Phase 1 Bookend Alternatives

Nechako WEI Meeting 29 - Wednesday, November 16, 2022

(In Vanderhoof, BC)

Michael Harstone, Compass Resource Mgt
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Katie Healey, Ecofish

Draft Meeting Objectives

The following draft objectives have been proposed for the workshop:

- To review and provide an update since the last meeting
- To review and assess the performance of the Phase 1 Bookend Flow Alternatives
- To discuss and identify which Phase 1 Bookend Alternatives are better (or worse) at meeting BOTH your individual AND the collective interests of the Main Table (e.g., through some ranking exercises that you will be asked to do)
- To share and discuss ways to develop new and improved Phase 1 Flow Alternatives to be modeled
- To discuss the workplan and schedule for 2023
- To review any other next steps

Nechako WEI Process Steps

Timeline

Step 1 (2017)
Pre-engagement on methods and topics for the water engagement

Step 2 (January – March 2018)
Report out on Step 1 and develop plan for focused Water Engagement Initiative.

Step 3 (March – July 2018)
Launch search for independent facilitator (EDI Environmental Dynamics Inc. selected)

Step 4
Broad based engagement is underway to gain an understanding of interests to be addressed. Includes public meetings, small group workshops and one on one dialogue.

Step 5 (Future stage)
Develop options to address interests raised in Step 4.

Step 6 (Future stage)
Report back and present draft options for further refinement. Includes public meetings, small group workshops and one on one dialogue.

Step 7 (Future stage)
Finalise options and develop implementation plan, including regulatory approval where required.

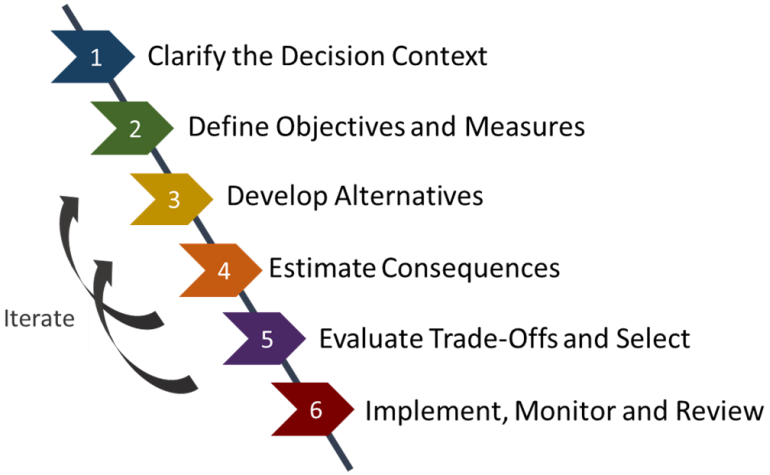
Assessment of Flow Alternatives – Snapshot Overview

Purpose

To explore and determine ways to improve Rio Tinto water management operations on the Nechako, given the multiple and competing water uses

Schedule

- Multiple Main Table Meetings over the next 12 months or so
- ~ 1 day meetings every 8-10 weeks



Planning Framework

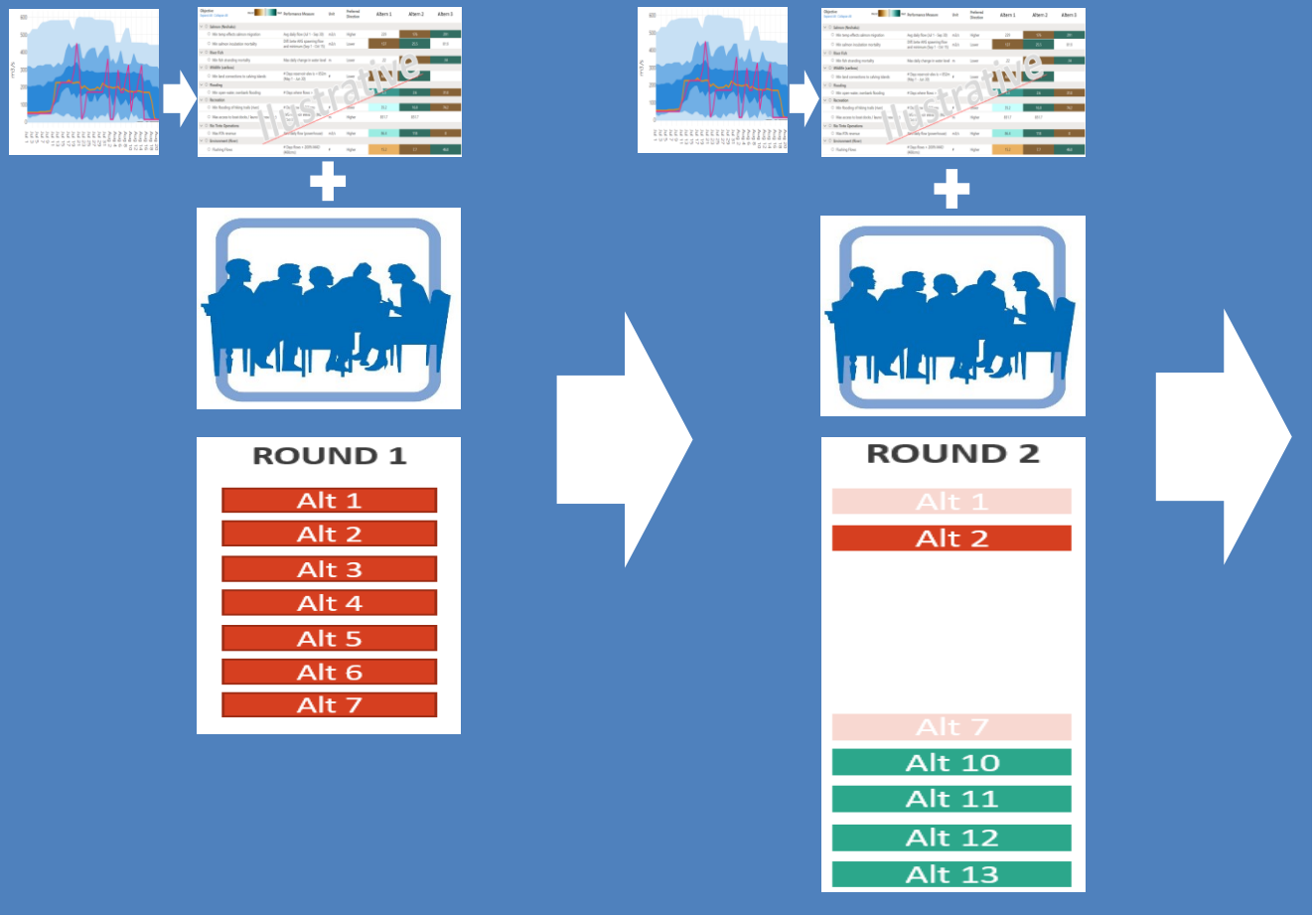
Structured Decision Making (consistent with *Provincial WUP Guidelines*)

WEI Main Table

To collaboratively share interests; identify and assess different flow alternatives; and aim to reach agreement on a preferred (and balanced) flow regime for the water control facilities

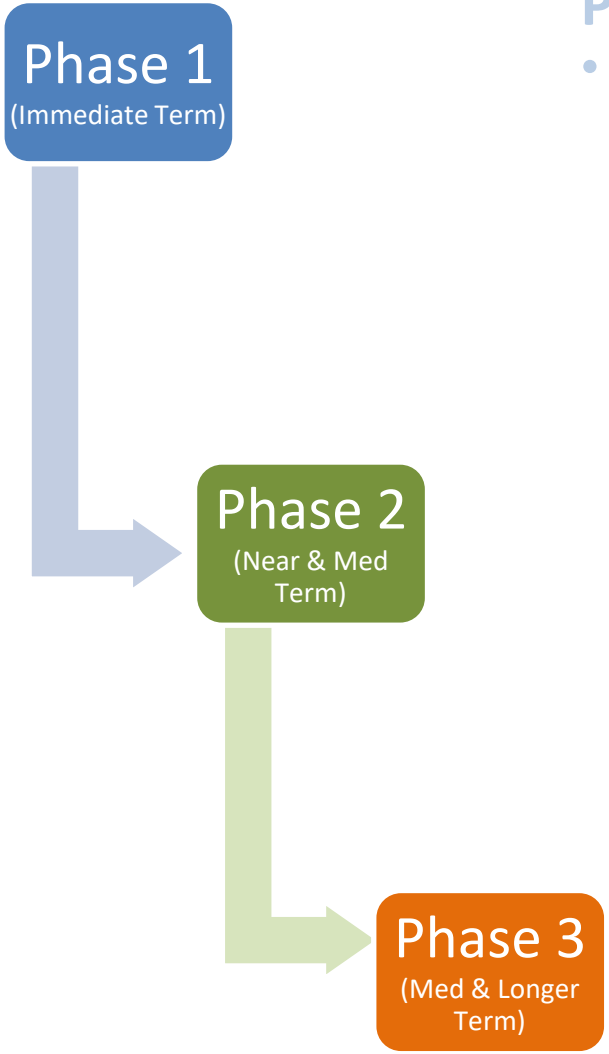
Refresher from our last meetings

SDM Process Steps



Refresher from our last meetings

Structure and Sequencing – as agreed to



Phase 1 Flow Alternatives

- Flow alternatives that Rio Tinto could unilaterally make within the immediate term (e.g., next calendar year) with notification to regulators, First Nations and stakeholders with time to undertake any internal assessments that may need to be carried out.

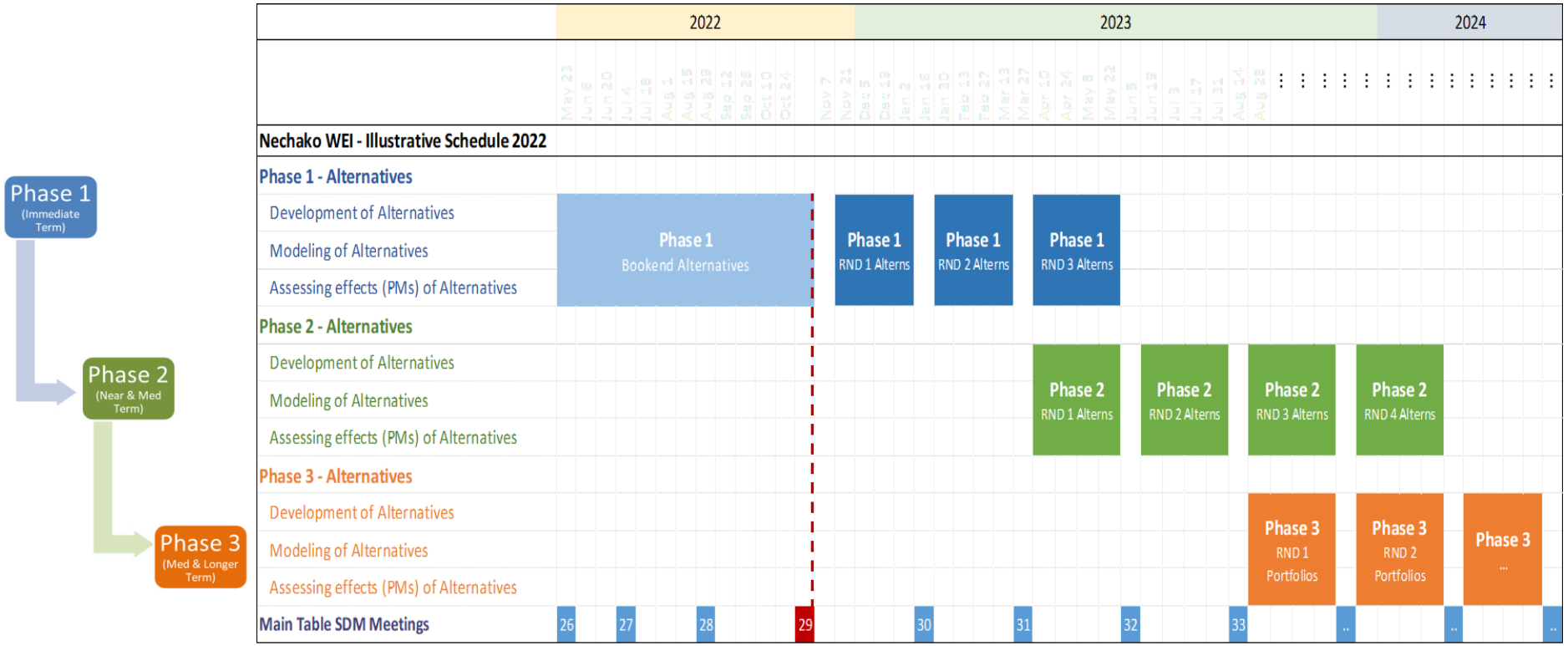
Phase 2 Flow Alternatives

- Flow alternatives that would require Rio Tinto to seek some form of approval / authorization(s) according to their existing water license and/or flow related agreements and/or commitments with First Nations.

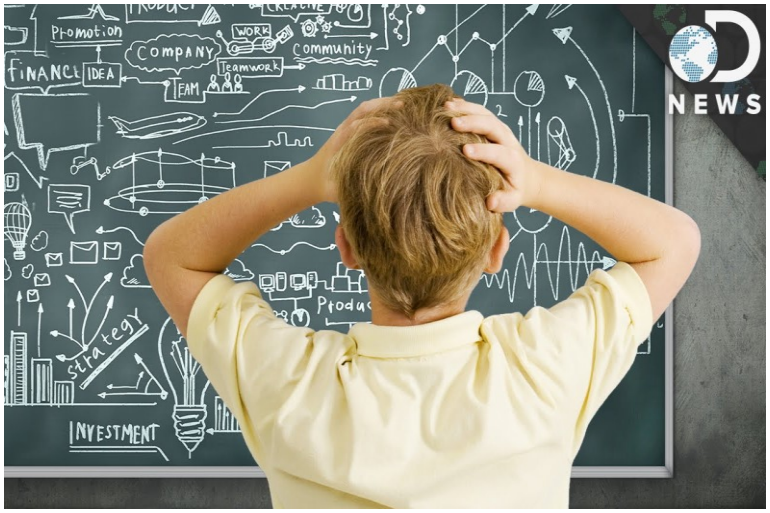
Phase 3 Flow Alternatives

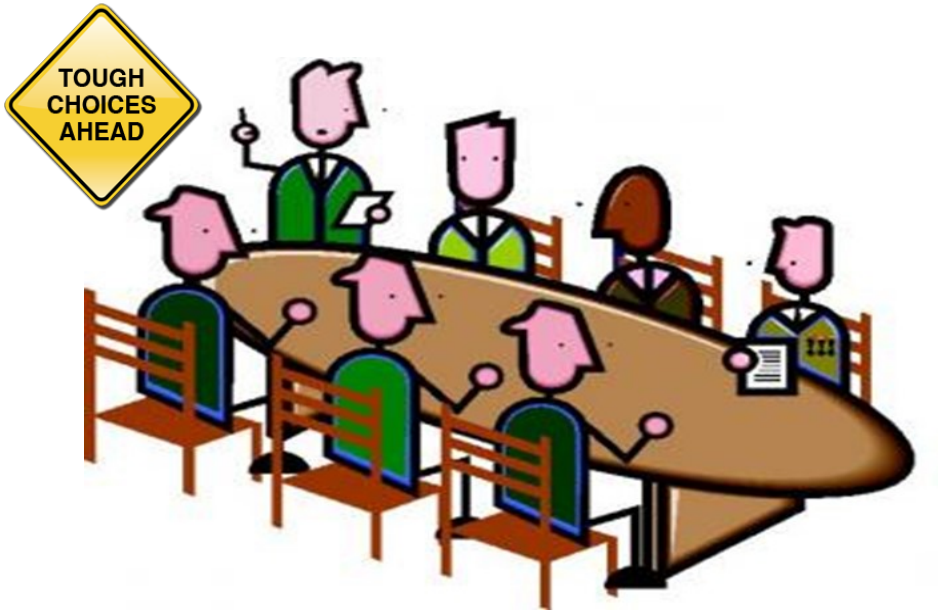
- Combination of new water management facilities (mitigation / enhancement projects) and potential changes to flow releases to the Nechako River to maintain and/or improve conditions related to key water uses.

Draft Workplan: as discussed



About Today


Promotion
Company
Community
FINANCE
IDEA
Teamwork
TEAM
NEWS
Strategy
INVESTMENT


TOUGH
CHOICES
AHEAD

About Today

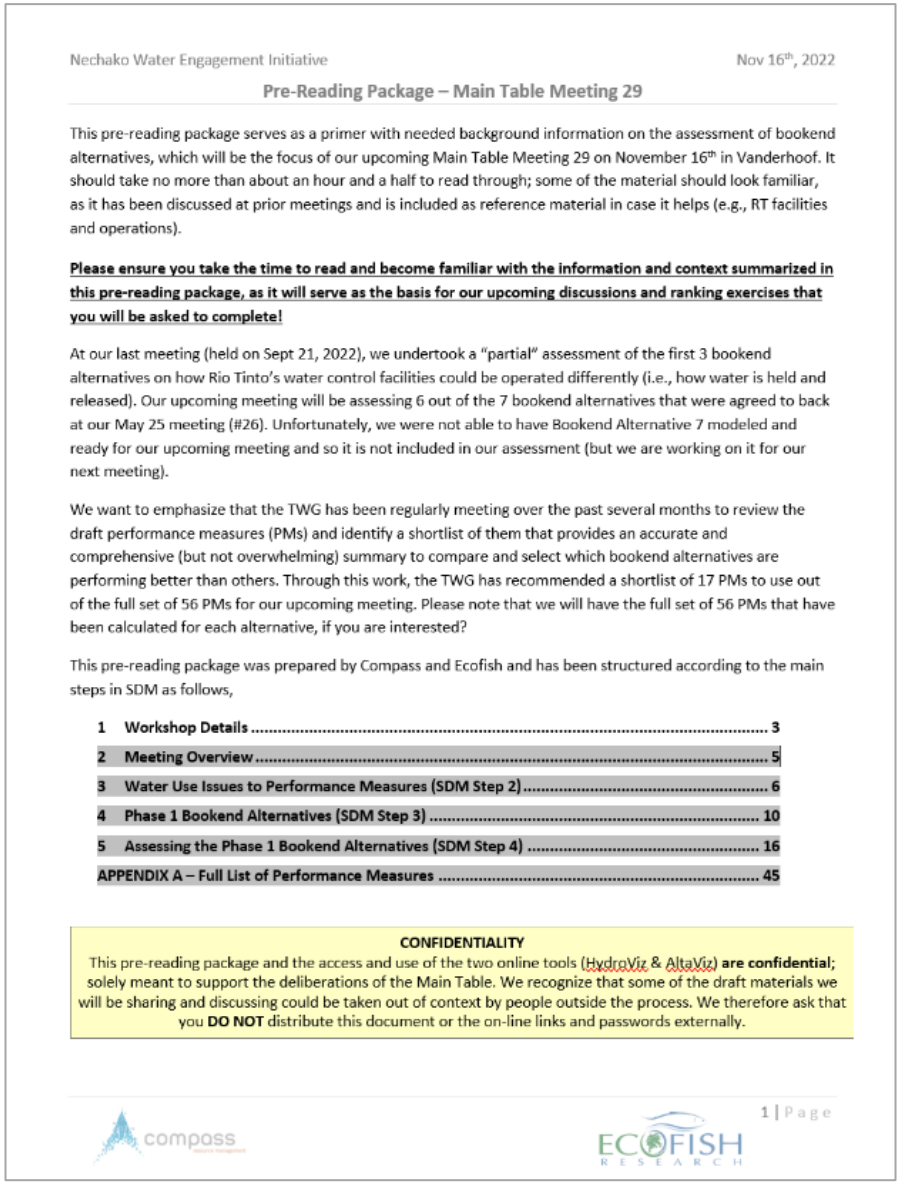
Pre-Reading that was sent out ➔

On-line webtools Training Session (Recorded)

HydroViz – Link here: https://www.hydroviz.ca/nechako

AltaViz – Link here: https://www.altaviz.ca/public/220db3fc-2aa8-4eea-9dd1-e3a26c4bb97a

Access Code (same for both): NECHAKOWEI



Nechako Water Engagement Initiative — Nov 16th, 2022

Pre-Reading Package – Main Table Meeting 29

This pre-reading package serves as a primer with needed background information on the assessment of bookend alternatives, which will be the focus of our upcoming Main Table Meeting 29 on November 16th in Vanderhoof. It should take no more than about an hour and a half to read through; some of the material should look familiar, as it has been discussed at prior meetings and is included as reference material in case it helps (e.g., RT facilities and operations).

Please ensure you take the time to read and become familiar with the information and context summarized in this pre-reading package, as it will serve as the basis for our upcoming discussions and ranking exercises that you will be asked to complete!

At our last meeting (held on Sept 21, 2022), we undertook a "partial" assessment of the first 3 bookend alternatives on how Rio Tinto's water control facilities could be operated differently (i.e., how water is held and released). Our upcoming meeting will be assessing 6 out of the 7 bookend alternatives that were agreed to back at our May 25 meeting (#26). Unfortunately, we were not able to have Bookend Alternative 7 modeled and ready for our upcoming meeting and so it is not included in our assessment (but we are working on it for our next meeting).

We want to emphasize that the TWG has been regularly meeting over the past several months to review the draft performance measures (PMs) and identify a shortlist of them that provides an accurate and comprehensive (but not overwhelming) summary to compare and select which bookend alternatives are performing better than others. Through this work, the TWG has recommended a shortlist of 17 PMs to use out of the full set of 56 PMs for our upcoming meeting. Please note that we will have the full set of 56 PMs that have been calculated for each alternative, if you are interested?

This pre-reading package was prepared by Compass and Ecofish and has been structured according to the main steps in SDM as follows,

CONFIDENTIALITY

This pre-reading package and the access and use of the two online tools (HydroViz & AltaViz) **are confidential**; solely meant to support the deliberations of the Main Table. We recognize that some of the draft materials we will be sharing and discussing could be taken out of context by people outside the process. We therefore ask that you **DO NOT** distribute this document or the on-line links and passwords externally.

compass — ECOFISH RESEARCH

About Today


1 Clarify the Decision Context
2 Define Objectives and Measures
3 Develop Alternatives
4 Estimate Consequences
5 Evaluate Trade-Offs and Select
6 Implement, Monitor and Review
Iterate

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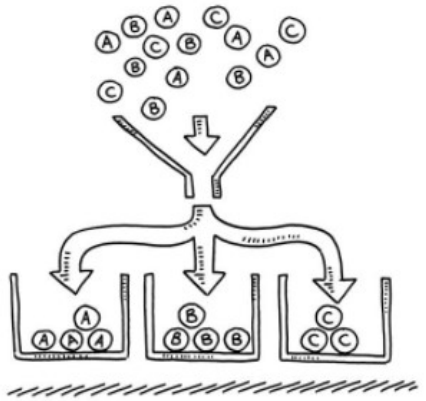
57 Water Use Issues



Recommended Shortlist ➔ 17 PMs

Flooding and Erosion

Culture and Heritage

Fish and Wildlife

Issues	#	Performance Measures	Details	
Reservoir fish habitat	13	Average annual pelagic habitat	Location:	Nechako Reservoir
			Timing:	All Year
			Unit:	Km2
			Direction:	More is better
			MSIC:	20%
River water temperature and migrating salmon	18	a: # of days average daily temp exceeds 18C (at Finmore) b: # of days average daily temp exceeds 19C c: # of days average daily temp exceeds 20C	Location:	Chinook: entire Nechako River Sockeye: below confluence with Stuart River
			Timing:	Salmon migration period Jun 15 – Aug 29
			Unit:	Days
			Direction:	Fewer is better
			MSIC:	20%
River water temperature and juvenile salmon	19	Maximum # of consecutive days average daily temp >18C	Location:	Chinook: entire Nechako River
			Timing:	Growing season, Jun 15 – Aug 30
			Unit:	Days
			Direction:	Less is better
			MSIC:	20%
River Chinook spawning habitat	20	Average habitat based on flow curve	Location:	Nechako River between Cheslatta Falls and Vanderhoof
			Timing:	Aug 15 - Oct 15
			Unit:	m^2
			Direction:	More is better
			MSIC:	20%

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Phase 1 Bookend Alternatives

Phase 1

	Altern 1	Altern 2	Altern 3	Altern 4	Altern 5	Altern 6	Altern 7
Primary Purpose	**Status Quo** To serve as a reference to explore the benefits and costs of making flow changes	**Nechako River** **Aquatic Species & Ecosystems** *Provide a more naturalized hydrograph ("freshet") to promote ecosystem functions that benefit a range of aquatic species*	**Nechako River** **Sockeye** *Lower STMP temperature targets (18°c or 19°c) for sockeye migration*	**Murray-Cheslatta** **Aquatic Species & Ecosystems** *Provide a more naturalized hydrograph (i.e., reduce flow variability, especially through STMP) to promote ecosystem functions that benefit a range of aquatic species.*	**Reservoir** **Wildlife** *Minimize flooding of bird nests.*	**Reservoir** **Aquatic Species & Ecosystems** *Maximize reservoir productivity*	**Murray-Cheslatta & Nechako River Flood Mitigation** *Minimize flooding of Cheslatta gravesites.* *Minimize overland flooding at Vanderhoof*
Base Flow Condition	Status Quo	status quo for smelter, tier 1 power sales, AWA, STMP, SLS min flow, and physical infrastructure (i.e., max/min r…ervoir elevations) All other constraints can be altered (flooding, tier 2 power sales, ice jam, beavers etc.)					

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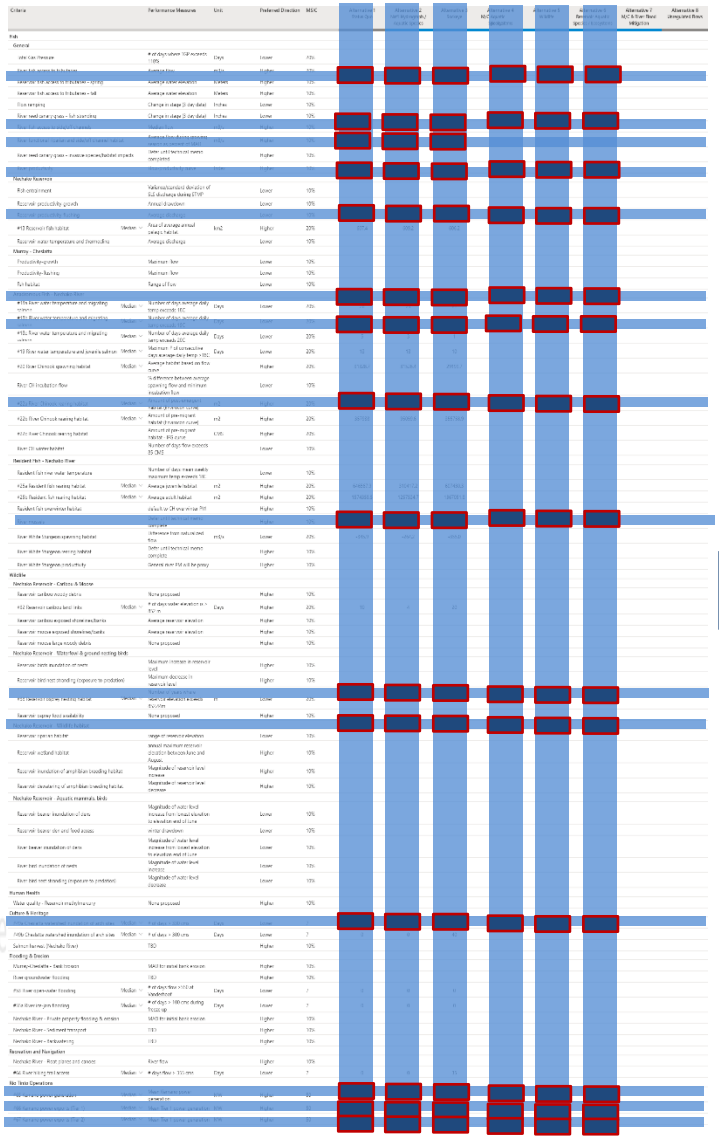
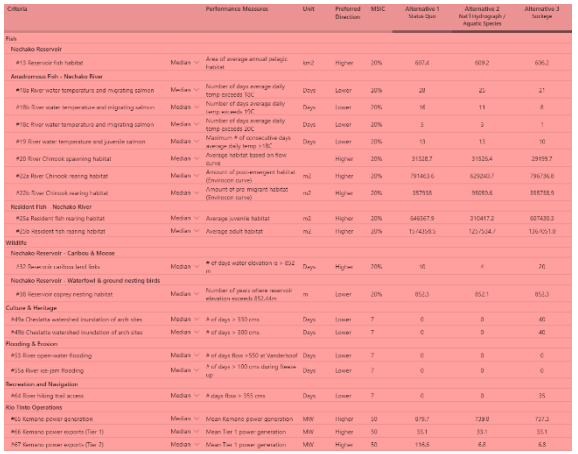


Assessment



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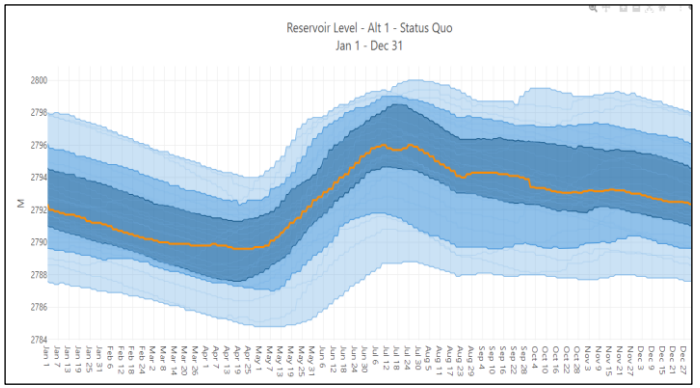
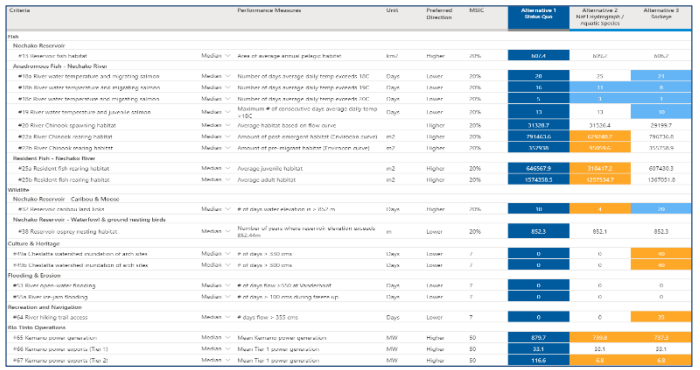
1 Clarify the Decision Context





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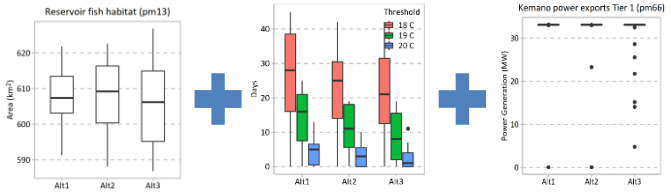
Iterate



Questions?

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We are here! Broad based engagement is underway to gain an understanding of interests to be addressed. Includes public meetings, small group workshops and one on one dialogue.

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Finalise options and develop implementation plan, including regulatory approval where required.

Phase 1 Bookend Alternatives

Michael Harstone
Jayson Kurtz

At our WEI Meeting 27

Building Phase 1 Bookend Alternatives

- **Discussed and agreed to a number of illustrative bookend alternatives to be developed and further developed by the TWG**
- **They were meant to be "illustrative" and provide a cross section of the nature and type of operating alternatives that could be developed**
- **THEY WERE designed as a basis to LEARN from and NOT as the basis to reach agreement on** *(as they are not particularly multi-interest focused)*

At our WEI Meeting 27

Phase 1 – Draft & Illustrative Bookend Flow Alternatives (developed through TWG)

	Altern 1	Altern 2	Altern 3	Altern 4	Altern 5	Altern 6	Altern 7
Primary Purpose	**Status Quo** To serve as a reference to explore the benefits and costs of making flow changes	**Nechako River** **Aquatic Species & Ecosystems** *Provide a more naturalized hydrograph ("freshet") to promote ecosystem functions that benefit a range of aquatic species*	**Nechako River** **Sockeye** *Lower STMP temperature targets (18°c or 19°c) for sockeye migration*	**Murray-Cheslatta** **Aquatic Species & Ecosystems** *Provide a more naturalized hydrograph (i.e., reduce flow variability, especially through STMP) to promote ecosystem functions that benefit a range of aquatic species.*	**Reservoir** **Wildlife** *Minimize flooding of bird nests.*	**Reservoir** **Aquatic Species & Ecosystems** *Maximize reservoir productivity*	**Murray-Cheslatta & Nechako River Flood Mitigation** *Minimize flooding of Cheslatta gravesites.* *Minimize overland flooding at Vanderhoof*
Base Flow Condition	Status Quo	status quo for smelter, tier 1 power sales, AWA, STMP, SLS min flow, and physical infrastructure (i.e., max/min reservoir elevations) All other constraints can be altered (flooding, tier 2 power sales, ice jam, beavers etc.)					
Operational Changes / Targets	None	The flow timing will follow the Ecofish naturalized flow hydrograph, scaled to the annual volume of water that is available (including additional volume from current tier 2 power sales). This will result in more flow May-July, will maintain flows in the STMP period, and possibly result in lower flow at other times of the year.	There are two options to achieve this: • Maximize spillway release July 20 to Aug 20 (and see how cool we can reach) • Target 18 and 19C by releasing known volume of water (based on Alec's temp/flow modeling) This will result in more flow during mid-July to mid-Aug, and less flow at other times of the year.	Ramping rates (how fast flow increases/decreases) would be applied to the STMP period. Maximum flow for individual STMP events will not change, but the events will start sooner and end later, resulting in more volume to reach the same temperature compared to status quo. To provide a more natural-shaped hydrograph, high flows will continue to be released on the decline of freshet, leading into the STMP. The flow reduction following the STMP will be more gradual. This will result in a longer freshet, similar magnitude but longer duration STMP flow pulses, and less flow at other times of the year.	Minimize reservoir level increases during bird breeding season (April 15 – Aug 15). There are two options to achieve this: • Hold reservoir steady during bird breeding season (prevent nest flooding) • Reach full pool prior to bird breeding season (prevent bird nesting) Assuming the latter, this will result in and higher flow during freshet and lower flow during the fall and winter.	Maximize reservoir elevation during the growing season (May – Sept) This will require filling the reservoir as fast as possible in the spring and will result in lower flow during the initial onset of freshet, until the reservoir is full. When the reservoir is full, flow will likely increase for the duration of freshet.	Hard constraint of 300cms maximum at Cheslatta falls This will require lower reservoir elevations during winter/spring, resulting in higher river flow during this period and lower flow during the freshet (i.e., more stable flow to Nechako River).

Phase 1 Bookend Alternatives

Base Flow Conditions

(i.e., Aim was not to alter these parameters)

- Meet hydropower flows to meet Smelter load and Tier 1 power sales
- Meet minimum AWA and STMP flow requirements
- Meet Skins Lake Spillway (SLS) min flows
- Physical constraints of system (e.g., max/min reservoir elevs)

Flexible Operating Parameters

(i.e, parameters that could be altered and/or re-prioritized in development of bookends)

- Re-allocating monthly AWA flow release schedule
- Hydropower flows for Tier 2 power sales
- Ramping rates at SLS
- Flood risk thresholds (e.g., Cheslatta Falls)
- Flow operations for beavers and avoiding ice jams

Phase 1 Bookend Alternatives

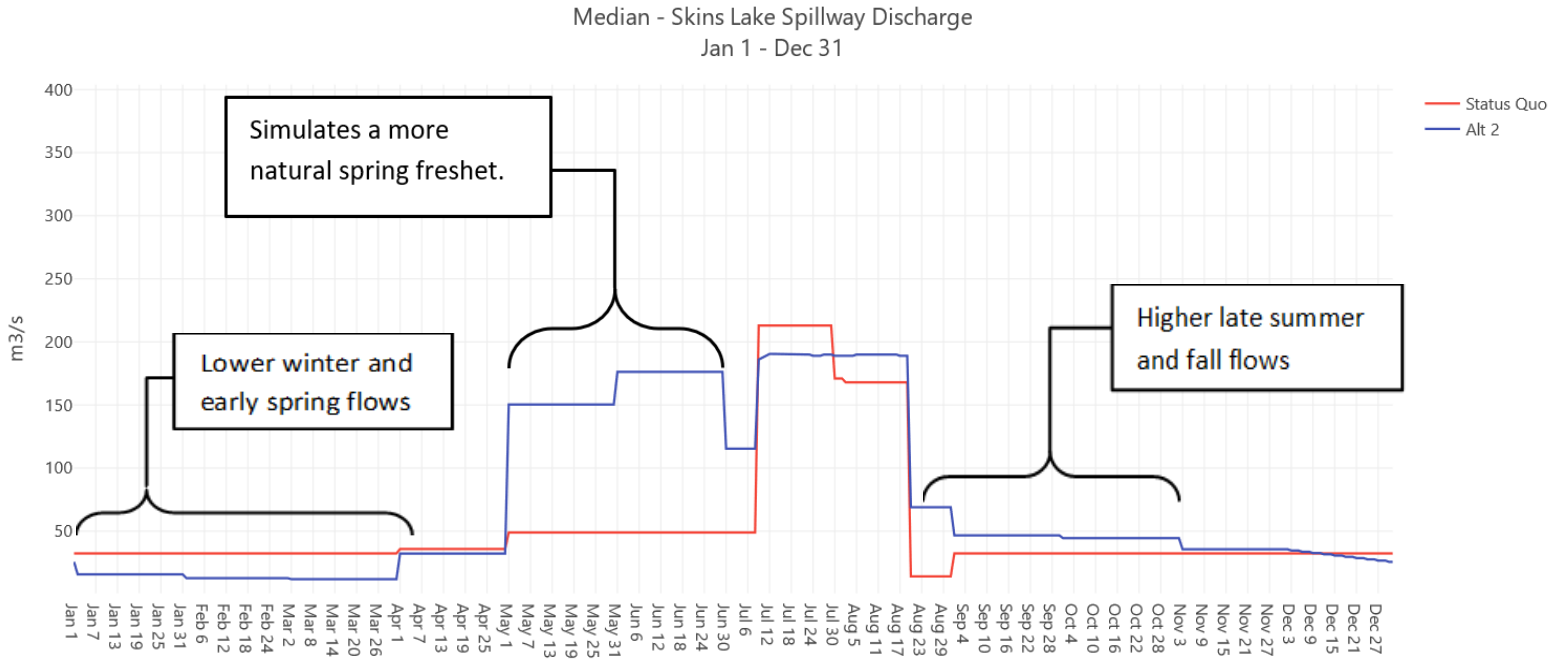
Alternative 1 – Status Quo

- This alternative is modeled to represent the current operations at Rio Tinto's water control facilities
- It incorporates water license and other flow related criteria that are currently used to manage the water through the facilities

Phase 1 Bookend Alternatives

Alternative 2 – Naturalized Hydrograph

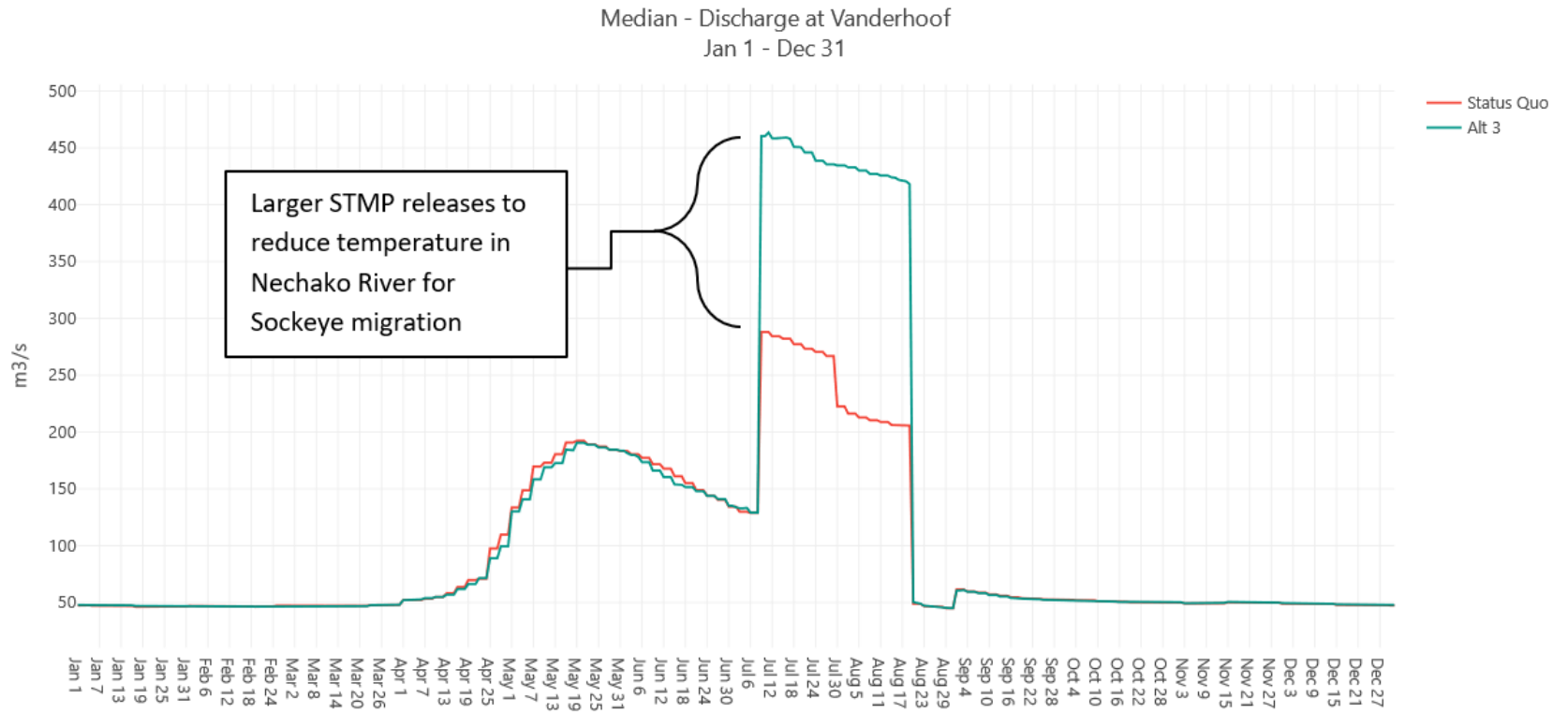
- Alt 2 is intended to benefit aquatic species and ecosystems in the Nechako River by providing a more naturalized hydrograph (i.e., shaped with a spring freshet)
- This alternative was created by scaling the BC Water Tool Nechako Reservoir watershed mean monthly discharge by 30% (to reflect the general flow allocation 30% Nechako, 70% Kemano) as a minimum SLS release.
- As a result, the Alt 2 hydrograph has moderately less flow during the early freshet but considerably more during mid freshet.



Phase 1 Bookend Alternatives

Alternative 3 – Salmon Migration (Temperature)

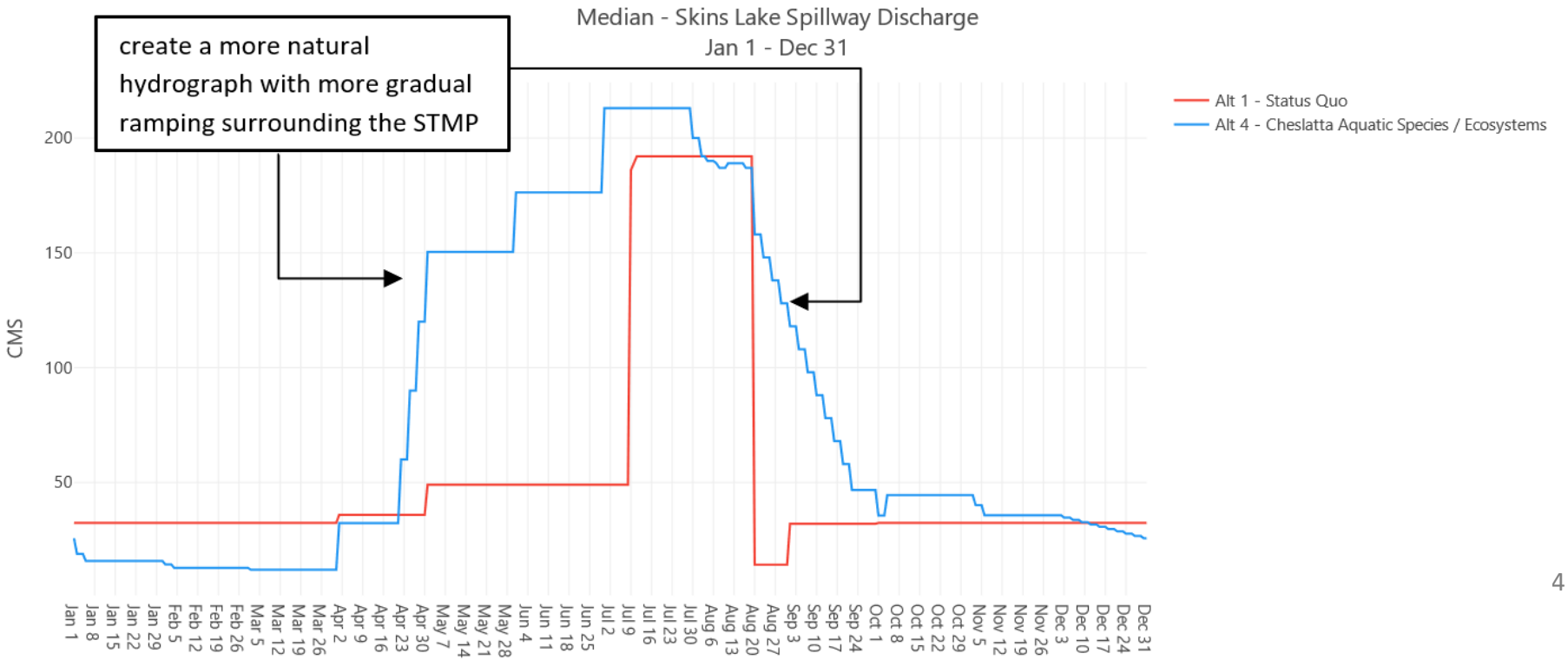
- Alt 3 is intended to benefit salmon migration success by reducing water temperature in the Nechako River below the current STMP target of 20C.
- This Alt was created by doubling the current STMP flows in July and Aug.



Phase 1 Bookend Alternatives

Alternative 4 – Cheslatta Aquatic Species / Ecosystems

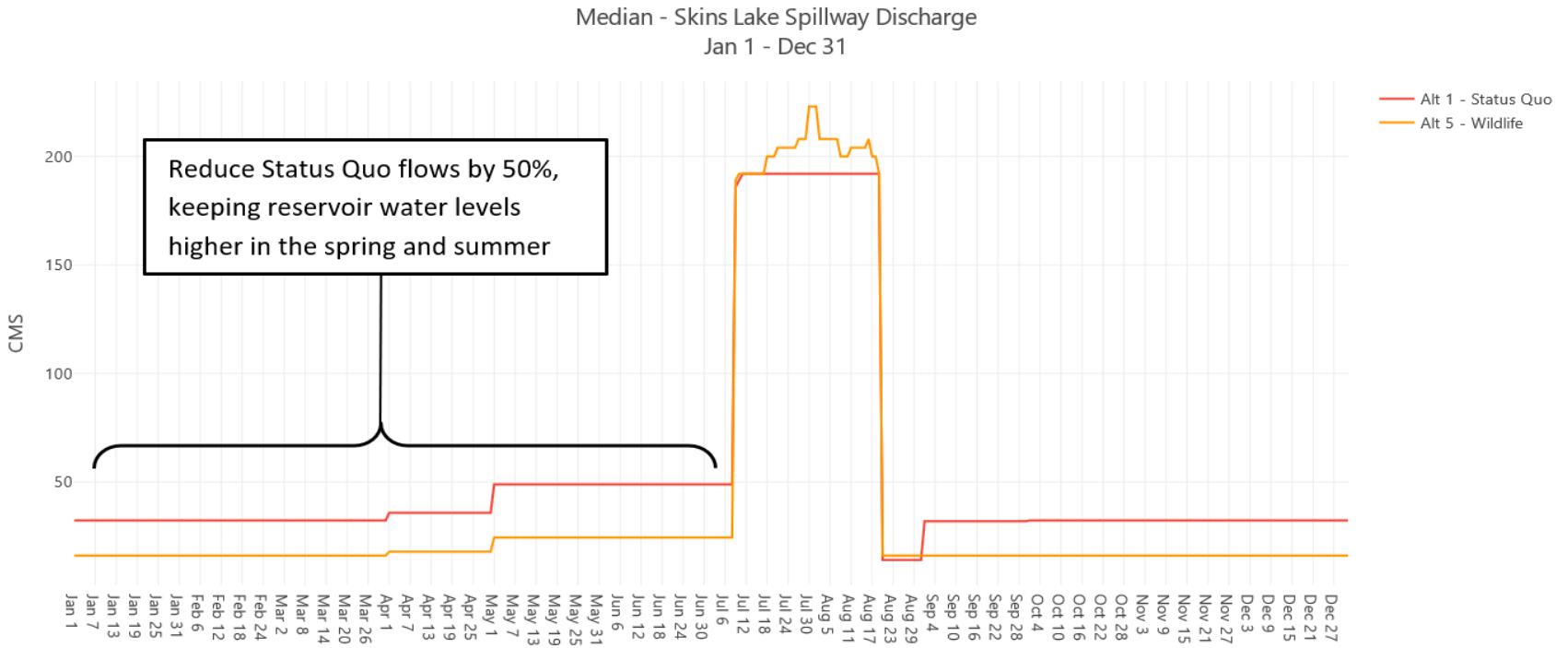
- Alt 4 is intended to benefit aquatic species / ecosystems in the Cheslatta watershed
- It provides a more naturalized hydrograph (i.e., reduced flow variability, especially during STMP period and eliminated the flow reduction between freshet and STMP)
- Also, it was designed for more gradual ramping leading into and following the STMP period.



Phase 1 Bookend Alternatives

Alternative 5 – Wildlife (Reservoir)

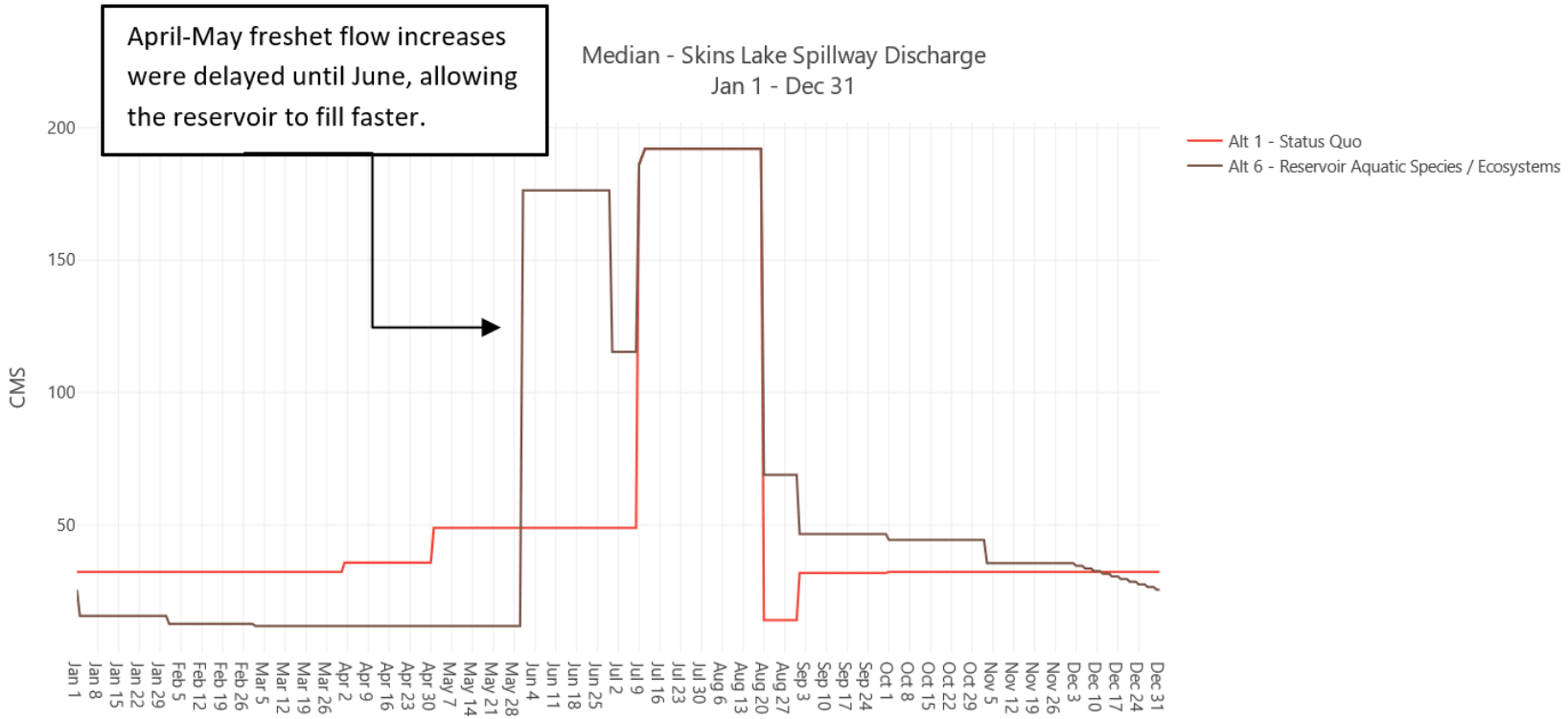
- Alt 5 is intended to benefit wildlife in the reservoir, specifically nesting birds (i.e., bring the reservoir to near full pool prior to bird nesting to prevent rising water from flooding nests).
- This alternative was created by reducing status quo flows by 50%, allowing the reservoir to fill faster and higher.



Phase 1 Bookend Alternatives

Alternative 6 – Reservoir Aquatic Species / Ecosystems

- Alt 6 is intended to benefit aquatic species and ecosystems in the reservoir, specifically aquatic productivity.
- This alternative is based on Alt 2, except April-May freshet flow increases were delayed until June, allowing the reservoir to fill faster.

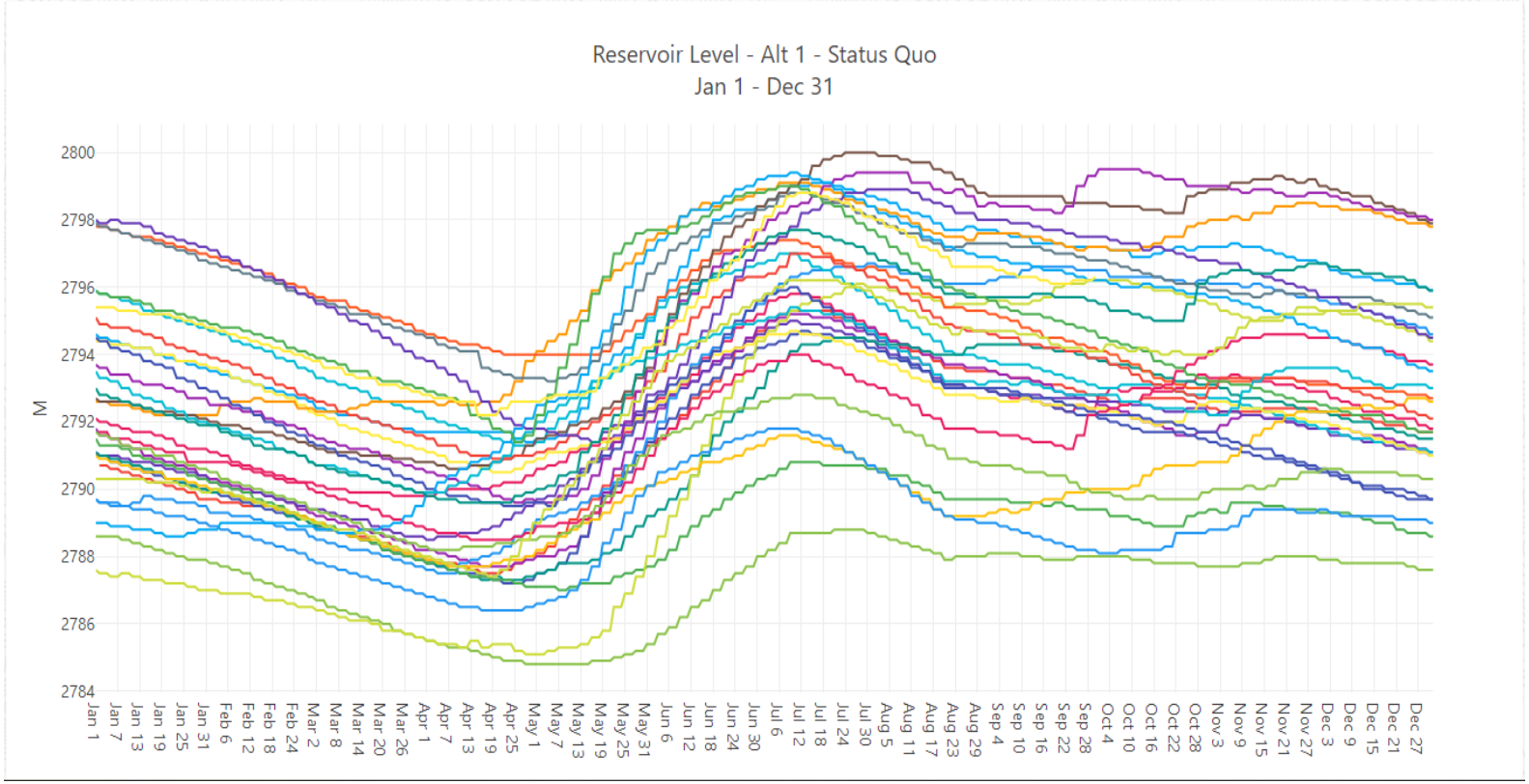


Assessing Bookend Alternatives

- Hydrology

Michael Harstone
Clayton Schroeder

Modeling Outputs: Using Hydrographs



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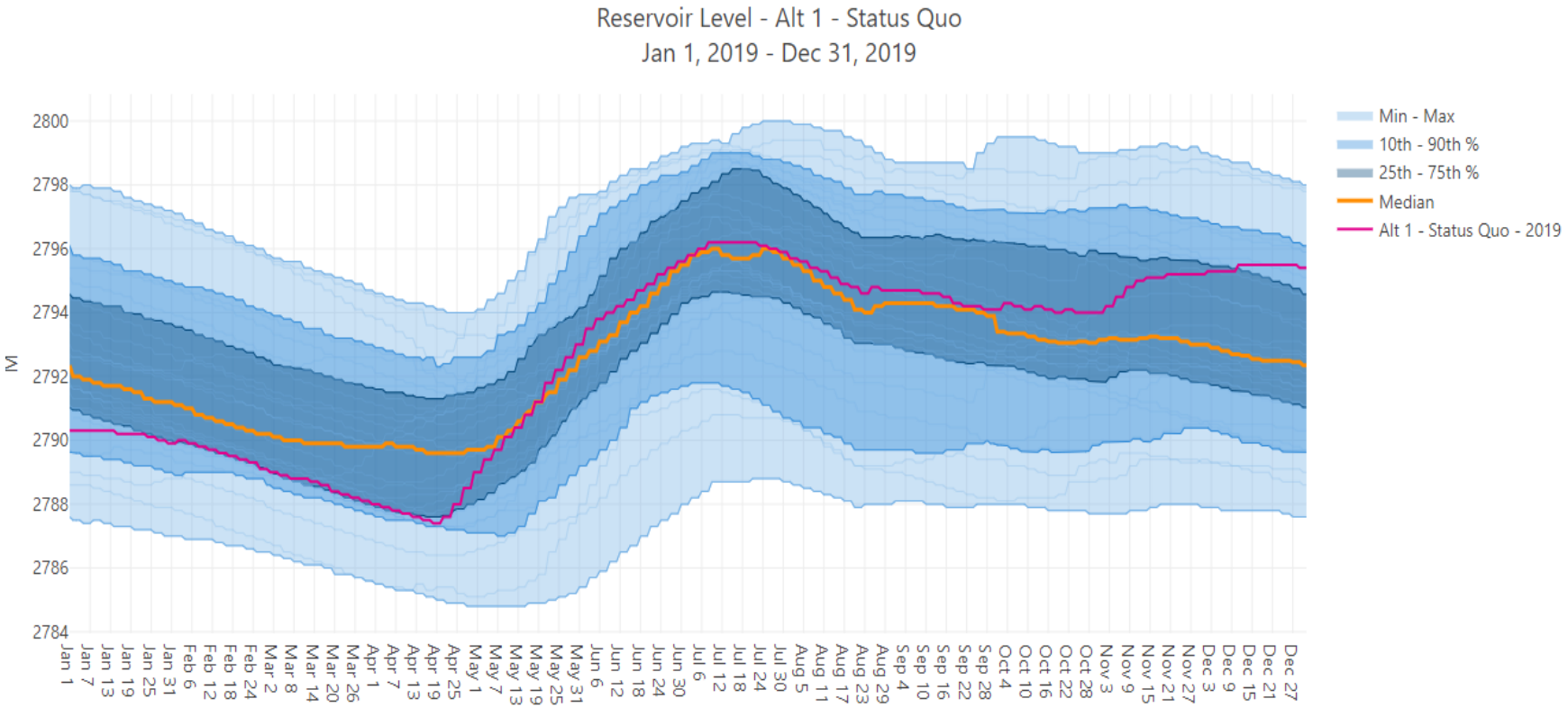
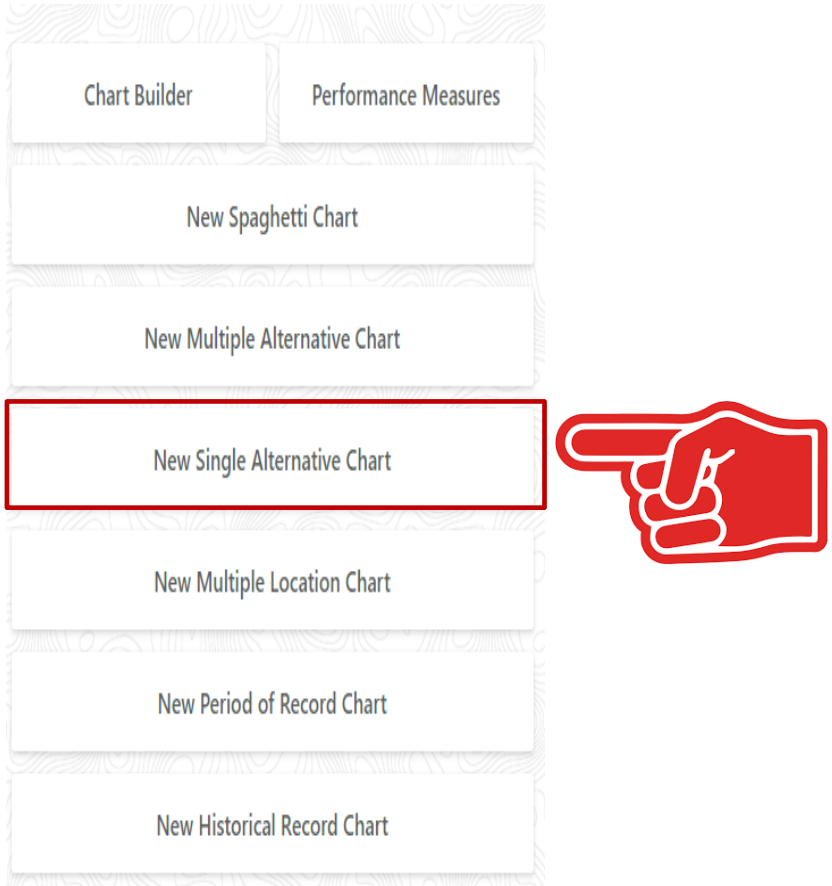


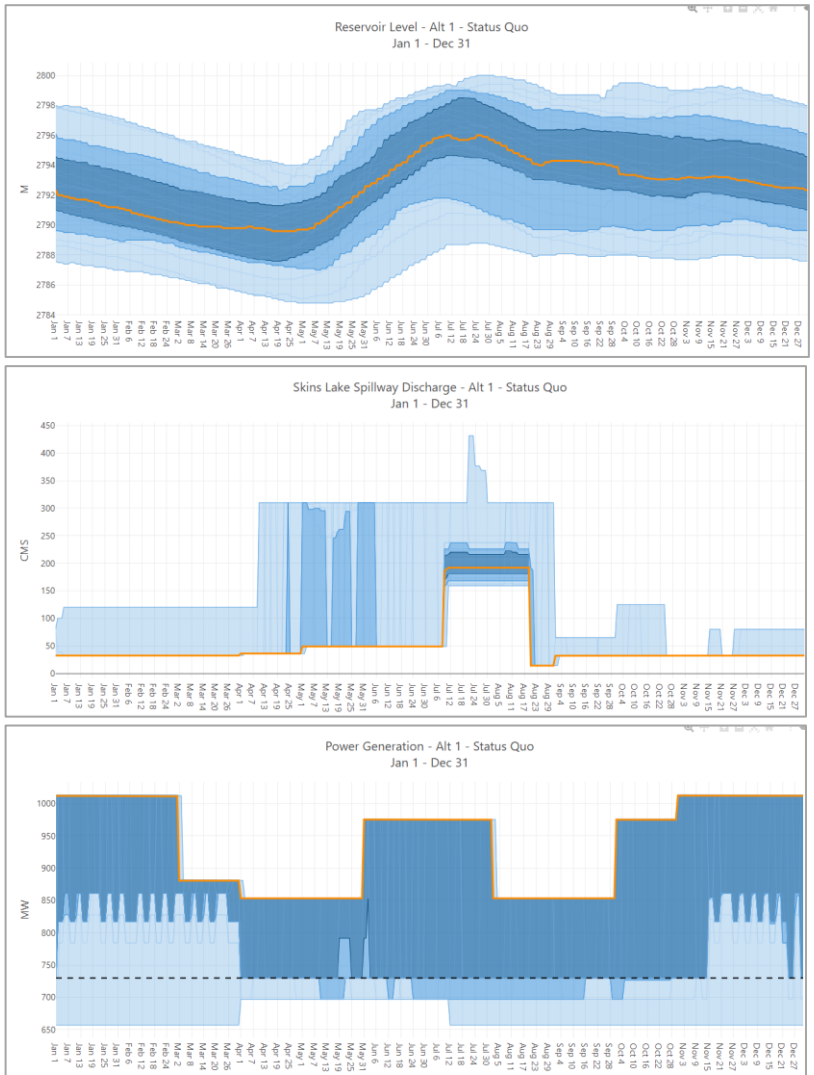
	Maximum	Across the entire dataset, the maximum value recorded on a given day
	90th percentile	90 % of all recorded values were below this point, and 10% were above. This represents a 1 in 10 year **higher** river flow / or higher reservoir level event
	75th percentile	75 % of all recorded values were below this point, and 25% were above
	50th percentile (median)	50% of records would be above, and 50% would be below this point. This represents an average'y' river flow or reservoir level where half the years would be expected to be above or below this point.
	25th percentile	25 % of all recorded values were below this point, and 75% were above
	10th percentile	10% of all recorded values were below this point, and 90% were above. This represents a 1 in 10 year **lower** river flow / or lower reservoir level event
	Minimum	Across the entire dataset, the minimum value recorded on a given day
	Selected Year	Represents a single year from the selected dataset

HydroViz – Online Tool

https://www.hydroviz.ca/nechako

Access Code: NECHAKOWEI





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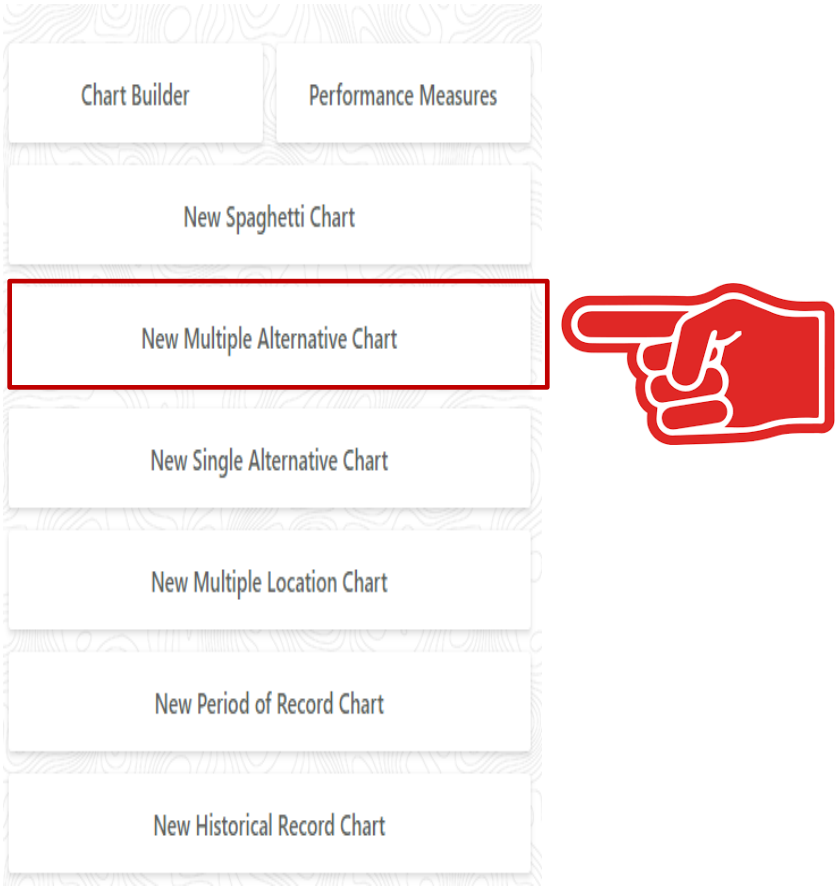
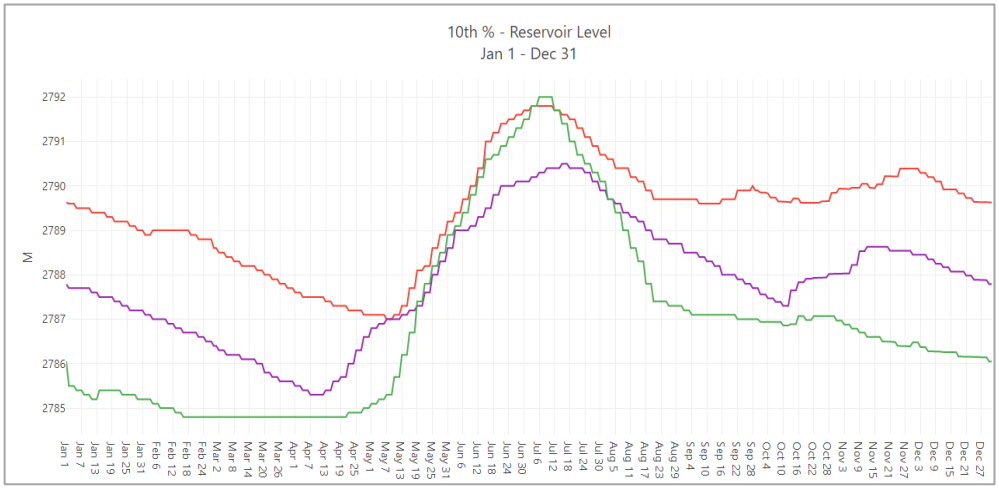
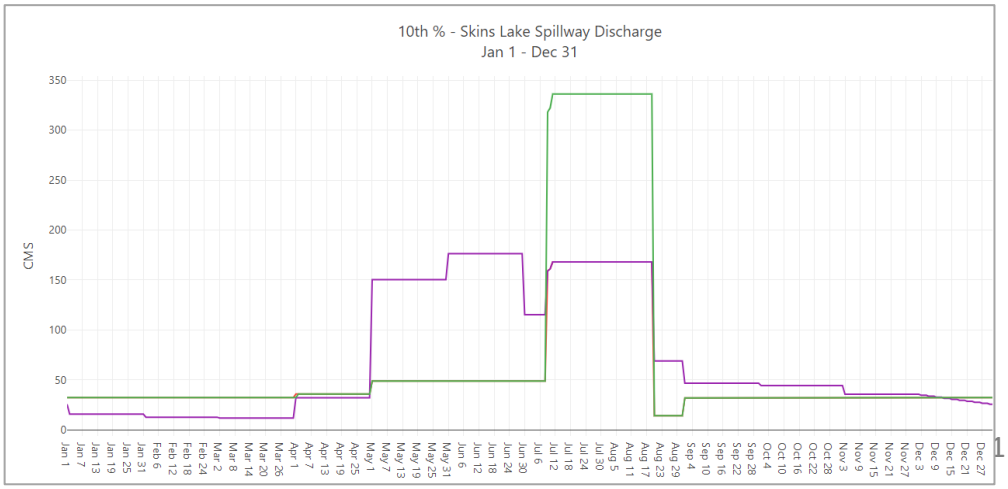
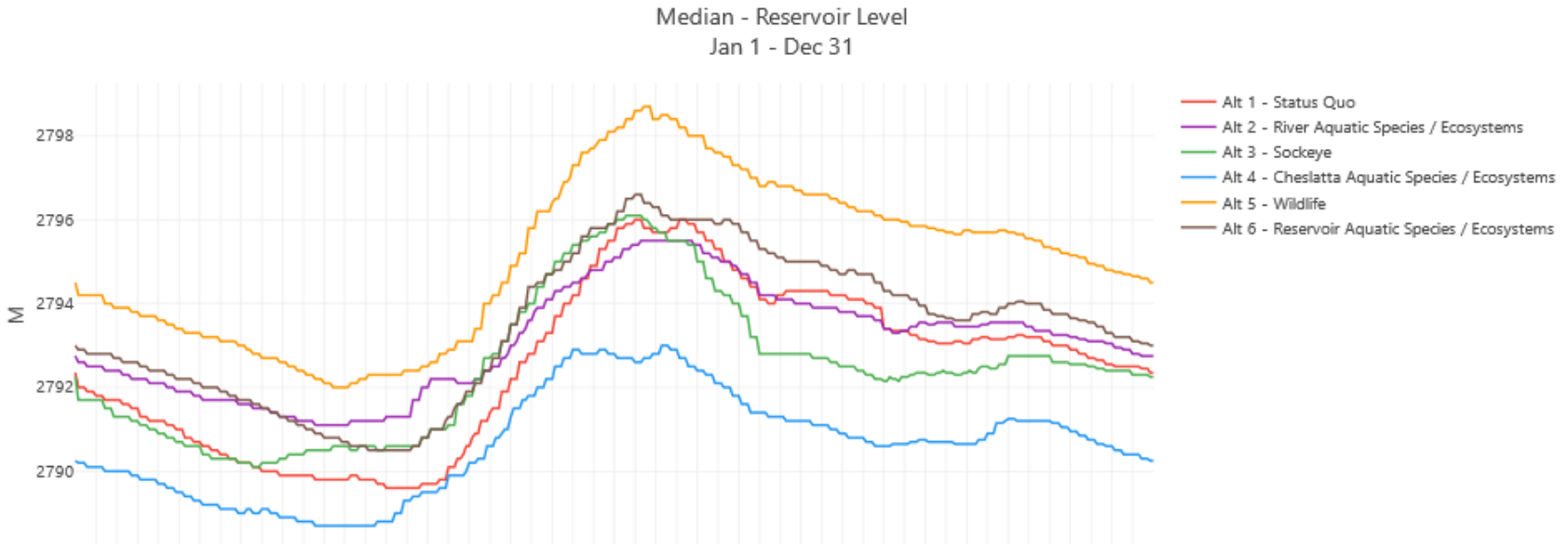
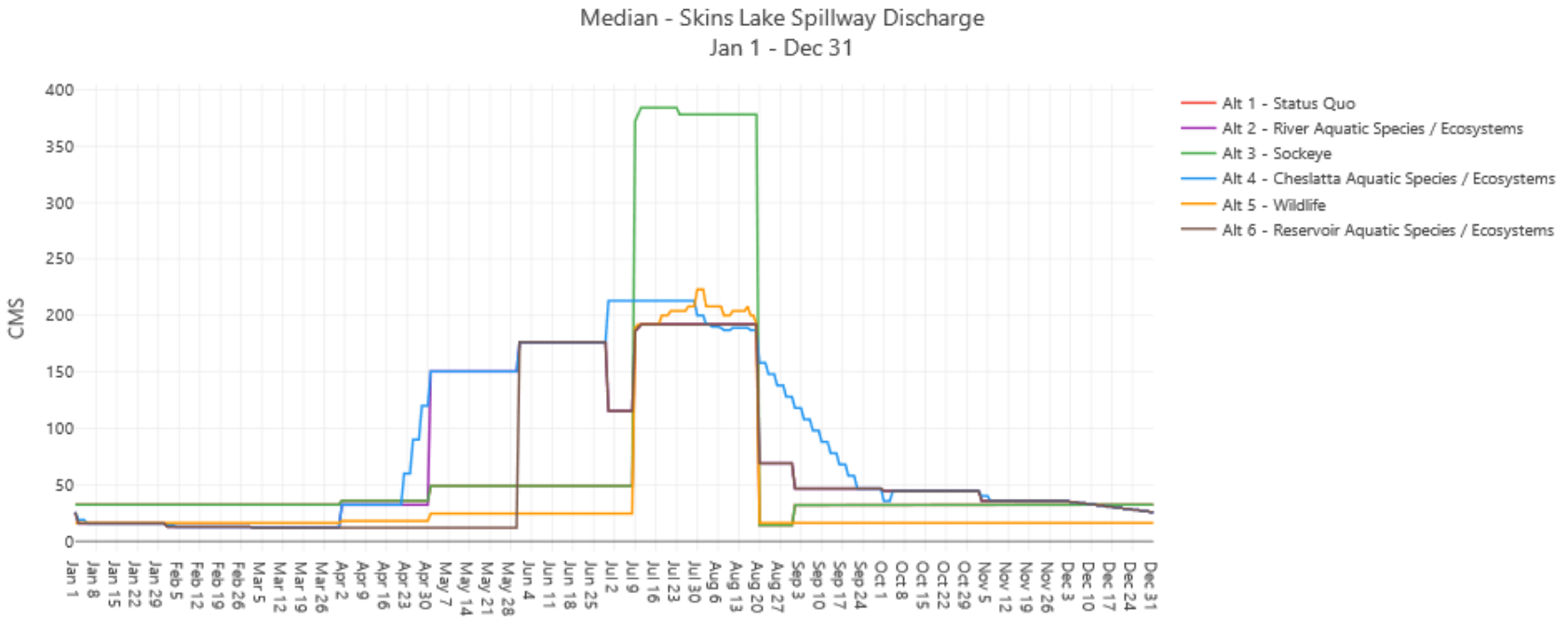




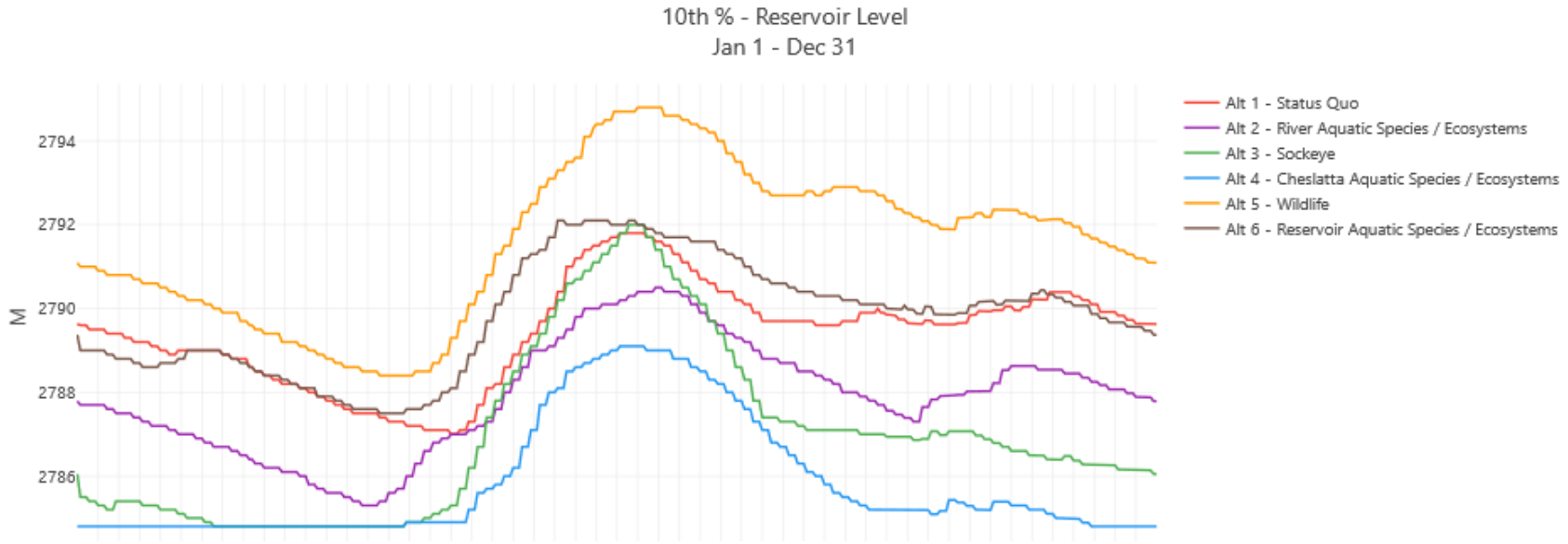


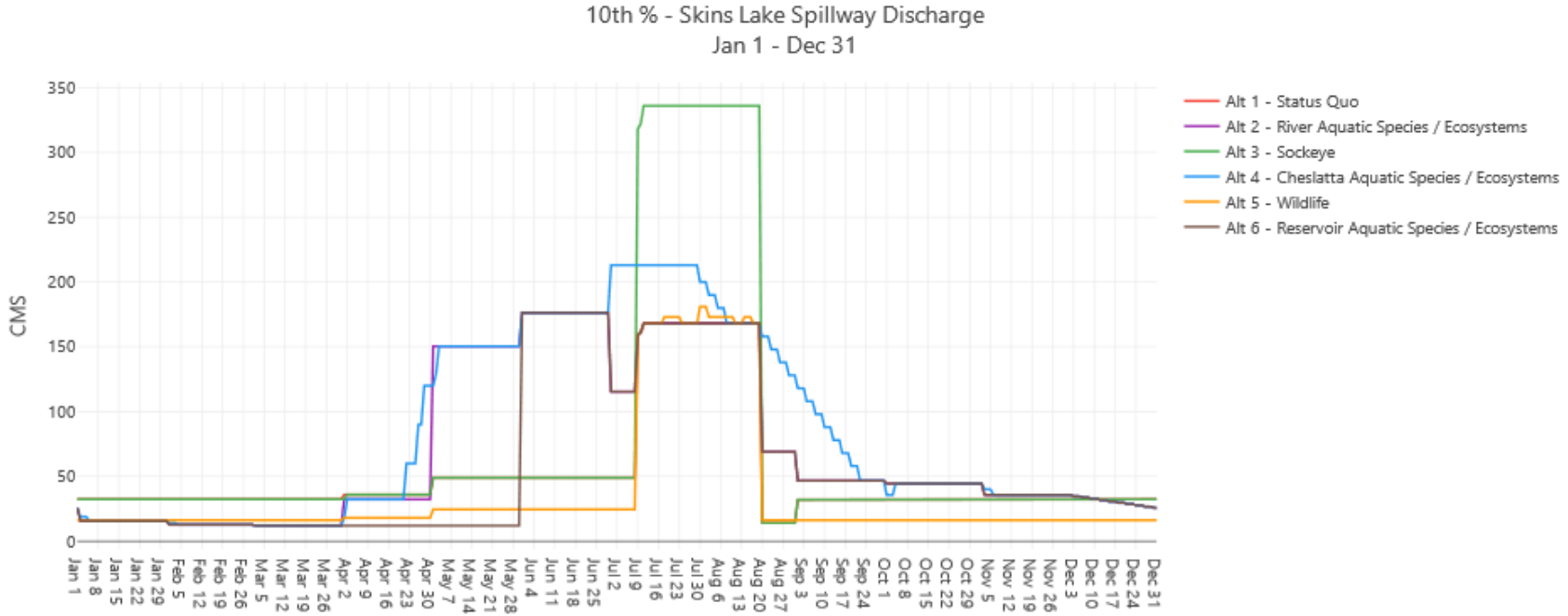
Hydrograph Comparisons - Phase 1 Bookend Alternatives



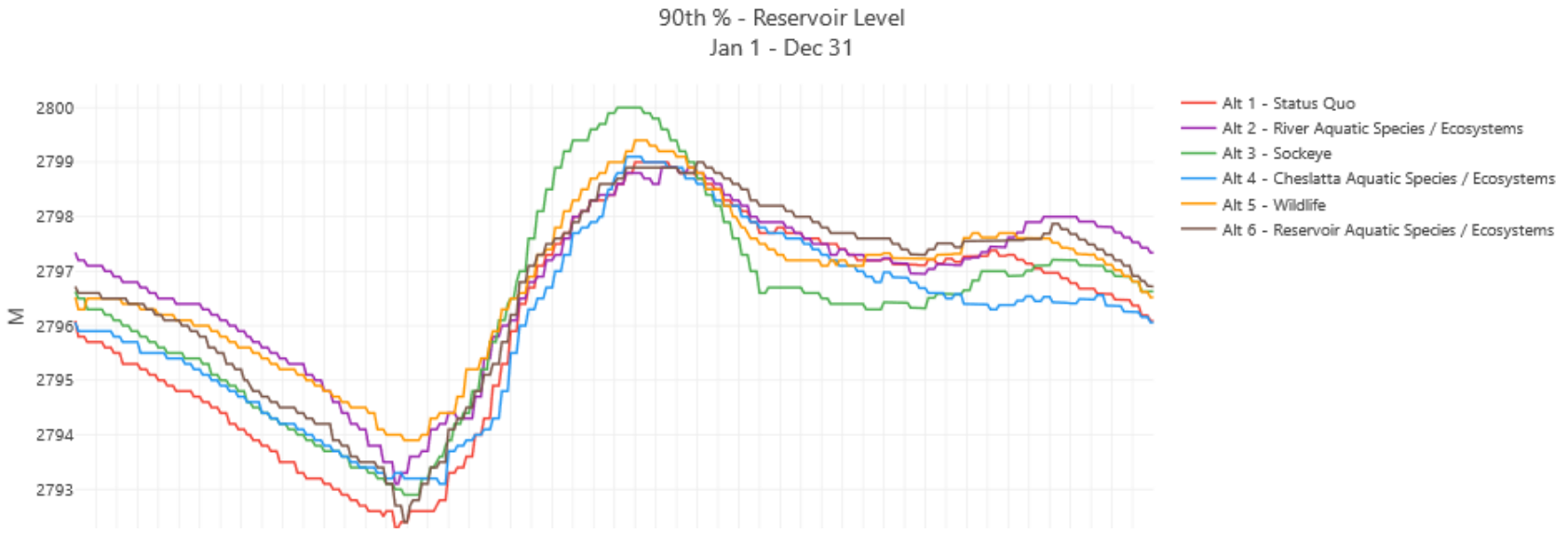


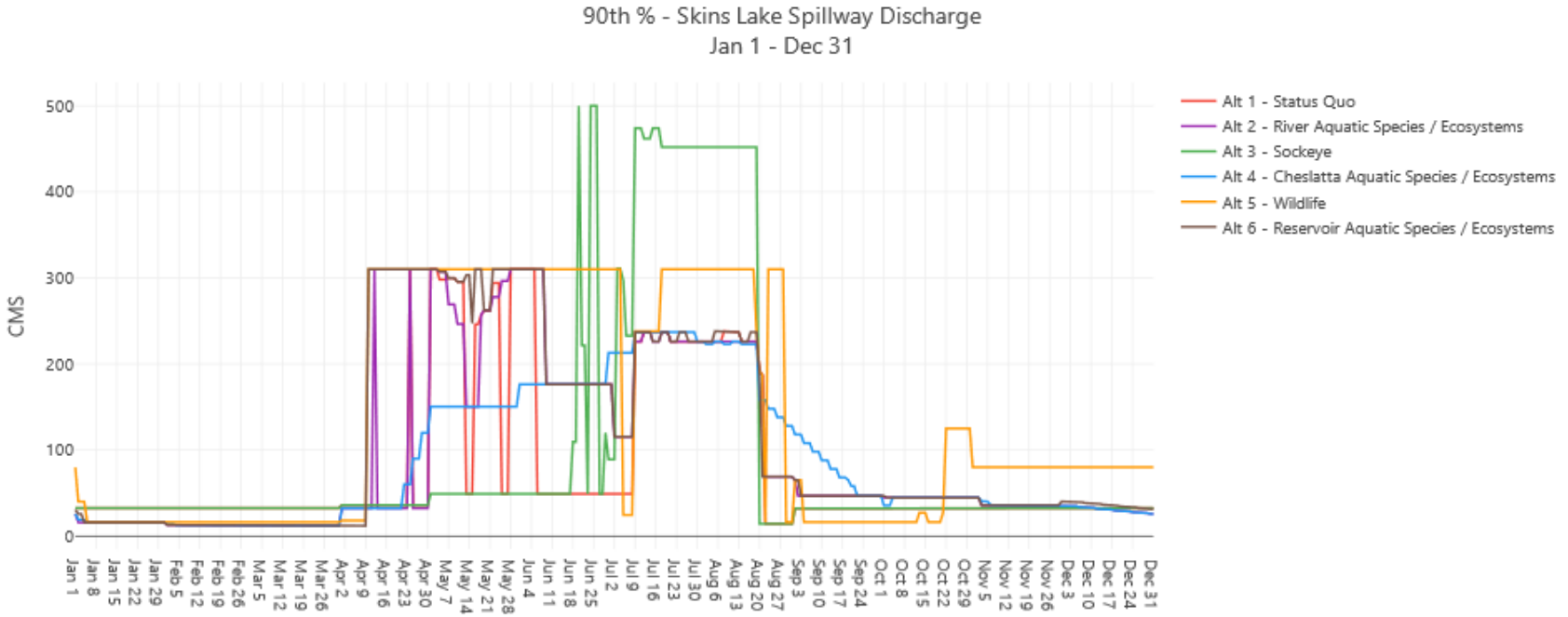
Hydrograph Comparisons - Phase 1 Bookend Alternatives





Hydrograph Comparisons - Phase 1 Bookend Alternatives





HydroViz – Online Tool

https://www.hydroviz.ca/nechako

Access Code: NECHAKOWEI

Assessing Bookend Alternatives

- Shortlisted Performance Measures

Katie Healey
Jayson Kurtz

Cutting to the Chase …

Criteria		Performance Measures	Unit	Preferred Direction	MSIC	Alternative 1 Status Quo	Alternative 2 Nat'l Hydrograph / Aquatic Species	Alternative 3 Sockeye	Alternative 4 M/C Aquatic Species / Ecosystems	Alternative 5 Wildlife	Alternative 6 Reservoir Aquatic Species / Ecosystems
Fish											
#6 River fish access to side/off channels	Median	Average flow	CMS	Higher	20%	93.6	148.1	147.1	169.1	85	122.9
#12 Reservoir productivity-flushing	Median	Average discharge	CMS	Lower	20%	85.5	142.1	139.2	157.9	80.5	116.1
#17 Cheslatta watershed fish habitat	Median	Range of flow	CMS	Lower	20%	193.8	162.3	386	171.7	293.8	211
#18a River water temperature and migrating salmon	Median	Number of days average daily temp exceeds 18C	Days	Lower	20%	28	25	21	23	28	24
#18c River water temperature and migrating salmon	Median	Number of days average daily temp exceeds 20C	Days	Lower	20%	5	3	1	2	4	3
#21a River Chinook incubation flow	Median	Ratio of min incubation flow to average spawning flow	%	Higher	20%	50	16.1	32	12.3	27.3	16.1
#22a River CH rearing habitat Post-emergent Habitat	Median	Amount of post-emergent habitat (Envirocon curve)	m2	Higher	20%	771,723	601,407	771,655	574,511	636,607	579,932
#25a Resident fish rearing habitat	Median	Average juvenile habitat	m2	Higher	20%	646,568	310,417	607,430	216,831	670,198	434,408
Wildlife											
#32 Reservoir caribou land links	Median	# of days water elevation is > 852 m	Days	Higher	20%	10	4	20	0	36	18
#38 Reservoir osprey nesting habitat		Number of years where reservoir elevation exceeds 852.44m	Years	Lower	20%	13	13	15	10	25	15
#41b Reservoir wetland habitat		Number of years where reservoir elevation exceeds 852.94 m	Years	Higher	20%	9	8	12	6	18	9
#45b River bird inundation of nests		Number of years where Cheslatta discharge exceeds 275 cms	Years	Lower	20%	6	8	31	2	10	7
Culture & Heritage											
#49b Cheslatta watershed inundation of arch sites	80th %	# of days > 300 cms	Days	Lower	7	7	8	42	0	56	21
Flooding & Erosion											
#53 River open-water flooding	Max	# of days flow >550 at Vanderhoof	Days	Lower	7	2	30	55	11	47	33
Rio Tinto Operations											
#65b Smelter Power	Median	# of days smelter load isn't met	Days	Lower	7	0	167	226	44	0	0
#66 Kemano power exports (Tier 1)	Median	Mean Tier 1 power generation	MW	Higher	50	33.1	33.1	33.1	33.1	33.1	33.1
#67 Kemano power exports (Tier 2)	Median	Mean Tier 2 power generation	MW	Higher	50	116.6	6.8	6.6	6.6	104.8	49.2

Phase 1 Bookend Alternatives
Performance Measures

- *Katie and Jayson …*

Assessing Bookend Alternatives

- Consequence Table (PMs Summary)

Performance Measures: Assessing Bookend Alternatives

Criteria		Performance Measures	Unit	Preferred Direction	MSIC	Alternative 1 Status Quo	Alternative 2 Naturalized Hydrograph	Alternative 3 Sockeye Migration (Temp)	Alternative 4 Cheslatta Aquatic Ecosystems	Alternative 5 Wildlife (Reservoir)	Alternative 6 Reservoir Aquatic Ecosystems
Fish											
#6 River fish access to side/off channels	Median	Average flow	CMS	Higher	20%	93.6	148.1	147.1	169.1	85	122.9
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Wildlife											
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#45b River bird inundation of nests		Number of years where Cheslatta discharge exceeds 275 cms	Years	Lower	20%	6	8	31	2	10	7
Culture & Heritage											
#49b Cheslatta watershed inundation of arch sites	Median	# of days > 300 cms	Days	Lower	7	0	0	40	0	2	0
Flooding & Erosion											
#53 River open-water flooding	Median	# of days flow >550 at Vanderhoof	Days	Lower	7	0	0	0	0	0	0
Rio Tinto Operations											
#65b Smelter Power	Median	# of days smelter load isn't met	Days	Lower	7	0	167	226	44	0	0
#66 Kemano power exports (Tier 1)	Median	Mean Tier 1 power generation	MW	Higher	50	33.1	33.1	33.1	33.1	33.1	33.1
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Performance Measures: Assessing Bookend Alternatives

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#49b Cheslatta watershed inundation of arch sites	Median	# of days > 300 cms	Days	Lower	7	0	0	40	0	2	0
Flooding & Erosion											
#53 River open-water flooding	Median	# of days flow >550 at Vanderhoof	Days	Lower	7	0	0	0	0	0	0
Rio Tinto Operations											
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#66 Kemano power exports (Tier 1)	Median	Mean Tier 1 power generation	MW	Higher	50	33.1	33.1	33.1	33.1	33.1	33.1
#67 Kemano power exports (Tier 2)	Median	Mean Tier 2 power generation	MW	Higher	50	116.6	6.8	6.6	6.6	104.8	49.2

AltaViz – Online Tool

https://www.altaviz.ca/public/220db3fc-2aa8-4eea-9dd1-e3a26c4bb97a

Access Code: NECHAKOWEI

Commentary: Assessing Bookend Alternatives

Alt 1 Status Quo	Performs quite well across most of the interests. There are other alternatives that perform better for some PMs, but also others that perform worse. Exceptions for river temperature for migrating salmon (PM 18a-c) and river fish access to off channel habitats, for which all other alternatives perform equal to or better than Alt 1.
Alt 2 Aquatic Species / Ecosystems	Good for Cheslatta fish habitat and access to off channel habitat, but performs poorly for power, chinook salmon, and productivity interests. This alternative didn't perform as expected for Nechako fish PMs due to too much flow during critical rearing periods; this could be revised and improved by delaying the onset of freshet until after chinook salmon emergence.
Alt 3 Sockeye Migration	Performs well for low-flow fish PMs (emerging chinook salmon and resident fish habitat) and water temperature. It does not perform well for PMs sensitive to flow increases (productivity, Cheslatta fish habitat, flooding) and power.
Alt 4 Cheslatta Aquatic Ecosystems	Performs well for low reservoir interests. It is good for Cheslatta fish habitat, osprey and reservoir and river birds, Cheslatta culture and heritage sites, off channel access, and flooding. It does not perform well for reservoir wetlands, productivity, caribou, river fish habitat, and power.
Alt 5 Wildlife (Reservoir)	Opposite Alt 4; performs well for high reservoir interests. It is good for reservoir wetlands, productivity, caribou, river fish habitat, and power but does not perform well for river temperature and fish habitat, Cheslatta culture and heritage sites, and osprey.
Alt 6 Reservoir Aquatic Ecosystems	Alt 6 doesn't dominate any other alternatives (it generally performs more poorly than other alternatives across all interests). The interest it was specifically targeting turned out to be insensitive.

Assessing Alternatives

- Ranking Exercise

Michael & Clayton

Phase 1 Bookend Alternatives
Ranking Exercise

Purpose:

- To test out the draft PMs for helping to inform our assessments
- To get a better sense of people's priorities
- To explore and highlight what we like and don't like about the bookend alternatives
- To gain insight towards building the first round of Operating Alternatives

REMINDER About the Bookend Alternatives!

- They were predicated on **LEARNING** and not for any one of them to reach agreement on!

Phase 1 Bookend Alternatives
Ranking Exercise

Two ranking exercises will be used today,

1. **Direct Ranking** – is an intuitive technique where you will be asked directly which alternative(s) you most prefer

2. **Swing Weighting** – is an alternative method for identifying your preferred alternative(s) through the performance measures

Neither one is right. Both provide an alternative means of exploring priorities and values individually and collectively!

Direct Ranking
Exercise

Direct Ranking

You will be asked to indicate which alternatives are your 'most preferred' and 'least preferred', the steps are:

STEP 1: Rank each alternative from #1 (best or 'most preferred') to #6 (worst or "least preferred) according to how well the alternatives are meeting your interests

STEP 2: Distribute 100 points to your #1 (most preferred) alternative

STEP 3: Distribute a lesser amount of points to your next 'most preferred' alternative according to how well it meets your needs

Direct Ranking

FORM 1 - Alternatives

Your Name:

		Rank	Weight
Alternative 1	Status Quo	3	50
Alternative 2	Naturalized Hydrograph	2	95
Alternative 3	Salmon Migration Temperature	6	1
Alternative 4	Cheslatta Aquatic Species / Ecosystems	1	100
Alternative 5	Wildlife (Reservoir)	4	45
Alternative 6	Reservoir Aquatic Species / Ecosystems	5	10

On-Line Direct Ranking **Form 1** - AltaViz

On-Line Direct Ranking **Form 1** - AltaViz

On-Line Direct Ranking **Form 1** - AltaViz

Swing Weighting
Exercise

Swing Weighting

- An alternative way to identify your preferred alternatives according to the performance measures
- Provides a way to gain insight into the relative importance of each performance measure according to the improvements (**worst** to **best**) that can be made
- "**Swing**" refers to the importance of moving **one** performance measure from its worst to best value

Swing Weighting
FORM 2

STEP 1: Review each performance measure within each category according to the most important to you to change from **worst to best value**

STEP 2: Assign 100 points to the most important PM to swing from its **worst to best value**

STEP 3: Repeat for each remaining PMs by assigning a lower number of points for the importance to swing its value from **worst to best** relative to your most important PM

for example…

Swing Weighting
FORM 2

Criteria	Performance Measure	Unit	Worst	Best	Points
Fish					
#6 River fish access to side /off channels	Average Flow	CMS	Median: 85	Median: 169.1	
#12 Reservoir productivity-flushing	Average discharge	CMS	Median: 157.9	Median: 80.5	
#17 Cheslatta watershed fish habitat	Range of flow	CMS	Median: 386	Median 162.3	
#18a River water temperature and migrating salmon	Number of days average daily temp exceeds 18C	Days	Median: 28	Median: 21	
#18c River water temperature and migrating salmon	Number of days average daily temp exceeds 20C	Days	Median: 5	Median: 1	
#21a River Chinook incubation flow	Ratio of min incubation flow to average spawning flow	%	Median: 12.3	Median: 50	**100**
#22a River CH rearing habitat Post-emergent Habitat	Amount of post-emergent habitat (Envirocon curve)	M2	Median: 574,511	Median: 771,723	
#25a Resident fish rearing habitat	Average juvenile habitat	M2	Median: 216,831	Median: 670,198	

Swing Weighting
FORM 2

Criteria	Performance Measure	Unit	Worst	Best	Points
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#6 River fish access to side /off channels	Average Flow	CMS	Median: 85	Median: 169.1	
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#17 Cheslatta watershed fish habitat	Range of flow	CMS	Median: 386	Median 162.3	**100**
#18a River water temperature and migrating salmon	Number of days average daily temp exceeds 18C	Days	Median: 28	Median: 21	
#18c River water temperature and migrating salmon	Number of days average daily temp exceeds 20C	Days	Median: 5	Median: 1	
#21a River Chinook incubation flow	Ratio of min incubation flow to average spawning flow	%	Median: 12.3	Median: 50	**100**
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Swing Weighting
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#25a Resident fish rearing habitat	Average juvenile habitat	M2	Median: 216,831	Median: 670,198	**50**

Swing Weighting
FORM 2

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Fish					
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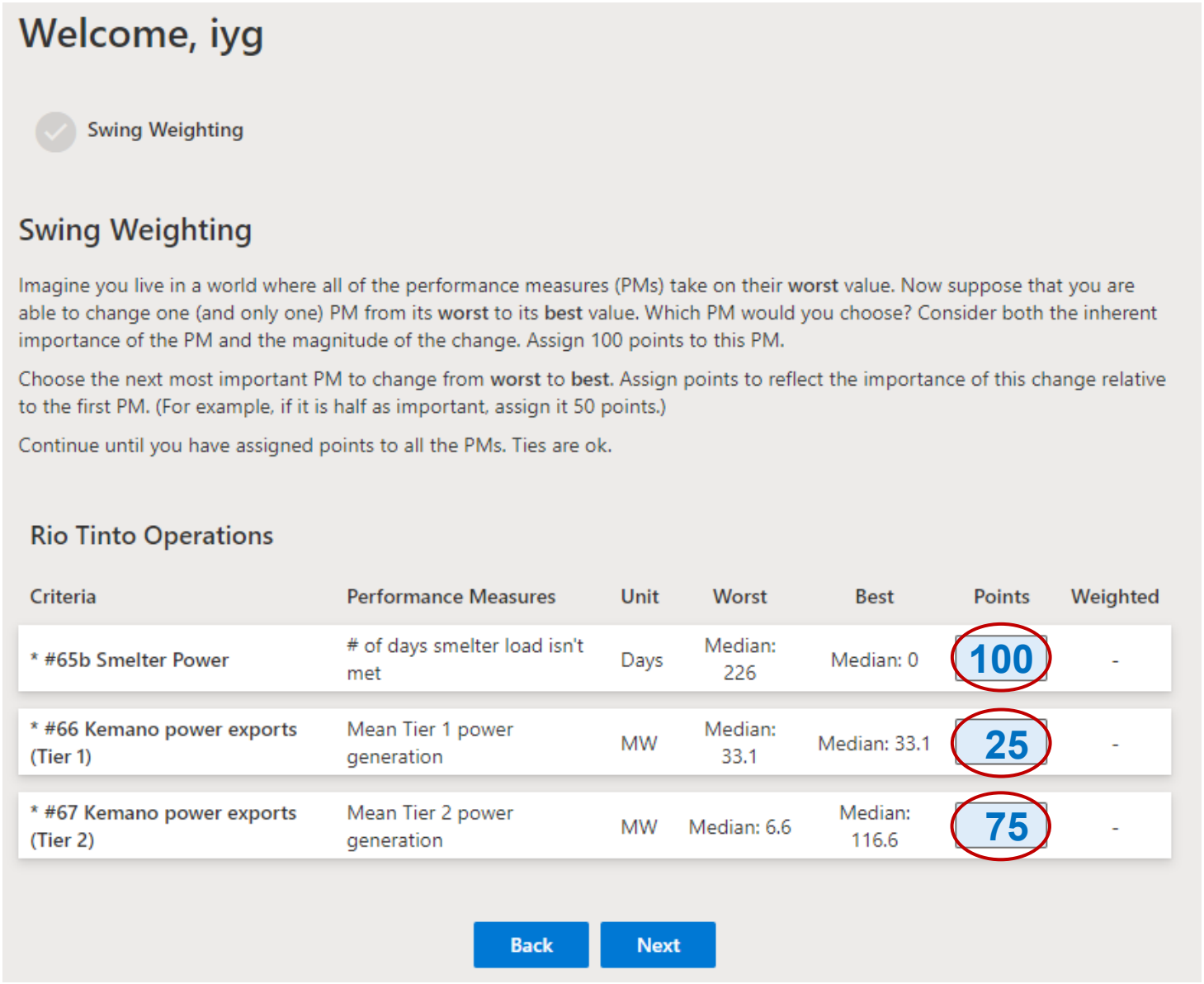
#12 Reservoir productivity-flushing	Average discharge	CMS	Median: 157.9	Median: 80.5	**15**
#17 Cheslatta watershed fish habitat	Range of flow	CMS	Median: 386	Median 162.3	**100**
#18a River water temperature and migrating salmon	Number of days average daily temp exceeds 18C	Days	Median: 28	Median: 21	**40**
#18c River water temperature and migrating salmon	Number of days average daily temp exceeds 20C	Days	Median: 5	Median: 1	**25**
#21a River Chinook incubation flow	Ratio of min incubation flow to average spawning flow	%	Median: 12.3	Median: 50	**100**
#22a River CH rearing habitat Post-emergent Habitat	Amount of post-emergent habitat (Envirocon curve)	M2	Median: 574,511	Median: 771,723	**5**
#25a Resident fish rearing habitat	Average juvenile habitat	M2	Median: 216,831	Median: 670,198	**50**

Swing Weighting
FORM 2

Criteria	Performance Measure	Unit	Worst	Best	Points
Wildlife					
*** #32 Reservoir caribou land links**	# of days water elevation is > 852 m	Days	Median: 0	Median: 36	**45**
*** #38 Reservoir osprey nesting habitat**	Number of years where reservoir elevation exceeds 852.44m	Years	25	10	**15**
#41b Reservoir wetland habitat	Number of years where reservoir elevation exceeds 852.94 m	Years	6	18	**100**
*** #45b River bird inundation of nests**	Number of years where Cheslatta discharge exceeds 275 cms	Years	31	2	**40**
Culture & Heritage					
* #49b Cheslatta watershed inundation of arch sites	# of days > 300 cms	Days	80th %: 56	80th %: 0	100
Flooding & Erosion					
* #53 River open-water flooding	# of days flow >550 at Vanderhoof	Days	Max: 55	Max: 2	100
Rio Tinto Operations					
* #65b Smelter Power	# of days smelter load isn't met	Days	Median: 226	Median: 0	100
* #66 Kemano power exports (Tier 1)	Mean Tier 1 power generation	MW	Median: 33.1	Median: 33.1	25
* #67 Kemano power exports (Tier 2)	Mean Tier 2 power generation	MW	Median: 6.6	Median: 116.6	75

On-Line Swing Weighting Form 2 – AltaViz



Swing Weighting
FORM 3

STEP 4: Review each Category of PMs relative to one another for moving the entire set of PMs from **worst to best value**

STEP 5: Assign 100 points to the most important Category of PMs to swing from their **worst to best value**

STEP 6: Repeat for each remaining Category of PMs by assigning a lower number of points relative to your most important PM

for example…

Swing Weighting
FORM 3

Criteria	Performance Measure	Unit	Worst	Best	Points
Fish					100
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#21a River Chinook incubation flow	Ratio of min incubation flow to average spawning flow	%	Median: 12.3	Median: 50	
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Wildlife					15
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Culture & Heritage					75
* #49b Cheslatta watershed inundation of arch sites	# of days > 300 cms	Days	80th %: 56	80th %: 0	
Flooding & Erosion					50
* #53 River open-water flooding	# of days flow >550 at Vanderhoof	Days	Max: 55	Max: 2	
Rio Tinto Operations					50
* #65b Smelter Power	# of days smelter load isn't met	Days	Median: 226	Median: 0	
* #66 Kemano power exports (Tier 1)	Mean Tier 1 power generation	MW	Median: 33.1	Median: 33.1	
* #67 Kemano power exports (Tier 2)	Mean Tier 2 power generation	MW	Median: 6.6	Median: 116.6	

Swing Weighting
FORM 3

Criteria	Performance Measure	Unit	Worst	Best	Points
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* #65b Smelter Power	# of days smelter load isn't met	Days	Median: 226	Median: 0	
* #66 Kemano power exports (Tier 1)	Mean Tier 1 power generation	MW	Median: 33.1	Median: 33.1	
* #67 Kemano power exports (Tier 2)	Mean Tier 2 power generation	MW	Median: 6.6	Median: 116.6	

On-Line Swing Weighting Form 3 – AltaViz

Swing Weighting

Imagine you live in a world where all of the performance measures (PMs) take on their **worst** value. Now suppose that you are able to change all the PMs of one (and only one) objective from their **worst** to their **best** value. Which objective would you choose? Consider both the inherent importance of the objective and the magnitude of the change. Assign 100 points to this objective.

Choose the next most important objective to change from **worst to best**. Assign points to reflect the importance of this change relative to the first objective. (For example, if it is half as important, assign it 50 points.)

Continue until you have assigned points to all the PMs. Ties are ok.

Criteria	Performance Measures	Unit	Worst	Best	Points	Weighted
Fish					100	-
* #6 River fish access to side/off channels	Average flow	CMS	Median: 85	Median: 169.1		
* #12 Reservoir productivity-flushing	Average discharge	CMS	Median: 157.9	Median: 80.5		
* #17 Chesiatta watershed fish habitat	Range of flow	CMS	Median: 386	Median: 162.3		
* #18a River water temperature and migrating salmon	Number of days average daily temp exceeds 18C	Days	Median: 28	Median: 21		
* #18c River water temperature and migrating salmon	Number of days average daily temp exceeds 20C	Days	Median: 5	Median: 1		
* #21a River Chinook incubation flow	Ratio of min incubation flow to average spawning flow	%	Median: 12.3	Median: 50		
* #22a River CH rearing habitat Post-emergent Habitat	Amount of post-emergent habitat (Envirocon curve)	m2	Median: 574511	Median: 771723		
* #25a Resident fish rearing habitat	Average juvenile habitat	m2	Median: 216831	Median: 670198		
Wildlife					15	-
* #32 Reservoir caribou land links	# of days water elevation is > 852 m	Days	Median: 0	Median: 36		
* #38 Reservoir osprey nesting habitat	Number of years where reservoir elevation exceeds 852.44m	Years	25	10		
* #41b Reservoir wetland habitat	Number of years where reservoir elevation exceeds 852.94 m	Years	6	18		
* #45b River bird inundation of nests	Number of years where Chesiatta discharge exceeds 275 cms	Years	31	2		
Culture & Heritage					75	-
* #49b Chesiatta watershed inundation of arch sites	# of days > 300 cms	Days	80th %: 56	80th %: 0		
Flooding & Erosion					50	-
* #53 River open-water flooding	# of days flow >550 at Vanderhoof	Days	Max: 55	Max: 2		
Rio Tinto Operations					50	-
* #65b Smelter Power	# of days smelter load isn't met	Days	Median: 226	Median: 0		
* #66 Kemano power exports (Tier 1)	Mean Tier 1 power generation	MW	Median: 33.1	Median: 33.1		
* #67 Kemano power exports (Tier 2)	Mean Tier 2 power generation	MW	Median: 6.6	Median: 116.6		

Phase 1 Bookend Alternatives
Results from Ranking Exercises

- Clayton…

Assessing Bookend Alternatives

- Selecting First Round Flow Alternatives

Selecting Round 1 Flow Alternatives

Name	Which to Carry Forward	What Improvements Should be Made to them (Intent)?
Alt 1 Status Quo		
Alt 2 Nechako Aquatic Species		
Alt 3 Sockeye Migration		
Alt 4 Cheslatta Aquatic Species		
Alt 5 Wildlife (Reservoir)		
Alt 6 Reservoir Aquatic Species		
Alt 7 Flood Mitigation		

New Ideas ??		

Next Steps