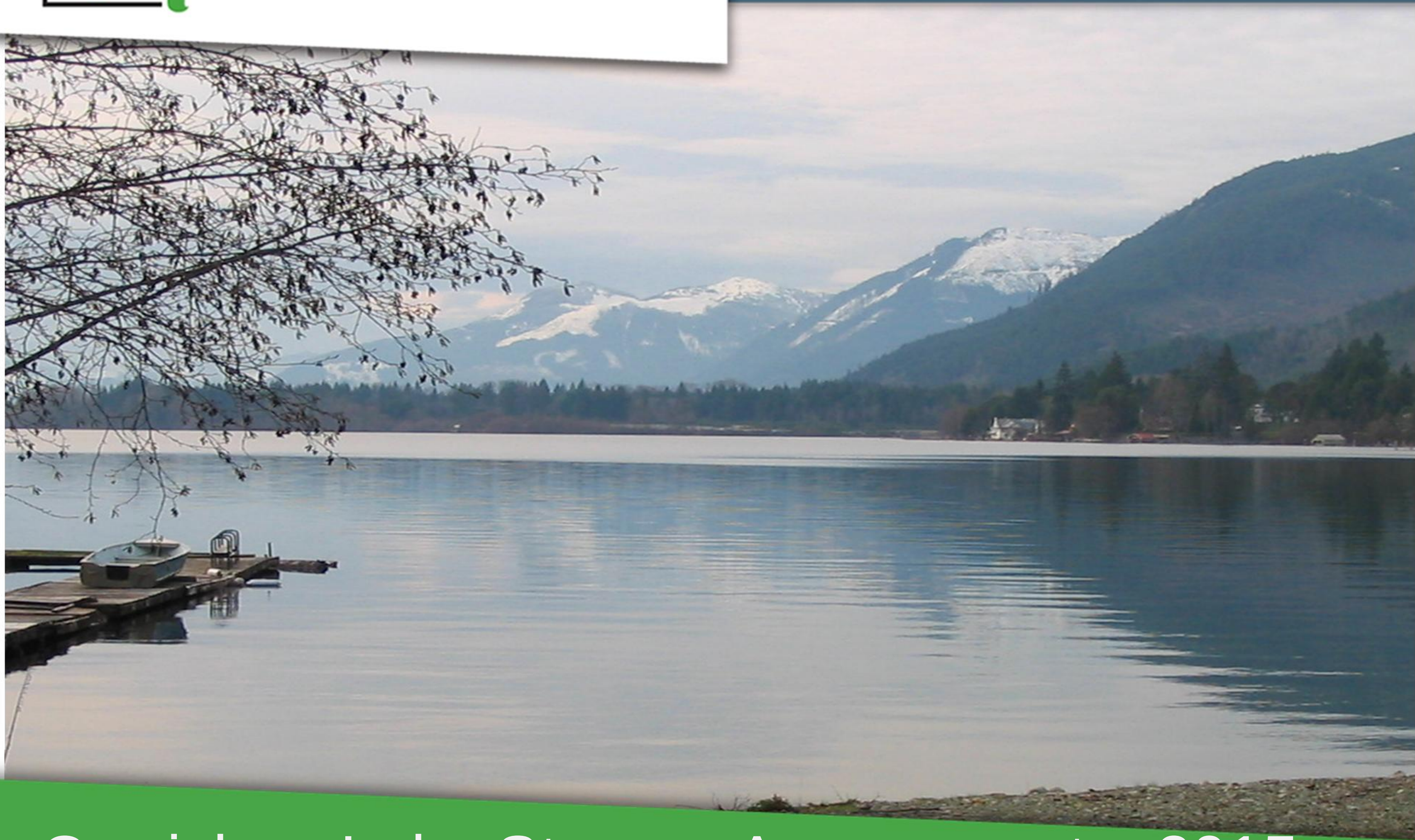
KERR WOOD LEIDAL
consulting engineers



Cowichan Lake Storage Assessment – 2015 Final Results

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

July 27, 2015

Purpose

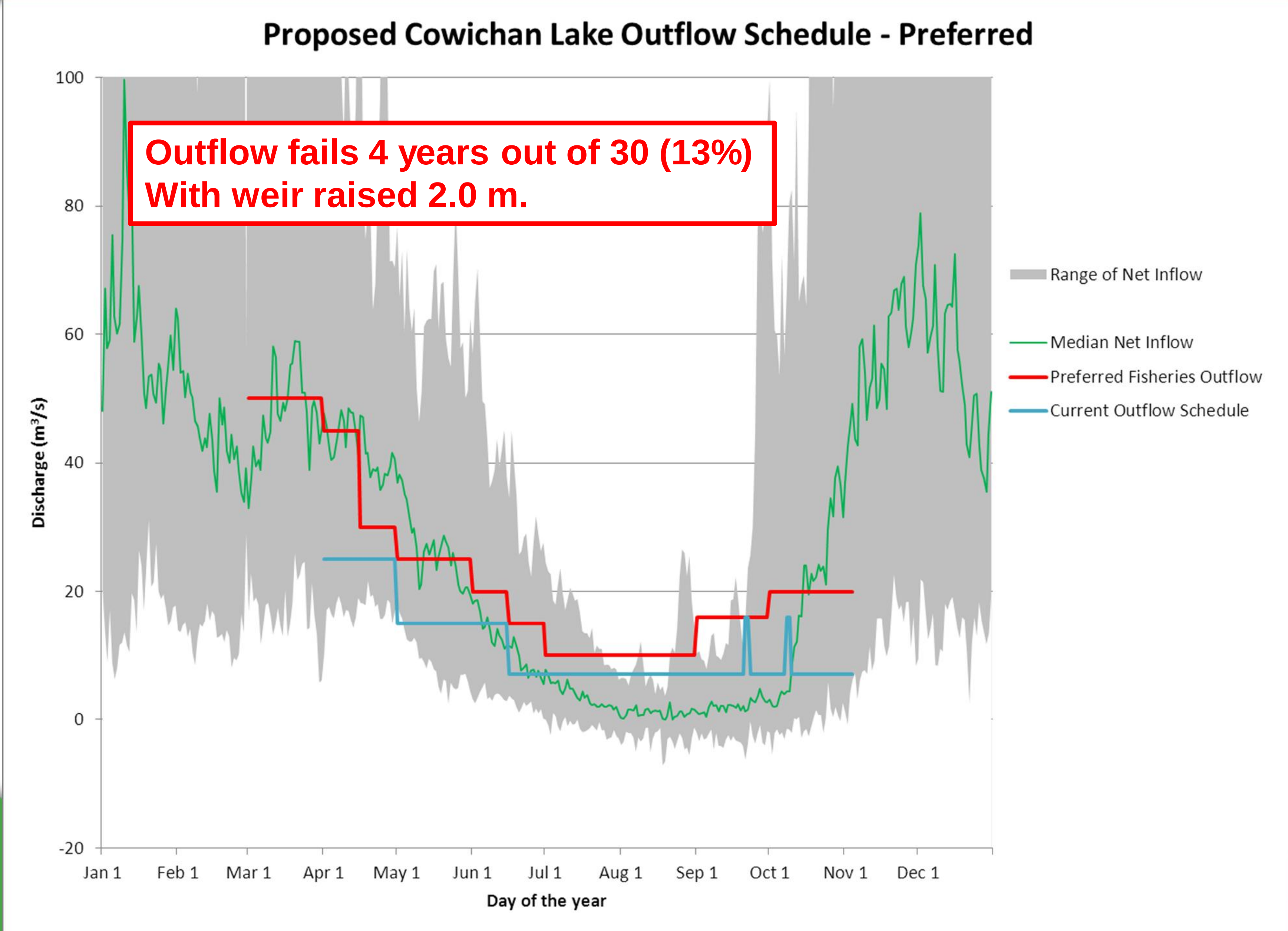
1. Establish a set of ‘optimum’ flow release schedules to test reliability of Cowichan Lake storage.
2. Develop inflow scenarios for both current (1985 to 2014) and future (2050s) climate conditions
3. Test reliability of increase storage of raising weir from 0.3 m up to 0.9 m under both inflow scenarios.
4. Refine ‘optimum” flow release until fish flows balance with limits of increased weir height.
5. Outline next steps.

Outflow Schedules – Discharge m^3/s

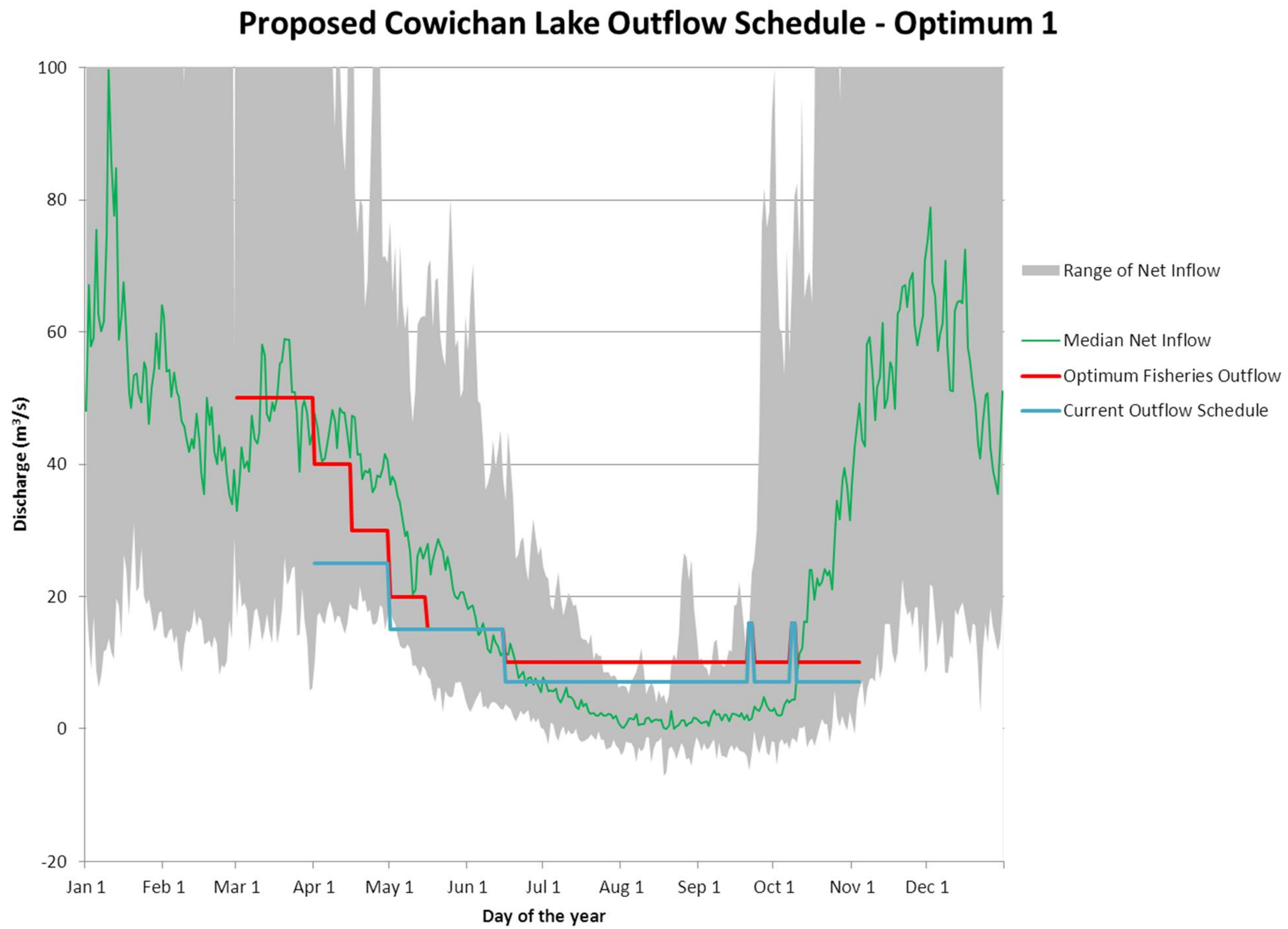
Period	Existing	Preferred	Optimum 1	Optimum 2
March	-	50	50	50
April 1 to 15	25	45	40	40
April 16 to 30	25	30	30	30
May 1 to 15	15	25	20	20
May 16 to 31	15	25	20	20
June 1 to 15	15	20	15	15
June 15 to 30	7	15	15	15
July 1 to Aug 31	7	10	10	8.5
Sept 1 to 30	7	16	10	8.5
Oct 1 to 30	7	20	10	8.5

Discharge in Cowichan River immediately downstream of Cowichan Lake
All schedules include two fish pulses of 16 m^3/s for 48 hr late Sept and early Oct.
Preferred and Optimum Flows are not considered final but were developed to test reliability of storage over a range of outflow. They consider only fish/conservation benefits.

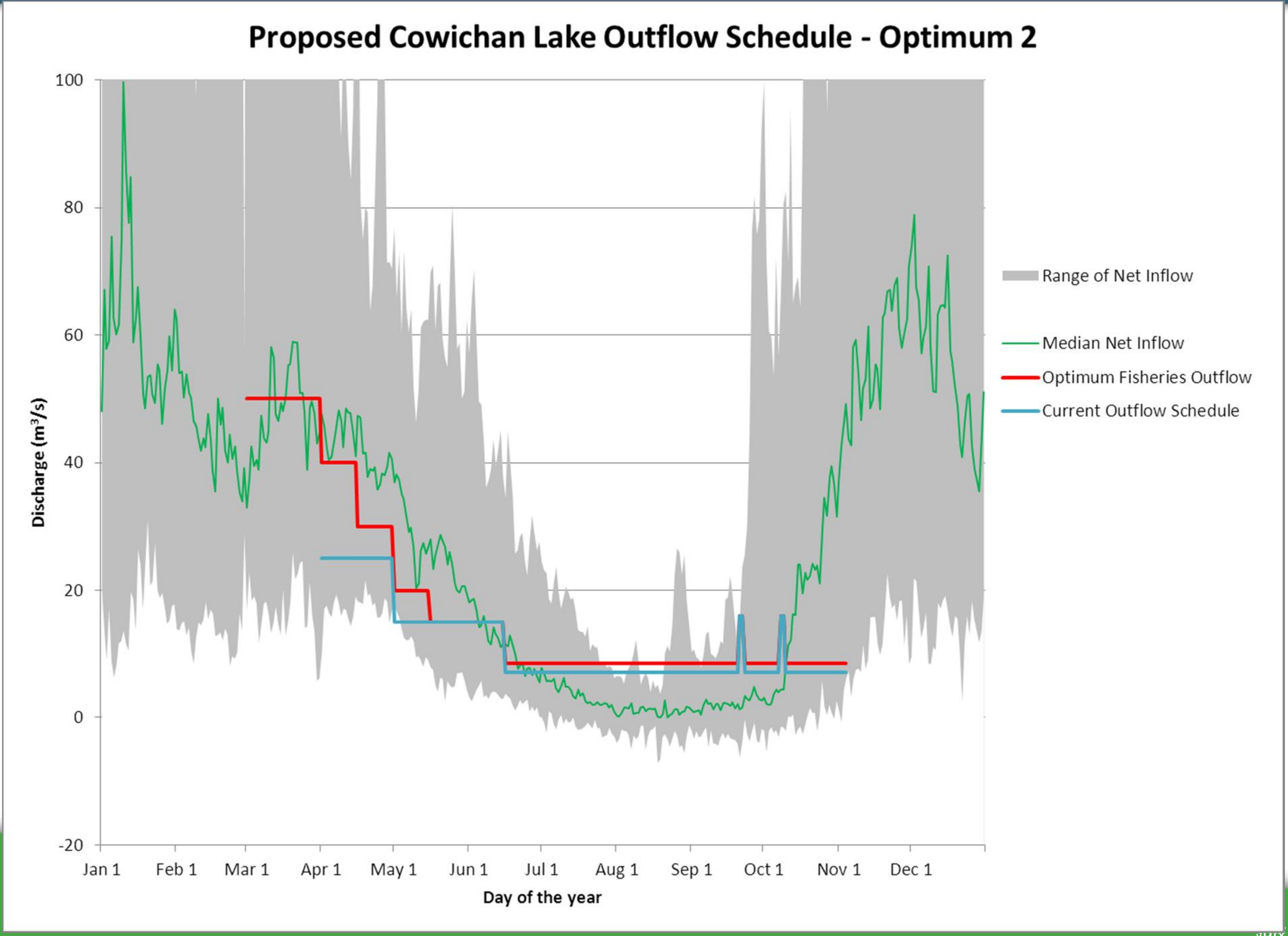
Preferred Outflow Schedule



Optimum 1 – Outflow Schedule



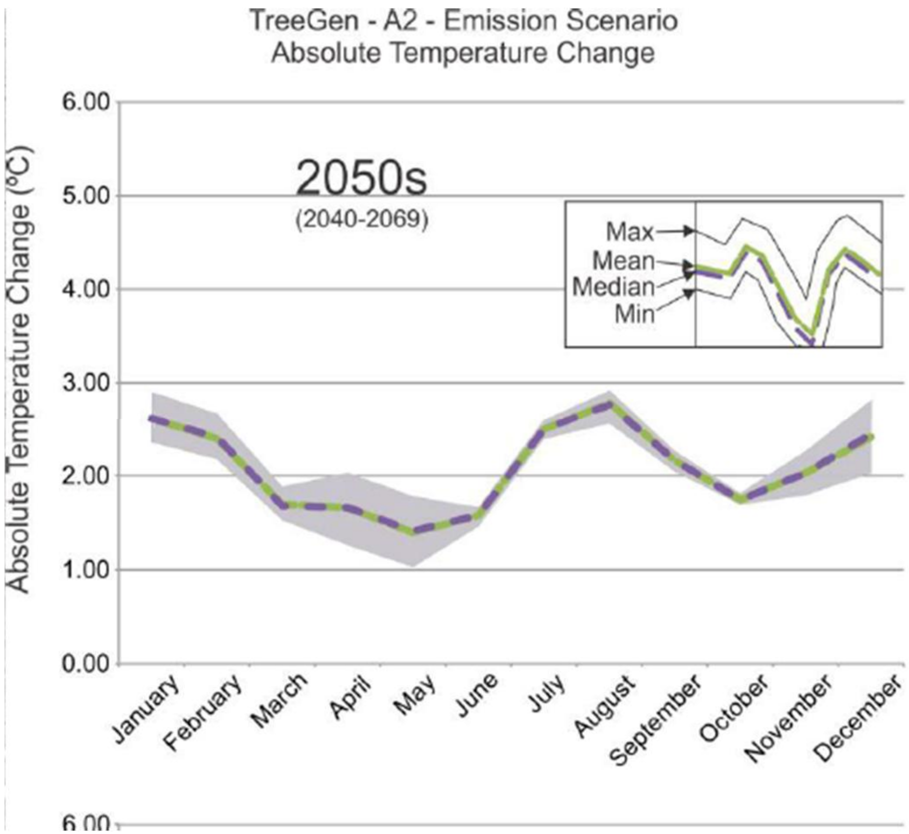
Optimum 2 – Outflow Schedule

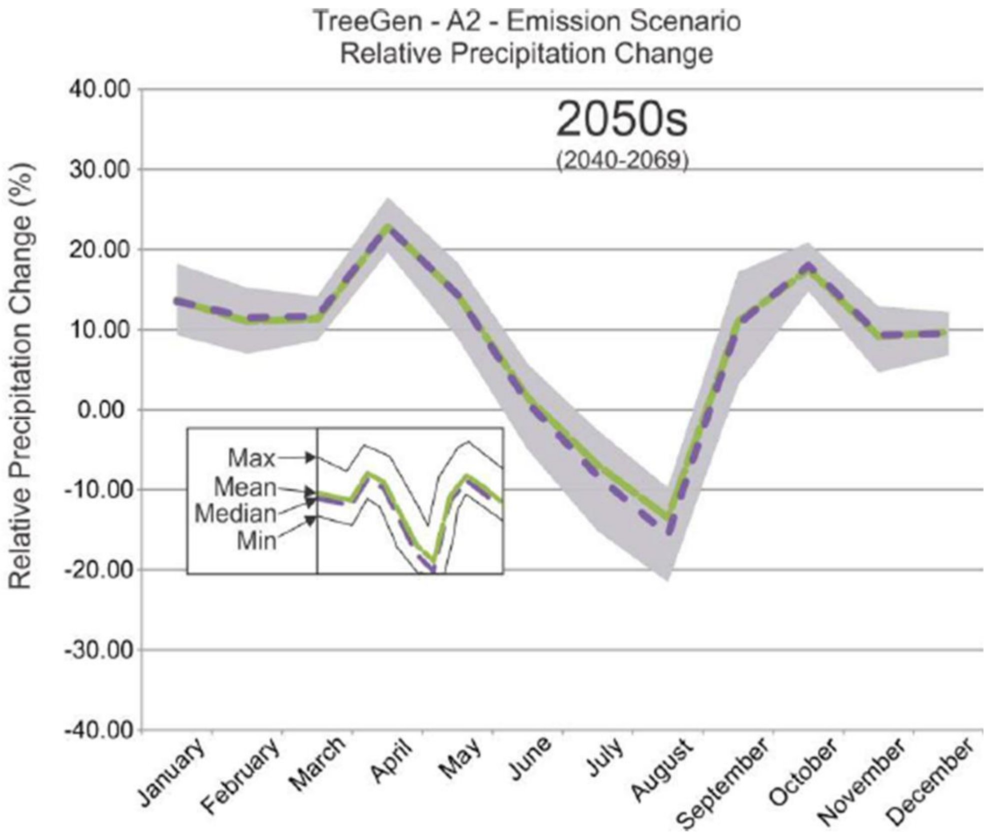


Climate Change

1. Future period 2050s (2041 to 2070)
2. Average annual temperature + 1ºC to +3ºC 10% to 20% increase in winter precipitation and 20% decrease in summer precipitation.
3. IPCC SRES A2 Greenhouse Gas Scenario “worst case” global emissions scenario.
4. Change in lake inflow – hydrologic/groundwater model developed by Simon Foster/Diana Allen – SFU

Climate Change – Change in Precipitation/Temp



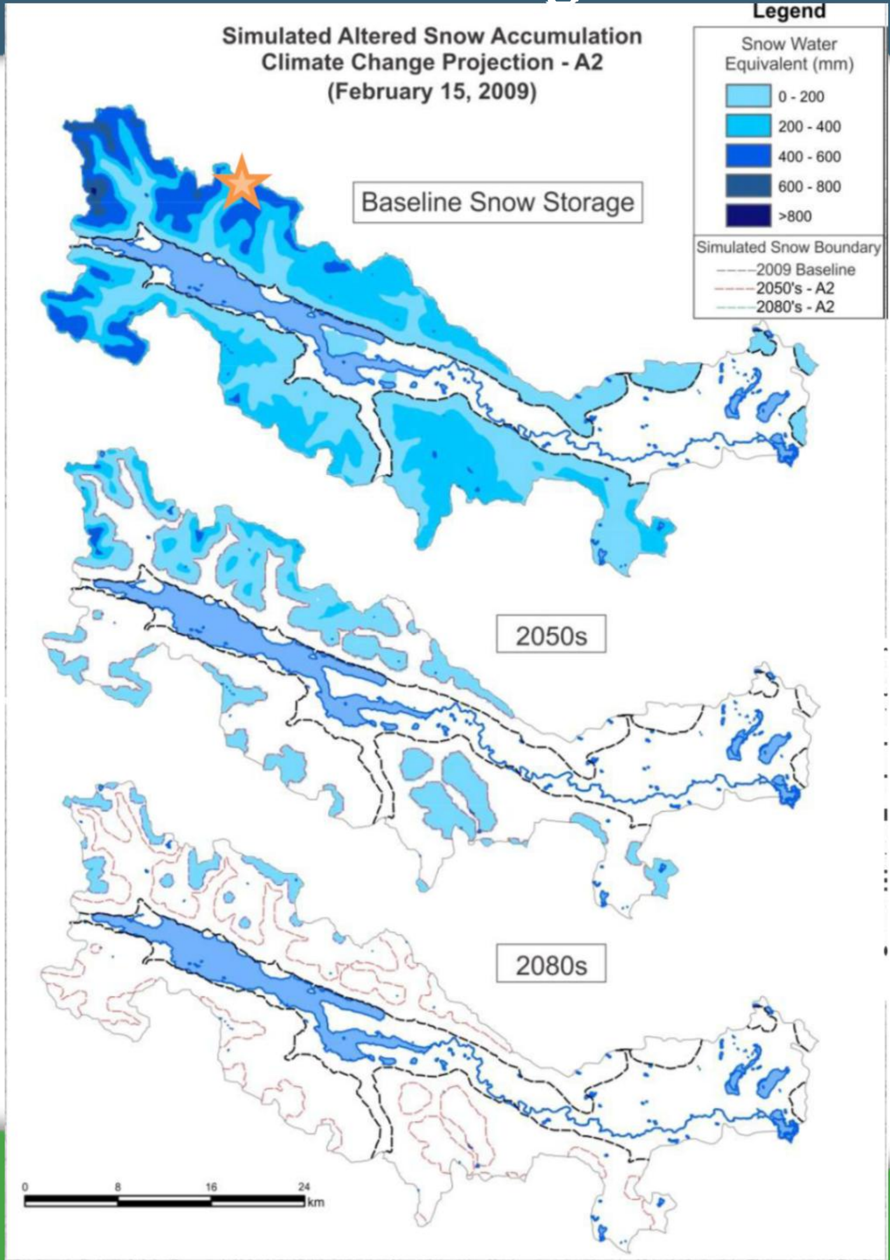


Average annual temperature + 1ºC to +3ºC

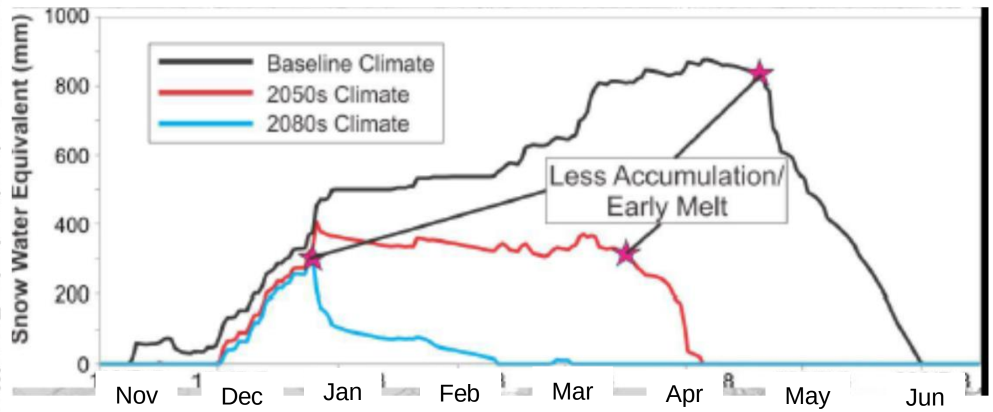
10% to 20% increase in winter precipitation and 10% to 20% decrease in summer precipitation.

Source: Simon and Allen, 2015

Climate Change – Change in snow

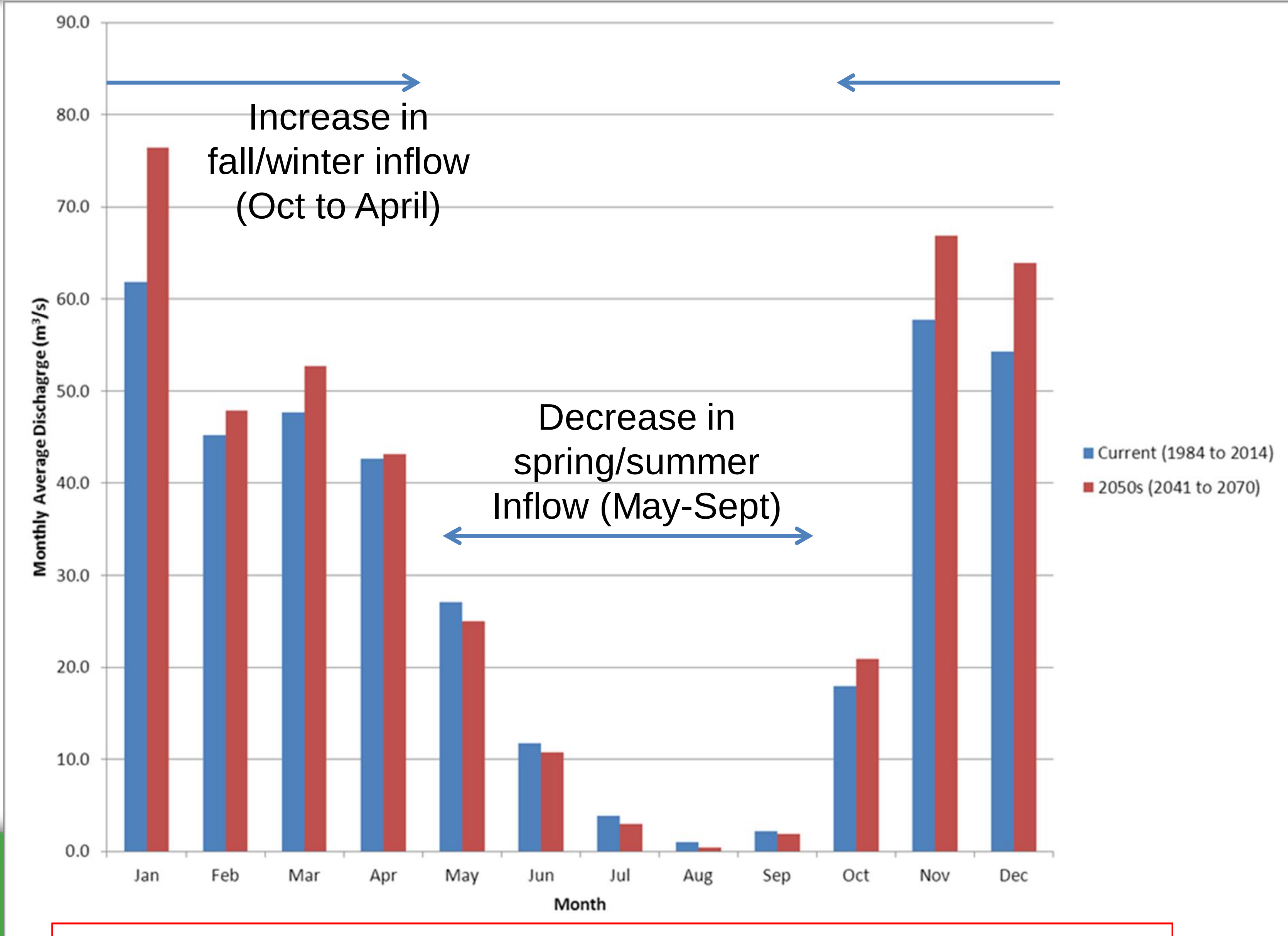


Modelled change in snow water equivalent Jump Creek Snow Pillow



Source: Simon and Allen, 2015

Current vs Future – Change in Inflow



Assumes no change in land cover from existing to future condition

Results – Existing Outflow Schedule (7 m^3/s summer baseflow)

Raise weir by (m):	Approx. Increased storage volume (million m^3)	Number of Years WL below ZSL (out of 30 years)		Fish Pulse Does not Occur at least once (out of 30 years)	
		Current Climate (1985-2014)	Future Climate (2050s)	Current Climate (1985-2014)	Future Climate (2050s)
0.9	56	< 1	<1	3 (10%)	**5 (17%)**
0.75	47	< 1	<1	3 (10%)	**5 (17%)**
0.6	37	< 1	<1	4 (13%)	**8 (27%)**
0.45	28	< 1	4 (13%)	5 (17%)	**10 (33%)**
0.3	19	7 (23%)	9 (30%)	8 (27%)	**10 (33%)**
0	0	9 (30%)	11 (37%)	13 (43%)	**17 (57%)**

Results – Optimum 1 Flow Release (10 m^3/s summer baseflow)

Raise weir by (m):	Approx. Increased storage volume (million m^3)	Number of Years WL below ZSL (out of 30 years)		Fish Pulse Does not Occur at least once (out of 30 years)	
		Current Climate (1985-2014)	Future Climate (2050s)	Current Climate (1985-2014)	Future Climate (2050s)
0.9	56	7 (23%)	6 (20%)	8 (27%)	**13 (43%)**
0.75	47	8 (27%)	8 (27%)	12 (40%)	**15 (50%)**
0.6	37	12 (40%)	13 (43%)	15 (50%)	**18 (60%)**
0.45	28	16 (53%)	16 (53%)	17 (57%)	**21 (70%)**
0.3	19	17 (57%)	16 (53%)	22 (73%)	**23 (77%)**

Results – Optimum 2 Flow Release (8.5 m^3/s summer baseflow)

Raise weir by (m):	Approx. Increased storage volume (million m^3)	Number of Years WL below ZSL (out of 30 years)		Fish Pulse Does not Occur at least once (out of 30 years)	
		Current Climate (1985-2014)	Future Climate (2050s)	Current Climate (1985-2014)	Future Climate (2050s)
0.9	56	5 (17%)	5 (17%)	6 (20%)	**7 (23%)**
0.75	47	6 (20%)	5 (17%)	7 (23%)	**9 (30%)**
0.6	37	8 (27%)	7 (23%)	9 (30%)	**13 (43%)**
0.45	28	9 (30%)	11 (37%)	11 (37%)	**14 (47%)**
0.3	19	14 (47%)	12 (40%)	14 (47%)	**16 (53%)**

Next steps

Future Assignment

1. Assess change in lake levels as a result of raising weir
2. Review effects of lake level changes on private properties, riparian vegetation, recreation, etc.
3. Compare effects of raising weir with increased reliability of flow release.
4. Agree on and recommend fish/conservation flow target
5. Agree on and recommend weir crest elevation to move forward with detailed planning and design.


Questions?