

During an annual unit outage in late 2023, Newfoundland and Labrador Hydro ("Hydro") executed field inspections and reviews of turbine components in Cat Arm in consultation with the turbine original equipment manufacturer ("OEM"). These inspections concluded that the runners on Cat Arm Unit 1 ("Unit 1") and Cat Arm Unit 2 ("Unit 2") were at the end of their life cycle and needed to be replaced, due to increased operational risk caused by excessive cavitation.[1] While there were no clear indications that the risk of failure was imminent, the risk associated with failure was elevated, and the OEM noted the runners had reached their end of service life. As the OEM was not on-site to complete the inspection, Hydro engaged a third-party consultant to conduct additional assessments in person during the annual unit outage the following year. These inspections confirmed that the runners associated with both units are at the end of their service lives and require replacement. Based on these findings, the consultant recommended replacement of the Unit 1 runner within 12 months, and replacement of the Unit 2 runner by the end of 2026. As Hydro's inventory contains only one spare runner, it was decided to proceed with the replacement of the Unit 1 runner in 2025 as recommended,[2] with the Unit 2 runner to be replaced in 2027 due to procurement lead times.

[1] Cavitation is a phenomenon involving pitting of the metallic surfaces of turbine parts due to the formation and collapse of vapour bubbles.

[2] Replacement of the existing Unit 1 runner with the capital spare will be completed in 2025 under Hydro's Hydraulic In-Service Failure Program. Hydro plans to propose to replenish its capital spare inventory in its 2026 Capital Budget Application ("CBA").

This project is required to ensure the continued reliable operation of Unit 2 and fulfillment of Hydro's legislated mandate to provide reliable service at the lowest possible cost, in an environmentally responsible manner. Without the replacement of the runner, the unit will continue to deteriorate and its reliability will decrease. Due to long lead times for runner procurement, currently expected to be approximately 19 months, Hydro determined this project should be presented as a supplemental application to minimize the operational risk to Unit 2.

This supplemental project has a multi-year approach, with completion planned in 2027 at an estimated cost of $4,949,800.

Contents

1.0 Introduction

This proposed project is for the purchase and installation of a new Pelton runner[3] for Unit 2. The Pelton runner includes a series of buckets attached to a circular disk and is a critical component of the hydroelectric generating unit turbine system, as shown in Figure 1. Other major components associated with the Pelton turbine system include the water nozzles, which direct high-pressure water to the buckets on the Pelton runner, and the runner removal platform, which allows maintenance access to the turbine system.

The Pelton runners used at Cat Arm are comprised of a specific casted metal alloy and require specialized heat treatment, preventing on-site repairs.[4] The Unit 2 runner was first assessed by the OEM in 2023, who suggested replacement of the runners on Unit 1 and Unit 2 which they deemed to have been at the end of service life. In addition, excessive cavitation was noted on each runner. While the OEM indicated that temporary repair may be possible, and there were no clear indications that risk of failure was imminent, the OEM indicated that cavitation repairs on site presented material risk to the asset.[5] In 2024, additional on-site inspections by an external consultant who specializes in Pelton turbines confirmed both runners were at the end of their service lives, with replacement necessary. Due to Hydro's inventory only containing one spare runner, which will be used for Unit 1, and long lead times for runner procurement of approximately 19 months, this proposed project to procure and install a new runner is required to minimize the operational risk to Unit 2.

[3] A Pelton runner is also referred to as an impulse runner, whereby the impulse of the water (kinetic energy) is captured in the bucket of the runner, converting the energy from kinetic to mechanical.
[4] The Pelton runners in use for Units 1 and 2 are different than Hydro's other turbine fleet which is mainly comprised of Francis turbines, and one single Kaplan turbine.
[5] The OEM was not on-site to complete the inspection and instead reviewed the results obtained by Hydro crews.

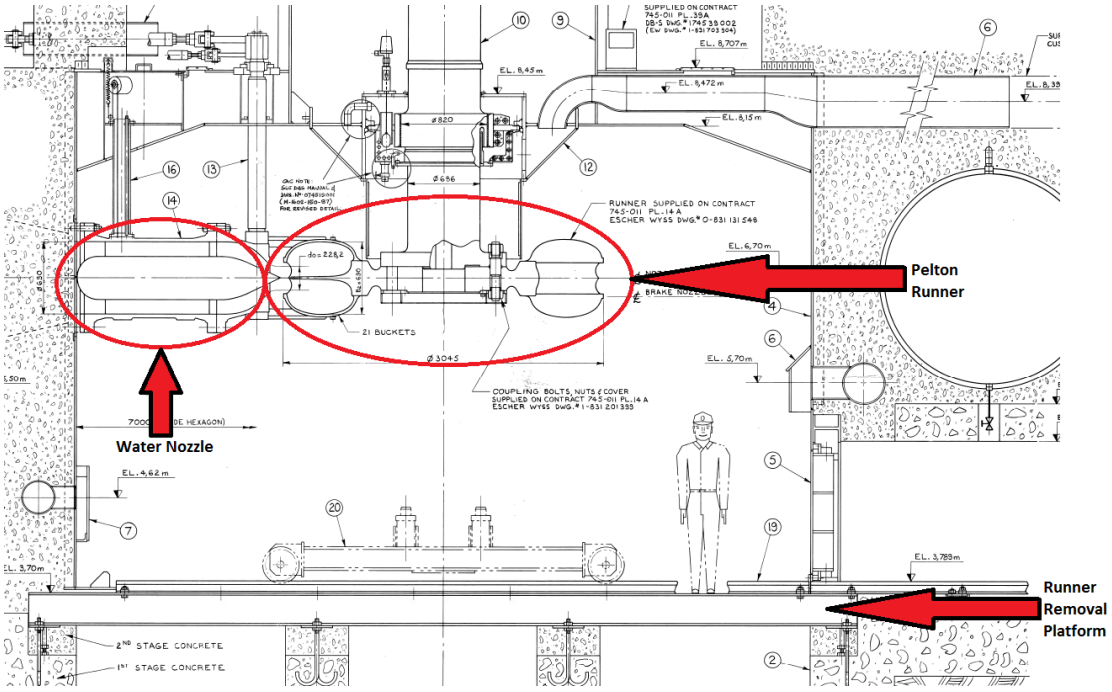

Figure 1: Sectional Profile of Pelton Turbine in Cat Arm

2.0 Project Description and Justification

Hydro is proposing this project to supply and install a new runner on Unit 2 in Cat Arm. Work activities in 2025 will include contract development, tendering, and procurement of the new runner, which will take approximately 19 months. In 2026, detailed engineering plans will be developed to install the new runner in 2027 during the annual maintenance season.

This project is required to ensure the reliable operation of Cat Arm. As confirmed by the OEM and third-party consultants, the runner on Unit 2 is at the end of its service life and requires timely replacement. Without the replacement of the Pelton runner, cavitation will continue to exponentially accelerate deterioration, impacting the reliable generation of energy from the unit. As indicated by the OEM, Hydro expects the service life of the new Pelton runner to be approximately 100,000 hours of operation.

3.0 Asset Overview

3.1 Asset Background

Cat Arm is located on the Northern Peninsula of Newfoundland, in close proximity to the Cat Arm reservoir and White Bay, and was first placed into service in 1985. The generating station has two

hydroelectric units producing 67.5 MW of power each, for a total plant capacity of 135 MW. The two hydroelectric units are of identical Pelton turbine design and installation, whereby high pressure water is directed through a nozzle assembly, which discharges a water jet stream towards a Pelton runner consisting of 21 buckets. As shown in Figure 2, the faces of the bucket are surfaces of double curvature, ellipsoidal in shape, and subjected to impulses of high kinetic energy.

Figure 2: Example of Pelton Runner

Hydro utilizes a robust inspection and maintenance program to track the performance and degradation of its turbine assets, which include various types of runners. To inspect the runner at Cat Arm, the permanently installed runner removal platform is used to gain access to the underside of the unit, allowing crews to inspect all areas of the turbine system.

In 2014, the Unit 1 runner experienced damage due to a broken piece on the leading edge of a bucket, as shown in Figure 3. Subsequent inspections on Unit 1 and Unit 2 also noted light cavitation on both runners. Upon review, it was determined that both the broken piece and light cavitation would not impact the operation of the units, and the runners could safely be placed back into service.

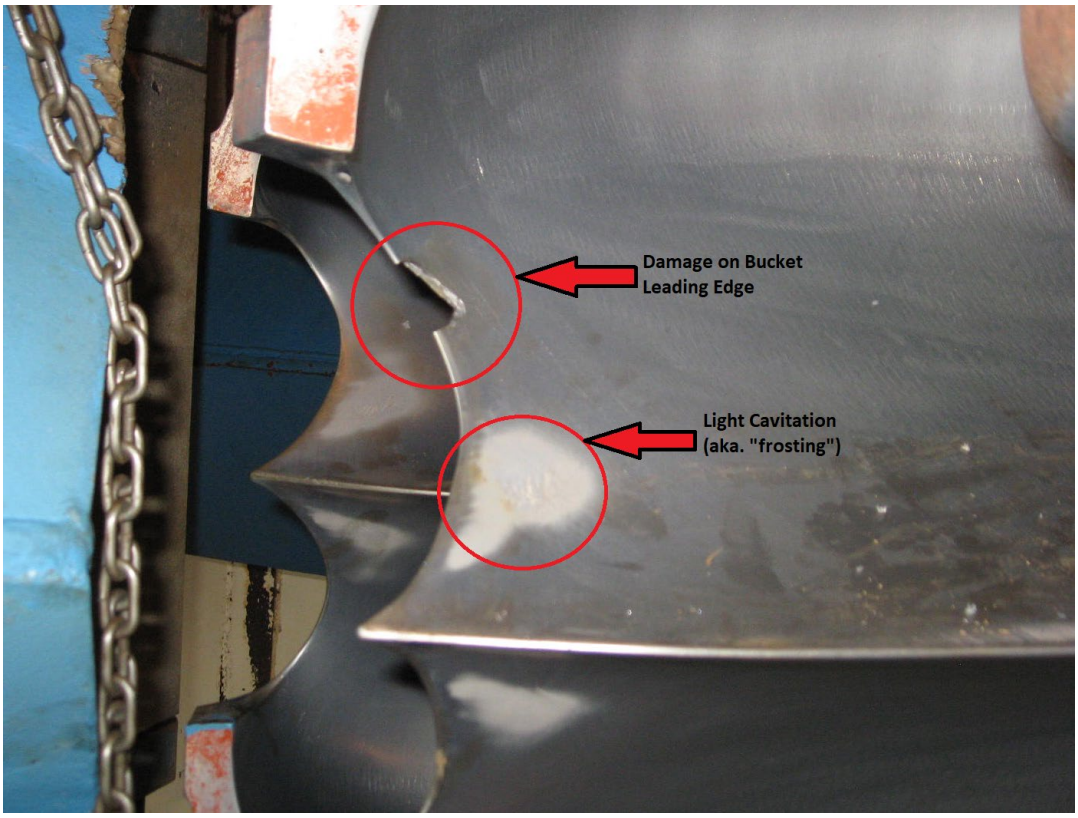

Figure 3: Cat Arm Unit 1 Pelton Runner Damage (2014)

Hydro previously experienced a failure of the runner removal platforms for Unit 1 and Unit 2 due to under-designed elements. Hydro retained the services of a third-party engineering consultant to re-design the platforms in 2019, with new platforms successfully installed for Unit 2 in 2020, and Unit 1 in 2023. During the years in which contract development, material procurement, and outage planning were underway for the installation of the new platforms, the level of inspections performed on the runners diminished due to accessibility difficulties.

After the maintenance platform was placed back into service for Unit 1 in 2023, a runner inspection determined that the cavitation, previously noted as light, had progressed. Hydro engaged the OEM for a review of the cavitation observed on Unit 1 and also expanded the services to include Unit 2. The review by the OEM concluded that both runners at Cat Arm are at the end of their life cycle, and should be replaced.

After the review by the OEM in 2023, an on-site assessment of the runners was completed in 2024 by an external consultant who specializes in Pelton turbines. The consultant confirmed the runners have

reached the end of their service lives, and must be replaced. Based on these findings, the consultant recommended replacement of the Unit 1 runner within 12 months, and replacement of the Unit 2 runner by the end of 2026. As Hydro's inventory only contains one spare runner, it was decided to proceed with the replacement of the Unit 1 runner in 2025 as recommended, with the Unit 2 runner to be replaced in 2027 due to procurement lead times.

3.2 Historical Reliability

Since February 1985, Unit 2 has been in service to the Island Interconnected System and has performed as expected. Hydro tracks performance data for its hydraulic units using the derated adjusted forced outage rate ("DAFOR");[6] this data is filed quarterly with the Board of Commissioners of Public Utilities.[7] As expected, the unit has experienced some forced outages over the past 40 years of service associated with various pieces of equipment, with notable issues and remedial actions including:

- Replacement of the direct current solenoid on the quick shutdown valve due to failure;
- Replacement of the air admission solenoid;
- Replacement of deteriorated solenoid coils; and
- Bleeding off level transducers when oil is removed to avoid air pockets, preventing high generator bearing oil levels and accumulator tank low oil levels.

3.3 Asset Condition

Unit 2 is currently in operating condition and has performed as expected during the past 40 years of service; however, as the Unit 2 runner has reached the end of its service life, capital maintenance investment is needed to make the necessary replacement to maintain its condition.

3.4 Condition-Based Remaining Life

The Unit 2 runner has reached the end of its useful service life and must be replaced.

[6] DAFOR is a metric that measures the percentage of time that a unit or group of units is unable to generate at its maximum continuous rating due to forced outages or unit deratings.
[7] "Quarterly Report on Asset Performance in Support of Resource Adequacy for the Twelve Months Ended December 31, 2024," Newfoundland and Labrador Hydro, January 31, 2025.

4.0 Analysis

4.1 Evaluation of Alternatives

Hydro has evaluated the following alternatives:

- Deferral;
- Upgrade life extension; and
- Like-for-like replacement.

4.1.1 Deferral

Deferral is not an option for this project, as the runner on Unit 2 is currently at the end of its service life at 40 years old. Deferral of this project presents an unacceptable risk to operation of the generating unit.

4.1.2 Upgrade Life Extension

The Unit 2 runner has reached the end of its useful life and must be replaced. As such, the alternative to pursue an upgrade life extension is not feasible.

4.1.3 Like-for-Like Replacement

This alternative involves like-for-like replacement of the Unit 2 runner at Cat Arm.

4.2 Least-Cost Evaluation

Hydro has not identified any viable alternatives to facilitate a least-cost evaluation.

4.3 Recommended Alternative

The recommended alternative is the like-for-like replacement of the Unit 2 runner, which requires the procurement and installation of one new runner for the unit. Hydro recommends completing the proposed runner replacement to ensure the reliable operation of Unit 2.

As Hydro's inventory only contains one spare runner, it was decided to proceed with the replacement of the Unit 1 runner in 2025,[8] with the Unit 2 runner to be replaced in 2027 due to procurement lead times.

4.3.1 Risk of Asset Stranding

Cat Arm is required to provide reliable power to the Island Interconnected System, and there are no plans to decommission this plant. Hydroelectric generating units with comparable capacities to Unit 1 and Unit 2 typically have an anticipated service life of 80 to 100 years; as such, Hydro believes the risk of asset stranding is low.

4.3.2 Risk Mitigation

Hydro assessed the pre- and post-implementation risk of the scope of work for this project in accordance with Hydro's Capital Risk Assessment process. The outcome of this assessment is provided in **Table 1.**

Table 1: Risk Scoring Pre- and Post-Implementation

	Impact	Likelihood	Score
Pre-Implementation	5	4	**20**
Post-Implementation	5	1	**5**
		Risk Mitigated	**15**
		Risk Mitigated per $1 Million	**3.0**

5.0 Scope of Work

This project proposes to supply and install a new runner on Unit 2 in Cat Arm. The scope of this project in 2025 includes contract development, tendering, and procurement of the new runner. In 2026, detailed engineering plans and contracts will be developed for the installation of the new runner, with runner delivery expected by year-end or early in 2027. The runner will be installed and commissioned during the annual maintenance season in 2027.

[8] Replacement of the existing Unit 1 runner with the capital spare will be completed in 2025 under Hydro's Hydraulic In-Service Failure Program. Hydro plans to propose to replenish its capital spare inventory in its 2026 CBA.

5.1 Project Budget

The estimate for this project is shown in Table 2.

Table 2: Project Estimate ($000)[9]

Project Cost	2025	2026	2027	Total
Material Supply	560.0	1,960.0	335.0	2,855.0
Labour	54.0	37.5	169.9	261.4
Consultant	32.5	65.0	77.5	175.0
Contract Work	0.0	0.0	693.0	693.0
Other Direct Costs	3.2	3.6	56.8	63.7
Interest and Escalation	33.2	189.4	274.4	496.9
Contingency	65.0	206.6	133.2	404.8
Total	**747.9**	**2,462.1**	**1,739.8**	**4,949.8**

5.2 Project Schedule

The project schedule is presented in Table 3.

Table 3: Project Schedule

Activity	Start Date	End Date
Planning:		
Open project and develop work orders.	April 2025	April 2025
Procurement:		
Develop procurement contracts.	April 2025	June 2025
Develop installation contracts.	April 2026	June 2026
Construction:		
Install new runner.	October 2027	October 2027
Commissioning:		
Commission new runner.	October 2027	October 2027
Closeout:		
Closeout work orders.	November 2027	December 2027
Complete lessons learned.	November 2027	December 2027

[9] Numbers may not add due to rounding.

6.0 Conclusion

Hydro is proposing to supply and install a new runner on Unit 2 in Cat Arm. As confirmed by the OEM and a third-party consultant, the runner on Unit 2 is at the end of its service life and requires timely replacement. Without the replacement of the runner, the unit will continue to deteriorate, and its reliability will decrease. Hydro recommends proceeding with this project to ensure the continued reliable operation of Unit 2.

Affidavit

IN THE MATTER OF the *Electrical Power Control Act, 1994,* SNL 1994, Chapter E-5.1 ("*EPCA*") and the *Public Utilities Act*, RSNL 1990, Chapter P-47 ("*Act*"), and regulations thereunder; and

IN THE MATTER OF an application by Newfoundland and Labrador Hydro for an approval of capital expenditures for the purchase and installation of a runner at the Cat Arm Hydroelectric Generating Station pursuant to Section 41(3) of the *Act*.

AFFIDAVIT

I, Paul Dillon of St. John's in the province of Newfoundland and Labrador, make oath and say as follows:

1) I am Director of Engineering, Engineering and Technology, Newfoundland and Labrador Hydro, the applicant named in the attached application.
2) I have read and understand the foregoing application.
3) To the best of my knowledge, information, and belief, all of the matters, facts, and things set out in this application are true.

SWORN at St. John's in the province of Newfoundland and Labrador this 19th day of February 2025, before me:

Renée Reardon
Commissioner for Oaths, Newfoundland and Labrador

Paul Dillon

RENEE REARDON
A Commissioner for Oaths in and for
the Province of Newfoundland and Labrador.
My commission expires on December 31, 2029.