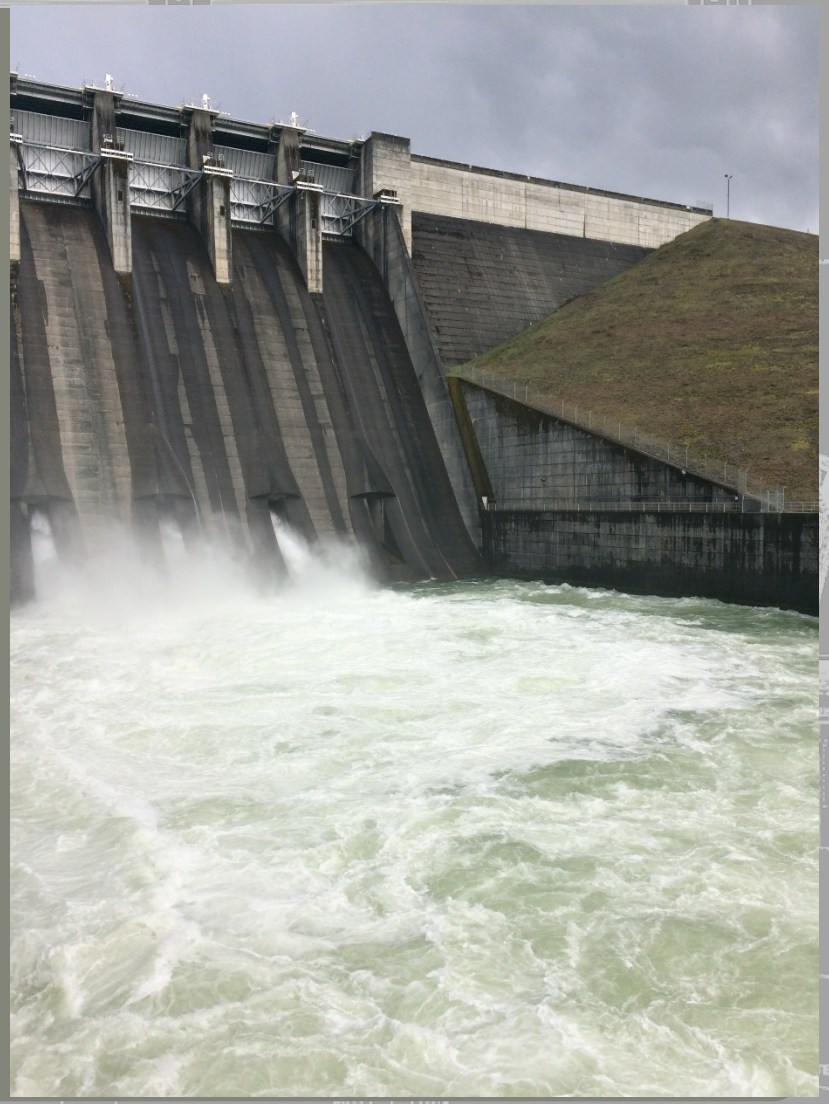
WATER MANAGEMENT IN THE WILLAMETTE BASIN – INSIGHTS FROM THE 2018 WATER YEAR. WHAT HAVE WE LEARNED? HOW DO WE MANAGE BETTER?

Greg Taylor
Willamette Fisheries Science Review
13 Nov 2019



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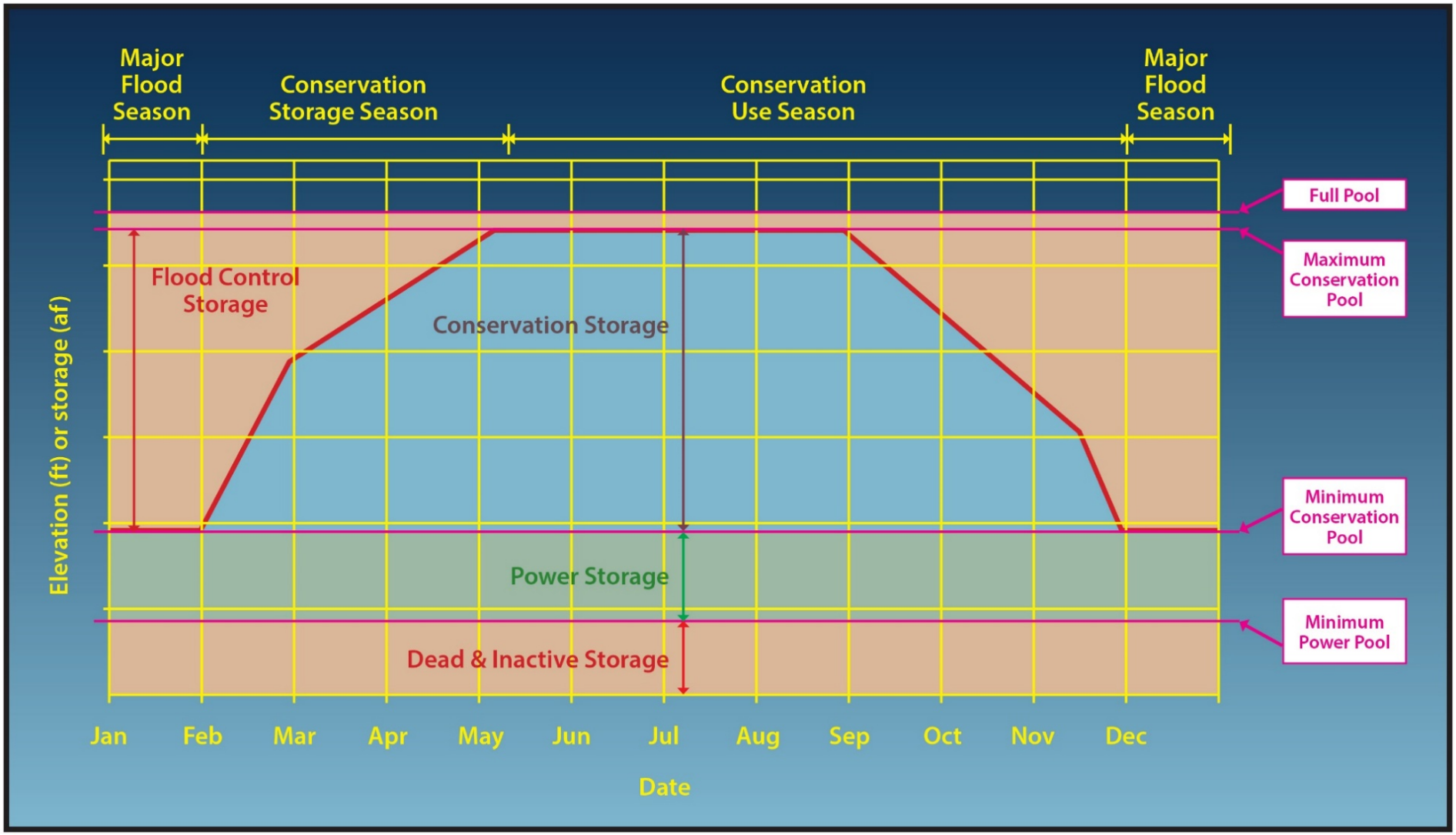
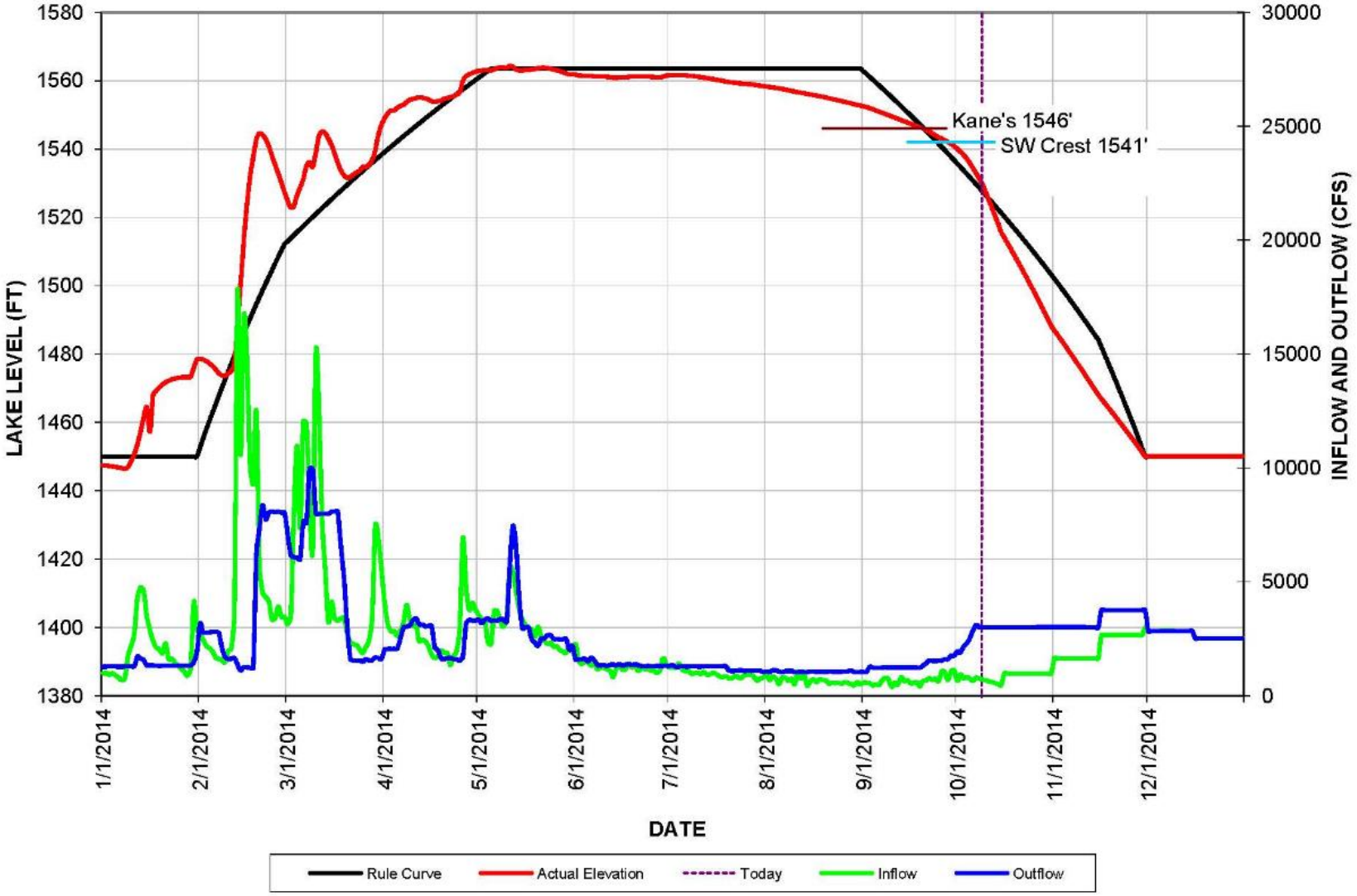

Major Flood Season
Conservation Storage Season
Conservation Use Season
Major Flood Season
Full Pool
Maximum Conservation Pool
Minimum Conservation Pool
Minimum Power Pool
Flood Control Storage
Conservation Storage
Power Storage
Dead & Inactive Storage
Elevation (ft) or storage (af)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date


LAKE LEVEL (FT)
INFLOW AND OUTFLOW (CFS)
DATE
Kane's 1546'
SW Crest 1541'
1580
1560
1540
1520
1500
1480
1460
1440
1420
1400
1380
30000
25000
20000
15000
10000
5000
0
1/1/2014
2/1/2014
3/1/2014
4/1/2014
5/1/2014
6/1/2014
7/1/2014
8/1/2014
9/1/2014
10/1/2014
11/1/2014
12/1/2014
Rule Curve
Actual Elevation
Today
Inflow
Outflow

1999 – Following the listing of Chinook salmon and winter steelhead USACE made substantial changes in the management of flows in the Willamette Basin

Adaptive approach working collaboratively with state and federal resource management agencies

Most significant specific adaptation to reservoir system operations has been the adoption of spring mainstem flow targets.

WATER MANAGEMENT SUMMARY

13 dams of the Willamette Valley are operated as a single system

Corps must balance between competing authorized purposes

Water management decisions include collaboration with agency partners

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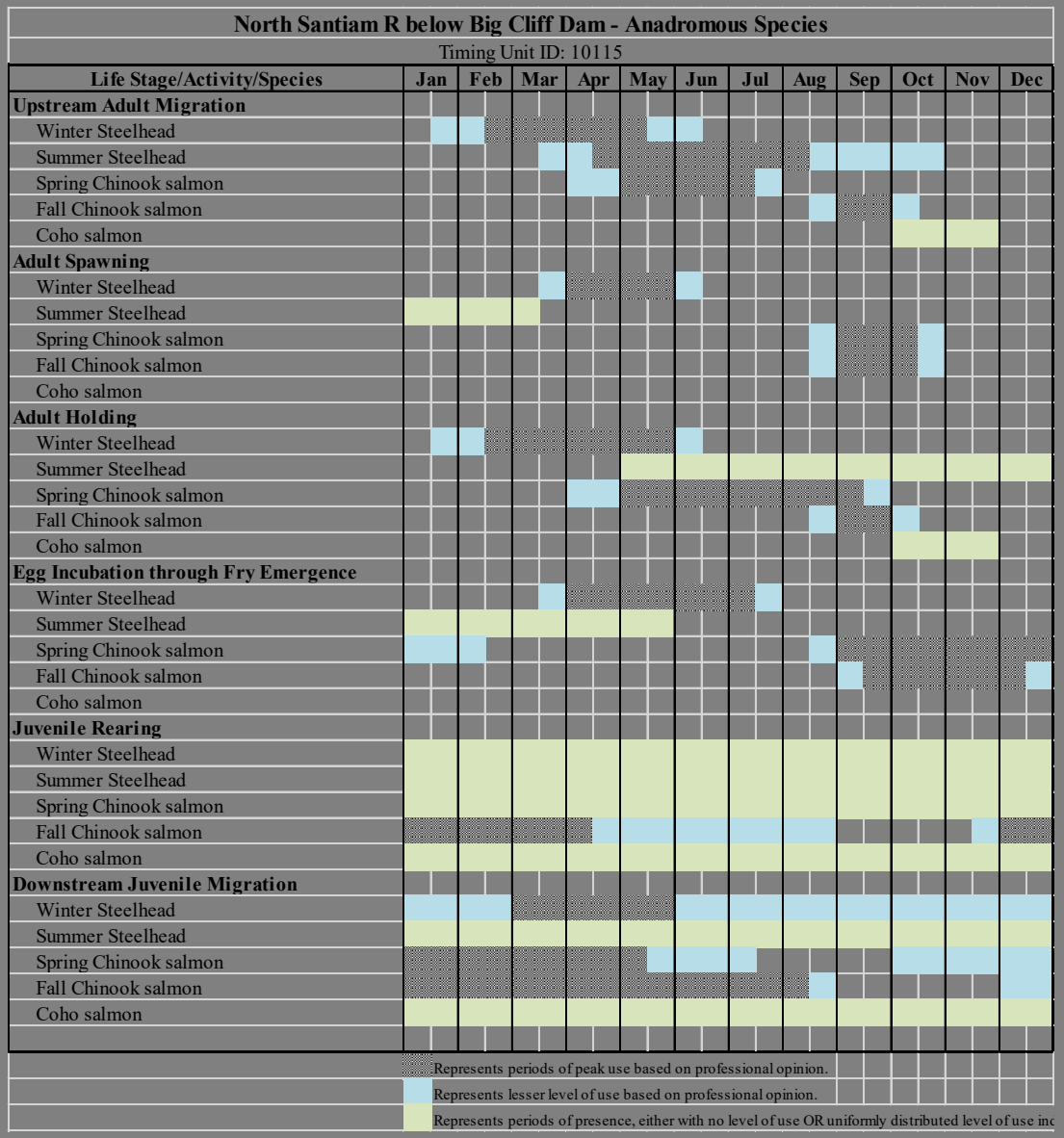
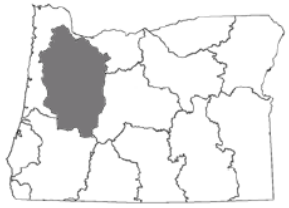
- Weather, water supply
- Rule curve
- Downstream control points
- Minimum flow
- Mainstem flow objectives
- Tributary flow objectives
- Hydropower, outage schedule
- Temperature operations
- Minimizing TDG
- Recreation - ramps
- Special operations request – RME, construction projects, maintenance
- Interim operations – temperature control, fish passage
- Fish life history requirements
- Algae
- Downstream water users



Water Supply

Snowpack Summary by Basin		Basin Snowpack % of Median	
	# of Sites	Current Yr	Last Yr
Clackamas Basin	11	84%	125%
McKenzie Basin	17	66%	125%
Middle Fork Willamette Basin	7	71%	125%
North Santiam Basin	4	106%	197%
South Santiam Basin	4	112%	196%

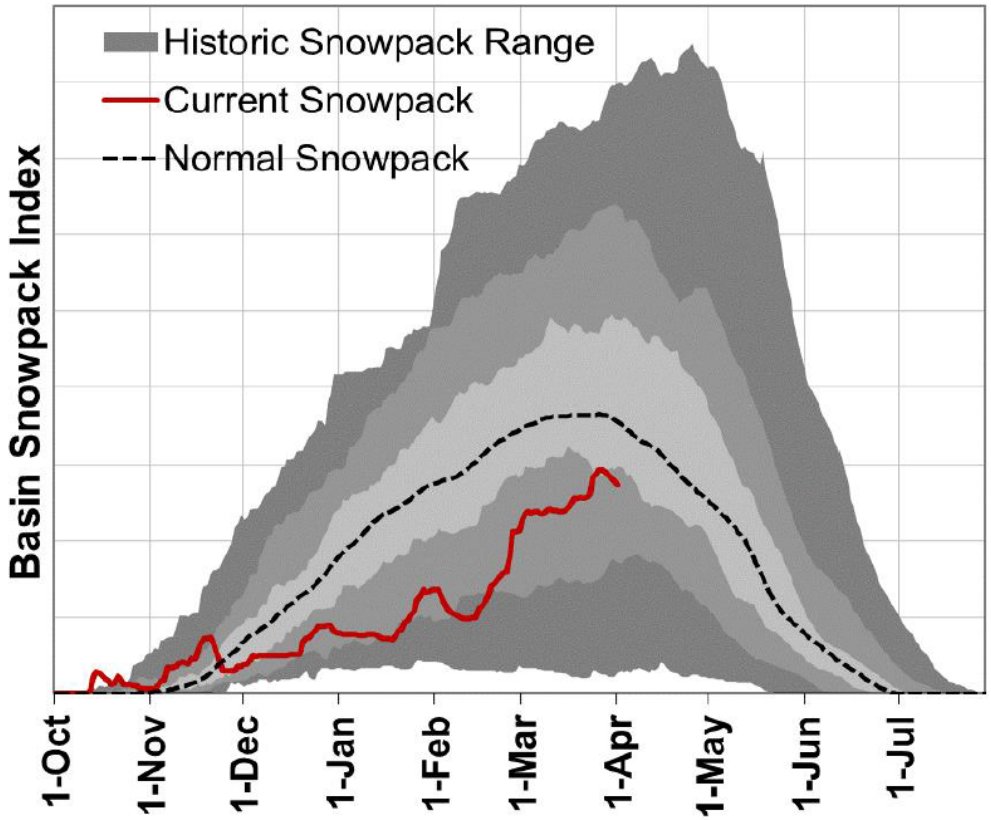
- **Varies Annually**
  - ► **Quantity, Location, Timing**



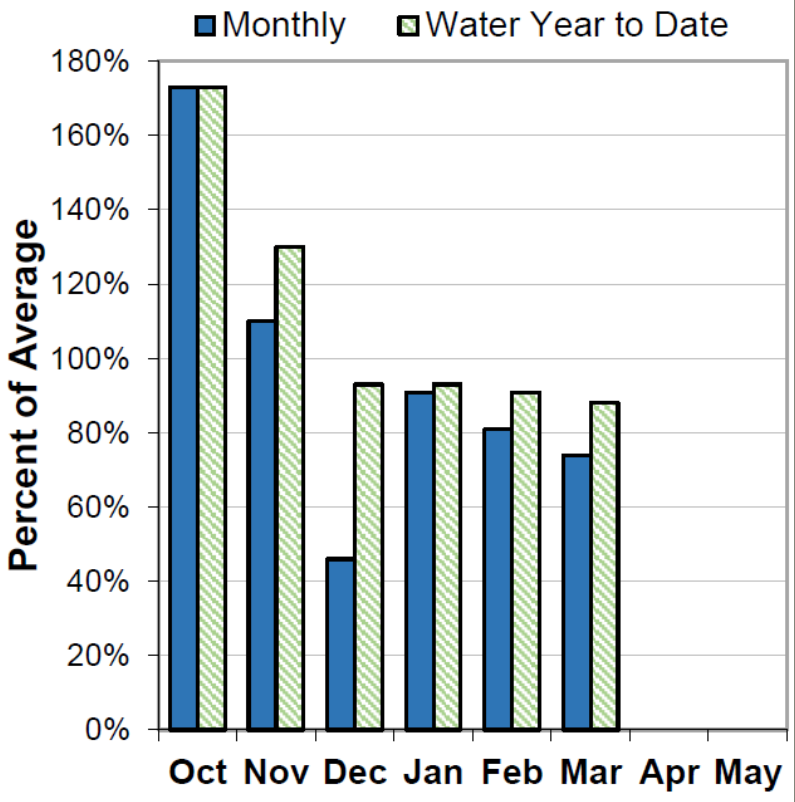
Willamette Basin

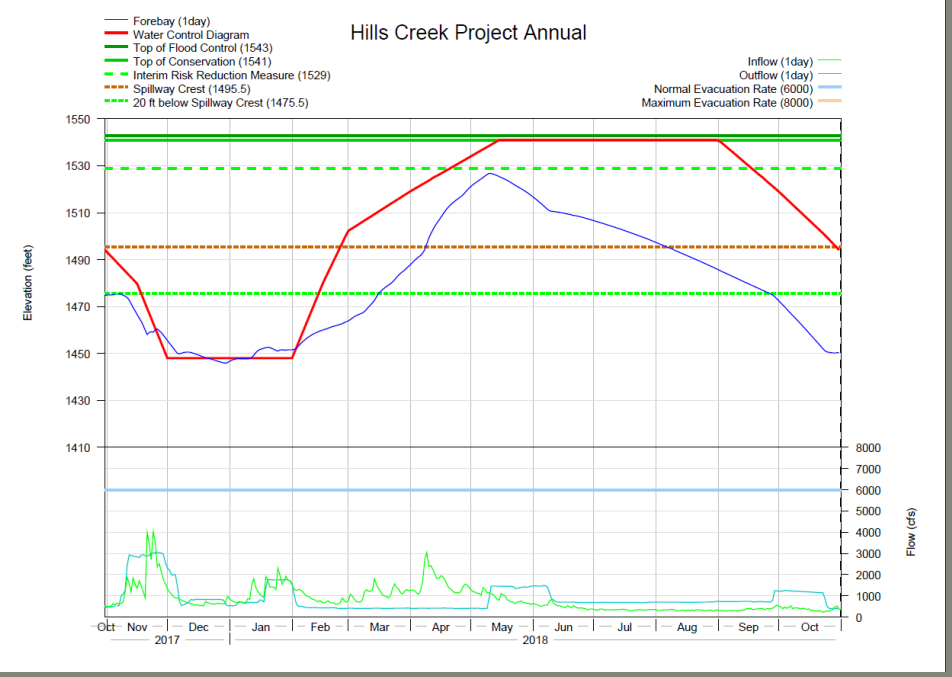
April 1, 2018

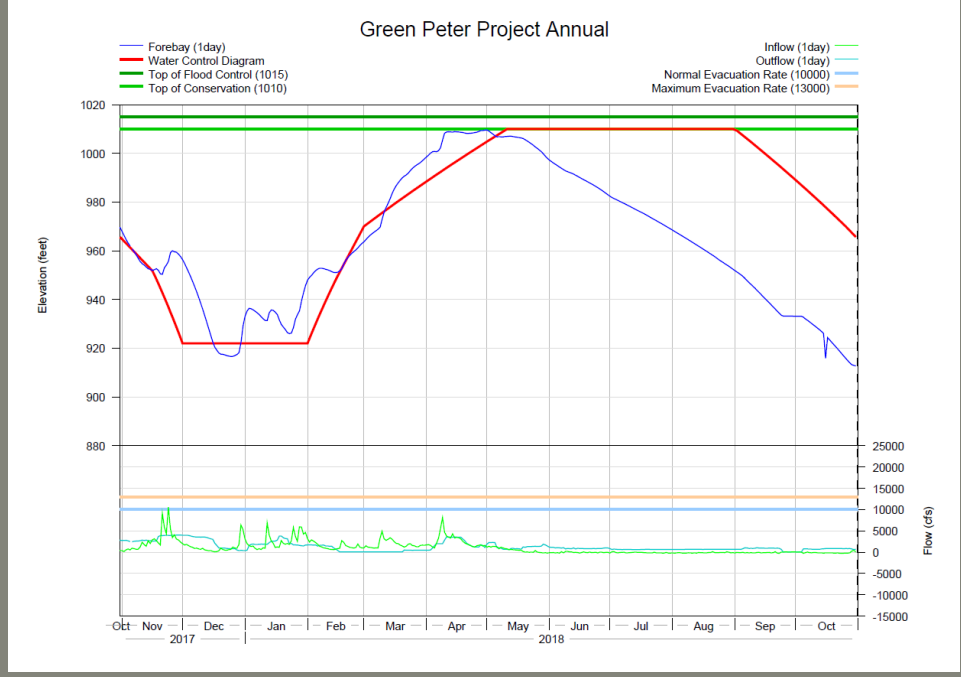
Mountain Snowpack

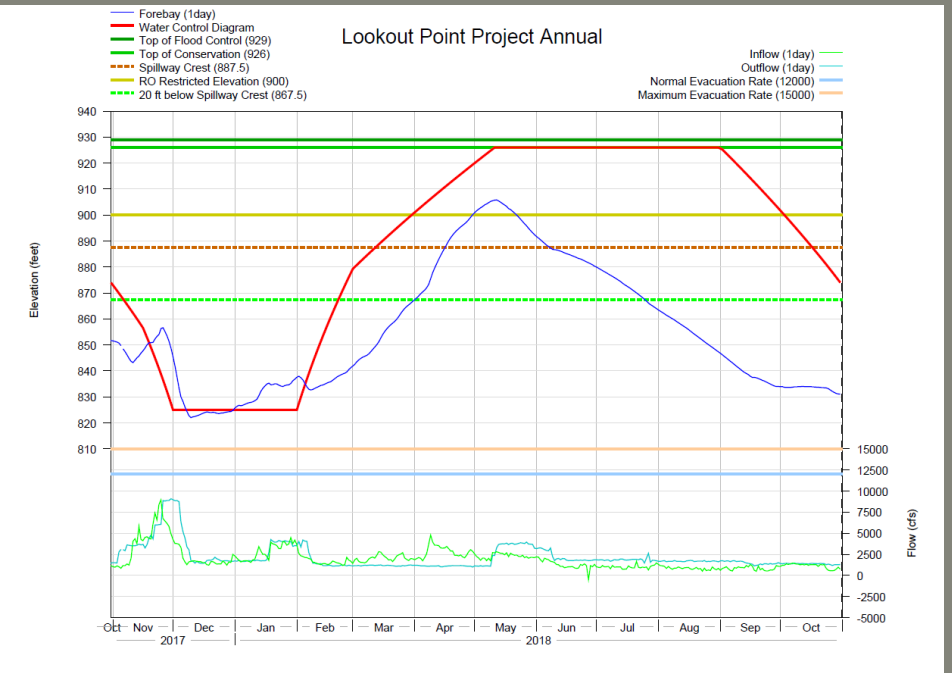


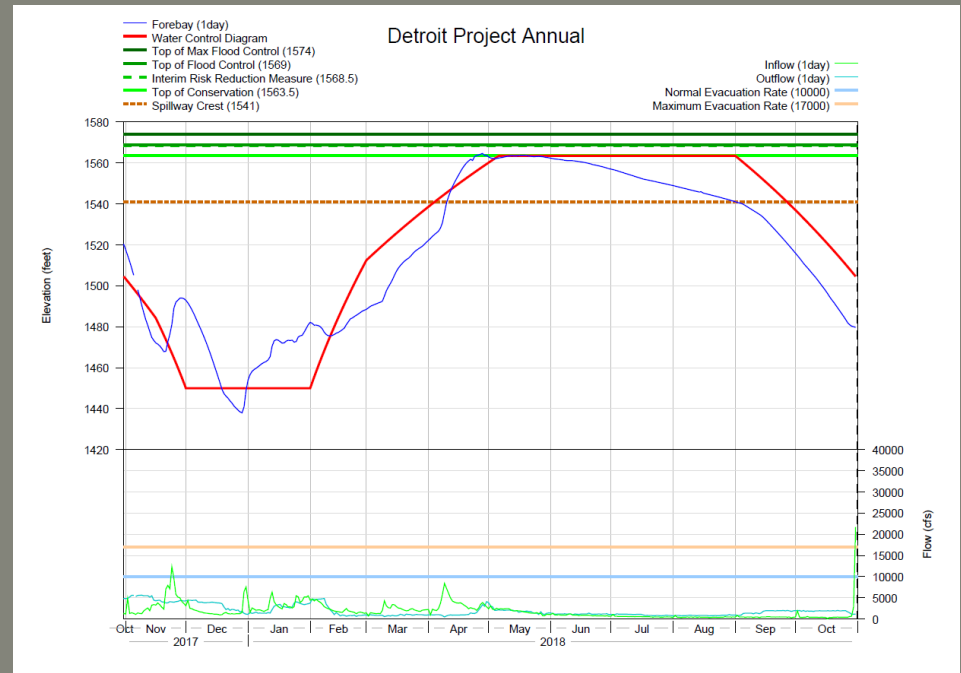
Basin Precipitation




Hills Creek Project Annual
Forebay (1day)
Water Control Diagram
Top of Flood Control (1543)
Top of Conservation (1541)
Interim Risk Reduction Measure (1529)
Spillway Crest (1495.5)
20 ft below Spillway Crest (1475.5)
Inflow (1day)
Outflow (1day)
Normal Evacuation Rate (6000)
Maximum Evacuation Rate (8000)
Elevation (feet)
Flow (cfs)
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
2017
2018


Green Peter Project Annual
Forebay (1day)
Water Control Diagram
Top of Flood Control (1015)
Top of Conservation (1010)
Inflow (1day)
Outflow (1day)
Normal Evacuation Rate (10000)
Maximum Evacuation Rate (13000)
Elevation (feet)
Flow (cfs)
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
2017
2018


Lookout Point Project Annual
Forebay (1day)
Water Control Diagram
Top of Flood Control (929)
Top of Conservation (926)
Spillway Crest (887.5)
RO Restricted Elevation (900)
20 ft below Spillway Crest (867.5)
Inflow (1day)
Outflow (1day)
Normal Evacuation Rate (12000)
Maximum Evacuation Rate (15000)
Elevation (feet)
Flow (cfs)
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
2017
2018


Detroit Project Annual
Forebay (1day)
Water Control Diagram
Top of Max Flood Control (1574)
Top of Flood Control (1569)
Interim Risk Reduction Measure (1568.5)
Top of Conservation (1563.5)
Spillway Crest (1541)
Inflow (1day)
Outflow (1day)
Normal Evacuation Rate (10000)
Maximum Evacuation Rate (17000)
Elevation (feet)
Flow (cfs)
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
2017
2018

Mainstem and Tributary Flow Objectives

From 2000 through 2003, the USACE worked with other federal and state agencies to develop a flow management strategy for the Willamette Basin.

Strategy established a framework for meeting mainstem Willamette River flow objectives as recommended by NMFS and ODFW (Friesen and Buckman 2003) (April 1-June 30).

Based on the mid-May system-wide storage forecast, and makes adjustments based on hydrologic conditions

BIOLOGICAL AND CONGRESSIONALLY AUTHORIZED MINIMUM FLOW OBJECTIVES FOR THE WILLAMETTE RIVER AT SALEM

APRIL 1 TO OCTOBER 31

Table 7. Willamette Mainstem Flow Thresholds for Adequate and Abundant Years

Period	ALBANY Minimum Instantaneous Flow (cfs)	SALEM Minimum Weekly Flow Threshold (cfs)	SALEM Minimum Instantaneous Flow (cfs)
April	Not defined	17,800	14,300
May	Not defined	15,000	12,000
1-15 June	4,500	13,000	10,500
16-30 June	4,500	8,700	7,000
July	4,500	6,000	Not defined
1-15 Aug	5,000	6,000	Not defined
16-31 Aug	5,000	6,500	Not defined
September	5,000	7,000	Not defined
October	5,000	7,000	Not defined

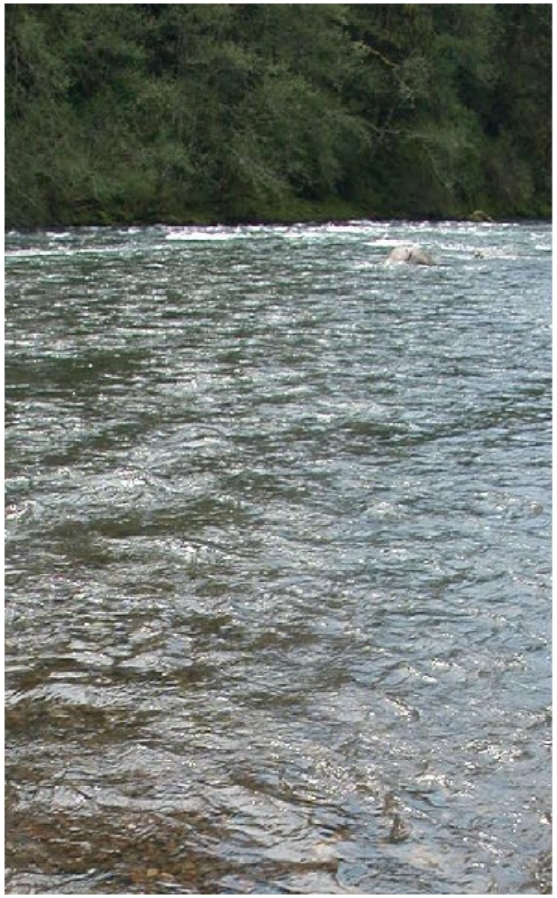
Characteristics of Water Year Types	Abundant	Adequate	Insufficient	Deficit
Mid May Storage (MAF)	≥ 1.48	1.2 – 1.47	0.9-1.19	< 0.90
Frequency	58%	17%	9%	16%
Meet All Mainstem Flow Objectives?	Yes	Yes	No	No
Alternative Flow Targets below Objectives	N/A	N/A	Linear sliding scale based on flow targets used during 2001 water year	Balance seasonal flows to retain some control of discharge
Likely Status of Priority Recreation Reservoirs	Full throughout most or all of the recreation season	Full throughout most or all of the recreation season	May fill; unlikely to remain full throughout the season	Unlikely to fill
Likely Status of other Reservoirs	Likely to fill; drafted as necessary to meet mainstem flows	May fill; unlikely to remain full throughout season	Unlikely to fill	Unlikely to fill

TRIBUTARY FLOWS

Table 9. Minimum flow objectives below Willamette Basin dams

Minimum Flow (cfs)										
	BCL	FOS	DEX	HCR	FAL	CGR	BLU	FRN	COT	DOR
January 1	1200	1100	1200	400	50	400	50	30	50	100
February 1	1000	800	1200	400	50	400	50	50	75	190
March 1	1000	800	1200	400	50	400	50	50	75	190
March 16	1500	1500	1200	400	50	400	50	50	75	190
April 1	1500	1500	1200	400	80	400	50	50	75	190
May 1	1500	1500	1200	400	80	400	50	50	75	190
May 16	1500	1100	1200	400	80	400	50	50	75	190
June 1	1200	1100	1200	400	80	400	50	50	75	190
July 1	1200	800	1200	400	80	400	50	30	50	100
July 16	1000	800	1200	400	80	400	50	30	50	100
September 1	1500	1500	1200	400	200	400	50	30	50	100
October 16	1200	1100	1200	400	50	400	50	30	50	100
December 1	1200	1100	1200	400	50	400	50	30	50	100

TRIBUTARY TARGETS
SPAWNING AND INCUBATION FLOWS



2000 cfs
05/08/03

1200 cfs
06/24/03

850 cfs
07/23/03

HOW DO WE MANAGE BETTER?

Prioritization

Between: Subbasins, Species, Life Histories, Authorized Purposes, BIOP Requirements (Spring v Fall Spawning, Reservoir Rearing v Mainstem Habitat, Ramping Rates etc).

Tools for Understanding and Evaluating Trade Offs

Cougar Project Annual

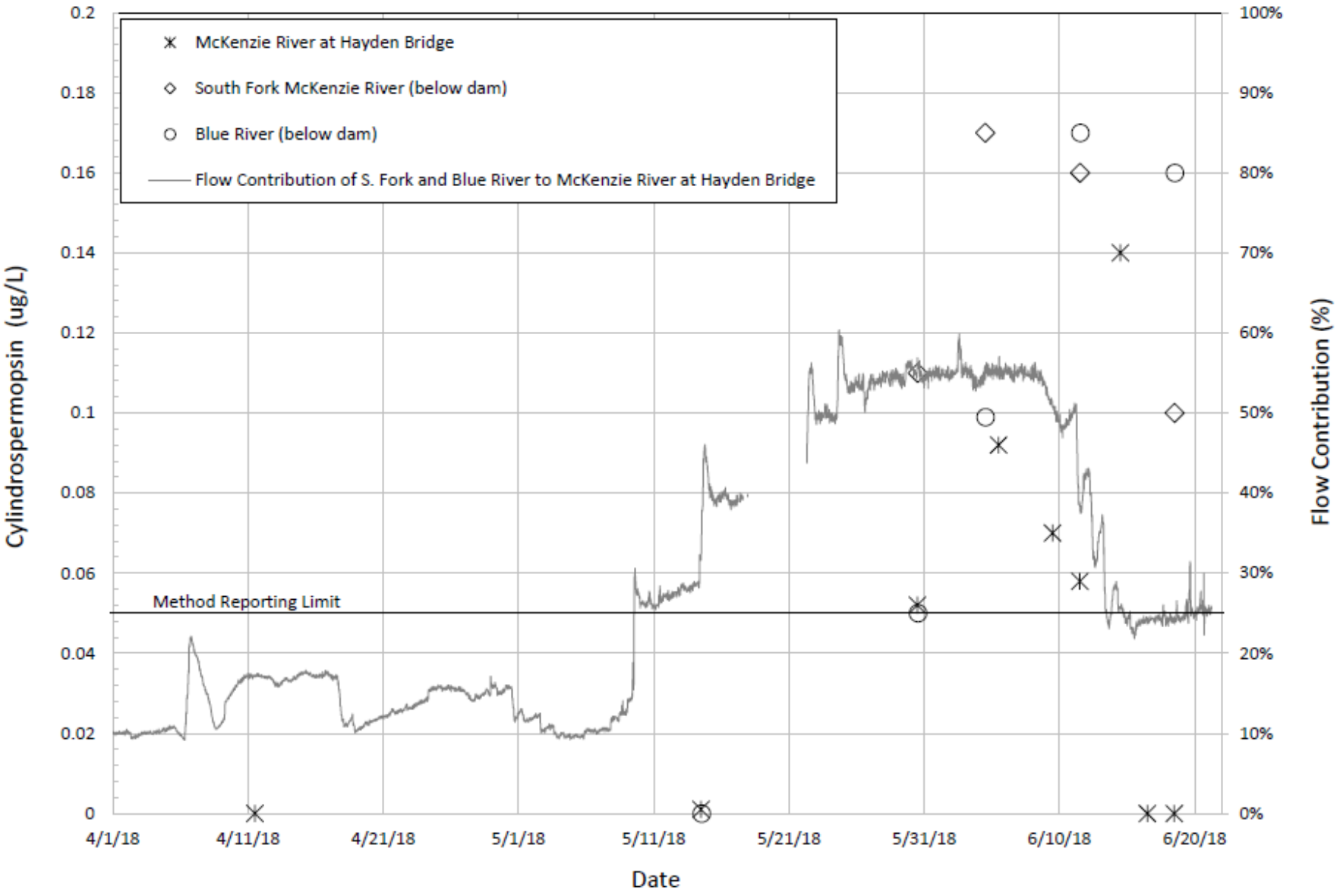
Forebay (1day)
Water Control Diagram
Top of Flood Control (1699)
Top of Conservation (1690)
Interim Risk Reduction Measure (1685)
Spillway Crest (1656.75)
20 ft below Spillway Crest (1636.75)

Outflow (1day)
Inflow (1day)
Normal Evacuation Rate (5000)
Maximum Evacuation Rate (6500)

Elevation (feet)
1700
1675
1650
1625
1600
1575
1550
1525
1500
1475
1450

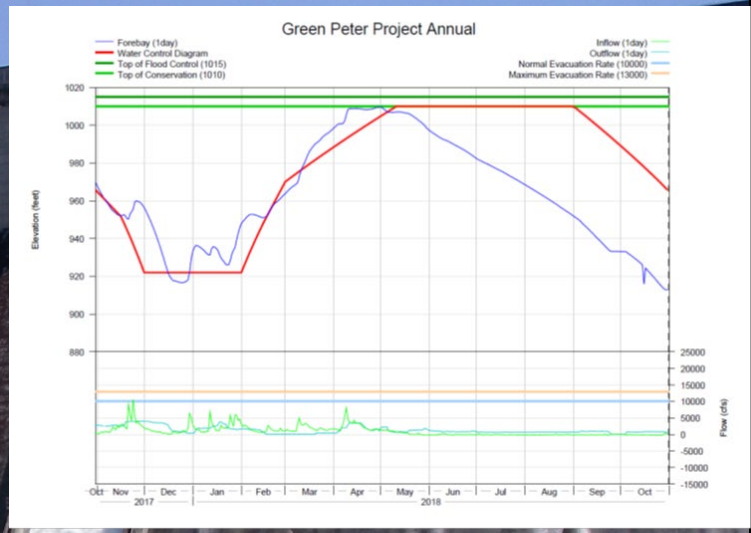
Flow (cfs)
4375
3750
3125
2500
1875
1250
625
0
-625

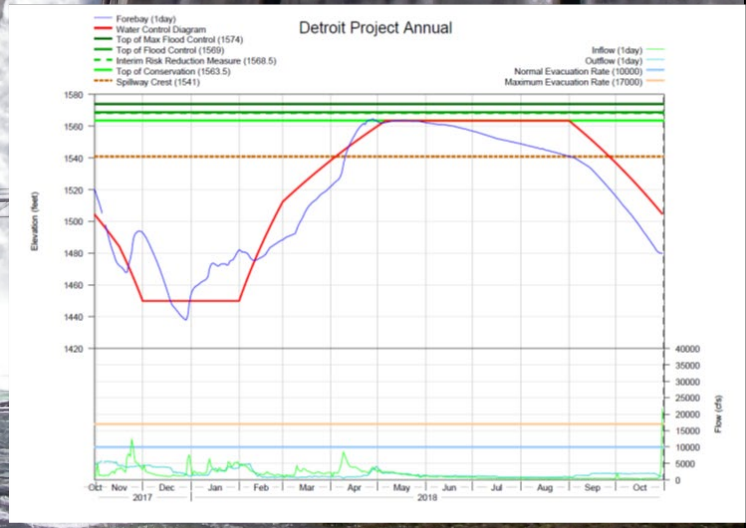
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
2017
2018

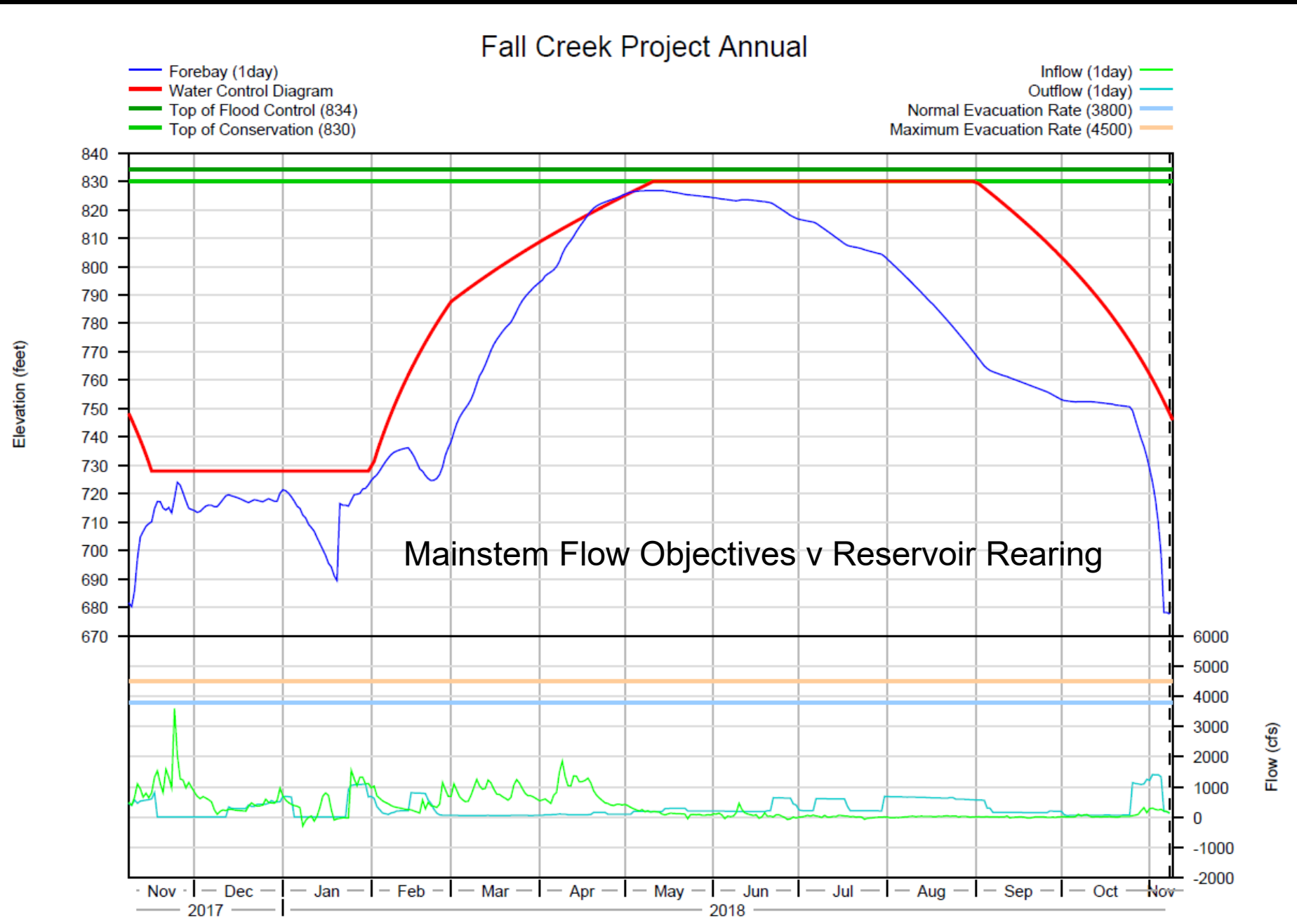


Note: The OHA acute or short-term drinking water toxicity value for children 5 years and younger for **cylindrospermopsin** is .7 ug/L.

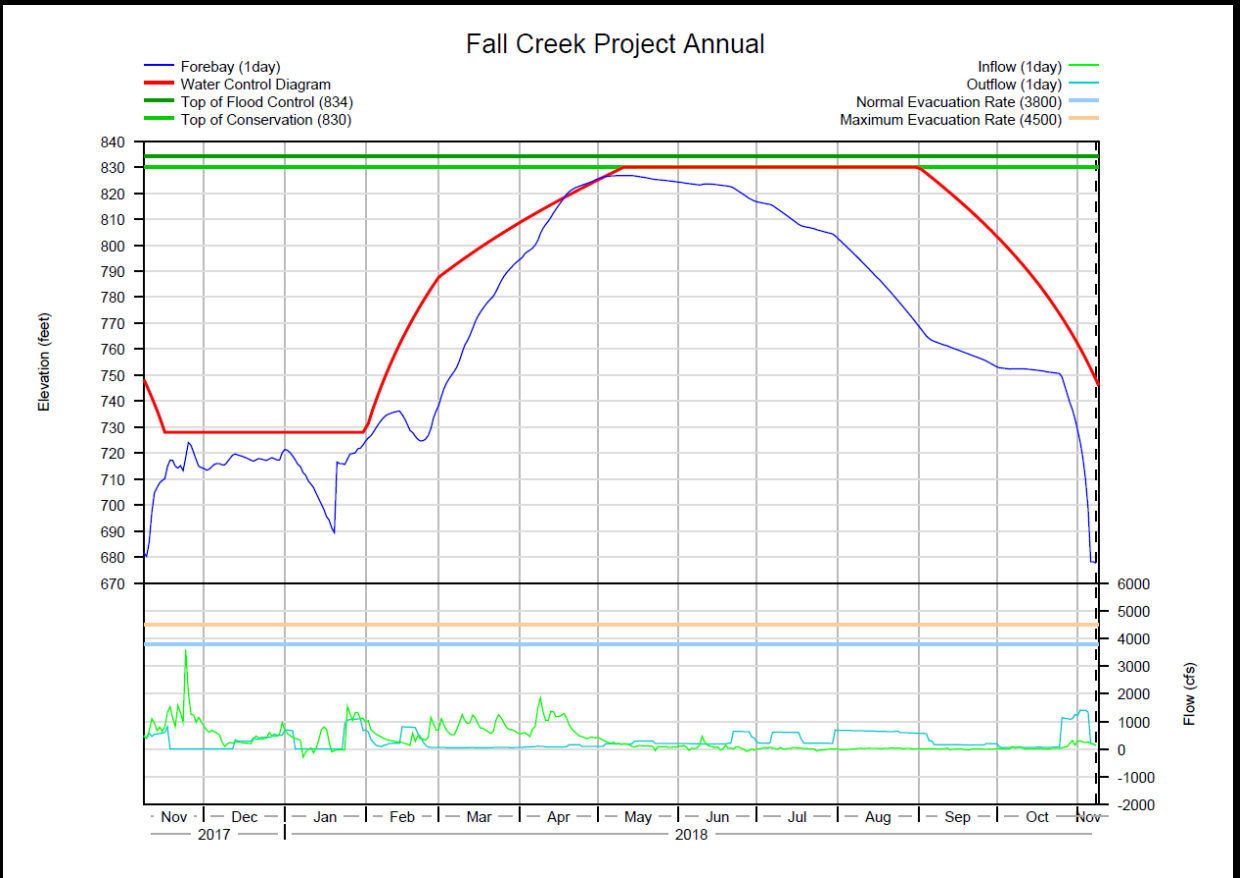
Detroit Downstream Passage and Temperature Control v Mainstem Augmentation v Chinook BIOP Spawning Objective South Santiam

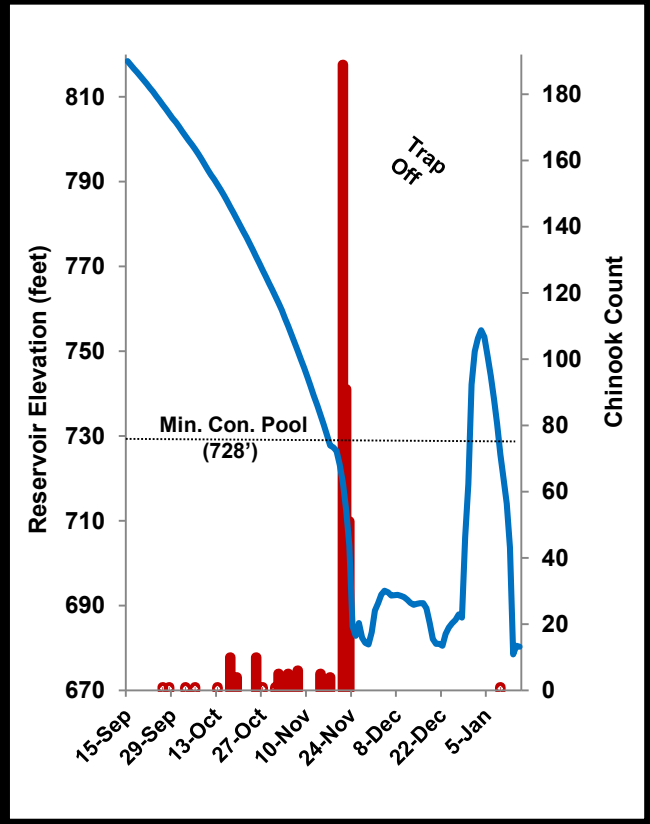





Fall Creek Project Annual
Forebay (1day)
Water Control Diagram
Top of Flood Control (834)
Top of Conservation (830)
Inflow (1day)
Outflow (1day)
Normal Evacuation Rate (3800)
Maximum Evacuation Rate (4500)
Elevation (feet)
840
830
820
810
800
790
780
770
760
750
740
730
720
710
700
690
680
670
Mainstem Flow Objectives v Reservoir Rearing
6000
5000
4000
3000
2000
1000
0
-1000
-2000
Flow (cfs)
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
2017
2018

Fall Creek Drawdown





Summary

- Managing flows to support multiply life histories, species, and authorized purposes is complex.
- Often objectives to support one life history, species, or authorized purposes are in conflict with another.
- Adaptively managing the system to achieve maximum benefit requires prioritization and a mechanism for evaluating tradeoffs.