

Cowichan Lake Water Management Rule Curve & Rule Band January 20, 2011

KERR WOOD LEIDAL associates limited CONSULTING ENGINEERS

Craig Sutherland, M.Sc., P.Eng.

Water Resources Engineer

Cowichan Lake Level and River Flow

Summary

- History of the weir and purpose
- How river flow and lake level are managed
- How can water be better managed?
- Rule Curve / Rule Band
- Example Years

Dynamic Environment
Cowichan Lake and Cowichan River

Cowichan River
Skutz Falls

November
– natural uncontrolled flow

(200cms+)

August
- flow controlled by weir

(4-7cms)

Cowichan Lake Weir

History / Background

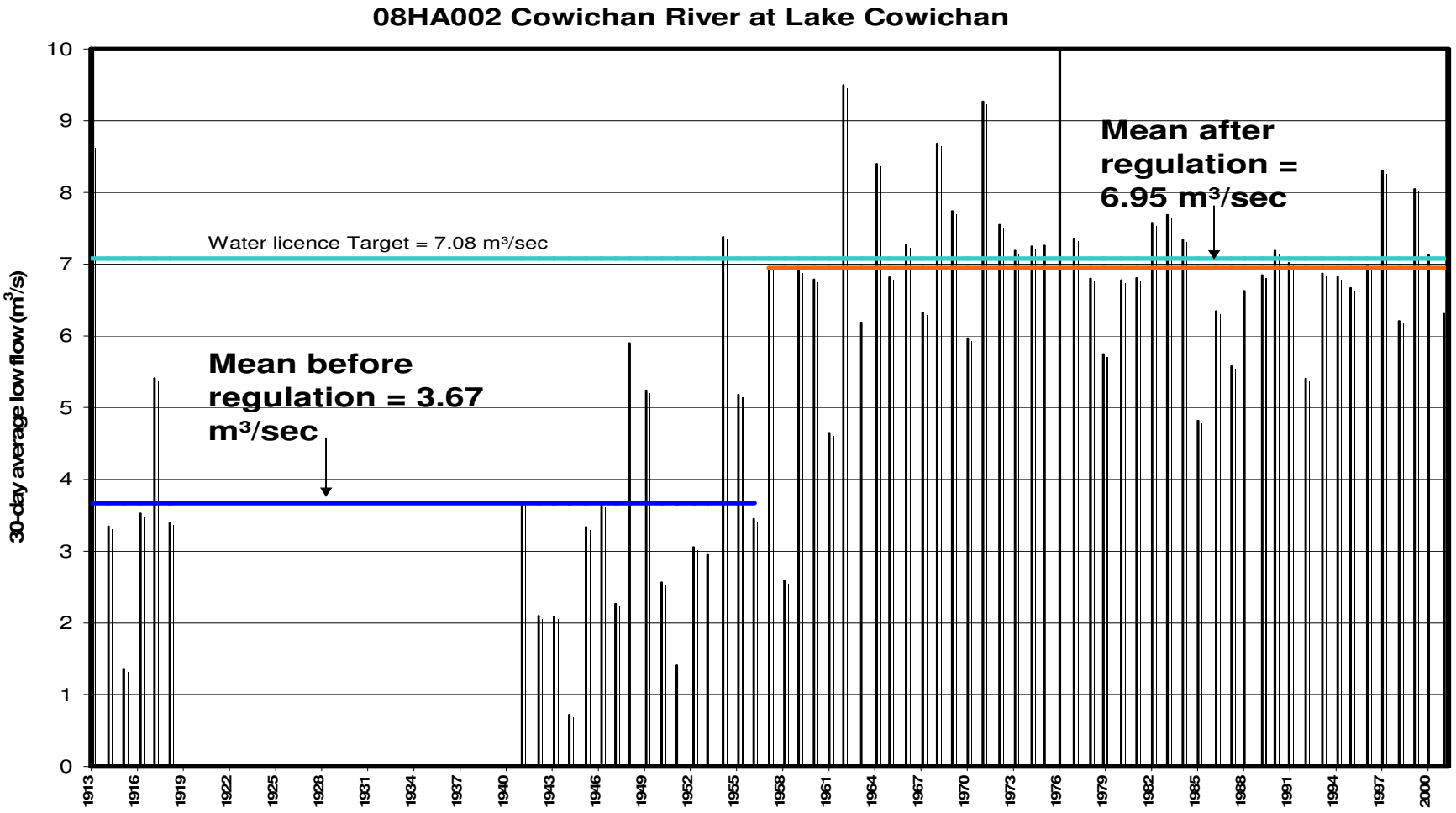
Constructed in 1956 by BC Forest Products to supply water for Crofton Pulp/Paper Mill

Operated by Catalyst Paper on behalf of many water users in the watershed:

- Industry
-Municipal treated sewage dilution and municipal water supply
-Fisheries / River Habitat Health
- First Nations/Cultural Importance and
- Recreation (lake and river)

What good does the weir do?

Summer river mean water flows have doubled since 1957



How are lake levels and river flows managed?

One thing to keep in mind…

Change in lake level always depends on inflow (flow from tributary streams and rainfall) and outflow (Cowichan River flow and evaporation)

When inflow larger than outflow => lake level increases

When inflow less than outflow => lake level falls

Weir typically controls spring/summer lake levels by:

1. Decreasing flow in spring to less than or equal to inflow to store water behind weir
2. Releasing flow in the summer greater than inflow to maintain summer baseflow

Some definitions

Full Storage Level (FSL) – water level at top of the weir

Zero Storage Level (ZSL) – below this lake level flow in the river would drop below 7 m^3/s.

Control period – Typically April 1 to September/November depending on rain

Water levels at the Weir during typical year

Full Supply Zero Storage No Control

April to Early July

End of October

November

Direction of Flow

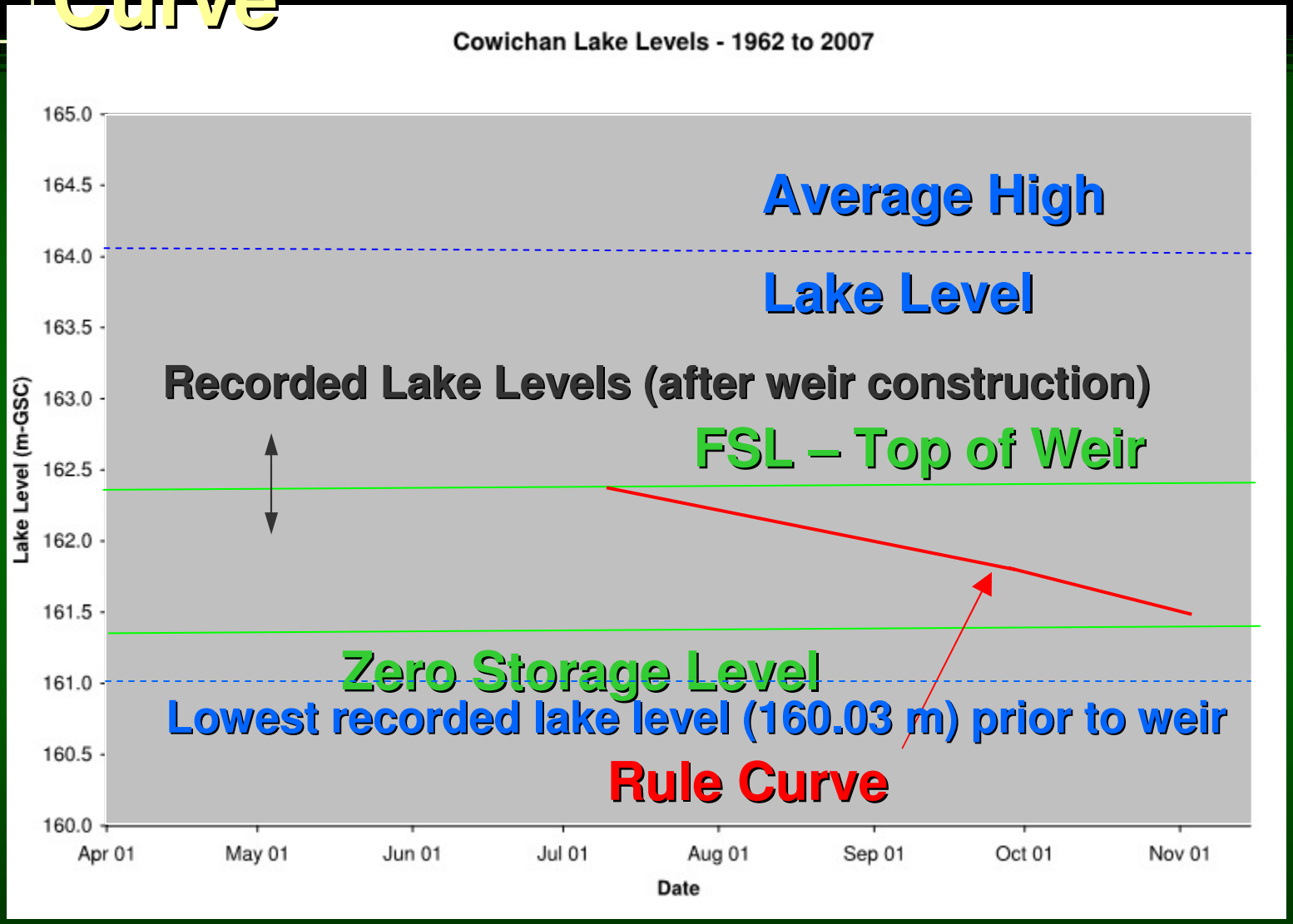
How is water managed?

Ideally:

1. Lake at Full Supply Level on July 9th
2. River flow 7 m^3/s from June 15th until return of fall rains (late September to early November)
3. Also spring flows of 25 m^3/s and 15 m^3/s prior to June 15th.

But depends on inflow

How is water managed: Rule Curve



Ideally lake level at FSL July 9 then falls along Rule Curve

How is water managed now: Rule Curve

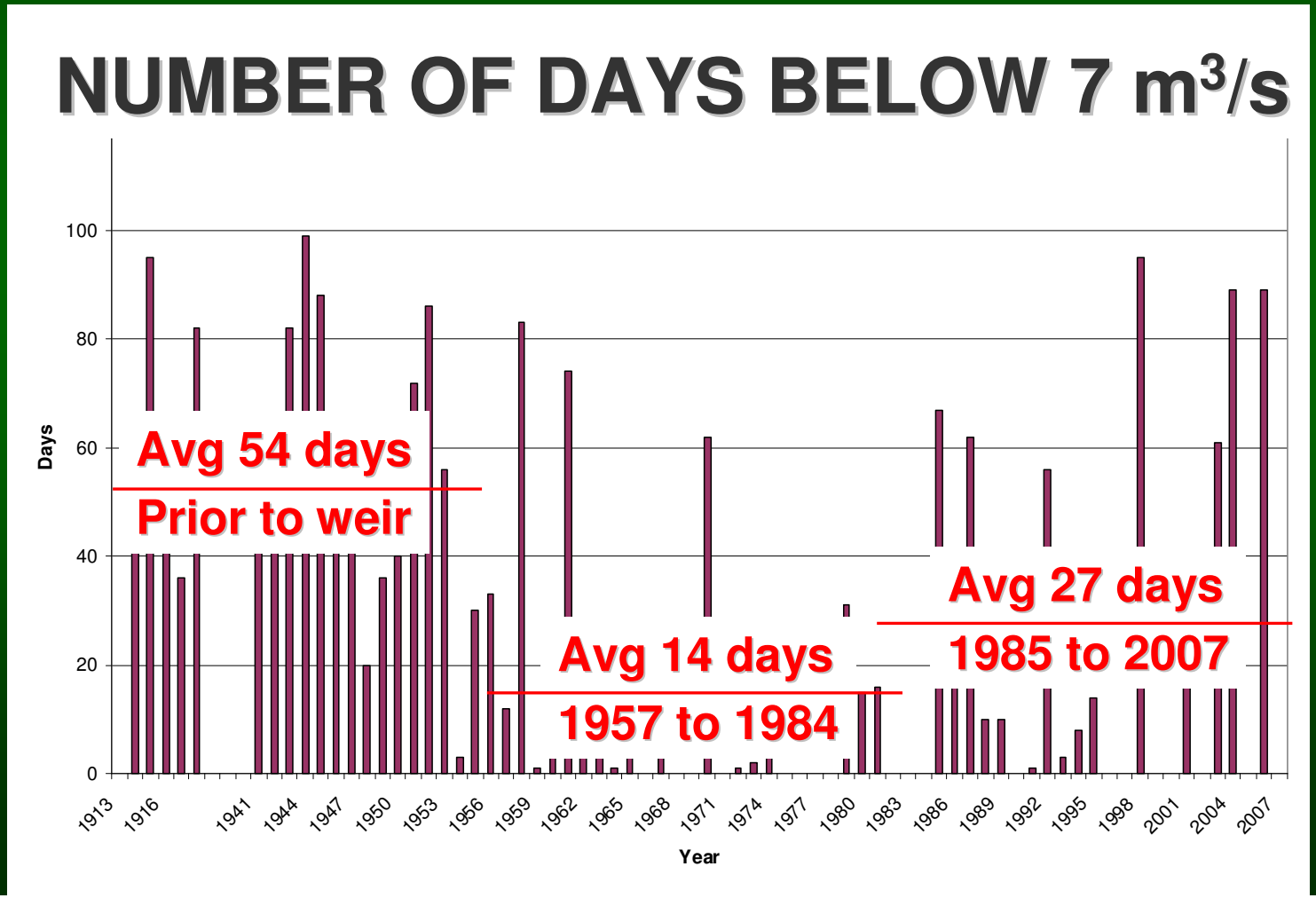
What happens when lake levels do not follow rule curve because inflow is below/above normal?

Cowichan River "Ad-hoc" Committee makes recommendation on required change in river flow

Recommendation is submitted to MoE for approval

Past summers

Having to reduce flows below 7 m^3/s is becoming more common



How can water be better managed

1. Current tool (rule curve) developed in the 1960s for managing water to the mill.
2. Many other factor's must now be considered:

1 - Fisheries requirements (spring flows, ramping rates)

2 – Recreation needs (river flow and summer lake levels)

3 – Other uses (treated wastewater dilution, first nations cultural values – bathing, etc.)

4 – Changing pattern of inflow

Current rule curve is not flexible enough

How can water be better managed

Approach - Rule Curve vs. Rule Band

Rule curve defines "ideal" lake level over time needed to maintain minimum flow.

Assumes normal summer inflow and lake level at FSL on July 9th.

Does not provide any guidance when lake inflow is not normal and lake level is not "on the curve"?

How can water be better managed

Approach - Rule Curve vs. Rule Band

Rule band allows lake levels to rise or fall within a specified range depending on inflow to the lake while attempting to maintain 7 m^3/s in the river.

Defines what is to happen when water levels are outside of the band based on defined risk and potential impacts to all stakeholders.

How can water be better managed

Approach - Rule Curve vs. Rule Band

Allows for capture of some summer rainfall (if it occurs) which provides:

1. More water to support flows during longer dry summers
2. Water for optional fish pulses (short increases in river flow in the fall)

How can water be better managed

Approach - Rule Curve vs. Rule Band

At the same time, better defines when river flows should be changed…

increased to 9.0 m^3/s when lake levels above the band

reduced to 5.0 m^3/s when lake levels below the band.

How can water be better managed

Approach - Rule Curve vs. Rule Band

Finally,

Provides more flexibility in managing lake level/river flow prior to July 9 (Early-season) to better maintain lake levels near FSL in most years.

Recognizes potential impacts of unlikely high inflow and lake levels during this period.

EXAMPLE YEARS

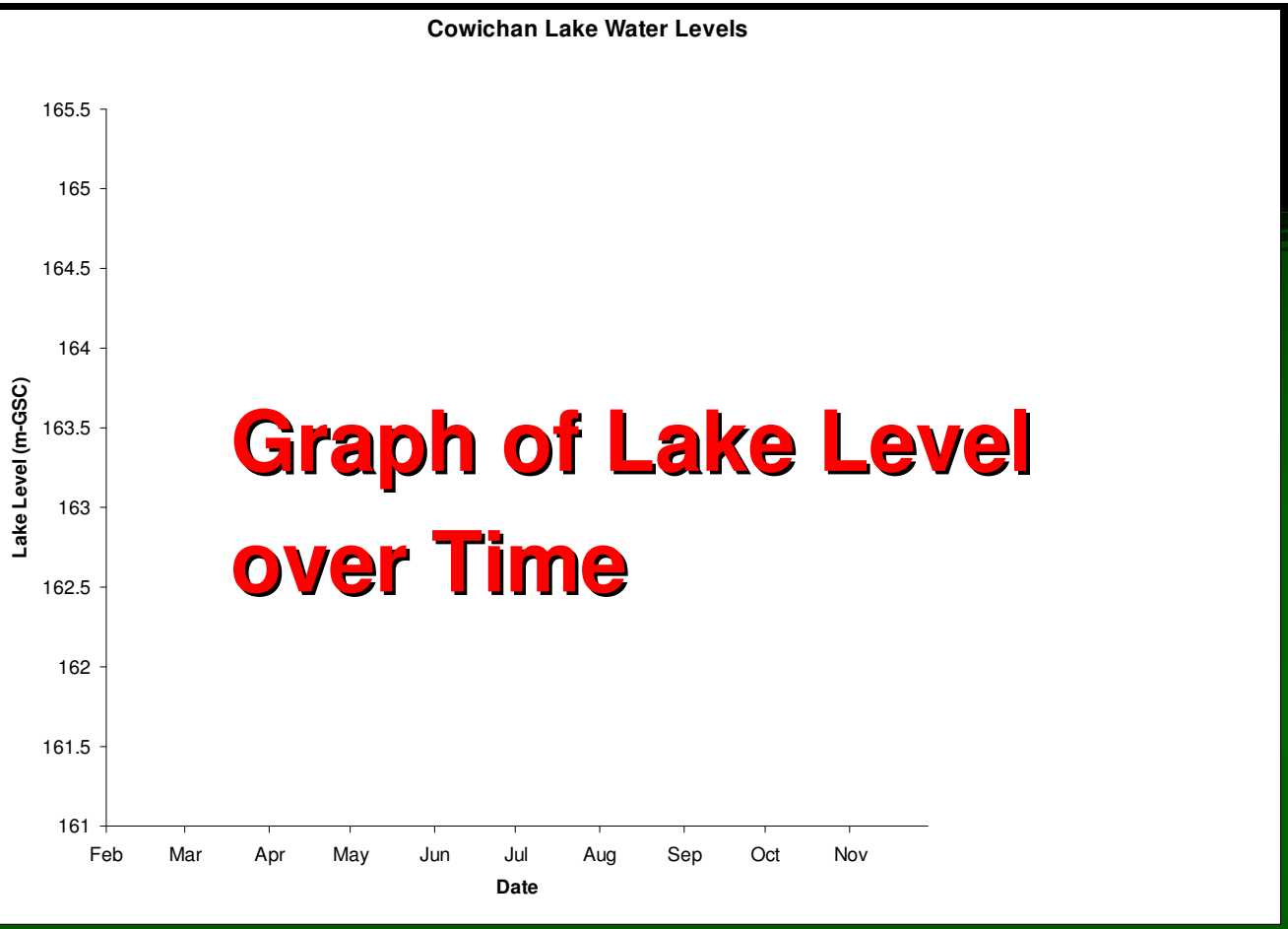
- 2006 – Average Year
- 2003 – Dry Year

  (Apr to Oct Inflow about 70% of average with little snowpack)
- 1999 – Wet Year

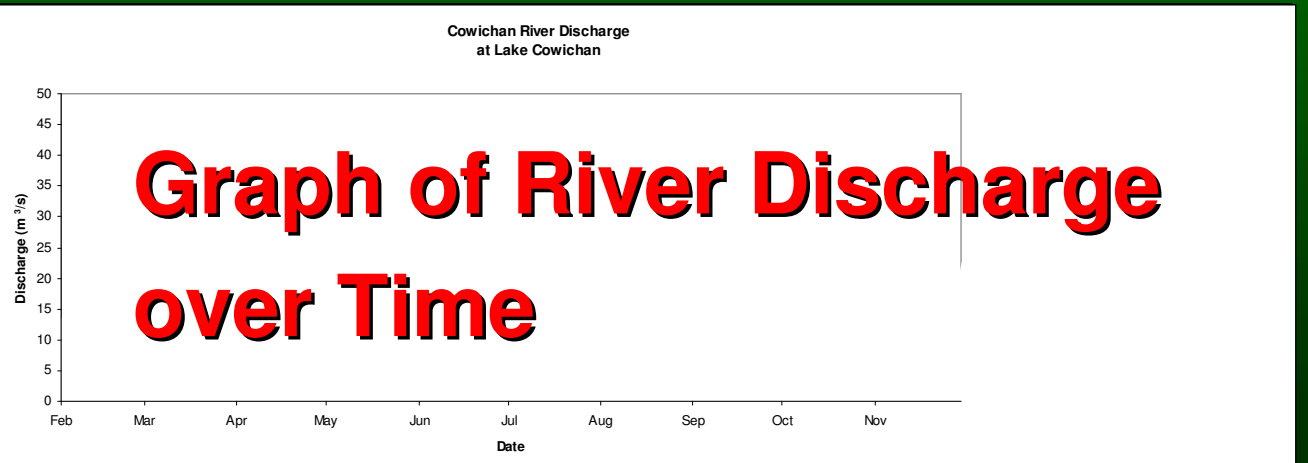
  (About 160% of average with significant snowpack)

Range of Recorded Lake Levels

Rule Band



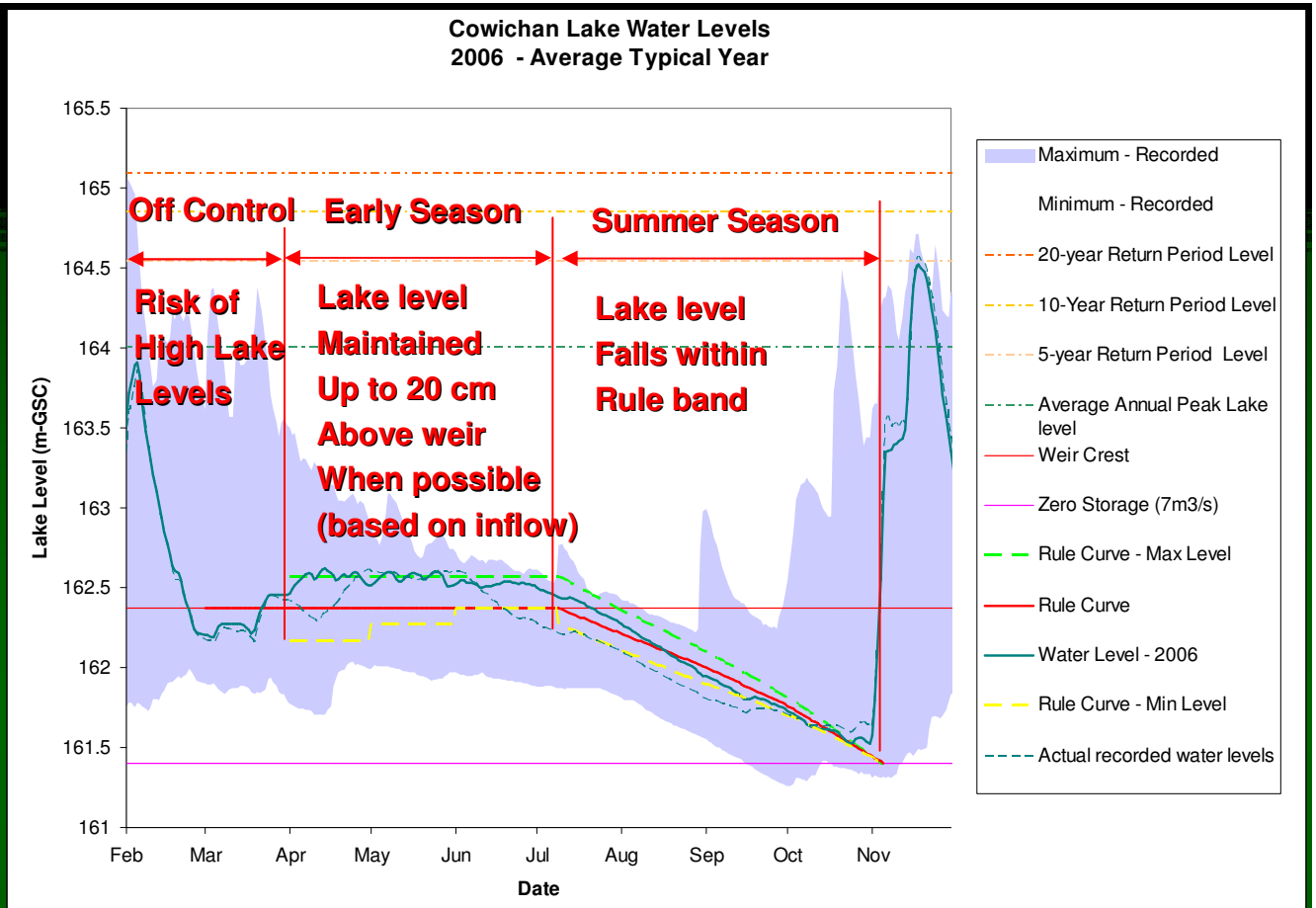
Range of Recorded Discharges

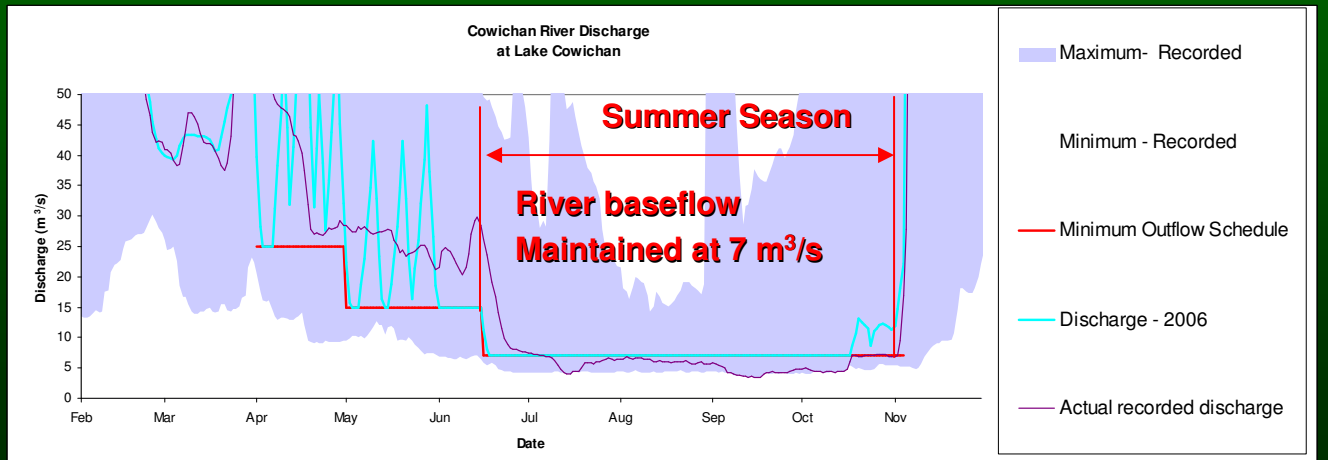


2006 – Normal / Avg. Year

- Lake level maintained above FSL until July 9th

- Minimum Flow (7 m^3/s) maintained until end of October and return of fall rains

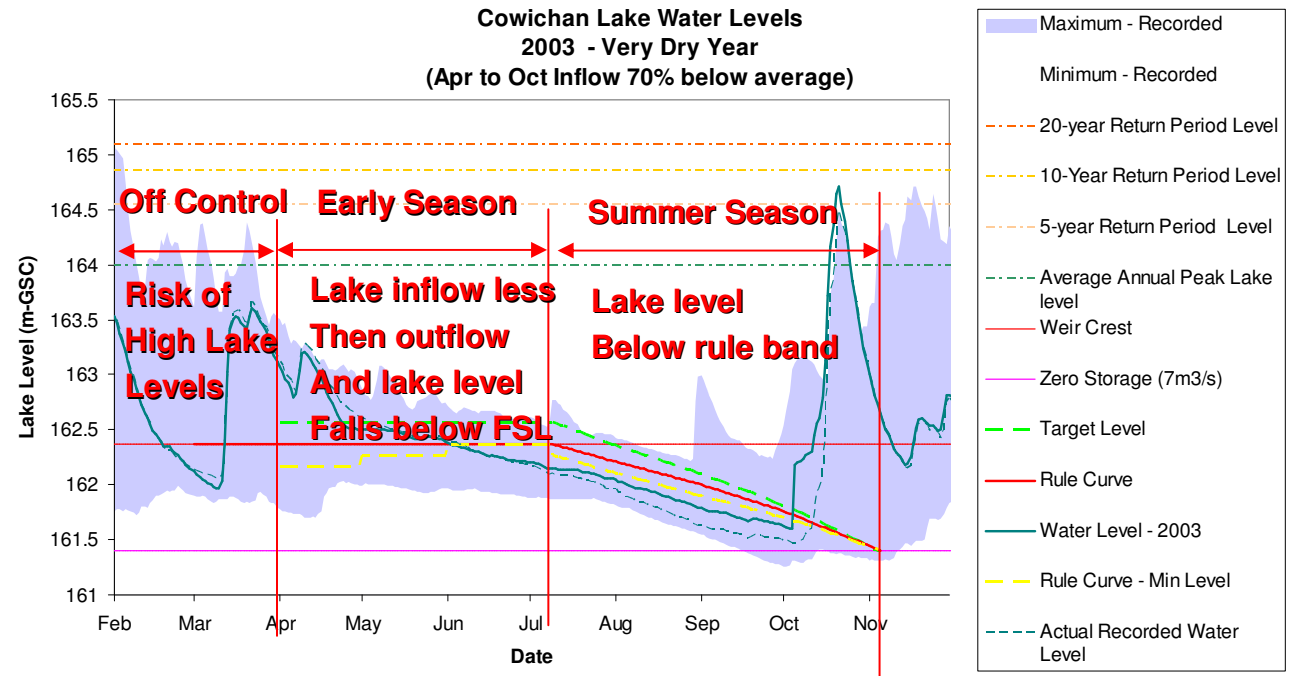


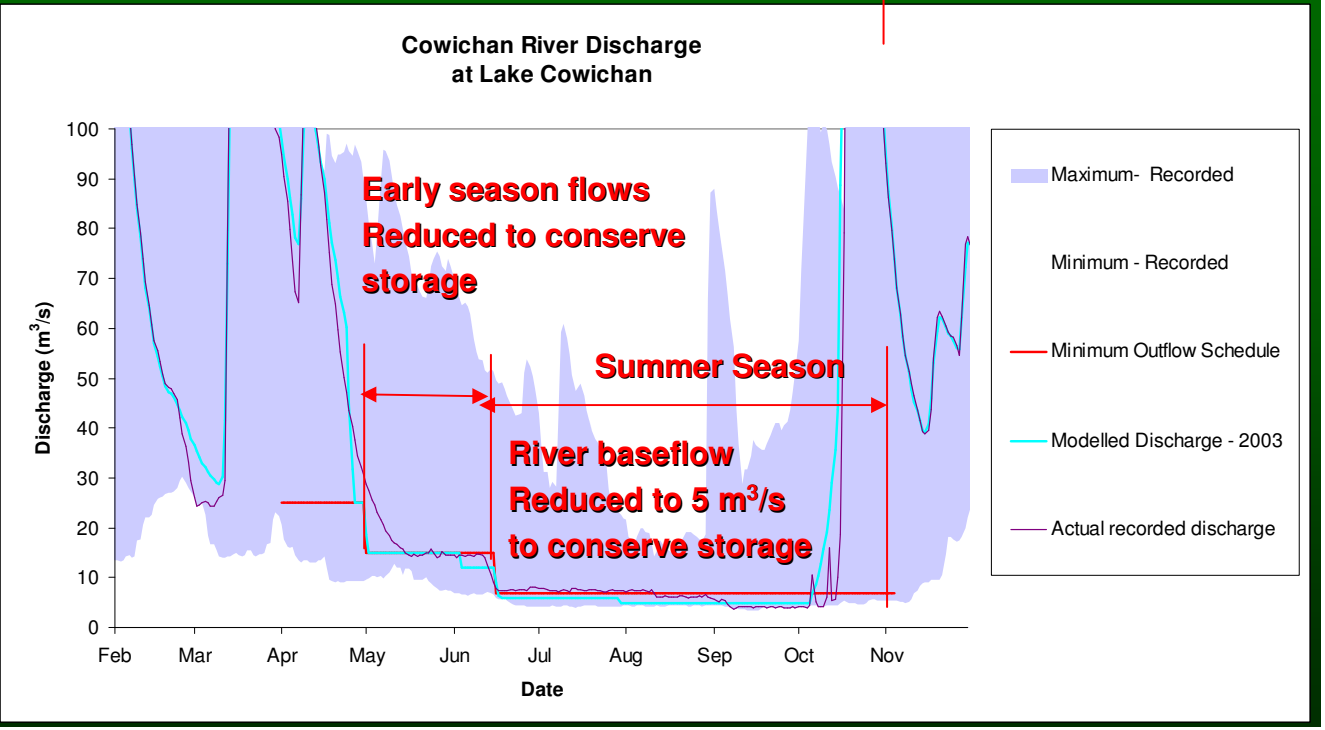


2003 – Dry Year (70% of average)

-Low lake inflow results in lake level dropping below FSL early in year

- River flows reduced to conserve storage

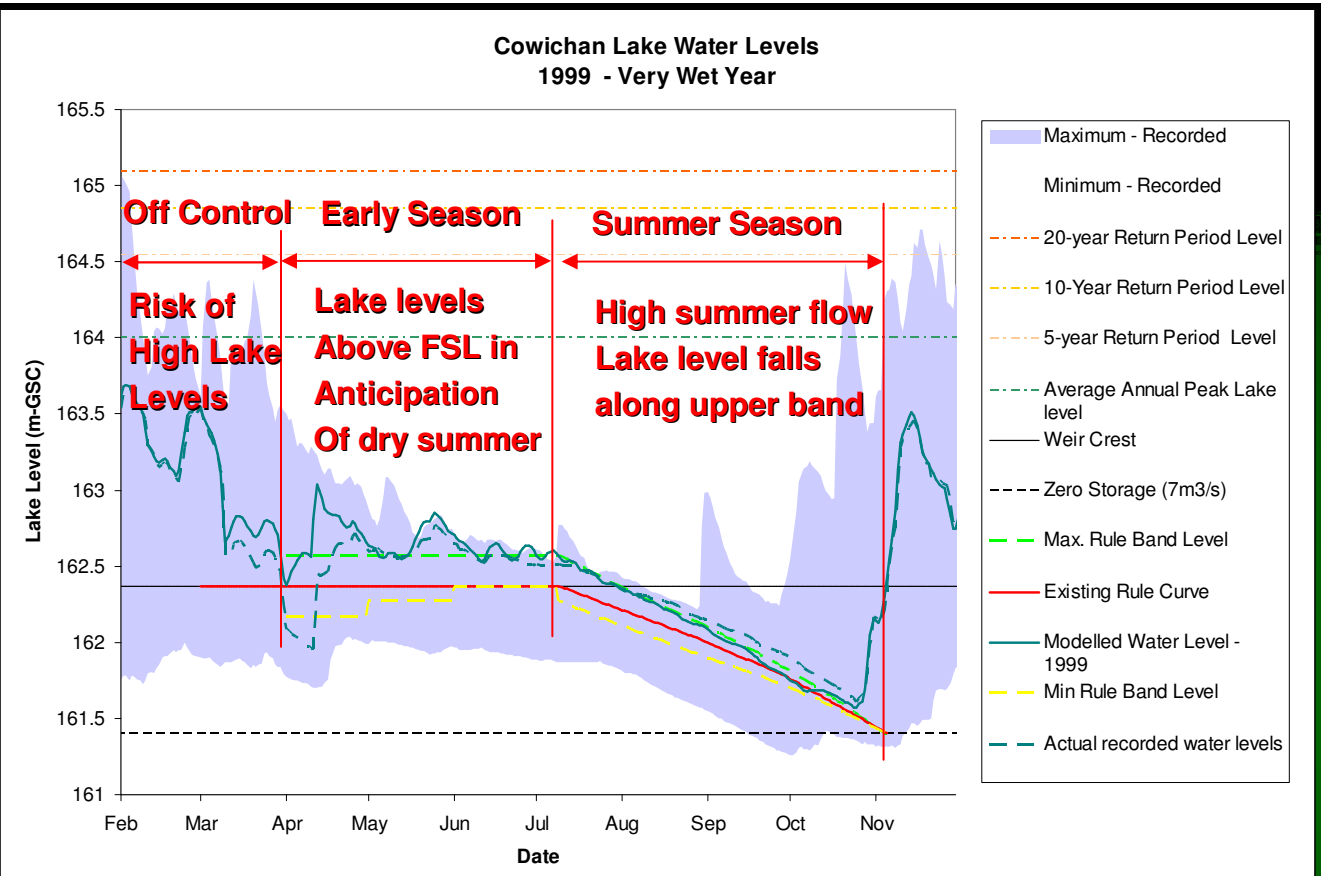


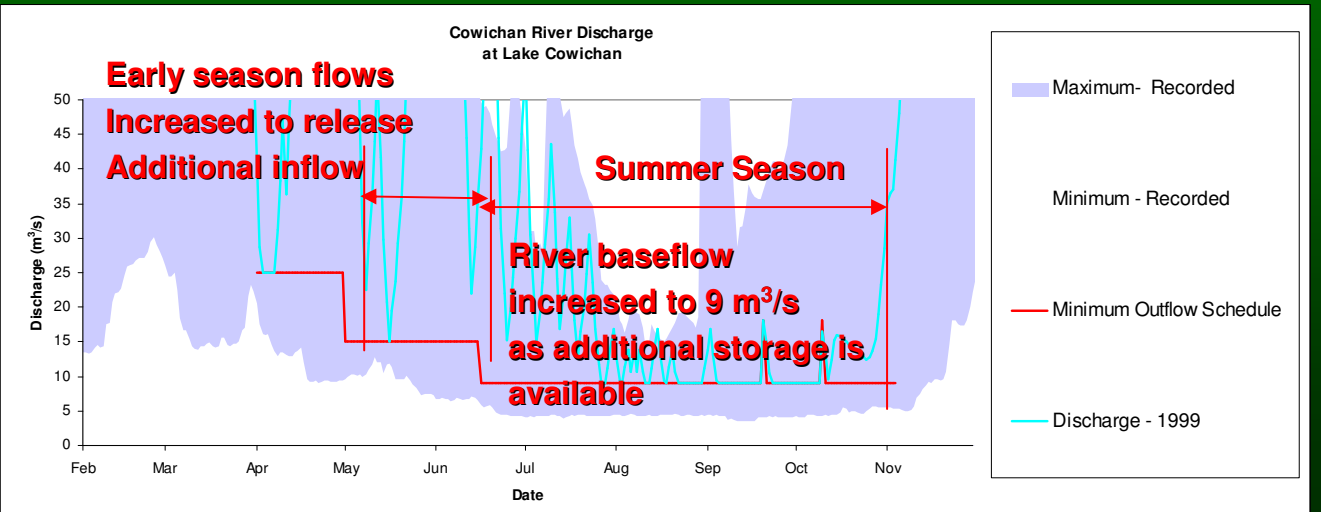


1999 – Wet Year (160% of avg.)

-Large snowpack and wet summer results in high inflow

- River flows increased as sufficient storage is available





Summary

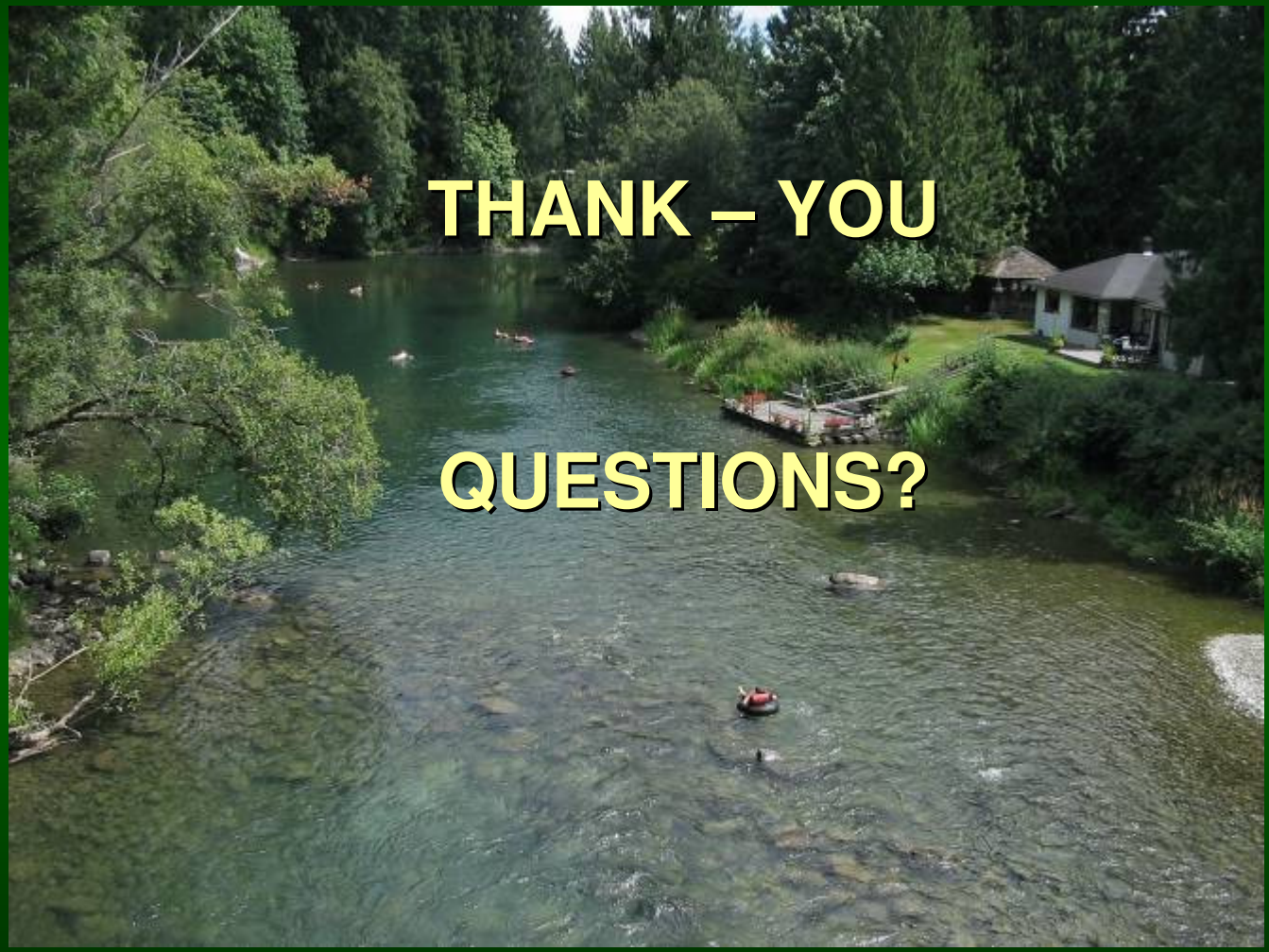
Rule Band allows:

1. Lake level to vary within specified band rather than along defined curve.
2. During normal (average) year lake level would still roughly follow the rule curve.
3. Would require river flows to be reduced in dry years to conserve storage.
4. During very wet years, lake levels could be up to 20 cm above weir on July 9th which would allow summer release of 9 m^3/s
5. Spring/Summer Lake levels would not exceed what has been seen in the past.

Summary

1. Rule band would be used by Ad-hoc Committee to make in-season flow management decisions.
2. MoE approval of Rule Band approach sp that weir can be operated within the band without need for consultation. Only if water levels fall outside band would MoE need to be contacted.
3. Part of a suite of water management tools including inflow forecasting based on snowpack and inflow monitoring.
4. Allows better use of existing infrastructure.

Cowichan Lake Outlet



How is the water is managed (Spring Operation Protocols – additional rules)

1. A minimum of 25 m^3/s prior to May 1;
2. A minimum of 15 m^3/s prior to June 15; and
3. Ramping rate (how quickly flows can change in the river)

To protect river values (fisheries, recreation, etc.)