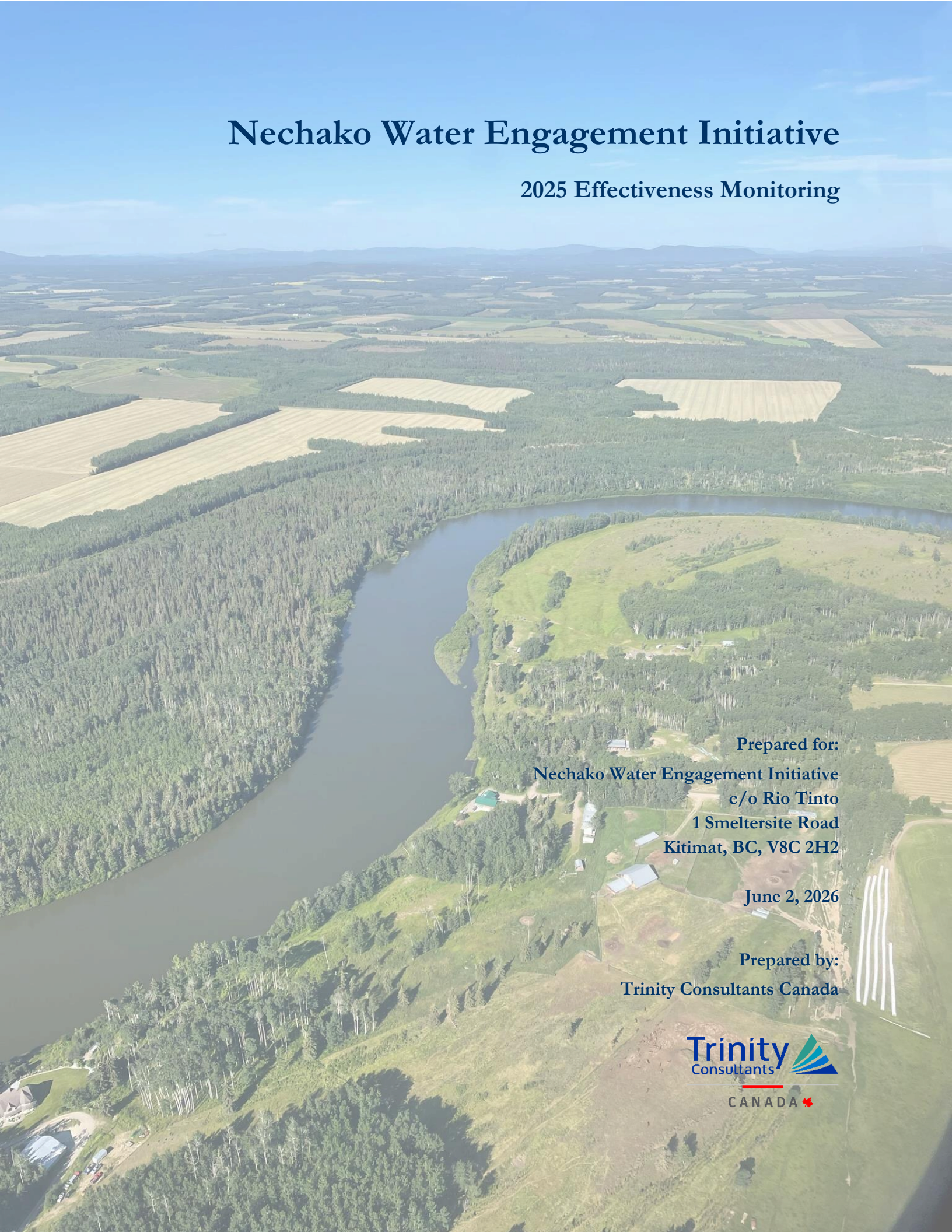
Nechako Water Engagement Initiative

2025 Effectiveness Monitoring



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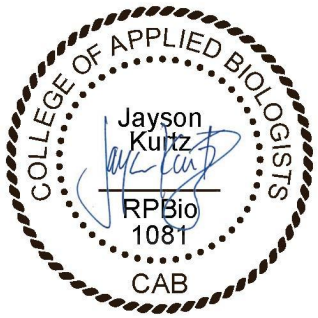
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1. INTRODUCTION

1.1. Water Engagement Initiative Overview

The Water Engagement Initiative (WEI) is a collaborative planning process designed to support informed and inclusive management decisions about the storage and release of water from Rio Tinto's Nechako Reservoir. WEI has three phases: Phase 1 focuses on incremental benefits including modest flow alternatives that Rio Tinto can implement in the near-term, while subsequent phases will include changes to approvals, licences, and power agreements and modified or new water management infrastructure.

WEI launched in 2019 with the establishment of a Main Table with representatives from First Nations, federal, provincial, and municipal governments, academia, special interest groups, the public, and Rio Tinto. Through facilitated discussion, the Main Table identified a wide range of environmental, cultural, social, and business interests and issues for consideration. With the support of a Technical Working Group, WEI undertook assessments of these interests/issues to better understand current conditions, evaluate constraints, and identify operating alternatives and other options to improve conditions. This work involved quantitative and value-based processes, including Structured Decision Making, to predict outcomes and resolve competing interests. In late 2023, the Main Table arrived at a consensus-based solution that included a new flow regime (Flow Alternative 6a), environmental studies to fill knowledge gaps, and physical works for immediate improvements. The WEI context, process, issues, and outcomes are detailed in the Phase 1 Report[1] which was approved by the Main Table in November 2024.

Since this important milestone, the WEI Main Table and Technical Working Group cadence has slowed, and Rio Tinto has embarked on implementing Phase 1 and planning for the next phase. One key component of Phase 1 implementation is monitoring the effectiveness of the new flow alternative in achieving the objectives set by the Main Table. This document reports the monitoring results for 2025. Alternative 6a for dry years was implemented May 10 through June 3, and the Stream Temperature Monitoring Program (STMP) ran July 10 – August 18. The effectiveness monitoring presented here reflect outcomes under Flow Alternative 6a (Figure 1).

[1] Environmental Dynamics Inc., Ecofish Research Ltd., and Compass Resource Management Ltd. 2024. Water Engagement Initiative: Final Phase 1 Report. Consultant's report prepared for the *Water Engagement Initiative* Main Table, November 2024.

1.2. Structured Decision Making and Performance Measures

To provide context for the monitoring approach described below, an overview of Structured Decision Making is summarized here.

Structured Decision Making is a systematic, science-based approach that facilitates informed and transparent choices between multiple, often competing interests. It incorporates technical expertise and stakeholder input to clarify objectives, evaluate how well different flow scenarios satisfy participant interests (e.g., through scenario modelling), and explore trade-offs between alternatives. Participants then use the results to refine the alternative scenarios until a preferred option is developed that best satisfies most or all interests. In this process, performance measures (PMs) are specific metrics that are used to develop and compare alternative scenarios. PMs represent the things that matter to participants and can be based on scientific, social, or cultural interests. PMs are usually presented in a consequence table, where the results of different alternatives are shown side-by-side for easy comparison.

In the context of WEI, PMs relate an issue (e.g., fish habitat, shoreline erosion, etc.) to a water management scenario (e.g., the amount or timing of flow/water level). In Phase 1, 19 PMs were developed for the flow alternative structured decision-making process (Table 1). Scenario modelling used historical inflow data (i.e., actual inflows in the last 30 years) to complete power, water level, and flow modelling, which was used to calculate PMs for interests of the Main Table (e.g., amount of fish habitat, days of flooding, power generation, etc.), and compare how PM results change across flow scenarios (e.g., lower summer flows than normal).

Table 1. Performance Measures used in the Phase 1 Structured Decision Making process to develop a preferred flow alternative.

Issue Name	Basin	PM #	PM	Monitoring Location	Timing	Units
River fish side channel habitat	Nechako River	6	Average flow (higher is better)	Below Cheslatta Falls (WSC station 08JA017)	May 1 - Sep 30	cm/s
Reservoir productivity-flushing	Nechako Reservoir	12	Average discharge (lower is better)	Skins Lake Spillway (WSC station 08JA023)	May 1 - Sep 30	cm/s
Cheslatta fish habitat	Cheslatta watershed	17	Range of flow (lower is better)	Skins Lake Spillway (WSC station 08JA023)	May 1 - Sep 30	cm/s
River water temperature & migrating salmon	Nechako River	18a	# days average daily temperature >18ºC (less is better)	Vanderhoof (WSC station 08JC001)	Jun 15 - Aug 29	Days
		18c	# days average daily temperature >20ºC (less is better)	Vanderhoof (WSC station 08JC001)	Jun 15 - Aug 29	Days
River Chinook Salmon incubation flow	Nechako River	21a	Ratio of minimum incubation to average spawning flow (higher is better)	Below Cheslatta Falls (WSC station 08JA017)	Aug 15 - May 15	%
River Chinook Salmon rearing habitat	Nechako River	22a V2	% maximum available post-emergent habitat (higher is better)	Below Cheslatta Falls (WSC station 08JA017)	Mar 1 - May 15	%
		22b V2	% maximum available pre-migrant habitat (higher is better)	Below Cheslatta Falls (WSC station 08JA017)	Mar 1 - May 15	%
Resident fish rearing habitat	Nechako River	25a	% maximum available juvenile habitat (higher is better)	Below Cheslatta Falls (WSC station 08JA017)	May 1 - Sep 30	%

Table 1. Continued (2 of 2).

Issue Name	Basin	PM #	PM	Monitoring Location	Timing	Units
Resident fish overwinter habitat	Nechako River	26	% maximum available overwintering habitat (higher is better)	Below Cheslatta Falls (WSC station 08JA017)	Nov 1 - Mar 31	%
Reservoir caribou land links	Nechako Reservoir	32	# days water elevation > 852 m (higher is better)	Skins Lake Spillway (WSC station 08JA023)	May - Jul 7	Days
Reservoir osprey nesting habitat	Nechako Reservoir	38	# years reservoir elevation > 852.44m (higher is better)	Skins Lake Spillway (WSC station 08JA023)	May 1 - Aug 15	Years
Reservoir wetland habitat	Nechako Reservoir	41b	# years where reservoir elevation > 852.94 m (higher is better)	Skins Lake Spillway (WSC station 08JA023)	May 1 - Sep 30	Years
River bird nest inundation	Nechako River	45b	# years where Cheslatta discharge > 275 cm/s (less is better)	Below Cheslatta Falls (WSC station 08JA017)	May 1 - Jul 21	Years
Archeological sites inundation	Cheslatta watershed	49a	# days > 300 cm/s (less is better)	Below Cheslatta Falls (WSC station 08JA017)	Jan 1 - Dec 31	Days
River open-water flooding	Nechako River	53	# of days flow >550 m^3/s (less is better)	Vanderhoof (WSC station 08JC001)	Apr 1 - Oct 31	Days
Kemano power generation	Nechako Reservoir	65b	# of days smelter load not met (Less is better)	Kemano	Jan 1 - Dec 31	Days
Kemano power exports	Nechako Reservoir	66b	Tier 1 reliability (higher is better)	Kemano	Jan 1 - Dec 31	MW
Kemano power exports	Nechako Reservoir	67	Mean Tier 2 power generation (higher is better)	Kemano	Jan 1 - Dec 31	MW

2. MONITORING APPROACH

During WEI Phase 1, different monitoring options were evaluated to determine the best approach to assess the effectiveness of the selected flow alternative in meeting Main Table interests.

Key considerations included:

1. Lessons learned from other processes (e.g., BC Hydro Water Use Plans, BC Independent Power Projects, the Missouri River Pallid Sturgeon Program, etc.).
2. The expected magnitude of change. Flow Alternative 6a is only modestly different from status quo, and the resulting ecological changes are also expected to be modest. The effort required to detect minor ecological changes is often disproportionately high compared to larger changes.
3. The timeline expectations of the Main Table and the time required for complex ecological ecosystems to respond to flow changes. Should the flow alternative be implemented right away, or is it acceptable to delay until baseline data is sufficient? Can the monitoring be completed before subsequent WEI phases, or will those phases need to be delayed until monitoring is complete.
4. The benefits and limitations of standard monitoring designs (e.g., before-after, before-after-control-impact, reference condition approach) in detecting subtle changes over the available timeframe.
5. The availability and uncertainty of baseline data.
6. The overall time, effort, and cost required to collect robust data (including baseline monitoring).

These factors led to the conclusion that direct monitoring of ecological or biological outcomes (e.g., fish population response or rearing habitat changes) would not be effective or feasible in Phase 1. Recognizing the lack of baseline data to support biological response monitoring, Phase 1 implementation includes data gap studies to ensure future monitoring can be effective. The effectiveness monitoring approach for 2025 was to use PMs as a proxy to bioecological response and compare predicted PM[2] results (used to develop flow alternatives, based on the last 30 years of flow records) to actual PM results based on 2025 flow data.

[2] Several of the Phase 1 PMs were counts (osprey nesting habitat, wetland habitat, and bird nest inundation) or averages (tier 1 power reliability) across years. These PMs were useful in structured decision making when comparing results of two different flow scenarios across multiple years of flow data. However, the statistics to calculate these PMs are less meaningful for a single year of data (e.g., 2026); hence, these PMs were omitted from effectiveness monitoring comparisons.

The physical indicators used to calculate PMs included:

- Reservoir elevation
- Skins Lake Spillway (SLS) discharge
- Nechako River flow and river elevation
- Nechako River temperature
- Kemano power output

All of these indicators are already being monitored using existing infrastructure and programs, making this approach timely, practical, and cost-effective.

3. RESULTS

Water level in Nechako Reservoir and flow at SLS and Nechako River at Vanderhoof for 2025 compared to historical data are provided in Figure 1 to Figure 3. Calculated performance measure results for 2025 are compared to the predicted PM results based on the historical record of flow (1990 to 2019) in Table 2. This comparison uses colored highlighting to indicate whether the 2025 results were predicted by most of the historical flow record (i.e., between the 20^{th} – 80^{th} percentile), were less typical and predicted by 20% of the historical flow record (i.e., the 0 - 20^{th} or 80^{th} - 100^{th} percentiles, or were not predicted (e.g., 2025 results were more extreme than any of the historical flow record predictions).

Figure 1. 2025 Nechako Reservoir water levels (sourced from Rio Tinto Flow Facts at https://www.getinvolvednechako.ca/flow-facts/).

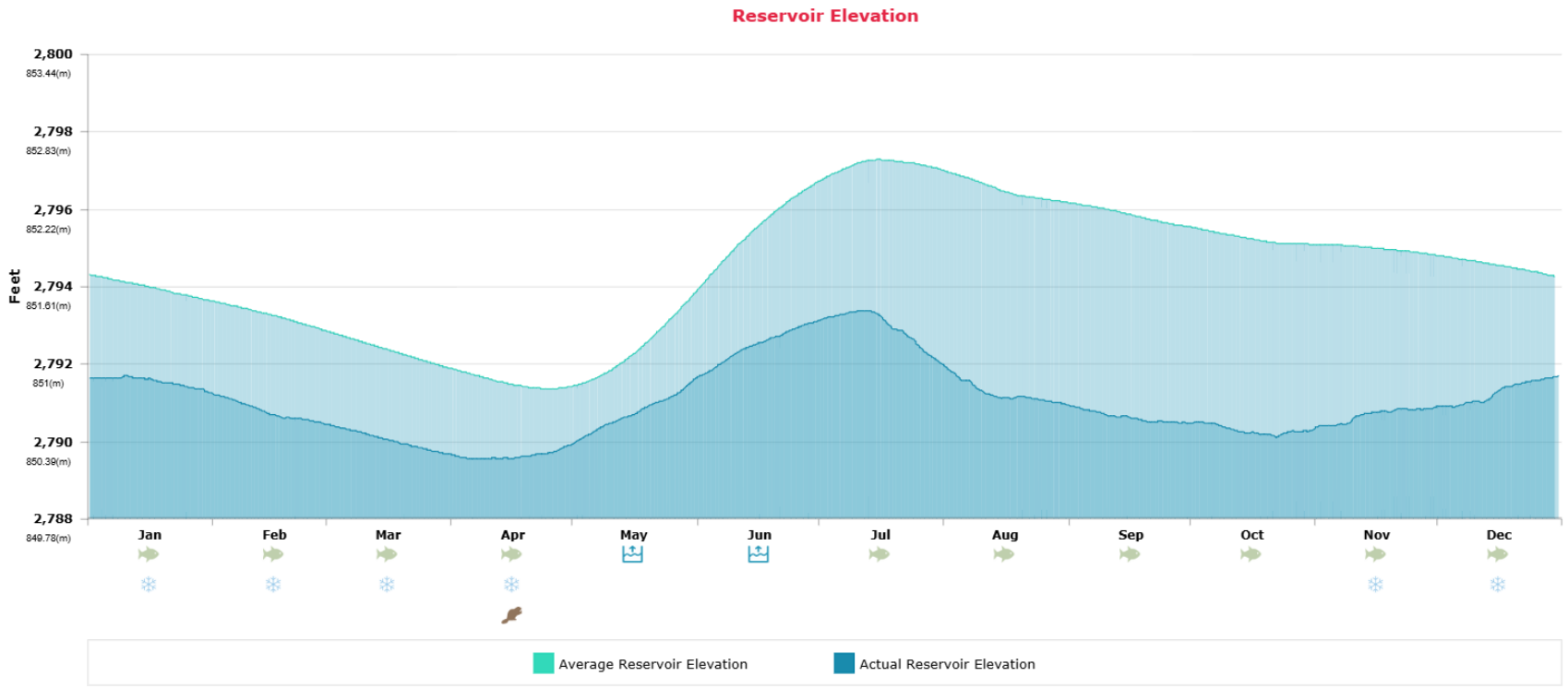


Figure 2. Skins Lake Spillway discharge in 2025 (sourced from Rio Tinto Flow Facts at https://www.getinvolvednechako.ca/flow-facts/).

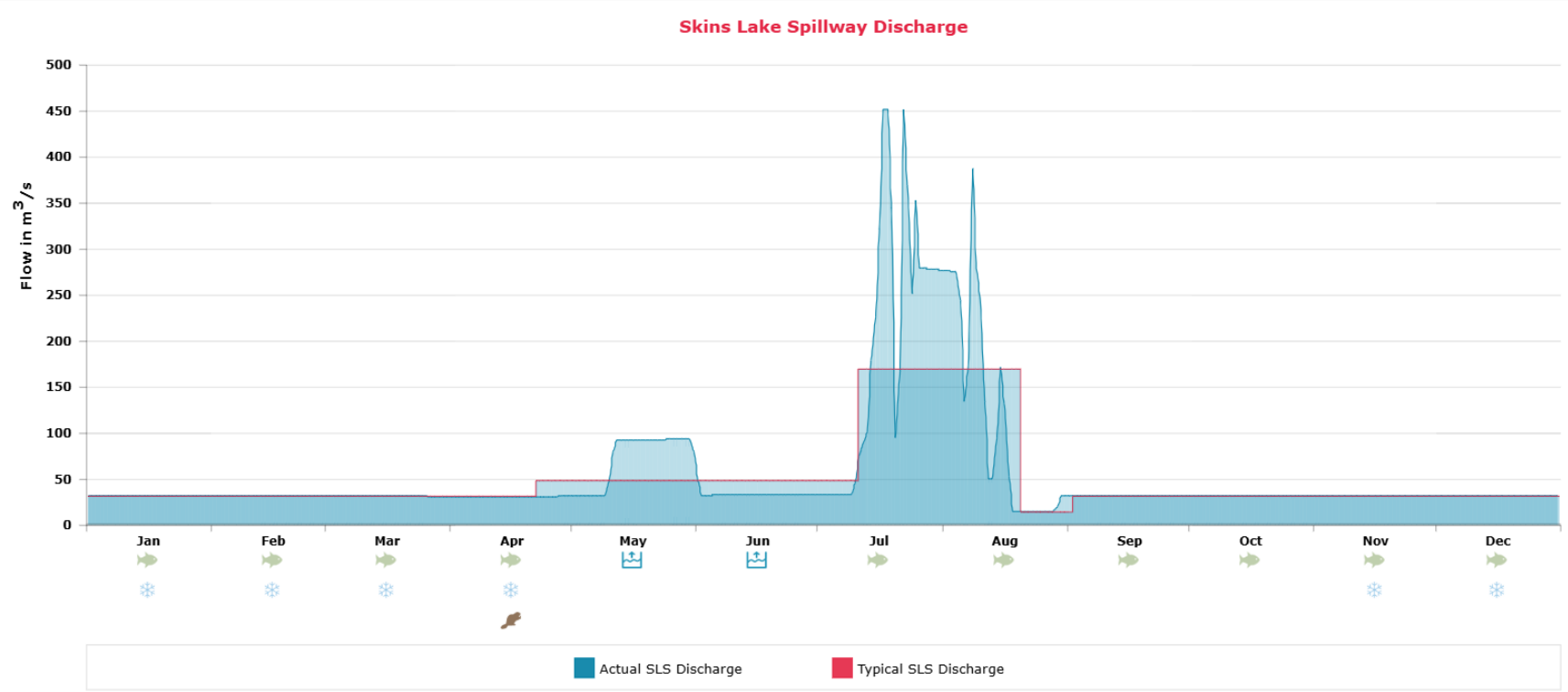


Figure 3. Nechako River discharge at Vanderhoof in 2025 (sourced from Rio Tinto Flow Facts at https://www.getinvolvednechako.ca/flow-facts/).

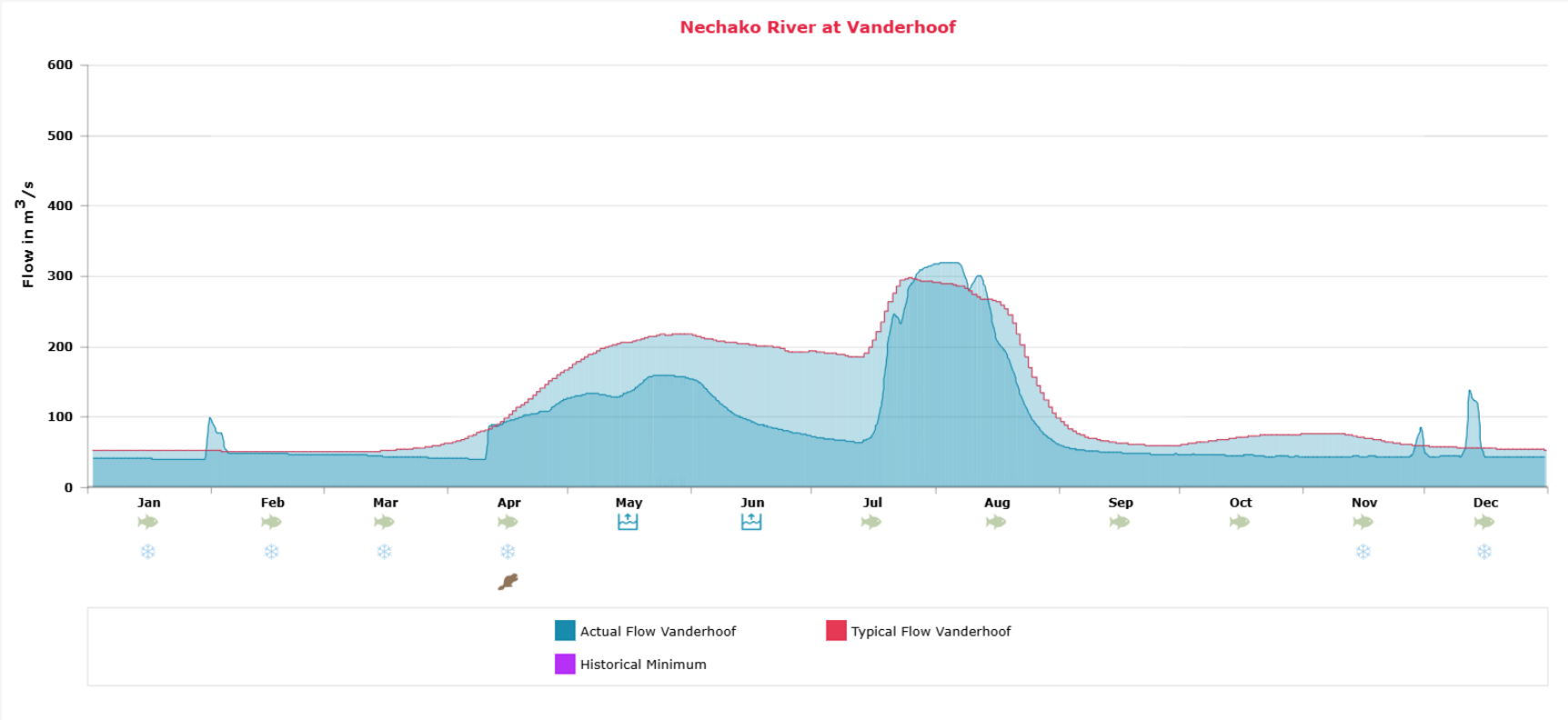


Table 2. Alt 6a (dry year) PM outcomes for 2025 (calculated using 2025 flow data flow) and based on simulated predictions (calculated using historical flow data from 1990 to 2019).

Basin	Issue	PM	What is Better	2025 Actual Results[1]	Simulated Predictions[2] (modelled from 1990 to 2019				
					Min.	20p	Median	80p	Max.
Nechako Reservoir	Productivity (flushing)	Average discharge	Lower	88.9	73.1	79.4	84.9	97.0	258.1
	Caribou land links	# days water elevation > 852 m	Higher	0.0	0	0	8	35	55
Cheslatta watershed	Fish habitat	Discharge range	Lower	437.7	145	168	192	296	400
	Archeological site inundation	# days > 300 m^3/s	Lower	8	0	0	0	2	100
Nechako River	Fish access to side-channels	Average discharge	Higher	88.3	81.1	87.1	92.6	104.7	278.6
	Water temperature & migrating salmon	# days average daily temperature > 18°C	Lower	59	0	16	31	40	45
		# days average daily temperature > 20°C	Lower	10	0	0	6	8	13
	Chinook incubation habitat	Min. incubation / average spawning flow	Higher	59.6	21.0	46.7	50.3	52.5	55.1
	Chinook post-emergent habitat	% of max. available habitat	Higher	100	16	99	100	100	100
	Chinook pre-migrant habitat	% of max. available habitat	Higher	83.3	12.5	76.8	84.8	86.7	91.7
	Resident fish rearing habitat	% of max. available habitat	Higher	73.4	18.8	61.5	66.2	67.4	70.8
	Resident fish overwinter habitat	% of max. available habitat	Higher	92.6	49.4	95.4	95.6	96.3	97.3
	Open-water flooding	# days discharge > 550 m^3/s	Lower	0	0	0	0	0	2
Kemano	Smelter power	# days smelter load not met	Lower	183	0	0	0	0	0
	Tier 2 power exports	Average Tier 2 power generation	Higher	0.0	4.5	32.4	136.3	177.3	177.5

[1] Notes:

- 2025 results within the 20th - 80th percentile of the predicted range (e.g., typical conditions) are shown in white.
- 2025 results towards the extremes of the predicted range are shown in light orange (i.e., 0 - 20th percentile, lower than typical conditions) and light blue (i.e., 80th-100th percentile, higher than typical conditions).
- 2025 results outside the predicted range are show in dark orange (below the predicted minimum) and dark blue (above the predicted maximum).

[2] Notes:

- Grey indicates where the 2025 results fall within the range of simulated predictions.

4. DISCUSSION/RECOMMENDATIONS

The year 2025 was the first time that flow alternative 6a was implemented (dry year option). Most PMs (i.e., nine of 15) fell within the range of values predicted from historical data. Three of these PMs were within the 20th - 80th percentile of predicted results based on historical inflows (e.g., typical conditions), three were less than the median but still within the overall predicted range, and one was more than the median but still within the overall range. Six PMs fell outside the predicted range, indicating more extreme conditions than anticipated. PMs that performed better under low/stable water conditions were Chinook Salmon incubation habitat and Nechako River resident fish rearing habitat, while PMs that performed worse under these flow conditions were Cheslatta watershed fish habitat, water temperature and migrating salmon, smelter power, and tier 2 power exports.

Similar to 2024, the primary drivers of PM performance in 2025 were ongoing record drought[3] and high summer air and water temperatures across the watershed. In response to drought conditions, Rio Tinto reduced Kemano power generation and imported electricity for the smelter to conserve water in the reservoir. Despite these actions, the reservoir water level remained well below normal. Nonetheless, discharge from SLS achieved minimum flow requirements and higher-than normal flows to meet STMP requirements. Tributary inflows (including the Stuart and Nautley) were also lower than normal. As a result, the Nechako River experienced lower flows than normal most of the year, but higher flows than normal during STMP.

It is important to emphasize that the monitoring approach and PM results described above do not necessarily represent actual results "on the ground" (e.g., they do not tell us how many fish were produced, or how many bird nests were damaged). Rather, the monitoring describes whether the flow regime produced the predicted PMs. Nonetheless, for the anticipated magnitude of change, the effort expended, and other constraints, this approach is reasonable to give at least an indication of how river flow/ reservoir water level addressed the environmental, cultural, social, and business interests of WEI participants. It is important to note, that although Flow Alternative 6a was implemented in 2025, the PM outcomes were similar to those of 2024 (also a drought year) when Flow Alternative 6a was not implemented. Continued monitoring is required in both dry/normal and wet years to determine whether the flow regime satisfies WEI interests.

[3] 2024 and 2025 had the lowest and second lowest, respectively, freshet volume for the reservoir on record.

5. CLOSURE

The 2025 monitoring results provide an important early benchmark for evaluating how flow conditions affect key environmental, cultural, social, and business interests identified through the WEI process. Flow Alternative 6a was implemented in May 2025, and the comparison of actual PM's to the status quo suggests there were limited changes in directions, highlighting the influence of ongoing climatic conditions on PM performance and the importance of adaptive water management. Continued monitoring of Flow Alternative 6a will allow the assessment of whether the alternative meets WEI objectives and inform future WEI phases.