June 11, 2018

Cowichan Water Use Planning Update

Welcome

Tonight's Agenda:

- Provide information about the development of a Water Use Plan for the Cowichan Valley;
- Present the Public Advisory Group's recommendations;
- Answer questions.

Schedule

6:00 pm Open House (please walk around)

7:00 pm Presentations

7:30 pm Question & Answer

8:30 pm Close

Leadership Partners:

Cowichan Tribes, Cowichan Valley Regional District, Catalyst Paper Corporation, and Cowichan Watershed Board

We thank the members of the Public Advisory Group for participating in this community-based planning initiative, the Federal and Provincial Governments who have provided funding, along with Catalyst Paper, Cowichan Tribes and the Cowichan Watershed Board who provided additional financial support.

Grant program funding by Infrastructure Canada: Clean Water and Waste Water Program

Water Use Planning Overview

Goal:

To seek agreement on a long-term solution to ensure water resources are sustainable and available to meet the region's future water use requirements.

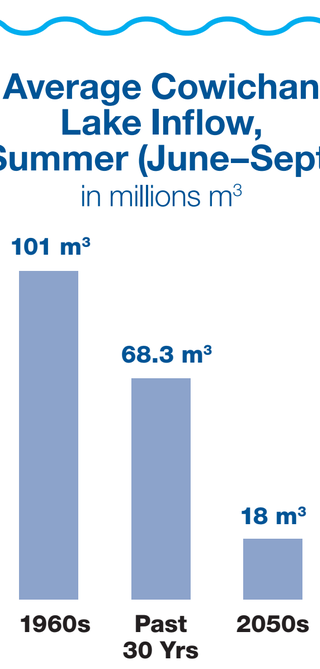
Why We Need a New Plan:

The Cowichan water management system can no longer reliably serve all the water uses it currently supports. Rainfall, snowmelt, and system demand have changed significantly since the Cowichan River Weir was built in the 1950s. Climate projections show that wet and dry seasons will continue to grow more extreme, stressing the current system even more dramatically.

All the options that have been identified to address the shortfall in water availability have undesirable consequences that need to be considered and weighed to find an acceptable balance.

Since the 1960's, the amount of water coming into Cowichan Lake in summer (June–Sept) has dropped by one third.

Average Cowichan Lake Inflow, Summer (June–Sept)
in millions m^3



About the Process:

Leadership: The CVRD, Cowichan Tribes, the Cowichan Watershed Board, and Catalyst Paper have joined together to initiate a community planning process.

Public Participation: A 19-member Public Advisory Group (PAG) was selected as a representative cross-section of water use interests and community concerns. This group met to discuss and evaluate an exhaustive set of alternatives. This process resulted in the recommendations for new water control facilities and changes to how water is stored and released down the Cowichan River presented at tonight's session.

Next Steps: The Public Advisory Group's proposal is an important milestone on a long journey. The support of the PAG for the proposed plan is contingent on a set of supporting recommendations. These recommendations define a series of next steps in the water use planning process that the leadership partners may want to move forward with. A decision still needs to be made by the leadership partners on whether or not to proceed with these recommendations from the PAG.

The Cowichan Basin Water Management Plan process was completed over a 3 year period with substantial public input and resulted in 89 key recommendations in the final 2007 plan. This Cowichan Water Use planning process addresses one of that plan's core recomendations: working towards long term water supply.

For more detail on the planning process please see blue panels

Issues and Interests

The **Public Advisory Group (PAG)** worked together to develop a shared understanding of the problem and work on solutions that considered all values at stake potentially impacted from changes in the management of water levels and flows. These considerations were used to evaluate the trade-offs between various water management options through a values-based public planning process.

The following interest areas were highlighted during the planning process as important for assessing the different alternatives:

Culture & Heritage

- First Nations Salmon Harvesting Rights (FSC)
- Traditional Knowledge Transfer & Generation
- Ceremonial Bathing (Cultural Practices)
- Archaeological Sites

Environment (Cowichan River)

- Geomorphology
- Connectivity (lateral)
- Water Quality
- Fish Passage
- Salmonid Rearing
- Salmonid Spawning
- Wildlife and Riparian

Environment (Cowichan Lake)

- Water Quality
- Vancouver Lamprey
- Littoral Habitat
- Wildlife and Riparian

Industry & Commercial

- Catalyst Paper
- Agriculture (Irrigation / GW Wells)
- Commercial Fisheries

Lakefront Properties

- Flooding and Inundation
- Private Property Lakefront Areas
- Docks / Wharves
- Private water pump intakes

Municipal

- Waste Water
- Water Supply – Lake
- Water Supply – River

Recreation and Tourism

- Lake – Recreational Beach Use
- Lake – Boat Access / Navigation
- Lake – Aesthetics
- River – Boating and Tubing
- Angling / Fishing

Water Management

- Infrastructure Capital and Operating Costs

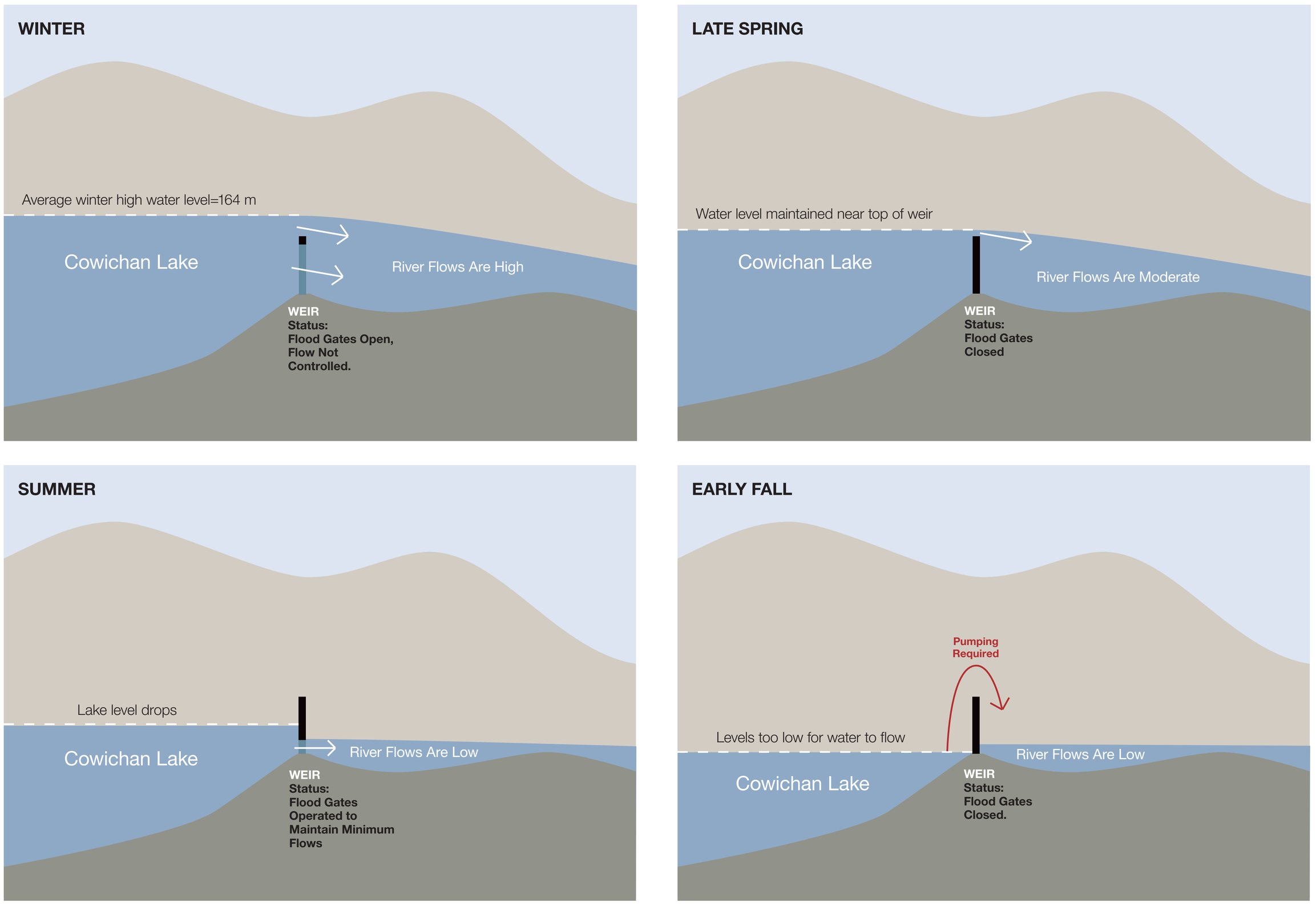
Fundamental Trade-Offs

All the water use alternatives explored and assessed during the process had significant trade-offs, particularly in light of the increasing water insecurity in the future.

Some of the key characteristics that the new alternatives tried to achieve were:

- Avoiding higher lake levels in the spring (during high inflow events) to avoid any increased risk of inundation and flooding of lakefront areas
- Maintaining access and functionality of beach areas and recreation facilities throughout the summer time and early fall period
- Maintaining river flows for fish, recreation, tourism, municipal water supply and wastewater dilution, and industrial interests (e.g., Catalyst Paper)
- Maintaining lake levels for aquatic habitat of threatened species in the lake and to avoid unsightly visual effects with lake levels falling below historical levels
- Maintaining spring and fall pulse flows for fish and fish habitat down the Cowichan River

Weir Operation, Lake Levels, and River Flows



Water use alternatives were constructed from one or more of these building blocks:

- Changes to minimum flow requirements for the Cowichan River,
- Changes to the rule curve which governs the operation of the weir and therefore water levels in Cowichan Lake, and
- Potential new infrastructure to increase the storage capacity of Cowichan Lake (i.e., increasing the weir height, permanent pump station, etc.)

Alternatives could also include potential new enhancement projects that may be appropriate to mitigate adverse effects.

Reaching Agreement

The Public Advisory Group examined a total of 16 different water use alternatives over three rounds of evaluation. All of them had different impacts to the issues or interests valued by different groups. The PAG recognized that:

- there was no “win-win” alternative.
- a new plan is needed: the current status quo is not a viable long-term option.

At the final meeting of the PAG a new alternative was proposed to bridge the remaining differences of opinion. The new alternative was adaptive in nature by recommending an interim increase to the height of weir until there was resolution for compensating potentially affected lakefront property owners for raising the weir height up to a maximum of 0.7m above the current weir.

Summary of Preferred Alternative

Infrastructure

Weir Height – Increased Storage Capacity

The PAG recommends **increasing the height of the weir by +30cm on an interim basis** until a more detailed assessment is carried out to confirm that the height of the weir is below the minimum elevation range of the natural boundary. New infrastructure would be built to accommodate up to a +70cm increase in storage capacity but be operated at +30cm until such time as the compensation issues are resolved.

A longer term **maximum weir height increase to +70cm,** would only be allowed after a compensation mechanism was established and agreed to by individual property owners for any increases above the natural boundary and their affected property rights.

Pumping – “Negative” Storage Capacity

The PAG recommends allowing for **temporary pumping to be used as an emergency measure** to maintain a minimum flow of 5cms down the Cowichan River during future severe summer droughts.

Operations

Timing of Control Period

The PAG recommends **starting to store water and control outflows to the Cowichan River one month earlier** than current start date. Timing of control may be modified based on a review of in-season hydrological conditions*

This recommendation is conditional that control should start **no earlier than March 1** unless a detailed flood risk analysis concludes that there would be no increased flood risk associated with an earlier start date.

Flow Releases to Cowichan River

The PAG recommends **adjusting the magnitude and timing of spring flows,** which incorporate:

- **Minimum flow targets,** including “hard” targets, to meet in all years, and “soft” targets, to meet in wetter years when water is available.
- **Lake level targets,** including a target date (April 1st) for when water should be stored to the top of the weir and a drawdown limit to no more than 20cm below historical “zero storage” levels.
- These flows may be modified based on in-season hydrological conditions*

This recommendation is conditional that a detailed assessment of flood risk demonstrates there **no increase in spring flood risk** over the current weir and operations.

Rule Curve Updates

The PAG recommends modifying the rule curve to ensure that lake levels are targeted to reach close to the zero storage by the end of the control period (to avoid increased flood risk associated with fall storms)

* i.e., snow pack levels, short term weather forecast, long range seasonal forecast, environmental monitoring, etc

Support for this alternative is conditional on these recommendations:

1. **Refine the alternative parameters through an assessment using an updated climate change dataset and longer projected time series**
2. **Complete a more detailed flood risk analysis using a longer projected time series**
3. **Complete a more detailed assessment of the natural boundary to determine the elevation range in relation to any changes in the weir height, and depending on the results, develop a preliminary compensation framework to be implemented with the alternative**
4. **Develop an adaptation plan from present day until the 2050s (full implementation of the alternative) to transition the new facilities and operations from the current hydrology in the watershed to those forecast in the future**
5. **Operationalize to allow for in-season management based on in-season conditions (i.e., snow pack levels, short-term weather forecast, seasonal forecasting, environmental monitoring (e.g., snorkel surveys), etc.)**
6. **Complete a more detailed erosion assessment and develop a mitigation mechanism (if adverse impacts as a result of the operations are demonstrated)**
7. **Include a 10–15 year review period once implemented, based on necessary environmental field work and monitoring**
8. **Partner Organizations petition the provincial and federal governments to take responsibility and follow through with the PAG consensus recommendations**

Rule Curve: The guidelines that govern the rate at which stored water is released from a reservoir, in this case the controlled seasonal release of water from Cowichan Lake into Cowichan River.

“Do Nothing” versus the “PAG Recommended New Alternative”

Climate change and the changing nature of hydrology forecast for the watershed by the 2050s (or sooner) will lead to significant impacts regardless if action is taken or not. The PAG fully considered the “Do Nothing” option during the evaluation process, but felt the impacts of not making any changes to the weir or its operations were the worst and most unacceptable across all the options considered.

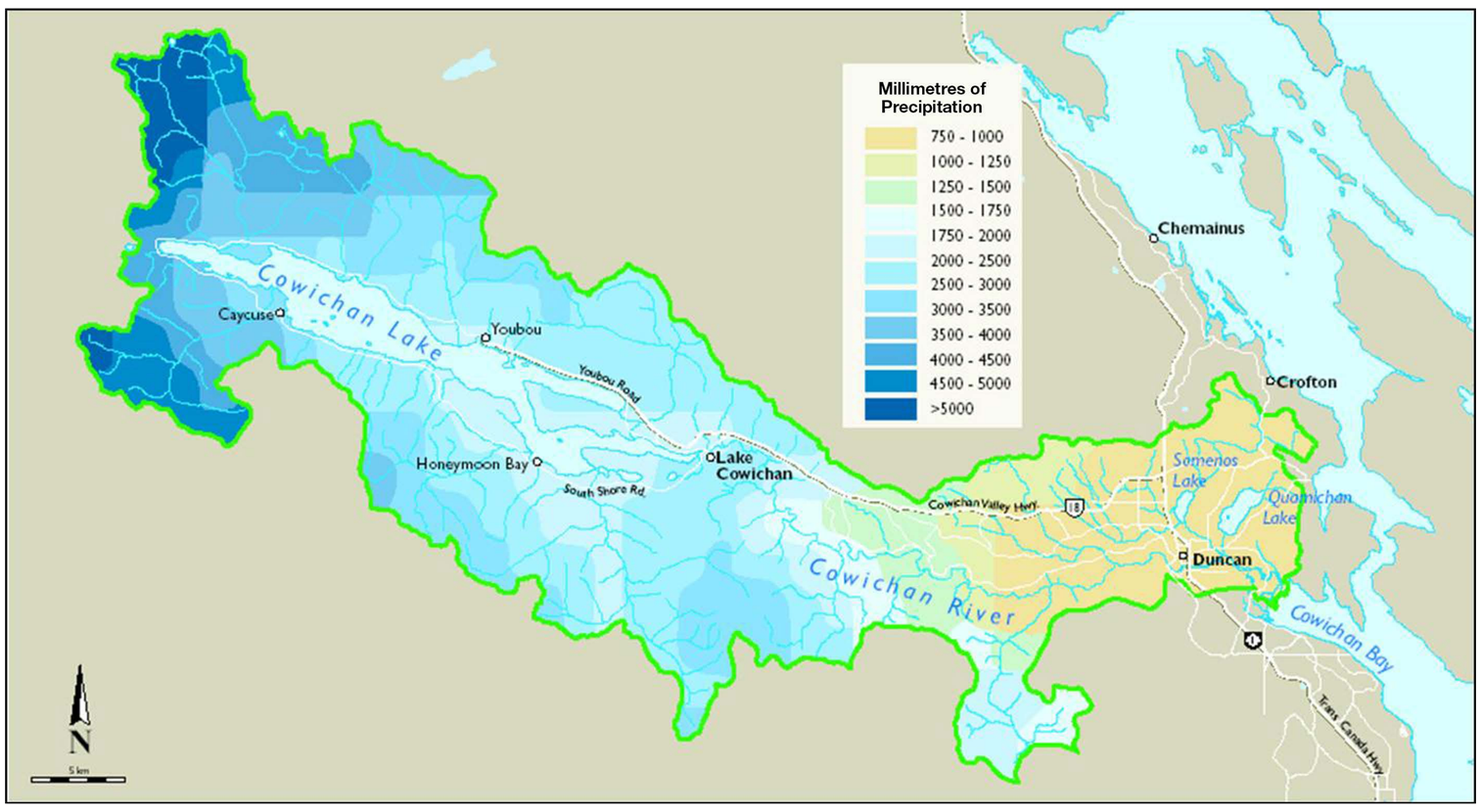
By the 2050s (or sooner!)

Interest Area	“Do Nothing” Option (i.e., current weir and operations)	PAG Recommended Alternative
Environment – Cowichan River and Estuary		
Health of fish and aquatic species are also important for First Nations Culture and Heritage and commercial and recreational fishing		
Salmon Stocks	The Cowichan River is one of the most productive rivers on the eastern side of Vancouver Island and without action it will look radically different by the 2050s. Salmon stocks that utilize the river to spawn and rear during the summer and early fall period will be decimated. Chinook, Coho and Steelhead are particularly vulnerable, and their populations will almost certainly be at critically low levels without intervention. There will be no Aboriginal, commercial, or recreation fisheries for these species, if this situation is allowed to occur. **Note:** If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, river flows would still be sub-optimal (i.e., 5cms) and not able to offset climate change effects and there would be a reliance on pumping in almost every summer.	The new recommended alternative will more than double base river flows in most years and better support passage flows in the spring and early fall for returning spawning salmon. As a result, salmon stocks will be more resilient to climate change effects and their populations would not be expected to reach a threatened status.[1] Compared to the “Do Nothing” alternative in the 2050s, the new alternative will lead to significant improvements to rearing, spawning, and side channel habitat critical for salmon survival; improved passage conditions for returning adult salmon to spawn and for juvenile salmon to return to the ocean. [1] Except possibly for spring-run Chinook where flows under the new alternative are not expected to fully offset challenges from climate change.
Cowichan Estuary	The Cowichan Estuary is one of the most important estuaries in British Columbia from an ecological perspective. By the 2050s, average summer time flows in the river will be reduced to about a third of what they are now (i.e., less than 2cms) under the “Do Nothing” option; and, as a result, there would be significant adverse impacts to the flora and fauna in the estuary.	Cowichan River flows to the estuary will be maintained at present summer and fall time levels on average in the 2050s. Accordingly, aquatic and terrestrial ecosystems in the estuary would not be expected to be impacted from a water quantity perspective.
Environment – Cowichan Lake		
Aquatic and Riparian Ecosystems and Endangered Species	By the 2050s, lake levels will drop on average by a foot or more below the historical low point in summers as water drains through the weir gates and boat lock to try and maintain some flows down the river. This will cause loss of habitat in nearshore areas for many aquatic species around the lake (e.g., Cutthroat Trout and Coho Salmon) and significantly reduce critical habitat of threatened species (such as Vancouver Lamprey, which only occurs in the upper watershed). As the shoreline retreats with lower lake levels, there will also be significant impacts to riparian areas reducing cover and food inputs and reducing the overall littoral productivity of the adjacent ecosystems. **Note:** If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, the drawdown of lake levels will further drop to 0.6m or more below the historical low point in the lake on average; and by more than 1.0m during dryer summers in the 2050s. The significance of the habitat losses in these cases will be much greater and for threatened species it is unlikely they would be able to survive based on our current understanding of their needs.	Lake levels would drop by no more than 20cm in the driest summer forecast in the 2050s for the new alternative. In 9 out of 10 years, lake levels would not fall below the normal minimum summer time level. Accordingly, there would not be expected to be any significant impacts to aquatic and threatened species relying on nearshore habitats.
Recreation & Tourism		
River – Water based recreation	Tubing down the Cowichan River is the most popular summer time activity in the region and a major tourism draw for local businesses. By the 2050s, river flows will drop to such low levels (below 2cms) that tubing will not be possible for large parts of the summer in most years (7 out of 10 years on average). Also note that the recreation and sport fisheries in the Cowichan River would likely be shut down by the 2050s under this option. **Note:** If pumping is allowed to augment summer river flows in the future, suitable tubing flows would be provided through the summers in the 2050s.	River flows will be maintained and provide suitable tubing flows (i.e., greater than 5cms) throughout all summers in the 2050s.
Lake – Water based recreation and beach areas	By the 2050s, lower summer lake levels of about 30cm will increase beach areas in many popular areas around the lake by about 1m to 5m (depending on the beach slope). **Note:** If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, lake levels would regularly be between 0.6m to 1.0m below the historical low point in the lake. While this would further increase beach areas, this drop would also: (a) expose mudflats along beach and lakefront areas, (b) create navigation hazards, (c) and damage and/or make some wharves and docks inaccessible to boating. There would also be significant negative visual impacts associated with a 1m drop around the lake (“bathtub ring” effect).	Once the weir height was increased by 0.7m, lake levels would be up to 45cm higher at the beginning of May and then dropping to 0cm higher by the end of July in most summers by the 2050s. These higher levels will reduce beach areas for portions of the late spring and early summer from between 1m to up to 6m depending on the beach slope. There would be no anticipated adverse impacts to boating / navigation, dock access, wharves and docks, and no visual impacts associated with lower lake levels with this alternative.

Interest Area	“Do Nothing” Option (i.e., current weir and operations)	PAG Recommended Alternative
Lakefront Properties		
Flooding	Flooding will occur as it always has independent of the weir and its operations, as lake levels are controlled by the natural constriction in the river downstream (by the trestle bridge) during large inflow events.	The new alternative is NOT associated with any greater risk of flooding during the control period when the weir will be operated.
Water Levels and Lakefront Areas	By the 2050s, lake levels will be lower on average by about 0.3m throughout the summer time period compared to lake levels today. Lower lake levels will increase beach front and lakefront areas by about 1m to up to 5m depending on the slope by the end of the summer. Note. If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, lake levels would drop by as much as 1.0m, in some summers, increasing lakefront areas by as much as 15m or more in some cases depending on the slope. In some areas, this will result in large areas of exposed mudflats and affect the use of docks and piers and other water-based infrastructure.	Once the weir height is increased on an interim basis by +0.3m, lake levels are expected to be about 15cm higher through May and June on average and unchanged from current levels through the remainder of the summer and fall. It should be emphasized that these higher levels are not expected to affect property rights (i.e., below the ‘natural boundary’ elevation). Once compensation is resolved with lakefront property owners and the weir height is increased to its full maximum height of +0.7m, lake levels would be up to 45cm higher at the beginning of May and then dropping to 0cm higher by the end of July in most summers by the 2050s.
Industry & Commercial		
Catalyst Paper	Water withdraws for mill operations would need to be cut back or stopped completely in most years by the 2050s in order to maintain adequate river flows to meet environmental and community water supply needs. **Note:** If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, mill operations would not be expected to be affected.	River flows will be maintained and provide flows for both mill withdrawals and minimum environmental flows throughout all summers in the 2050s. No impacts to the mill operations are expected in all future years.
Municipal		
Waste Water	Treated effluent is currently discharged to the Cowichan River. By the 2050s, river flows will be lower than needed to meet the dilution requirements for the area’s projected waste water needs. **Note:** If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, waste water dilution requirements would be met.	River flows will be maintained and provide flows needed to meet projected waste water dilution requirements in all future years.
Water Supply – Lake	Cowichan Lake is an important source of community water supply for the Town of Lake Cowichan and private water intakes around the lake. By the 2050s, average summer time lake levels will impact the Town’s current water supply infrastructure in most years (8 out of 10 years on average). **Note:** If pumping is allowed to augment summer river flows in the future with the “Do Nothing” option, a new deep water intake would be required for the Town of Lake Cowichan’s water supply system and many lakefront properties who pump their water from the lake would also be affected.	Lake levels would drop by no more than 20cm in the driest summer forecast in the 2050s for the new alternative. Lake levels would not fall below the Town of Lake Cowichan’s current water intake infrastructure. Accordingly, there would not be expected to be any impacts to community water supply or upgrades to infrastructure.
Water Management		
Infrastructure Capital	No capital costs are immediately required with the current weir and control facilities; however it was noted during the planning process that these facilities are aging and will be in need of upgrades in the not too distant future.	There are costs associated with building new water management infrastructure. Based on previous studies, costs are expected to be in the range of $15 million.
Operating Costs	If pumping is required to augment summer river flows in the future, there will be costs required to mobilize and operate emergency pumps. These costs are estimated to be at least $0.5M per year.	There will be costs required to mobilize and operate emergency pumps (in 1 out of 10 years).

Cowichan Watershed Overview

The Cowichan Watershed is the geographic area that drains into Cowichan Lake and Cowichan River. It is the largest of the Cowichan Valley Regional District's 16 watersheds.



Precipitation amounts vary widely from the mountains surrounding Lake Cowichan to the populous but dry lower valley. Lack of rain in summer makes summer drought conditions in the lower section more extreme.

- Supplies drinking water for around 25,000 people in three municipalities, five electoral areas, and two First Nations.
- Supplies 30% of region's fresh water needs for drinking, irrigation, sewage dilution and other uses.
- Supports key economic sectors:
  - Tourism
  - Agriculture/food production
  - Industrial/business processes (e.g. forestry, pulp mill, fish hatcheries, golf courses)
  - Key salmon fisheries with economic impacts along the coast of BC, Washington and Alaska
- Provides extensive recreational opportunities:
  - Hiking
  - Sports fishing
  - Swimming/tubing
- Culturally significant to First Nations for maintaining and carrying out their Constitutionally protected rights and title.
- Provides vital ecological systems including fish habitat/migration, ecosystem health, and wildlife.

Note:

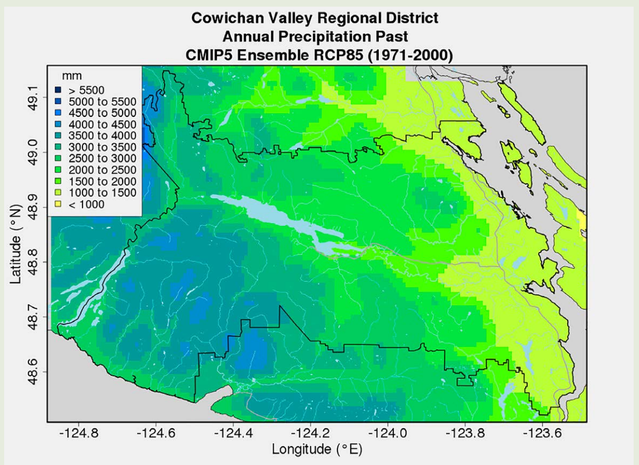
The Water Use Plan will encompass the Cowichan Watershed, but will primarily focus on water use related to potential changes in lake levels on Cowichan Lake and potential changes in flows down the Cowichan River. The Cowichan Watershed Management Plan focuses on overall issues affecting the watershed.

Future Projections

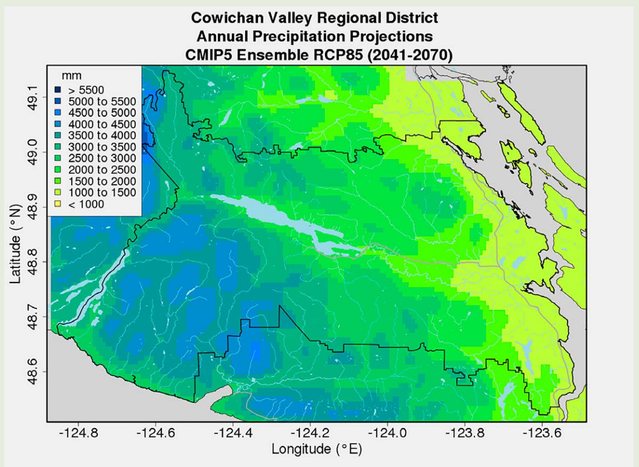
Precipitation

The wetter areas of the watershed are expected to grow wetter in coming years, while the drier areas grow drier. Higher winter temperatures will mean that winter rain will flow out of the system more quickly.

Annual Precipitation, Past



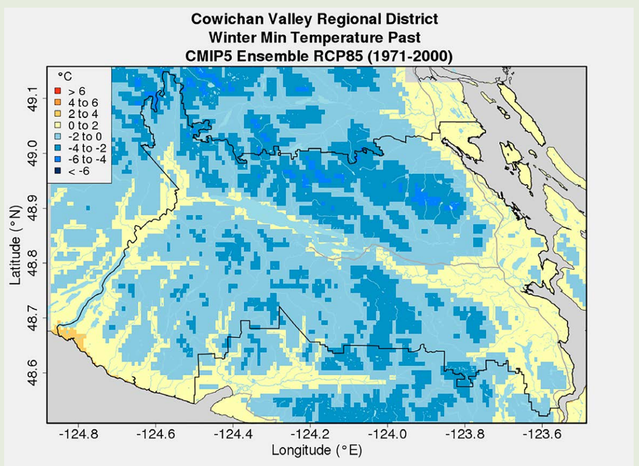
Annual Precipitation, 2050s



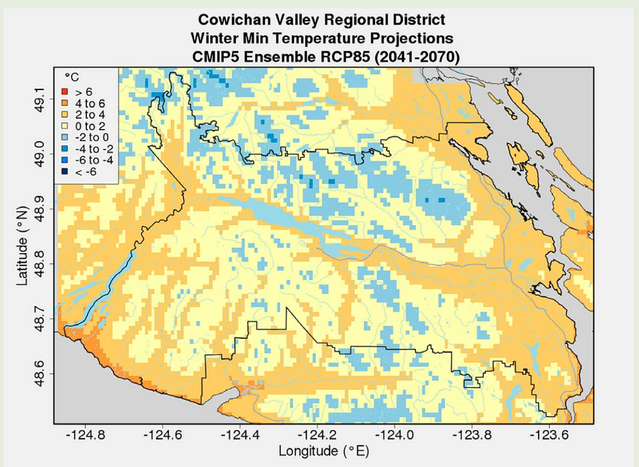
Winter Temperatures

In future, only the highest elevations will experience nighttime lows below freezing. Winter precipitation will increasingly fall as rain, not snow. Less snow means less runoff in the spring.

Winter Average Nighttime Low Temperature, Past



Winter Average Nighttime Low Temperature, Future



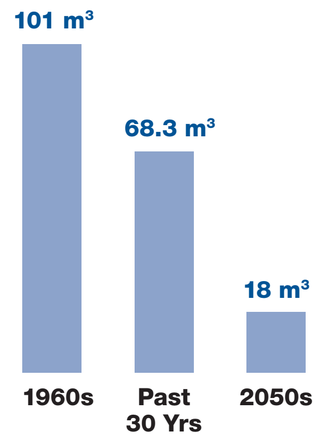
Climate Change in the Cowichan

The Cowichan Weir was constructed in the 1950s. Since then we have seen a significant trend toward drier summer conditions. This is expected to worsen in coming years with longer periods of drought and warmer temperatures.

Change is Already Here

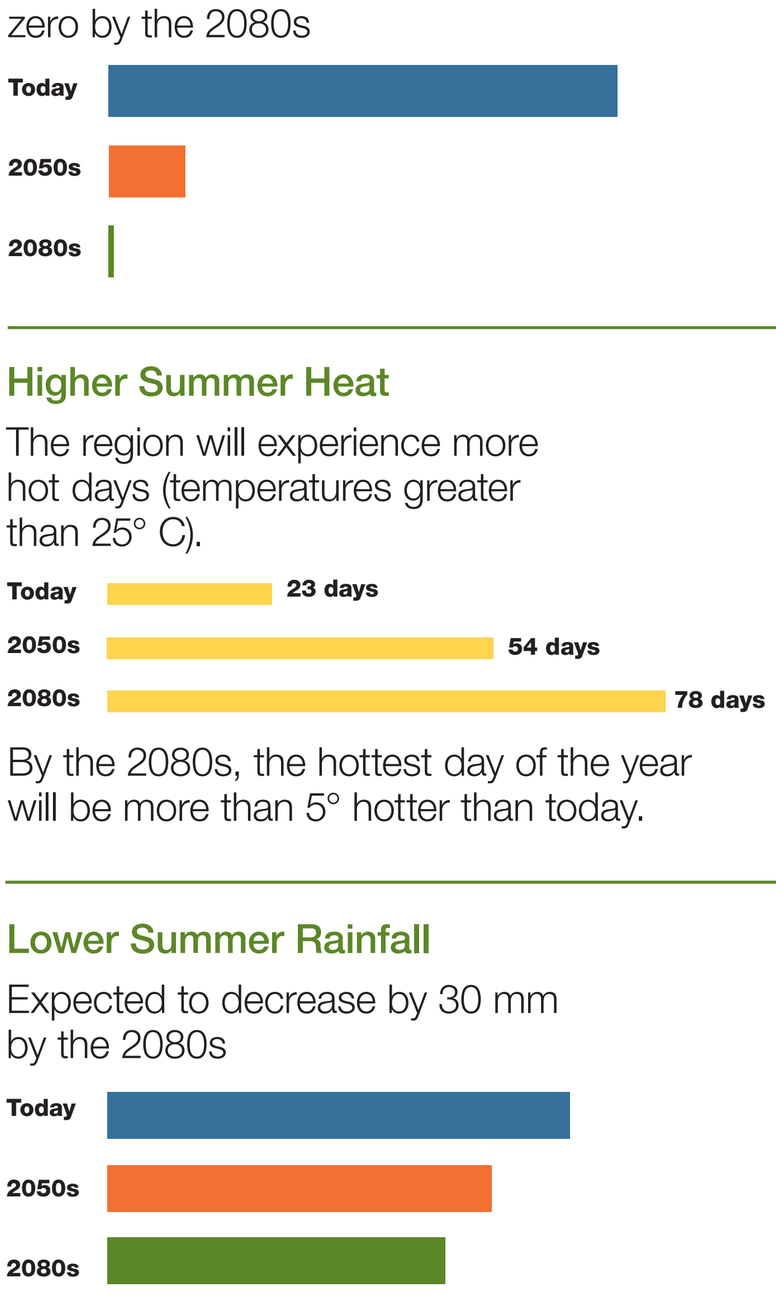
- On average, 33% less water flows into Cowichan Lake in the summer compared to the 1960s. This includes direct rainfall, as well as rain and snowmelt run-off from surrounding land and streams.
- According to Catalyst Paper (who owns and operates the weir), 8 out of the last 15 years have been drought summers (including three of the last four).

Average Cowichan Lake Inflow, Summer (June–Sept)
in millions m^3



Projections for the Future

Expected Change	Expected Impact
April 1 Snowpack Depth Expected to decrease to almost zero by the 2080s	Less snow = less spring runoff
Higher Summer Heat The region will experience more hot days (temperatures greater than 25° C). By the 2080s, the hottest day of the year will be more than 5° hotter than today.	Increased evaporation and increased irrigation demand
Lower Summer Rainfall Expected to decrease by 30 mm by the 2080s	Less summer inflow to lake/river
Longer Dry Spells	Longer period where storage is required

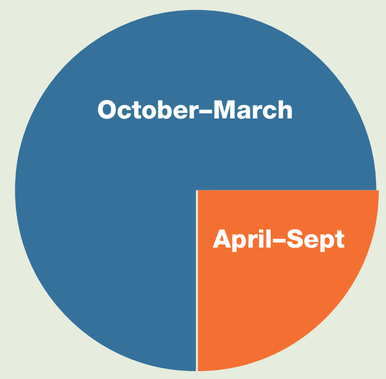


Seasonal Extremes

Seasonal swings between wet and dry periods create problems of surplus (flooding) and drought (insufficient river flows) in the region.

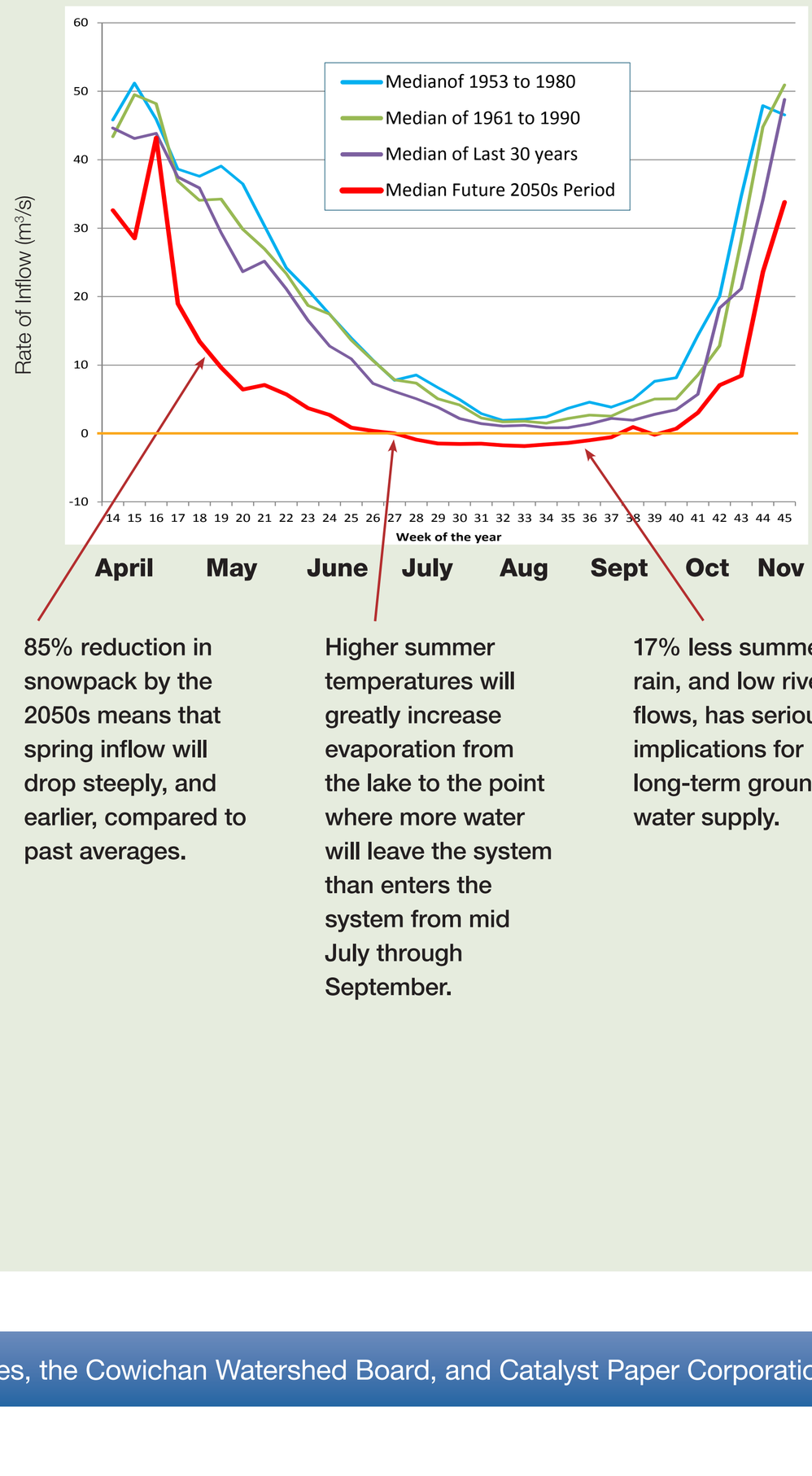
This trend is expected to worsen with climate change, making it even more difficult to balance adequate river flows and lake levels.

Cowichan Lake Annual Precipitation



Water Coming In to Cowichan Lake (inflow)

Past Vs. Projected 2050s, Weekly Averages



85% reduction in snowpack by the 2050s means that spring inflow will drop steeply, and earlier, compared to past averages.

Higher summer temperatures will greatly increase evaporation from the lake to the point where more water will leave the system than enters the system from mid July through September.

17% less summer rain, and low river flows, has serious implications for long-term groundwater supply.

Supply and Demand

A growing population, coupled with climate projections for warmer drier summers and longer periods of drought, suggest demand for water will be far greater than supply.

SUPPLY

Water in lake

Ground water storage

Inflow sources

- Direct rainfall
- Indirect rainfall from slopes and streams
- Snowmelt

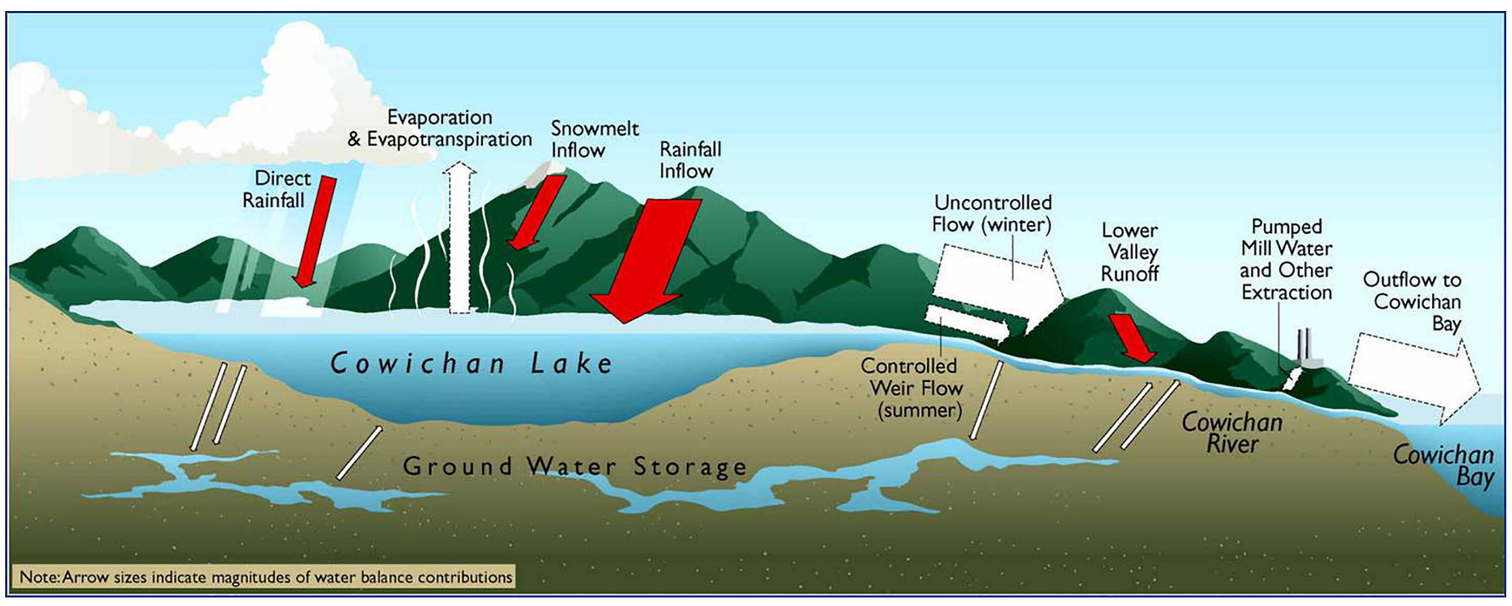
DEMAND

Outflow sources

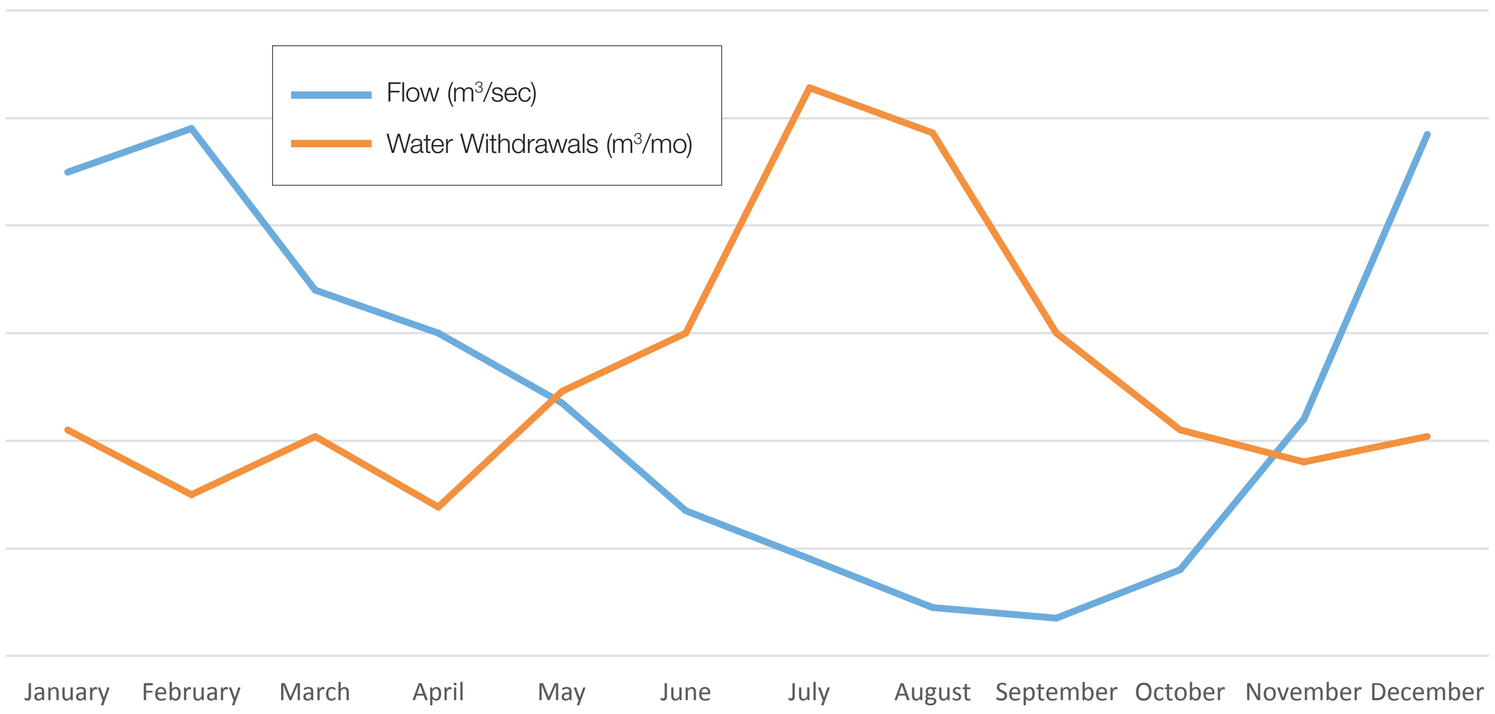
- Outflow to Cowichan Bay via river
- Extraction from river (e.g. pumped mill water)
- Extraction from groundwater:
  - Drinking water
  - Irrigation
  - Sewage dilution
- Evaporation

Water security was resident's top priority in CVRD's 2016 Community Satisfaction Survey

Water Flow and Storage in the Cowichan Watershed



Seasonal Pattern: River Flow Volume vs. Water Withdrawals



Even in average years, water is in limited supply during the summer when demand is at its peak.

The high rate of groundwater extraction (drinking water, irrigation, sewage dilution) increases pressure on an already-limited summer water supply.

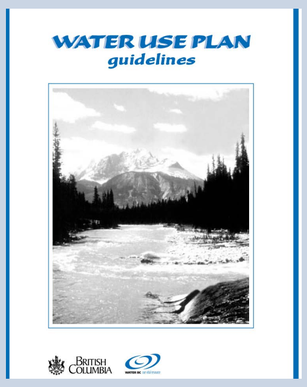
Planning Process Overview

Tonight we are presenting the results of a community planning process which is a critical step in the development of a draft Water Use Plan for the Cowichan region. This planning process follows the province's Water Use Plan Guidelines.

Goal: To systematically explore a range options and their impacts, resulting in recommendations for a balanced long-term solution to meet the region's future water use requirements for the Cowichan System.

Initiated by: A partnership of the CVRD, Cowichan Tribes, the Cowichan Watershed Board, and Catalyst Paper

Consulting team: Compass Resource Mgt, Kerr Wood Liedal, Ecofish Research



The planning process followed a structured approach guided by the Province's Water Use Plan Guidelines, prepared by the BC Ministry of Environment, BC Hydro and Fisheries and Oceans Canada in 1998.

Provincial Process

for initiating, developing, approving, monitoring and reviewing a water use plan:

Step 1	**Initiation and Announcement**
Steps 2-8	**Plan Development** **Product: Draft Plan**
Step 9	**Apply for Water Use Licanse**
Step 10	**Provincial Review and Decision** **Product: Authorized Plan**
Step 11	**Federal Review** **Product: Implemented Plan**
Step 12	**Monitoring and Compliance Assessment**
Step 13	**Periodic Plan Review**

Cowichan Water Use Community Planning Process

Step 4	**Define the issues and interests (and how to measure them)**
Step 5	**Gather additional information on impacts**
Step 6	**Create water use alternatives**
Step 7	**Assess the trade-offs between alternatives**
Step 8	**Determine and document the areas of consensus and disagreement**

The process used a **Structured Decision Making (SDM)** approach, consistent with Steps 4 through 8 in the provincial WUP Guidelines.

The process is designed to seek consensus on a set of operating rules (and, in some cases, changes to the water control facilities) in order to better satisfy the full range of water use interests at stake, while respecting legislation and other boundaries.

Structured Decision Making

SDM is a framework for thinking critically about management decisions. It provides an organized approach for identifying and systematically evaluating choices in a transparent and defensible way. SDM is rooted in the decision sciences and is recognized internationally as a standard for "best practices" in resource management. It has been applied to many different planning and risk management contexts, but is particularly useful in assisting groups grapple with complex, imperfect information, and multi-dimensional problems where there are difficult value choices and priorities to balance.

Structured Decision Making Steps

Public Advisory Group Was Formed

The PAG is comprised of 19 members, selected to represent a cross-section of the community. PAG members agreed to represent the interests of their agency or constituents and to ensure that solutions or recommendations proposed were acceptable to their organization.

Groups Represented on PAG

- **Provincial Government Representatives**
- **Federal Government Representatives**
- **First Nations**
- **Lakefront Property Owners**
- **Industry Stakeholders**
- **Local Municipalities**
- **Community and Environmental Associations**

Technical Support

Technical Sub-Groups (TSGs)

- PAG members
- Technical reps from government agencies and other organizations
- Members of the public

Lakefront TSG
Identify and develop methods for assessing impacts to lakefront properties and recreational values

Aquatic and Riparian TSG
Identify and develop methods for assessing aquatic and riparian ecosystem objectives

Independent Consultants

Provided:

- Meeting facilitation
- Technical support (decision analysis, environment, hydrology)

Compass Resource Management
Designed and facilitated the multi-stakeholder SDM process and providing the SDM expertise to assess options.

Ecofish Research Ltd. (Ecofish)
Environmental lead responsible for estimating potential impacts to aquatic and terrestrial habitats.

Kerr Wood Leidal Associates (KWL)
Provided water resources engineering and hydrological modeling.

PAG Members

Aaron Hamilton
Lake Cowichan First Nation

Carol Milo
Cowichan Valley Naturalists Society

Cheri Ayers
Member of public / farmer and consultant

Dale Desrochers
Fisheries and Oceans Canada (DFO)

Darryl Slater*
MFLNRO (Water Authorizations)

*Represents the statutory decision-maker responsible for the regulatory review and approval of a WUP and any future water license application. Participated as an observer to the public planning process.

Graham Kissack
Catalyst Paper

Greg Allen
Member of public / lakefront property owner

Joe Allan
Member of public

Kate Miller
Cowichan Valley Regional District (CVRD)

Larry George
Cowichan Tribes

Leroy Van Wieren
Cowichan Lake and River Stewardship Society

Michelle Geneau
City of Duncan

Michelle Mahovlich
Edelweiss Chalets Strata / lakefront property owner

Mike McCulloch
MFLNRO (Fisheries)

Nagi Rizk
Town of Lake Cowichan

Pam Jorgenson
TimberWest

Paul Slade
Member of public / local business owner

Shaun Chadburn
North Cowichan

Tom Rutherford
Cowichan Watershed Board

Objectives and Performance Measures (PMs) Were Developed

Together the Objectives and Performance Measures represent **"what matters"** and **"what can be affected"** by the water use alternatives considered for the Cowichan Water Use Plan. They served as the evaluation framework that the PAG used to help assess the consequences of the different potential alternatives that were explored.

Decision Objectives

One of the first steps for the Public Advisory Group was to identify the issues and interests associated with water use management and develop a set of well-defined **decision objectives** — all the things that people care about that could be affected by water use alternatives and that must be considered when choosing among different alternatives.

A practical set of decision objectives need to strike a balance between being complete (representing all the things that matter) and concise (a manageable number).

Decision Objectives for Cowichan Water Use Planning

Culture & Heritage
- First Nations Salmon Harvesting Rights (FSC)
- Traditional Knowledge Transfer & Generation
- Ceremonial Bathing (Cultural Practices)
- Archaeological Sites

Environment (Cowichan River)
- Geomorphology
- Connectivity (lateral)
- Water Quality
- Fish Passage
- Salmonid Rearing
- Salmonid Spawning
- Wildlife and Riparian

Environment (Cowichan Lake)
- Water Quality
- Vancouver Lamprey
- Littoral Habitat
- Wildlife and Riparian

Industry & Commercial
- Catalyst Paper
- Agriculture (Irrigation / GW Wells)
- Commercial Fisheries

Lakefront Properties
- Flooding and Inundation
- Private Property Lakefront Areas
- Docks / Wharves
- Private water pump intakes

Municipal
- Waste Water
- Water Supply – Lake
- Water Supply – River

Recreation and Tourism
- Lake – Recreational Beach Use
- Lake – Boat Access / Navigation
- Lake – Aesthetics
- River – Boating and Tubing
- Angling / Fishing

Water Management
- Infrastructure Capital and Operating Costs

Performance Measures (PMs)

PMs are specific metrics for comparing the **predicted** impacts of the alternatives on the objectives (similar terms: attributes, evaluation criteria). PMs make objectives specific — they define how an objective is to be interpreted and evaluated for the purpose of the decision. For this process, PMs were designed to capture how changes to lake levels and river flows affect the interest that is valued.

Examples of Performance Measures for Decision Objectives

Objective	PM Description
First Nations FSC Rights	Use environmental fish PMs as a proxy
Environment – River: Fish Passage	Habitat suitability measure based on relationships between suitable river flow for fish passage, accounting for time of year when specific species use the river
Recreation and Tourism: Beach Use Areas	Beach user days measure based on relationships between lake levels, optimal beach area, and preferred time of year for beach use (recreational season)
Recreation and Tourism: Lake Aesthetics	Qualitative rating (constructed 1-5 scale) of potential visual impacts ("bathtub ring") associated with low lake levels

Notes:
- Performance Measures that were developed for one objective were sometimes used as a proxy measurement for a different objective (see table for an example).
- Objectives and PMs were updated as needed throughout the process as the range of alternatives narrowed and as PAG members provided feedback to ensure they were representative of the underlying interests and how they may be affected.

Alternatives Were Developed

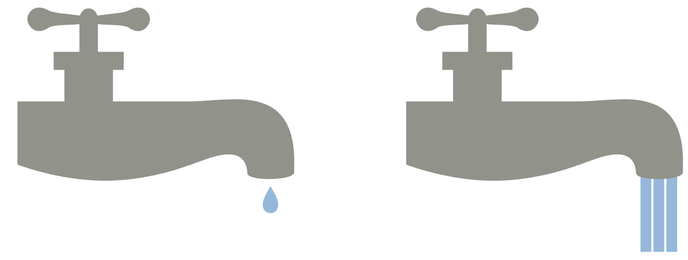
In this process, **alternatives** are the different actions (or "management levers") under consideration that can be modelled to predict their impact on lake levels and river flows throughout the year, and consequently, on **decision objectives** (as measured by **performance measures**).

Building Blocks of the Alternatives

Water use alternatives were constructed from one or more of these building blocks:

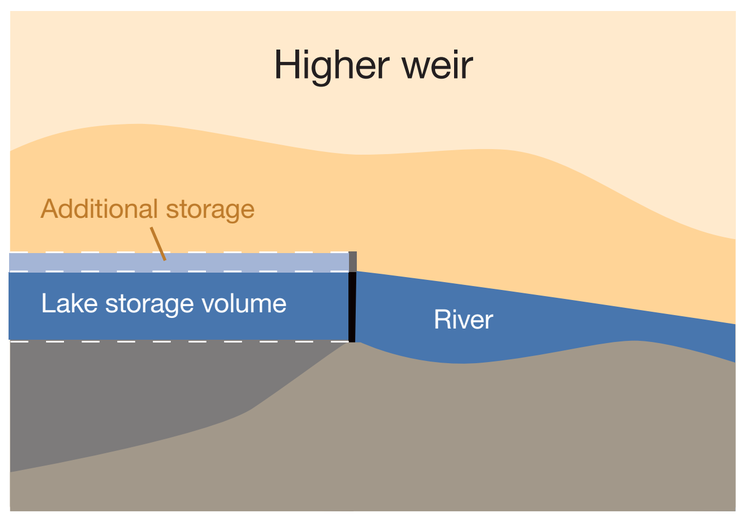
- Changes to minimum flow requirements for the Cowichan River,
- Changes to the rule curve which governs the operation of the weir and therefore water levels in Cowichan Lake, and
- Potential new infrastructure to increase the storage capacity of Cowichan Lake (i.e., increasing the weir height, permanent pump station, etc.)

Alternatives could also include potential new enhancement projects that may be appropriate to mitigate adverse effects.

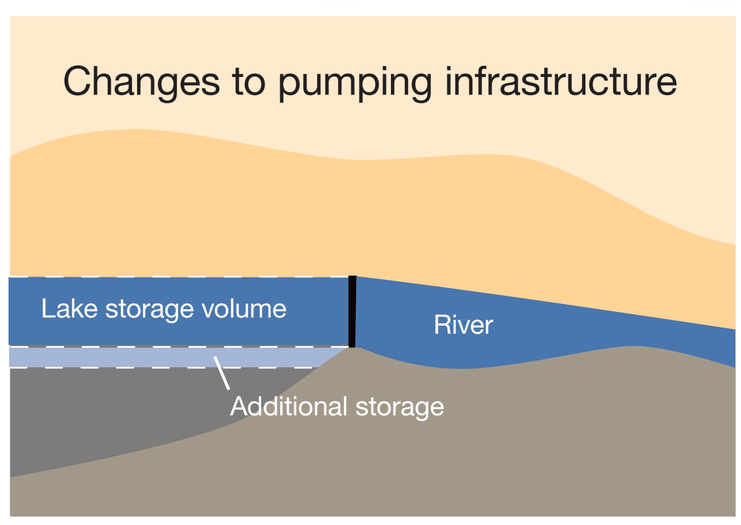


Rate of flow

Length of control period



Volume of additional storage



Parameters for Alternatives

Increased weir heights

- ❑ 0 m
- ❑ +0.3 m
- ❑ +0.5 m
- ❑ +0.7 m
- ❑ +1.0 m

Decreased summer lake levels (below historical)

- ❑ 0 m
- ❑ -0.15 m
- ❑ -0.3 m
- ❑ -1.0 m
- ❑ -1.5 m

Decreased fisheries flows

- ❑ 15/25 cms Spring flows

Summer base flows

- ❑ 5 cms
- ❑ < 4.5 cms

Earlier date to close the weir gates and boat lock and start storing water (i.e., the beginning of the control period, which is currently April 1 each year)

- ❑ March 1
- ❑ February 1

Consequences Were Analyzed

The Public Advisory Group used a number of tools to build a common understanding of the performance of different options.

These tools include:

- Data models of water level and flow (hydro-graphs) based on the variables for each alternative;
- Performance measures summarized through consequence tables and detailed graphs;
- Other information and supplemental analyses, including existing operations and facilities, characterization of potential effects on lakefront areas, research and monitoring studies.

Sample Consequence Table

Objective	Performance Measure	Alternatives A	B	C	D	E	F	G	H	I
Environment - River										
Fish Passage	Adult summer-run Chinook migration									
Fish Passage	Adult fall-run Chinook migration									
Lateral Connectivity	Side channel connectivity									
Rearing	Steelhead parr									
Rearing	Chinook fry									
Spawning	Early Steelhead incubation									
Environment - Lake										
Vancouver Lamprey	Lamprey rearing habitat (Scale 1-6)									
Littoral Productivity	Littoral rearing habitat									
Industry and Commercial										
Catalyst Paper	Impacted operations days									
Commercial Fisheries	*See fish PMs*									
Lakefront Properties										
Flooding and innundation	Max High Water Event - Mar 1 to Apr 30									
Private Property Lakefront Areas	Frontage length - representative areas									
Private Water Pump Intakes	*See Community Water Supply PMs*									
Municipal										
Community Water Supply	Intake pumping capacity - Town of Lake Cowichan									
Community Water Supply	Intake invert elevation - Town of Lake Cowichan									
Waste Water Dilution	Effluent dilution ratio (200:1) – Upper River									
Waste Water Dilution	Effluent dilution ratio (40:1) – Lower River									
Recreation and Tourism										
Beach Use Areas - Lake	Beach user days - representative areas									
Boat Access/Navigtn-Lake	Decrease in dock use days									
Boating & Tubing - River	Decrease in summer tubing days									
Lake Aesthetics	Visual Quality									
Water Management										
Capital Costs	Capital costs									
Operational Costs	AVG Operational costs (over 10yrs)									

Red cells = Performs worse compared to blue

Green cells = Performs better compared to blue

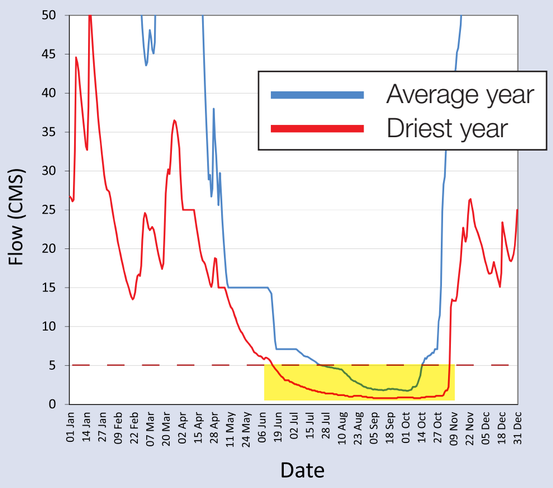
Decision objectives are organized in horizontal rows. **Alternatives** are shown in columns at right. For each alternative, the cells are filled in with values for each of the **performance measures** (i.e. evaluation criteria). In this illustrative example, the actual values are not shown, but we can see how various alternatives performed compared to column F (highlighted in blue).

Examples of Climate Data Models

Hydrological modelling helped the PAG understand how lake levels and river flows are likely to be impacted. These analyses revealed key insights and trade-offs. For example:

Low River Flows Under Status Quo

River Flows



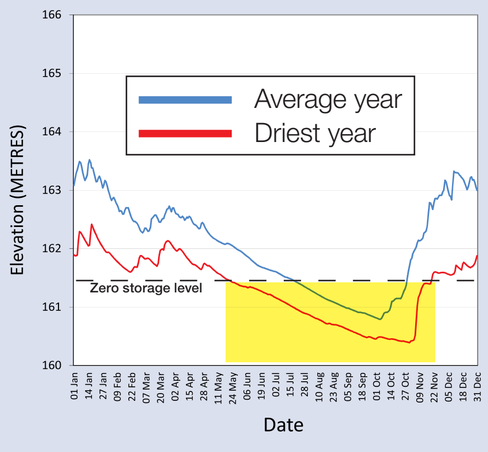
The graph at left represents the status quo alternative (the current infrastructure and operations) using the future climate change projections. Summer river flows will regularly fall below minimum rates (5 cms) without more storage because spring and summer inflows into the lake are expected to be significantly less in the future.

Summer River Flows vs. Lower Summer Lake Levels

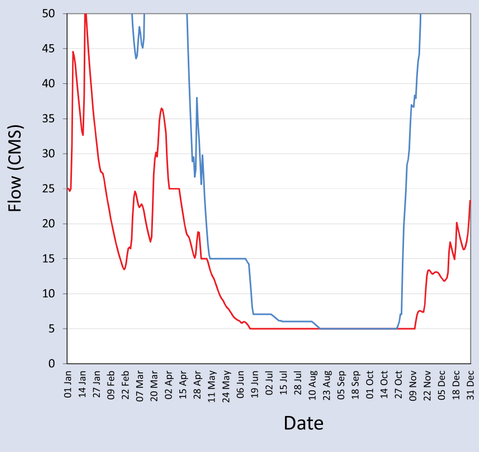
The graphs below represent a single alternative.

In this alternative, water is pumped from the lake in summer to maintain minimum summer river flows (5cms), as the graph at right shows. The graph at left shows that this results in lower lake levels in the summer, especially in drier years (dropping below historical "zero storage" level).

Lake Levels (Elevation)



River Flows



Higher Spring Flooding Potential vs. Lower Summer Lake Levels

Two alternatives are compared in the graphs below.

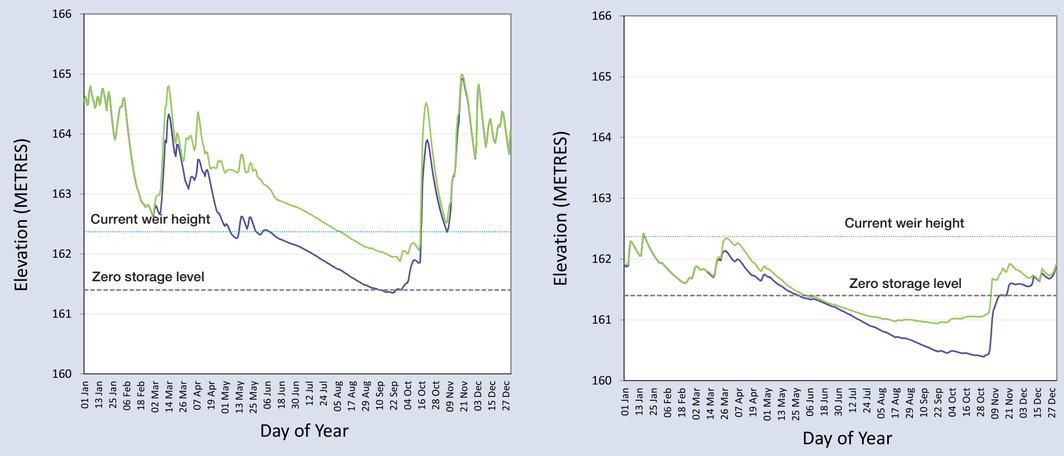
The graph on the left represents a wet year. Note that the green line climbs higher than purple in the spring, representing a greater risk of spring flooding with a higher weir and earlier storage date. The graph on the right represents a dry year. In this scenario, the pumping alternative (purple line) results in lower summer lake levels than the other alternative (green line).

Wettest Conditions

Highest Lake Levels (Elevation)
Predicted for the Alternatives Shown

Driest Conditions

Lowest Lake Levels (Elevation)
Predicted for the Alternatives Shown



Alternative with a higher weir and earlier storage date

Alternative with no increase in weir height and temporary pumping

Note:

All results shown use future climate change projections (2050s). These examples are from early rounds of alternatives. They are designed to show differences and highlight potential issues and trade-offs, and were intended to explore ways to build better alternatives.

Trade-Offs Were Evaluated

Iterative Structured Decision Making Process

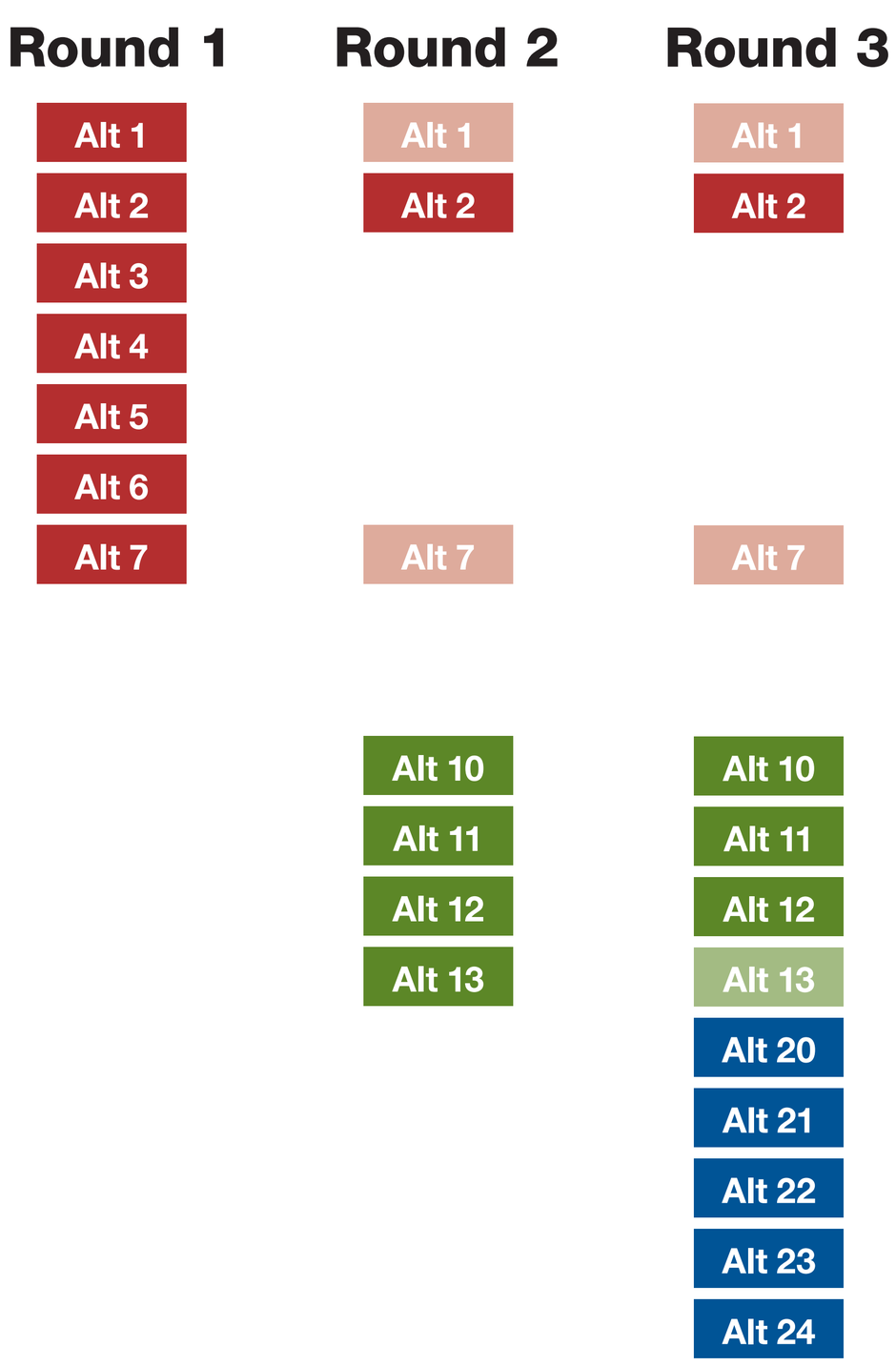
The PAG used their analysis of alternatives to construct a new, better set of alternatives. The second set of alternatives were used to generate another improved set of alternatives. This cycle of analysis and improvement continued for several rounds.

Rounds 1 & 2

- Helped with initial learning,
- Facilitated early discussions on the significance and acceptability of different consequences; and
- Gained insight into building better alternatives

Round 3

- Alternatives were designed to try and better balance trade-offs, and avoid some negative effects altogether, as was the case with avoiding any increase in flood risk over the current weir and operations.



Summary of Fundamental Trade-Offs

All the water use alternatives explored and assessed during the process had significant trade-offs between:

- Providing environmental flows for fish and aquatic species;
- Maintaining water levels for threatened aquatic species in the lake;
- Avoiding any increased flood risk on lakefront property owners;
- Minimizing adverse impacts on lakefront and water users on the lake and river.

Many PAG members felt strongly and opposed multiple alternatives, with most members opposing at least one alternative during the final round of evaluation.

At the final PAG meeting, none of the Round 3 alternatives were universally supported. Each alternative was opposed by at least 4 members of the PAG. This led to a creative new hybrid solution that bridged the main differences among PAG members and ultimately which served as the basis for the consensus recommendation.

A Consensus Was Reached

Because none of the Round 3 alternatives was supported by the Public Advisory Group, a new alternative was proposed at the final meeting. The final alternative attempted to resolve the most difficult trade-offs with a new hybrid alternative by including a set of recommendations and conditions on the final implementation.

Choosing a preferred alternative involved trade-offs and value-based choices. The PAG acknowledged and openly discussed difficult trade-offs and reviewed options with the aim of achieving an acceptable balance across all objectives. The PAG weighed the different options based on their impacts on the values of the larger group.

Despite the challenge of balancing difficult trade-offs, the PAG came to consensus around the preferred alternative.

Consensus is a goal but not a requirement of the water use planning process. The Provincial Water Use Guidelines define consensus as a decision that participants can accept, without having to agree on all the details of the recommendations put forward.

Summary of Preferred Alternative

Infrastructure

Weir Height – Increased Storage Capacity

The PAG recommends **increasing the height of the weir by +30cm on an interim basis** until a more detailed assessment is carried out to confirm that the height of the weir is below the minimum elevation range of the natural boundary. New infrastructure would be built to accommodate up to a +70cm increase in storage capacity but be operated at +30cm until such time as the compensation issues are resolved.

A longer term **maximum weir height increase to +70cm,** would only be allowed after a compensation mechanism was established and agreed to by individual property owners for any increases above the natural boundary and their affected property rights.

Pumping – "Negative" Storage Capacity

The PAG recommends allowing for **temporary pumping to be used as an emergency measure** to maintain a minimum flow of 5cms down the Cowichan River during future severe summer droughts.

Operations

Timing of Control Period

The PAG recommends **starting to store water and control outflows to the Cowichan River one month earlier** than current start date. Timing of control may be modified based on a review of in-season hydrological conditions*

This recommendation is conditional that control should start **no earlier than March 1** unless a detailed flood risk analysis concludes that there would be no increased flood risk associated with an earlier start date.

Flow Releases to Cowichan River

The PAG recommends **adjusting the magnitude and timing of spring flows,** which incorporate:

- **Minimum flow targets,** including "hard" targets, to meet in all years, and "soft" targets, to meet in wetter years when water is available.
- **Lake level targets,** including a target date (April 1st) for when water should be stored to the top of the weir and a drawdown limit to no more than 20cm below historical "zero storage" levels.
- These flows may be modified based on in-season hydrological conditions*

This recommendation is conditional that a detailed assessment of flood risk demonstrates there **no increase in spring flood risk** over the current weir and operations.

Rule Curve Updates

The PAG recommends modifying the rule curve to ensure that lake levels are targeted to reach close to the zero storage by the end of the control period (to avoid increased flood risk associated with fall storms)

* i.e., snow pack levels, short term weather forecast, long range seasonal forecast, environmental monitoring, etc

Support for this alternative is conditional on these recommendations:

1. **Refine the alternative parameters through an assessment using an updated climate change dataset and longer projected time series**
2. **Complete a more detailed flood risk analysis using a longer projected time series**
3. **Complete a more detailed assessment of the natural boundary to determine the elevation range in relation to any changes in the weir height, and depending on the results, develop a preliminary compensation framework to be implemented with the alternative**
4. **Develop an adaptation plan from present day until the 2050s (full implementation of the alternative) to transition the new facilities and operations from the current hydrology in the watershed to those forecast in the future**
5. **Operationalize to allow for in-season management based on in-season conditions (i.e., snow pack levels, short-term weather forecast, seasonal forecasting, environmental monitoring (e.g., snorkel surveys), etc.)**
6. **Complete a more detailed erosion assessment and develop a mitigation mechanism (if adverse impacts as a result of the operations are demonstrated)**
7. **Include a 10–15 year review period once implemented, based on necessary environmental field work and monitoring**
8. **Partner Organizations petition the provincial and federal governments to take responsibility and follow through with the PAG consensus recommendations**