T E C H N I C A L   M A N A G E M E N T   T E A M

BOR:	*John Roache / Mary Mellema / Pat McGrane*	**BPA:**	*Tony Norris / Scott Bettin / Robyn MacKay*
NOAA-F:	*Paul Wagner / Richard Dominigue*	**USFWS:**	*David Wills / Steve Haeseker*
OR:	*Rick Kruger / Ron Boyce*	**ID:**	*Russ Kiefer / Pete Hassemer*
WDFW:	*Cindy LeFleur / Charles Morrill*	**MT:**	*Jim Litchfield / Brian Marotz*
Kootenai:	*Sue Ireland / Billy Barquin*	**Spokane:**	*Deanne Pavlik-Kunkel / Andy Miller*
Colville:	*Sheri Sears / Steve Smith*	**Nez Perce:**	*Dave Statler*
Umatilla:	*Tom Lorz (CRITFC)*		

COE: *Doug Baus / Karl Kanbergs*

COLUMBIA RIVER REGIONAL FORUM

Technical Management Team
Annual Review of Lessons Learned: 2011

Wednesday, December 7, 2011
9:00 am - 3:30 pm PST
Ambridge Event Center
1333 N E MLK Blvd (cross-street is Clackamas)
Sellwood Room
Portland, Oregon
Map Quest [Directions]

AGENDA

Questions about the meeting may be referred to Robin Gumpert at (503) 248-4703.

Purpose: To provide an opportunity for TMT members and other interested parties to step out of the regular meeting format and review the management decisions and operations of the 2011 season in order to learn lessons that can enhance choices and decision making for 2012.

The timing of agenda items are offered as a guide for the day. Depending on information presented and group dynamics it may compress or expand. Presenters are reminded that their presentations are meant to provide visual cues that spark reflection and discussion, as opposed to a full blown analysis of the issue.

1. **9:00 Welcome, get settled and introductions** - *DS Consulting Facilitation Team*

2. **9:15 Conditions Review: What were the water, weather and fish conditions that existed throughout the year? How did this year compare to others? Is there something we can learn from this? Is there anything unique that bears sharing?**

   - 9:15-9:30 Weather and Water Summary - *Karl Kanbergs, COE Division*
   - 9:30-9:45 System Flood Control Summary - *Kasi Rodgers, COE Division*
   - 9:45-10:00 Water Quality - *Scott English, COE Division*
   - 10:00 - 10:15 Fish Passage
     1. Juvenile Summary - *Paul Wagner, NOAA*
     2. Adult summary - *Cindy LeFleur, WA*

3. Adult Run Timing - *Brandon Chockley, Fish Passage Center*

- 10:15 to 10:30 Lessons Learned from the 2011 Conditions Review?

10:30 Break

3. **10:45 Reservoir Operations Review: How effective were the proposed actions (SORs) at achieving desired results? What changes might be necessary to enhance results in the future? How did this year compare to others?**

- Libby Operations - *Joel Fenolio, COE Seattle District*
- Hungry Horse Operations - *John Roache, BOR*
- Grand Coulee Operations - *John Roache, BOR*
- Dworshak Spring/Summer Operations - *Steve Hall, COE Walla Walla District*
- Upper Snake Flow Augmentation - *Ted Day, BOR*

- Lessons Learned from the 2011 Reservoir Operations Review? Is there more flexibility that TMT could utilize to improve in-season operations?

12:30 Break for Lunch

4. **1:00 Review of Specific Operations: What was learned about specific operations that were requested by TMT members or other regional entities? How effective were these operations in achieving the intended goal? Should they be continued or modified in future years? Why or why not?**

- Bonneville Dam Operations Leading up to the Condit Dam Breach - *Lisa Wright, COE Division*
- Hanford Reach Operations - *Russel Langshaw, Grand County PUD*
- Performance Standard Testing - *Brad Eppard, COE Portland District*
- Juvenile Survival for 2011 - *Bill Muir, NMFS Science Center*
- Hatchery Subyearling Chinook Survival - *Jerry McCann, FPC*
- Chum Habitat Improvement - *Paul Wagner, NOAA Fisheries*
- Lower Granite Dam Minimum Operating Pool - *Doug Baus, COE Division*

- Lessons Learned from these specific operations?

5. **3:00 Other Lessons Learned?** Given the review of conditions, decisions and actions throughout the day, what are the overarching lessons that could impact future work of the TMT? Are there themes that might need further discussion at a future TMT meeting or other regional work group?

6. **3:30 Adjourn**

NOTE: Lunch will be brought in for all participating in or attending the meeting. A $10 contribution is required. **RSVP as soon as possible - and no later than Friday, December 2. Your RSVP is required to guarantee enough food for everyone! To RSVP and to make special food requests (e.g. vegetarian) please email JanHKelley@gmail.com or call 503-248-4703.**

Thank you in advance for your thoughtful participation.

Lower Granite Dam 2011 Minimum Operation Pool Summary

Doug Baus

Reservoir Control Center

Northwestern Division

December 7, 2011

US Army Corps of Engineers

BUILDING STRONG®

Objectives

•Operate Lower Granite (LWG) Dam for authorized purposes such as navigation

•Operate LWG in accordance with Minimum Operating Pool (MOP) provisions identified in the 2008 Federal Columbia River Powersystem Biological Opinion (BiOp)

•Coordinate operations with regional stakeholders when it is challenging to achieve the multipurpose objectives associated with LWG

Navigation Survey Data

- Less than the 14 foot depth authorization in the Federal Navigation Channel
- BiOp indicates LWG will be operated at Minimum Operating Pool (MOP) defined as 733.0 to 734.0 ft.
- LWG MOP operations would not provide sufficient depth in the Federal Navigation Channel

System Operation Request (SOR) 2011-01

- Objective of the SOR was to provide safe navigation and marine facility access in the Lower Granite Pool during the fish migration season."

- From Columbia River Towboat Association, Port of Clarkston, Port of Lewiston, Lewis and Clark Terminal, Valley Vision, Inc.

- Received on March 23, 2011

Coordination with TMT

- PNWA Presented SOR March 30
- In Coordination with TMT the Corps determined the modified MOP operation would provide adequate depth in the Federal Navigation Channel
- Action Agencies implemented the SOR during the 2011 Fish Migration Season (April 3-Aug 31)

Variable MOP Operation

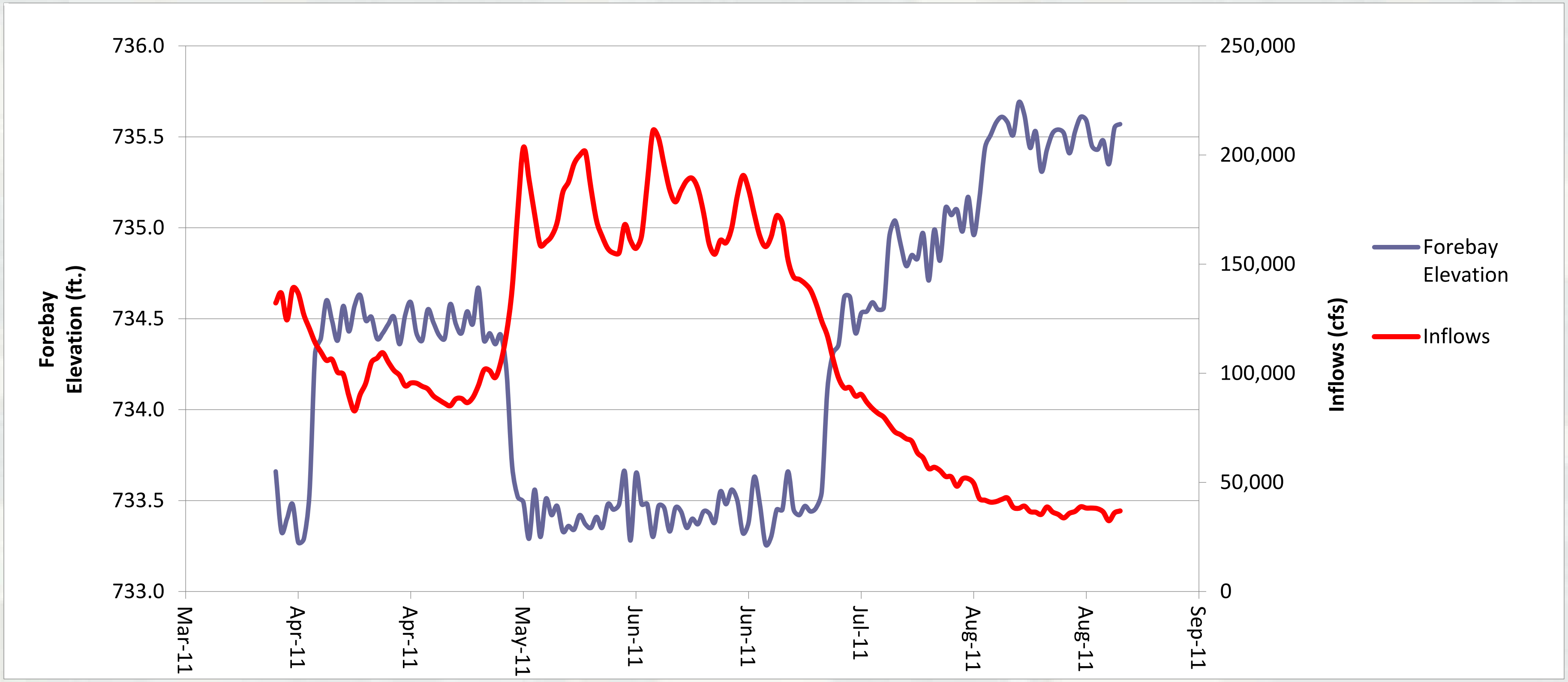
- MOP+2 April – August did not appear to be necessary to provide safe navigation

- To minimize duration of time at a MOP plus operation coordinated the following variable MOP operation:

  - LWG Inflow Dependent Ranges
    - Inflow >= 120 kcfs 733.0-734.0 feet (MOP)
    - Inflow >= 80 kcfs and < 120 kcfs 734.0-735.0 feet (MOP+1)
    - Inflow >= 50 kcfs and < 80 kcfs 734.5-735.5 feet (MOP+1.5)
    - Inflow < 50 kcfs 735.0-736.0 feet (MOP+2)

- Implemented from April 3 through August 31, 2011

Forebay Elevation vs. Inflows



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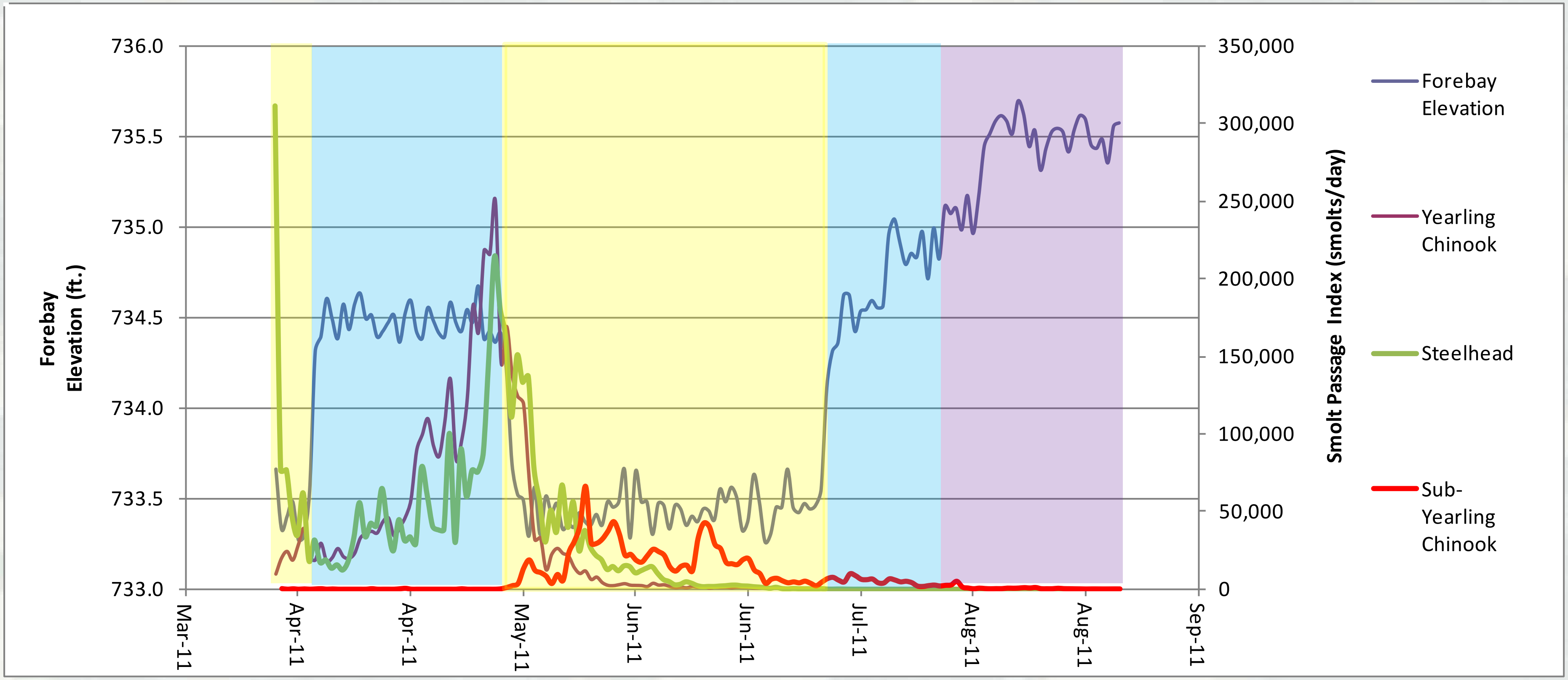
Lower Granite Dam Forebay Elevation vs Fish Passage Index



Variable MOP and LWG Fish Passage

Forebay Elevation	Fish Passage Season Days (Apr3-Aug31 = 151 Days)	Yearling Chinook Passage (CH1 Index 3, 806,010)	Steelhead Passage (Stlhd Index 3,987,736)	Sub-Yearling Chinook Passage (CH0 Index 1,157,092)
MOP	42% (63 Days)	23% (864,794)	48% (1,897,005)	88% (1,023,323)
MOP+1	38% (57 Days)	77% (2,941,129)	52% (2,090,649)	9% (106,273)
MOP+1.5	10% (15 Days)	0.0003% (13)	0.0016% (64)	2% (20,283)
MOP+2	11% (16 Days)	0.0001% (5)	0.0005% (18)	1% (7,213)

Summary

- Unique opportunity to working with regional partners developed creative solutions to balance the needs of various requirements

- Provided modified MOP operation to provide safe navigation

- Coordinated operations with Regional Partners through TMT consistent with the intent of the RPA

Acknowledgements

•Technical Management Team
•Glenn Vanselow - Pacific Northwest Waterways Association
•John Pigott – Columbia River Towboat Association
•Wanda Keefer – Port of Clarkston
•David Doeringsfeld – Port of Lewiston
•Arvid Lyons – Lewis and Clark Terminal
•Doug Matoon, Valley Vision, Inc.
•Steve Barton – Corps
•Bill Proctor - Corps
•Steve Hall – Corps
•Lisa Wright - Corps
•Tracy Schwartz – Corps
•Richard Turner – Corps
•Karl Kanbergs – Corps
•John McCoskery - Corps
•Steve Burrell – Corps
•Greg Bowers – Corps
•Gregg Teasdale – Corps
•Ann Glassley - Corps

Lower Columbia River Survival Study, 2011

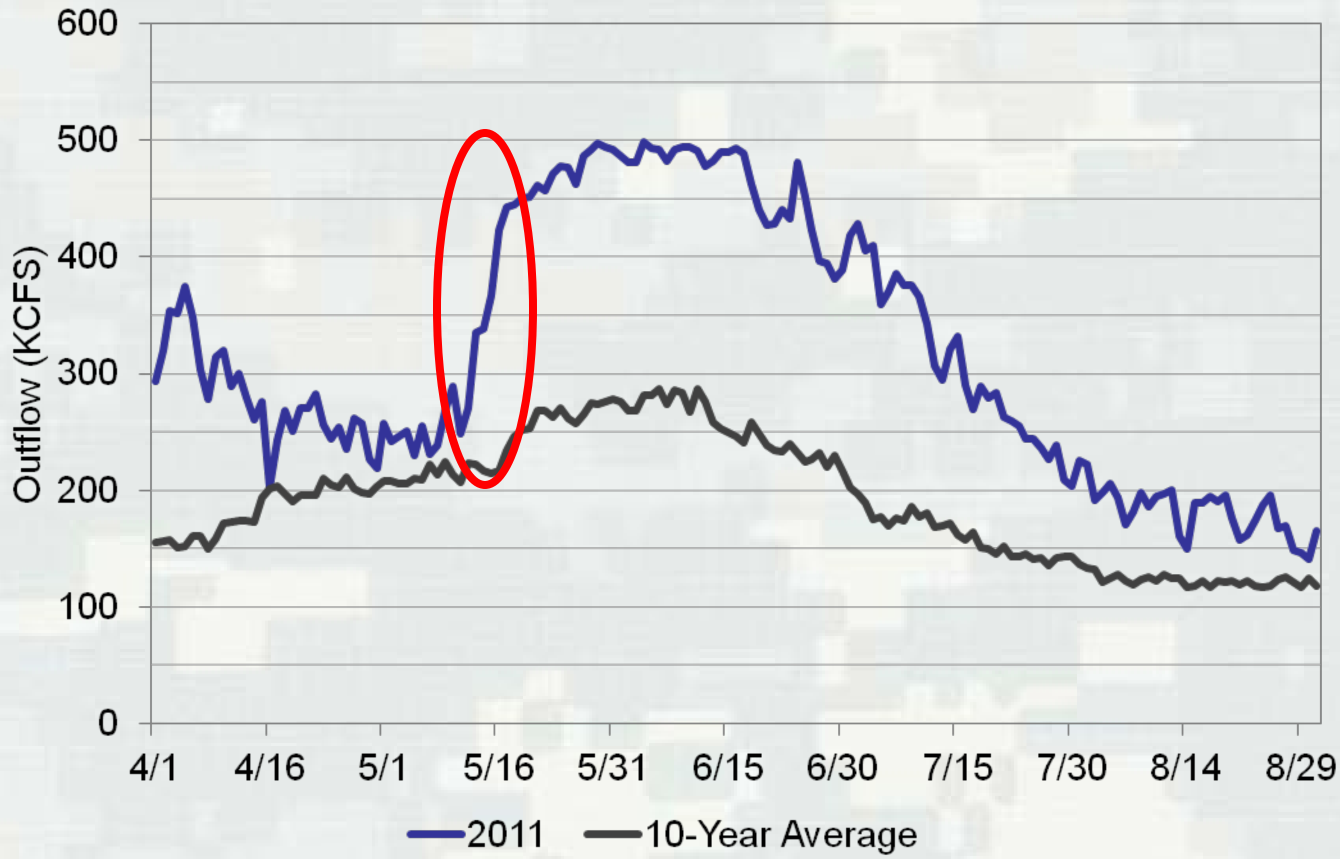
Brad Eppard USACE NWP
Presentation to Technical Management Team
07 December, 2011

Pacific Northwest
NATIONAL LABORATORY

LCR Survival Study: Objectives

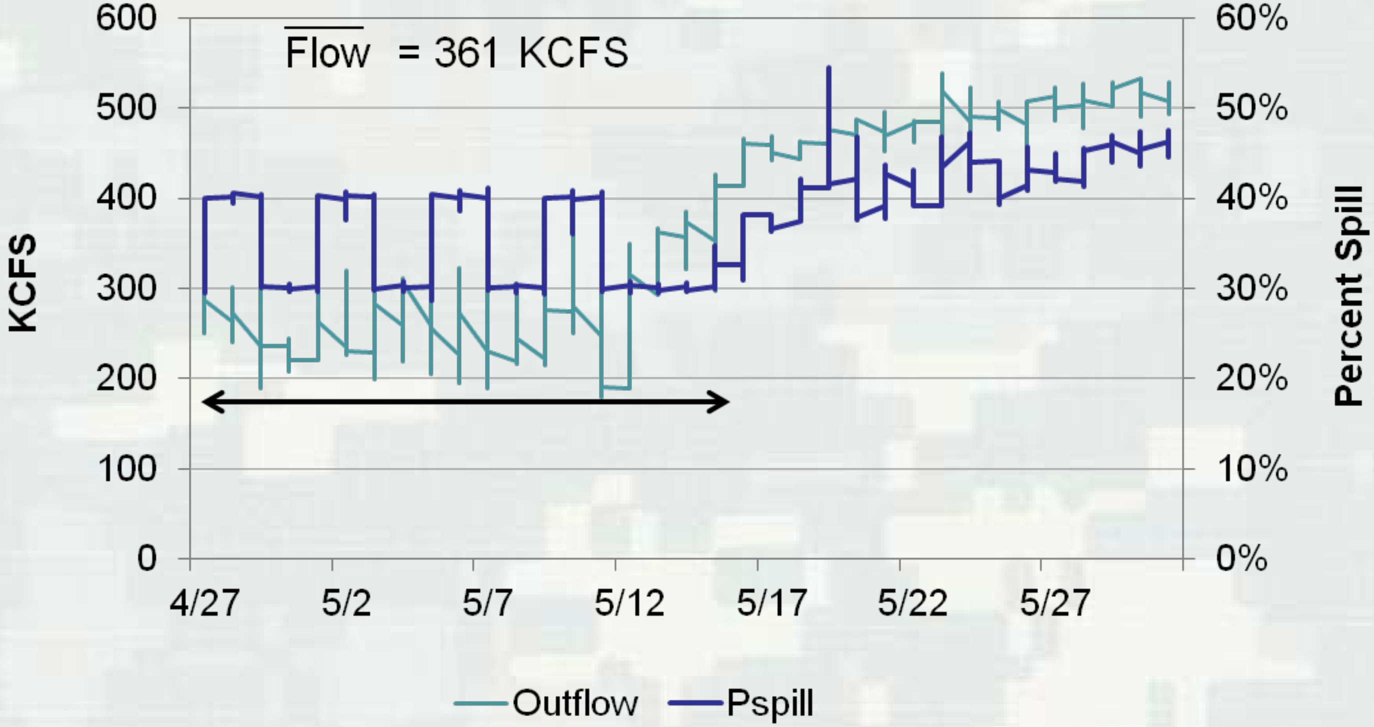
- John Day
  - Performance standard compliance tests at 30% and 40% spill (Spring) and either 30% or 40% in Summer
- The Dalles Dam
  - Performance standard compliance tests at 40% spill (Spring and Summer)
- Bonneville Dam
  - Performance standard compliance tests at 24h 100k spill (Spring) and either 85k/TDG or 24h 95k spill (Summer)

Outflow at The Dalles Dam



LCR Survival Study: John Day Dam

- Performance standard compliance tests at 30% and 40% spill



LCR Survival Study: JDA Results

Metric	Yearling Chinook Salmon			Juvenile Steelhead		
	30%	40%	Season	30%	40%	Season
Dam Survival	0.967 (0.010)	0.978 (0.011)	0.968 (0.007)	0.984 (0.009)	0.990 (0.010)	0.987 (0.006)
FB-TR Survival	--	--	--	--	--	0.977 (0.006)
SPE (%)	61.2	66.4	63.7	61.2	65.9	62.9
FPE (%)	89.4	88.4	88.5	95.0	96.5	96.1
FB Egress (h)	2.0	1.5	1.4	4.3	3.2	2.9
TR Egress (h)	0.6	0.6	0.6	0.6	0.6	0.6

★ ***Preliminary Data*** ★

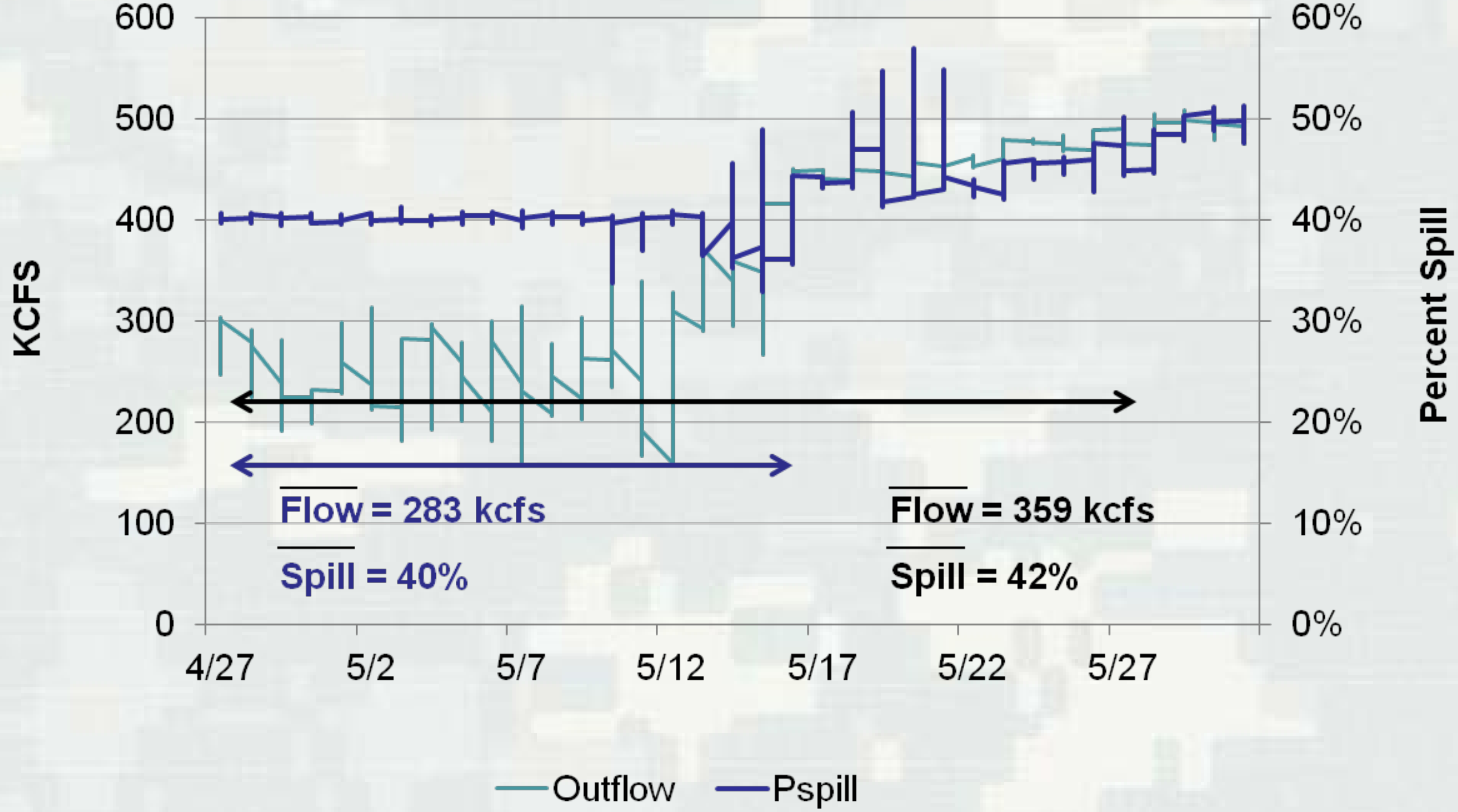
LCR Survival Study: TDA Results

Metric	Yearling Chinook Salmon		Juvenile Steelhead	
	40% Spill	All Season	40% Spill	All Season
Dam Survival	0.972 (0.010)	0.960 (0.007)	0.992 (0.012)	0.995 (0.008)
FB-TR Survival	0.971 (0.010)	0.960 (0.007)	0.992 (0.012)	0.995 (0.008)
SPE (%)	--	65.8	--	75.4
FPE (%)	--	83.1	--	89.1
FB Egress (h)	--	1.0	--	0.8
TR Egress (h)	--	0.2	--	0.2

★ ***Preliminary Data*** ★

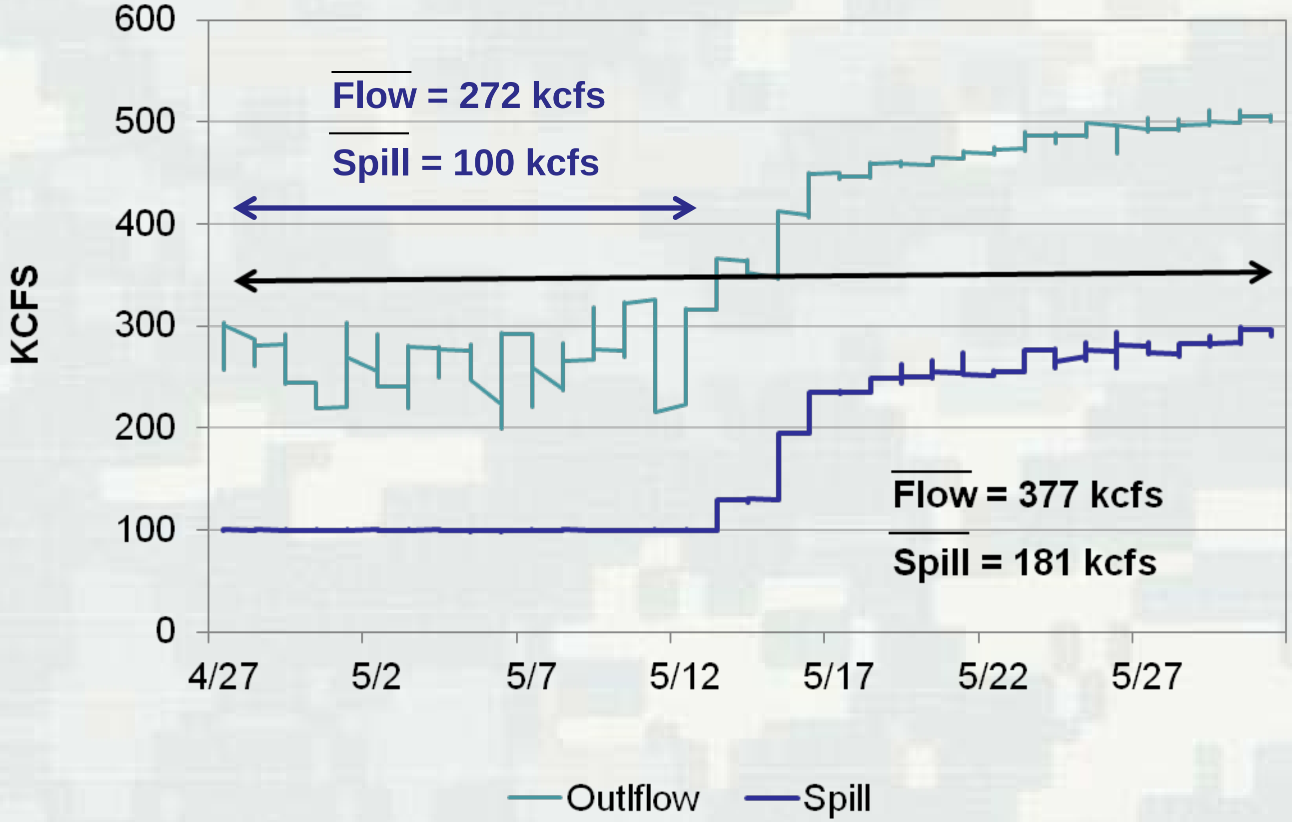
LCR Survival Study: The Dalles Dam

- Performance standard compliance tests at 40% spill



LCR Survival Study: Bonneville Dam

- Performance standard compliance tests at 24h 100k spill



LCR Survival Study: BON Results

Metric	Yearling Chinook Salmon		Juvenile Steelhead	
	100k Spill	All Season	100k Spill	All Season
Dam Survival	0.958 (0.004)	0.960 (0.018)	0.976 (0.018)	0.965 (0.021)
FB-TR Survival	0.958 (0.004)	0.953 (0.018)	0.975 (0.018)	0.959 (0.021)
SPE (%)	--	56.6	--	54.4
FPE (%)	--	70.7	--	74.0
FB Egress (h)	--	0.6	--	0.9
TR Egress (h)	--	0.4	--	0.4

★ ***Preliminary Data*** ★

LCR Survival Study: Summary

- John Day Dam
  - Prescribed operations were met until 16 May
    - Five 2-day blocks of 30% spill
    - Four 2-day blocks of 40% spill
  - Performance standards exceeded at both operations for both species
- The Dalles Dam
  - Prescribed operations were met until 17 May
    - 19 of 30 days during study period
  - Performance standards exceeded for both species
- Bonneville Dam
  - Prescribed operation met until 14 May
    - 14 of 30 days during study period
  - Performance standards
    - Chinook: 0.2 percentage points short (95.8); precision requirement met
    - Steelhead: exceeded survival requirement; precision requirement exceeded

Spring Chinook Adult Migration Timing at Bonneville Dam (Update with 2011 Data)

Brandon R. Chockley
Fish Passage Center
TMT Year End Review – December 7, 2011

Historic Adult Counting at BON

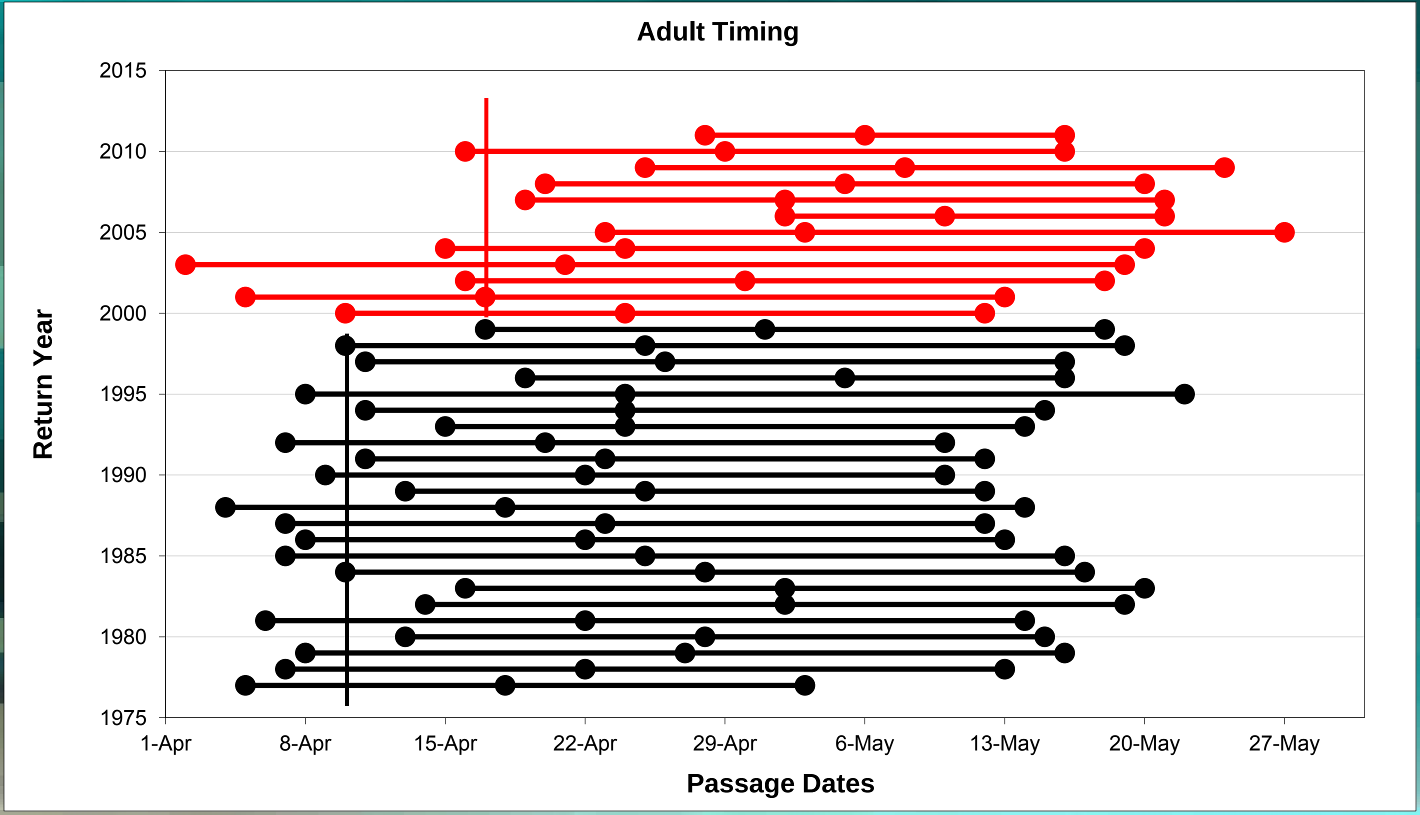
- Prior to 2001, counting at BON began on March 15th and ran through November 15th
- Since 2001, counting at BON is year round
  - Video counts from Nov. 1st to Mar. 31st
  - Direct counts from Apr 1st to Oct. 31st
- All Chinook counted from Jan 1st to May 31st, are considered spring Chinook
  - Adults are those > 22 inches in length
  - Jacks are those < 22 inches in length

Historic Adult Timing at BON

- **FPC adult count database has daily counts at BON back to 1977**
- **Daily counts allows for estimation of 10%, 50%, and 90% passage date for each year**
  - **Passage dates for spring Chinook adults and jacks were estimated separately**
- **Compared adult and jack spring Chinook passage dates of most recent 12 years (2000-2011) to earlier years (1977-1999)**
  - **Timing comparisons based on historic counting dates, beginning on March 15th**

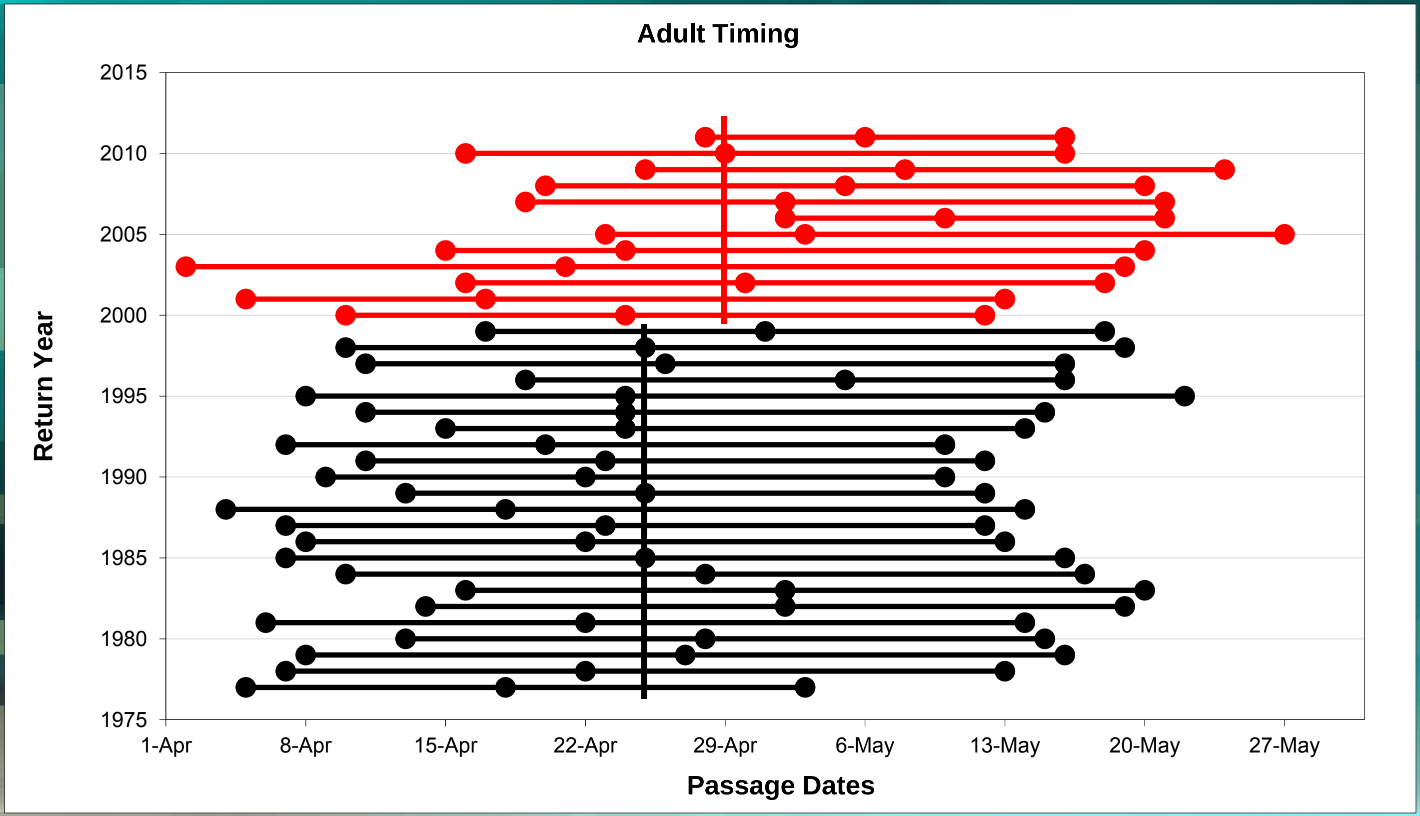
Historic Adult Timing at BON

- **Across years, passage dates are highly variable**
- **10% passage date for 2011 (Apr. 28th); 2nd latest in FPC record**
- **Average 10% passage date among recent years (2000-201) is later**
  - **Average 10% Passage Date (1977-1999) is April 10th**
  - **Average 10% Passage Date (2000-2011) is April 17th**



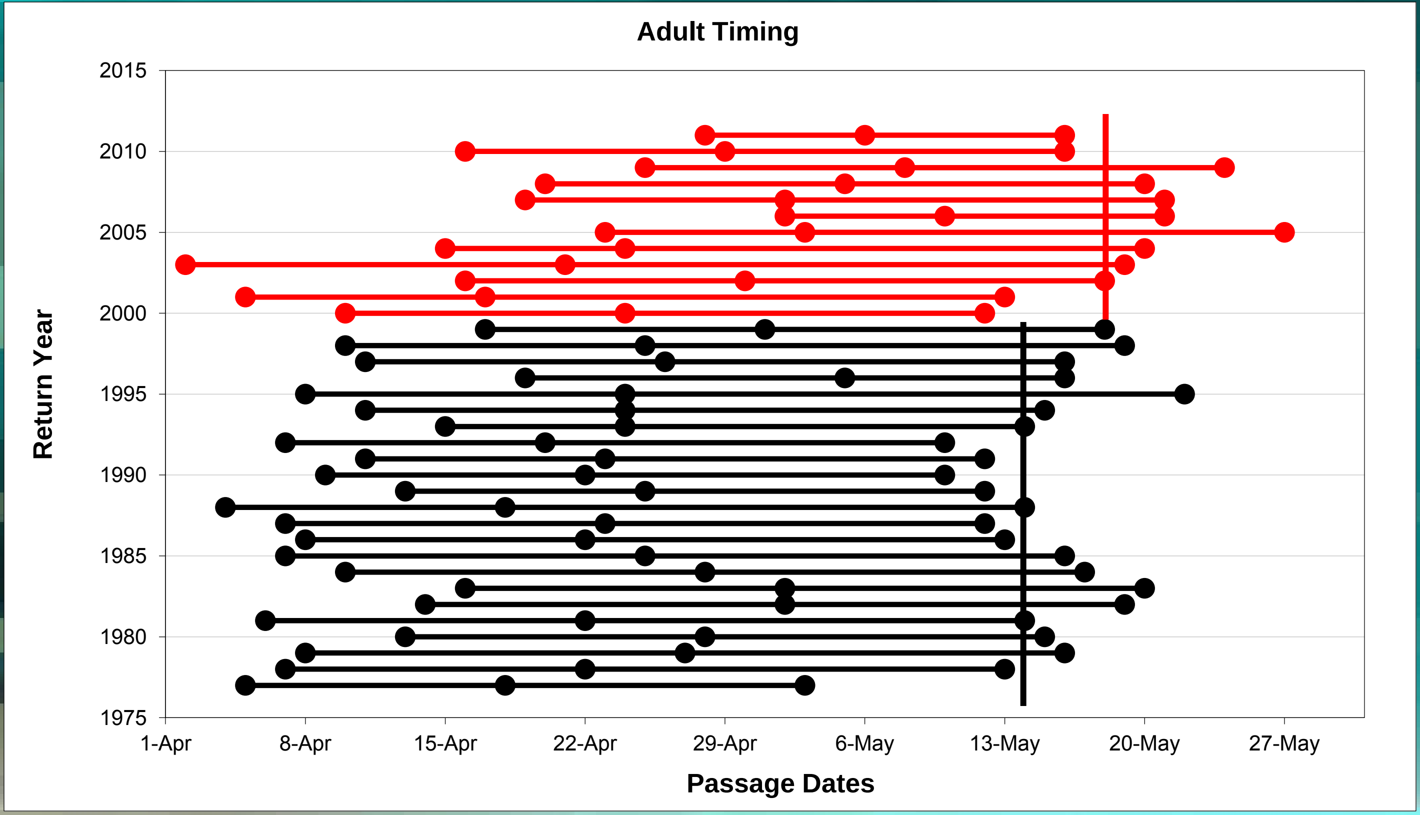
Historic Adult Timing at BON

- **50% passage date for 2011 (May 6th), 3rd latest in FPC record**
- **Average 50% passage date among recent years (2000-2011) is later**
  - **Average 50% Passage Date (1977-1999) is April 25th**
  - **Average 50% Passage Date (2000-2011) is April 29th**



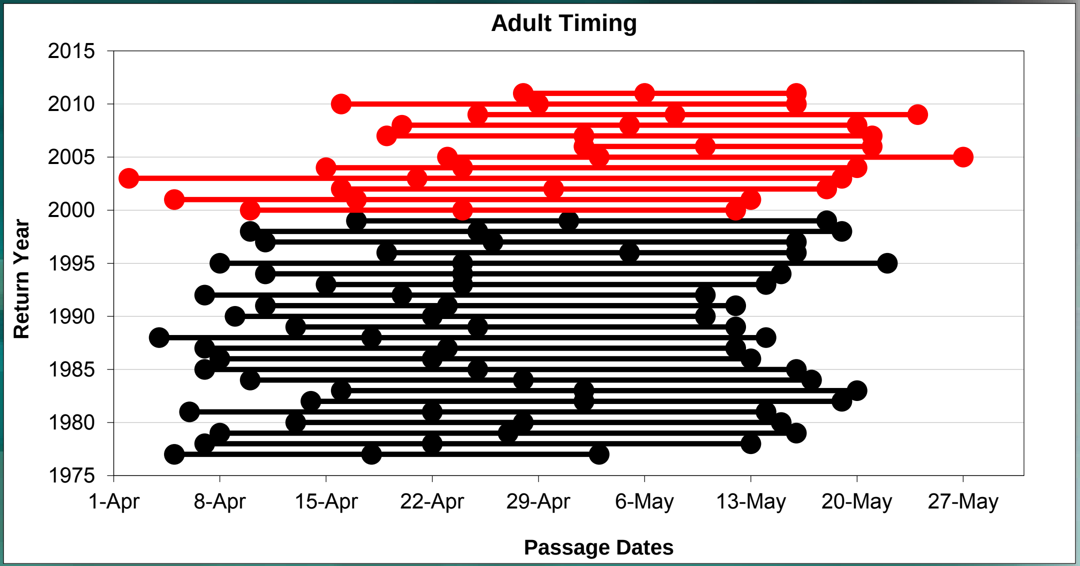
Historic Adult Timing at BON

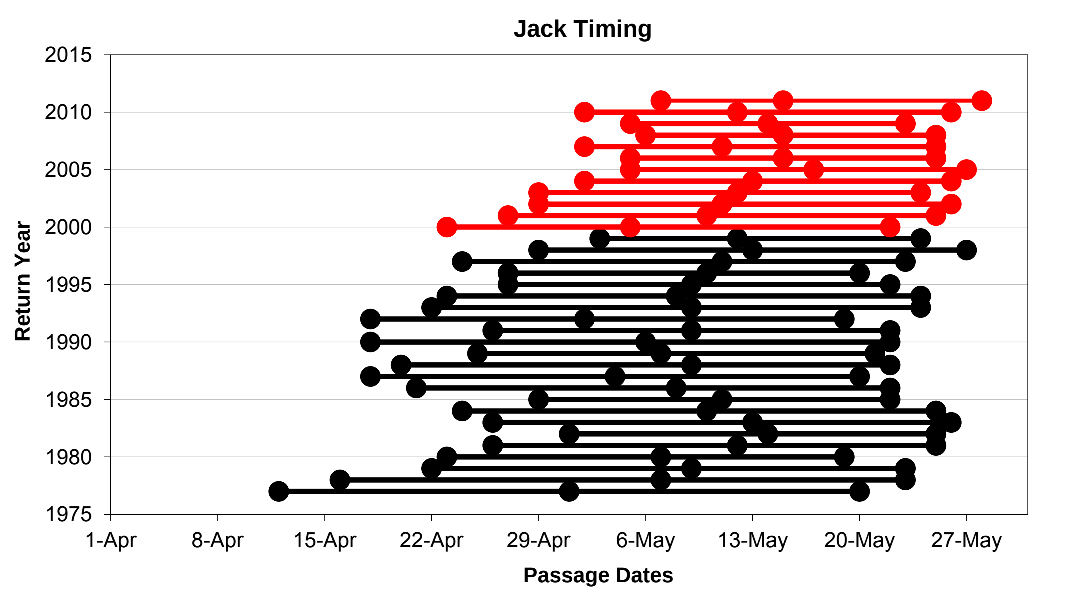
- 90% passage date for 2011 (May 16th); same as 2010
- Average 90% passage date among recent years (2000-2011) is later
  - Average 90% Passage Date (1977-1999) is May 14th
  - Average 90% Passage Date (2000-2011) is May 18th



Historic Jack Timing at BON

- **Spring Chinook jacks have later arrival timing at BON adults**



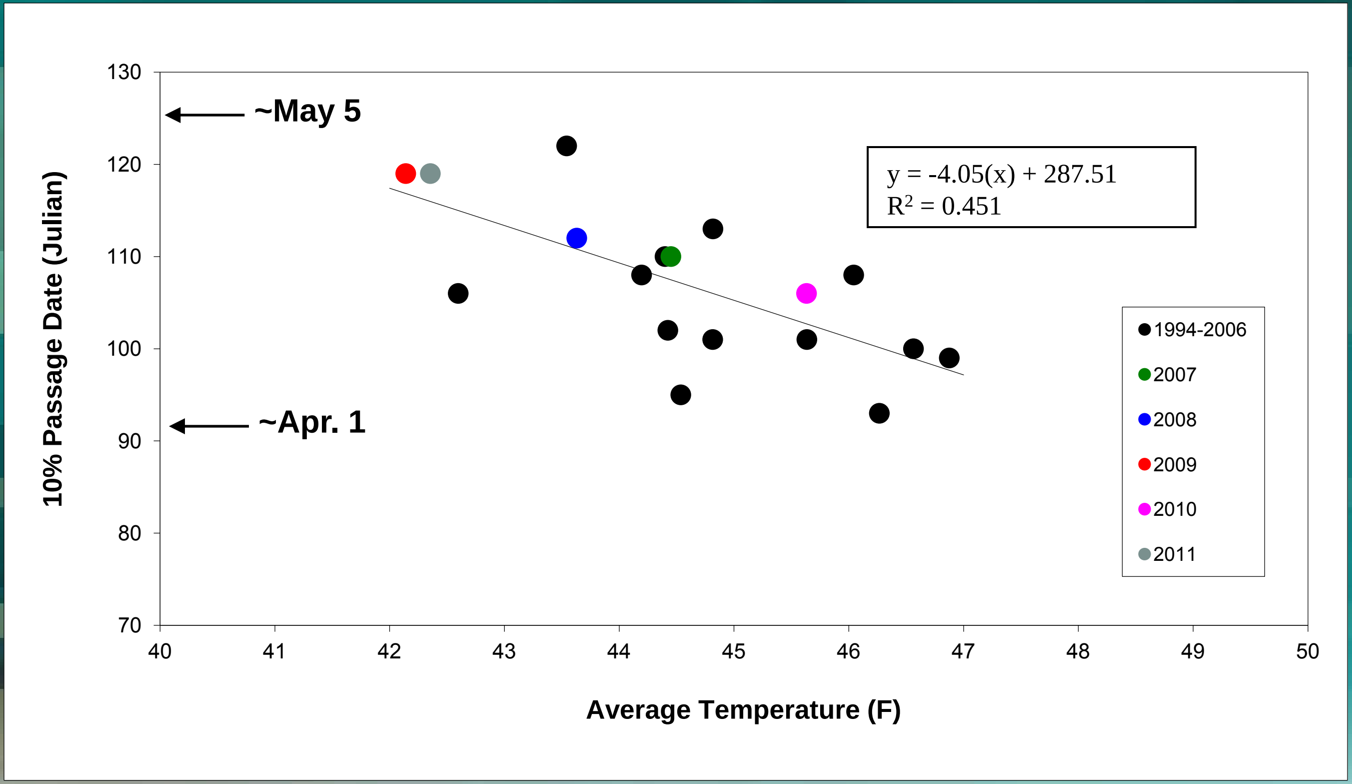


Adult Timing and Environmental Variables

- Linear regression used to investigate relationships between environmental variables and 10% passage
  - 10% passage date used was for adults and jacks combined
- Environmental variables were average temperature and average flow during period of March 15th to April 1st
  - Describes conditions encountered at beginning of run
- Temperature data used were from Warrendale TDG gauge
  - Located approximately 6 miles downstream of BON
  - Temperature data available back to 1994
- Flow data for analysis were total outflow at BON (Kcfs)
- Analyzed return years 1994 to 2011

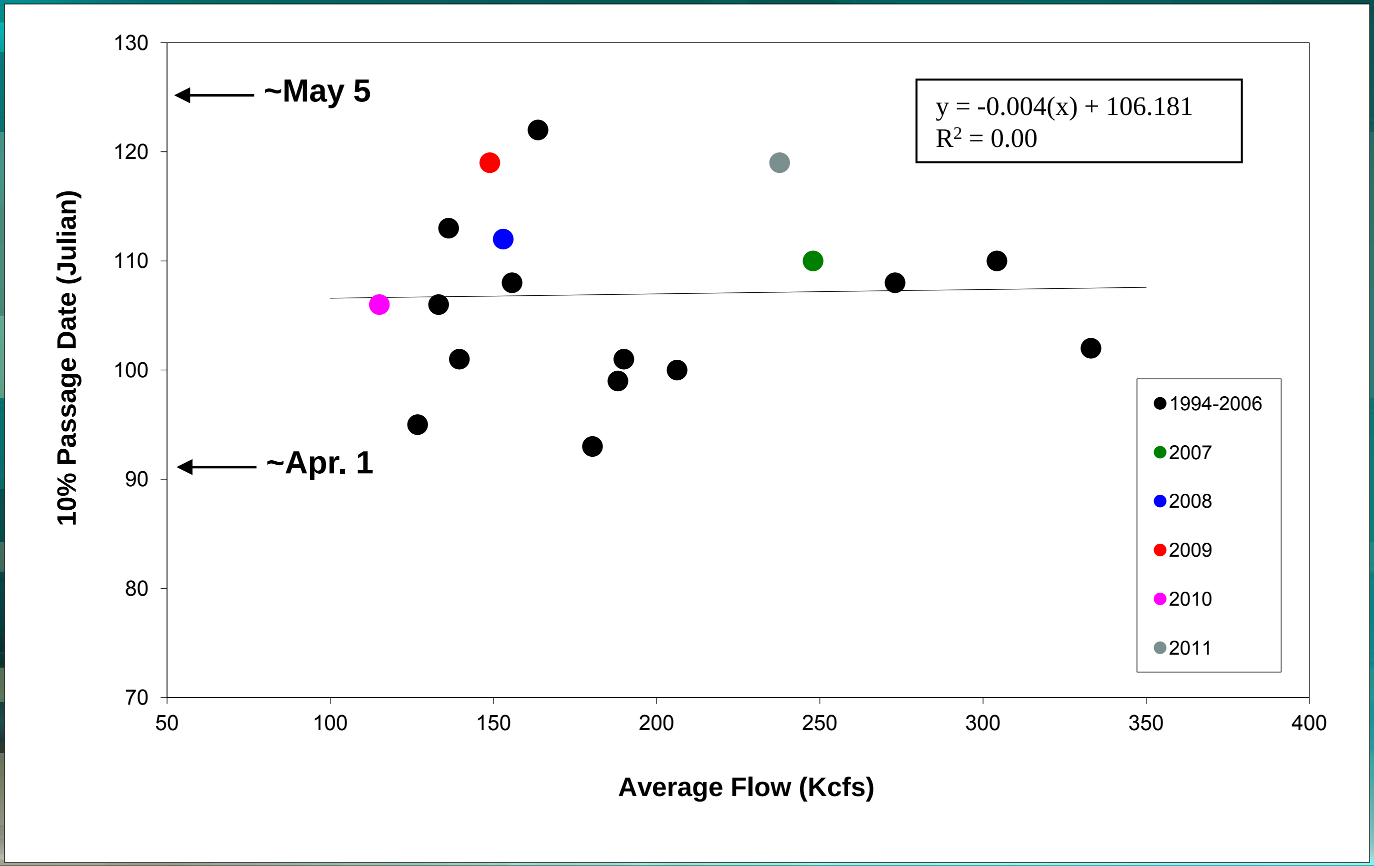
Adult + Jack Timing and Temperature

- **Significant relationship between average temperature (Mar 15-Apr 1) and 10% Passage Date (p = 0.001)**
- **Later 10% passage dates were associated with cooler temperatures**



Adult + Jack Timing and Flow

- **No significant relationship between average flow (Mar 15-Apr 1) and 10% Passage Date (p = 0.909)**

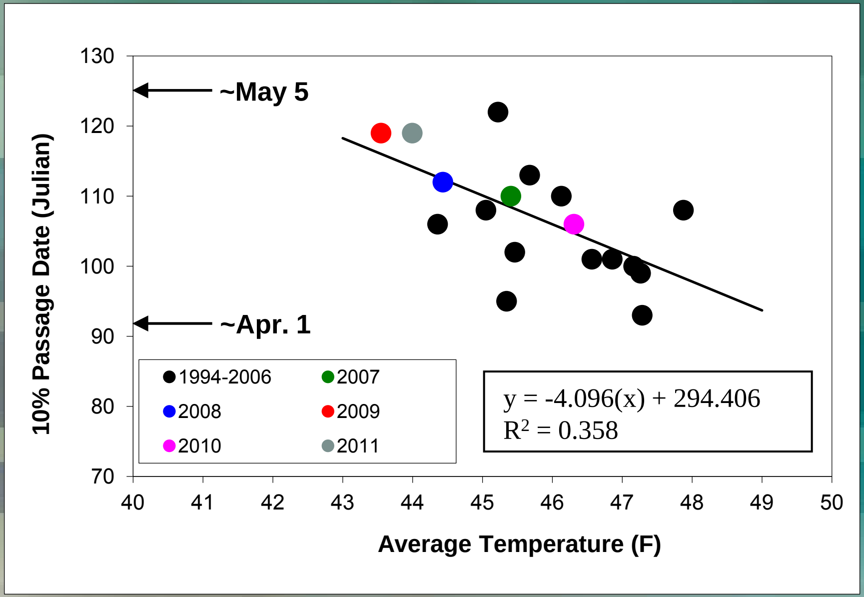


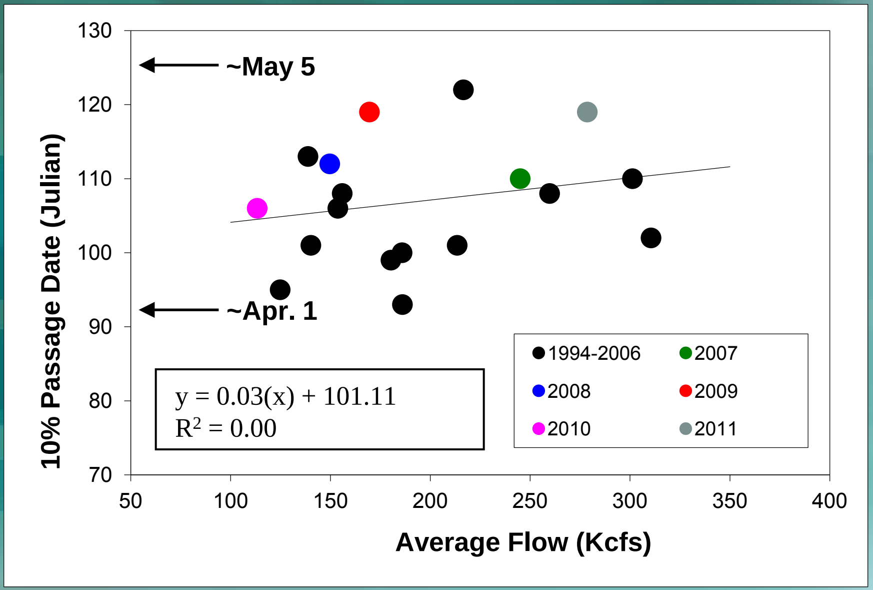
Summary

- Based on the years we used to describe recent years (2000-2011), timing of spring Chinook adults and jacks is later than previous years (1977-1999)
  - 4-6 days for spring Chinook adults
- Arrival of spring Chinook jacks usually later than adults
- Temperature seems to have an effect on timing of spring Chinook adults at BON
  - Cooler temperatures associated with delayed passage timing
- Flow does not have an effect on timing of spring Chinook adults at BON

Adult + Jack Timing and Environmental Variables

- In past years, WDFW has asked the FPC to do same analyses but use period of Mar. 15-Apr. 15 for estimating environmental variables
- Same results as with Mar. 15-Apr. 1 period
    - Significant relationship between average temperature and 10% passage date (p = 0.005)
    - No significant relationship between average flow and 10% passage date (p = 0.382)





RECLAMATION
Managing Water in the West

Upper Snake Flow Augmentation 2011

U.S. Department of the Interior
Bureau of Reclamation

KEY CONCEPTS

- **Provide up to 487 kaf of extra water above Brownlee**

- **Provided during the April to August period**

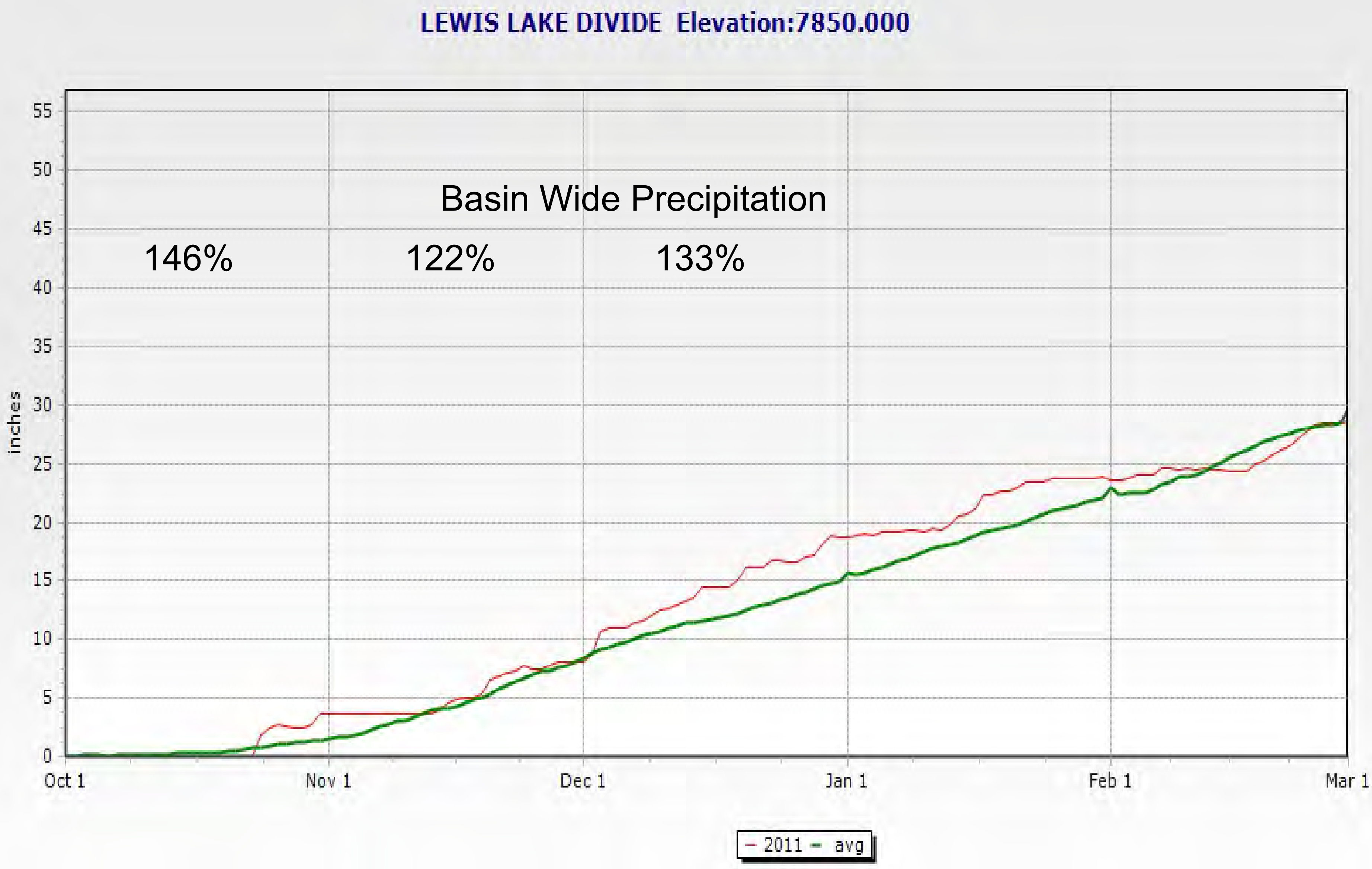
- **Attempt to shift water from August to earlier periods**

- **Must work within State water law and the Nez Perce Agreement**

- **Comes from a combination of Reclamation uncontracted storage, rentals from irrigators, and natural flow water rights**

RECLAMATION

RECLAMATION


LEWIS LAKE DIVIDE Elevation:7850.000
Basin Wide Precipitation
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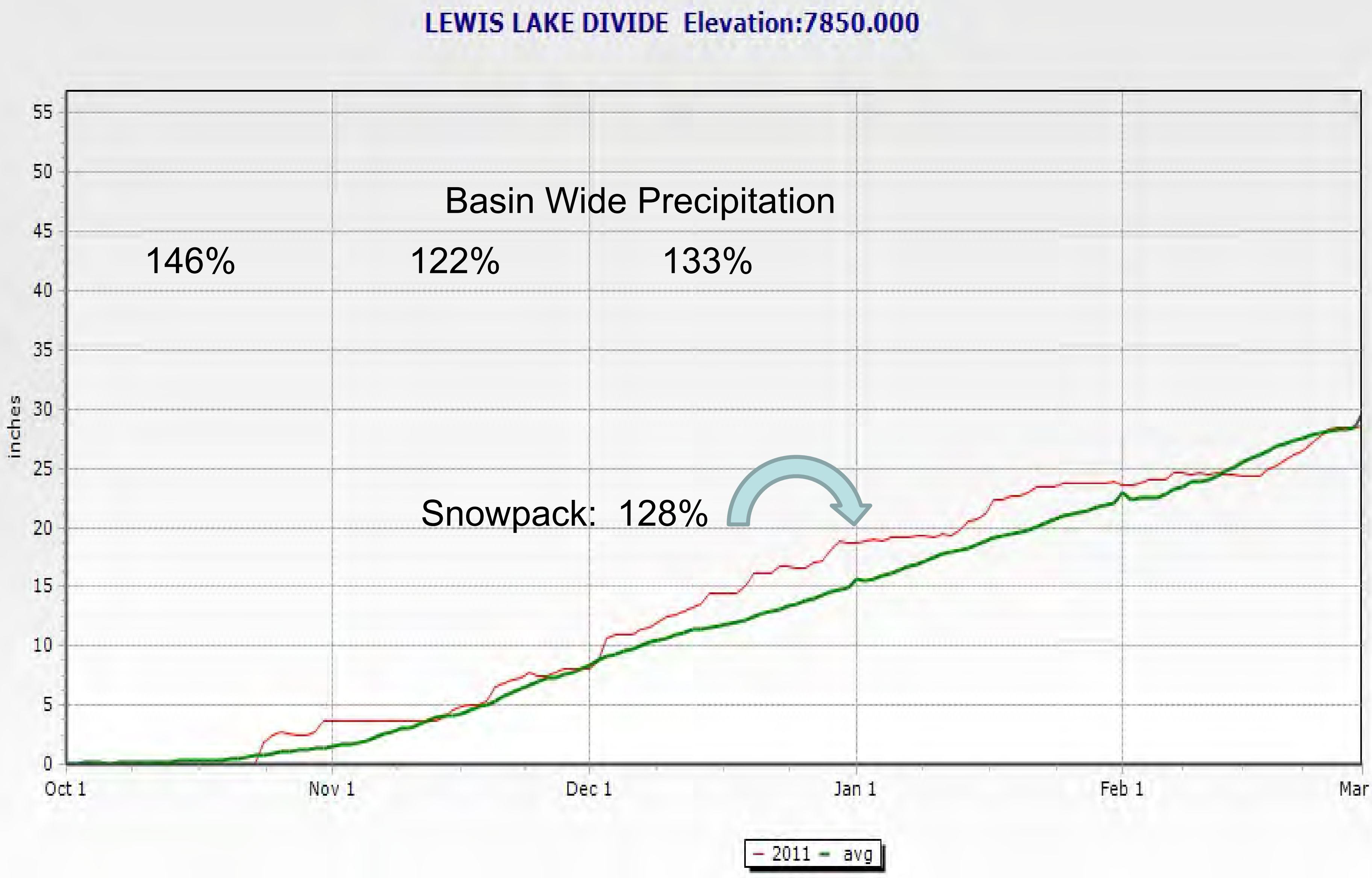

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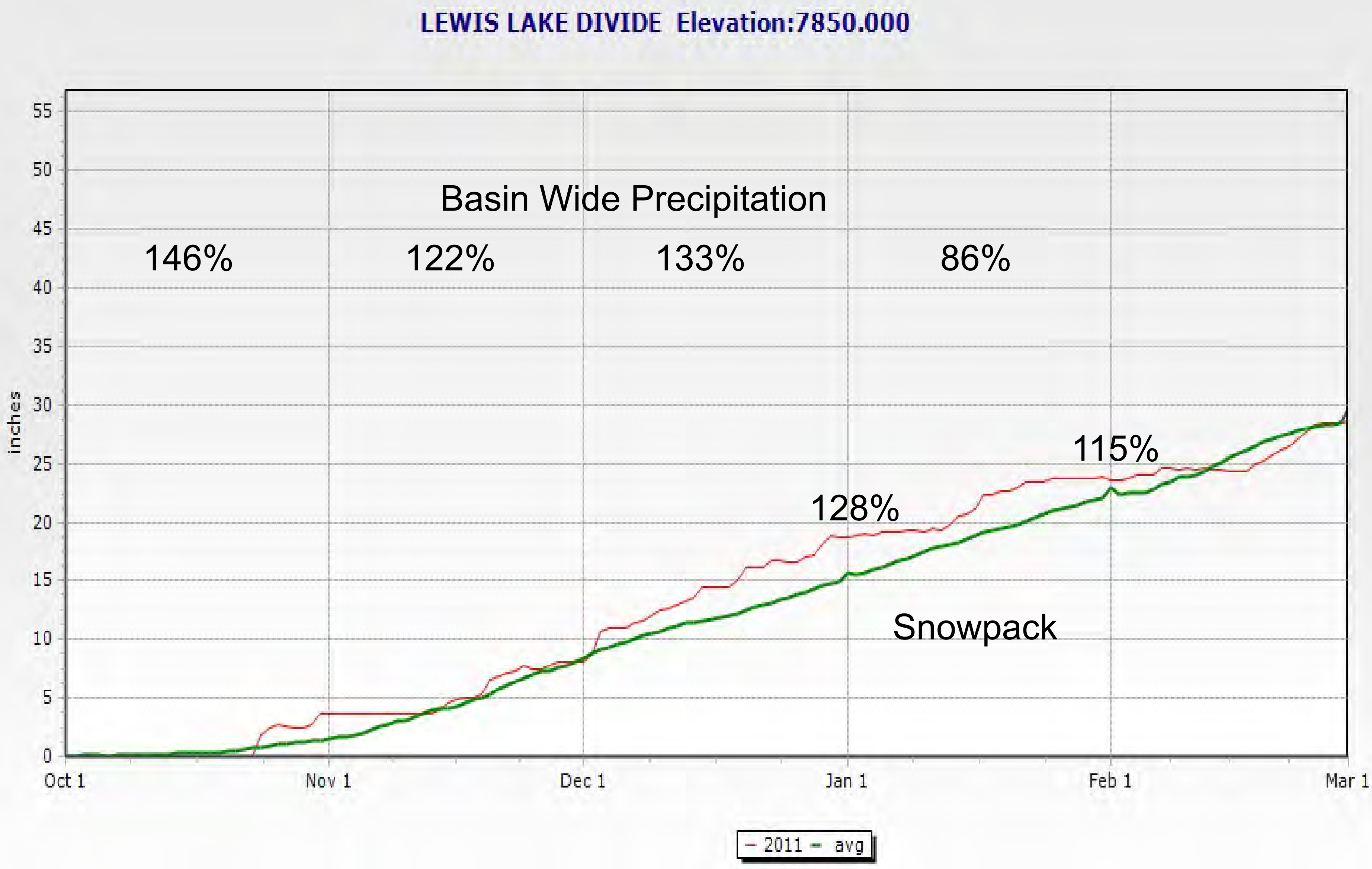

LEWIS LAKE DIVIDE Elevation:7850.000
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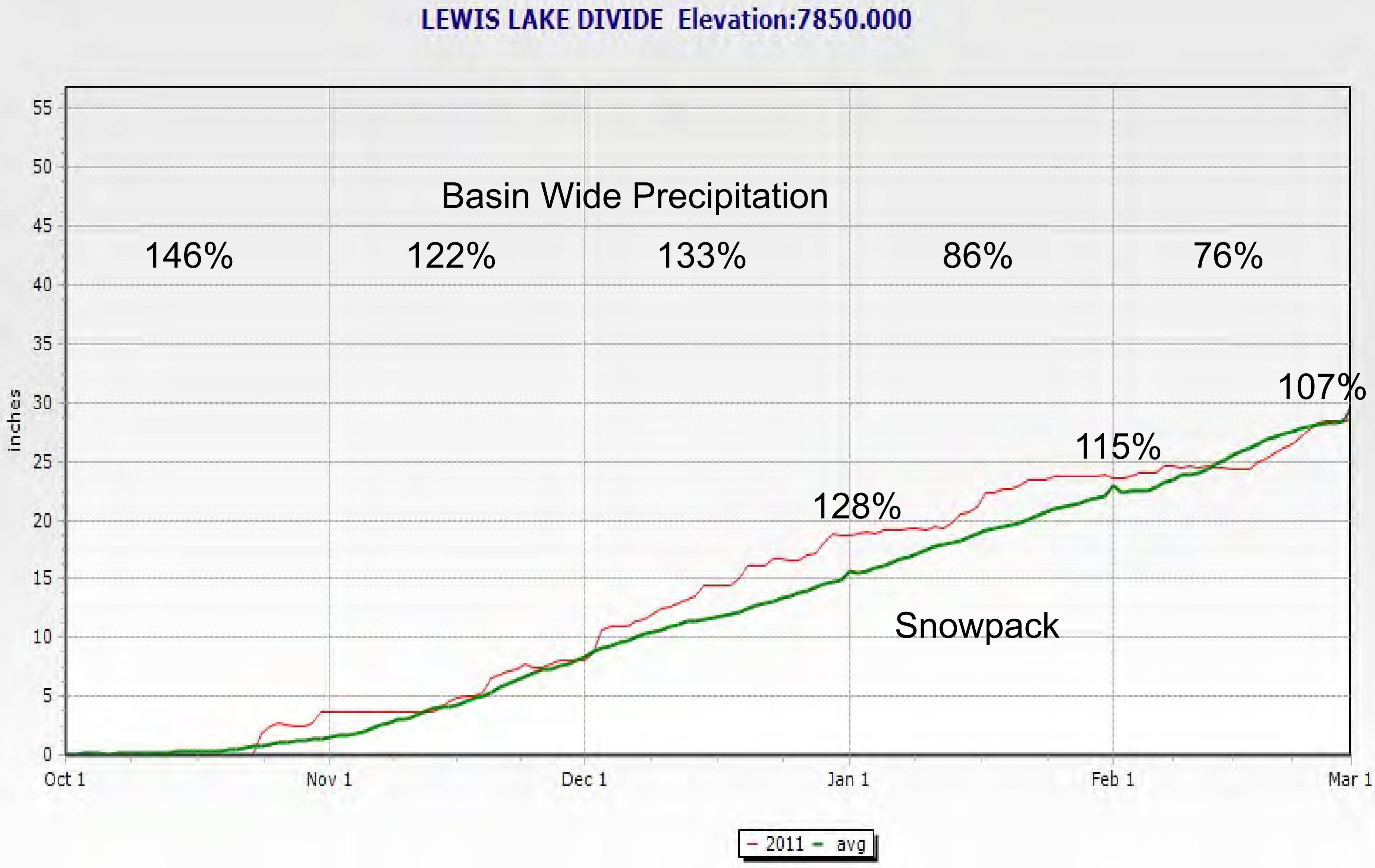

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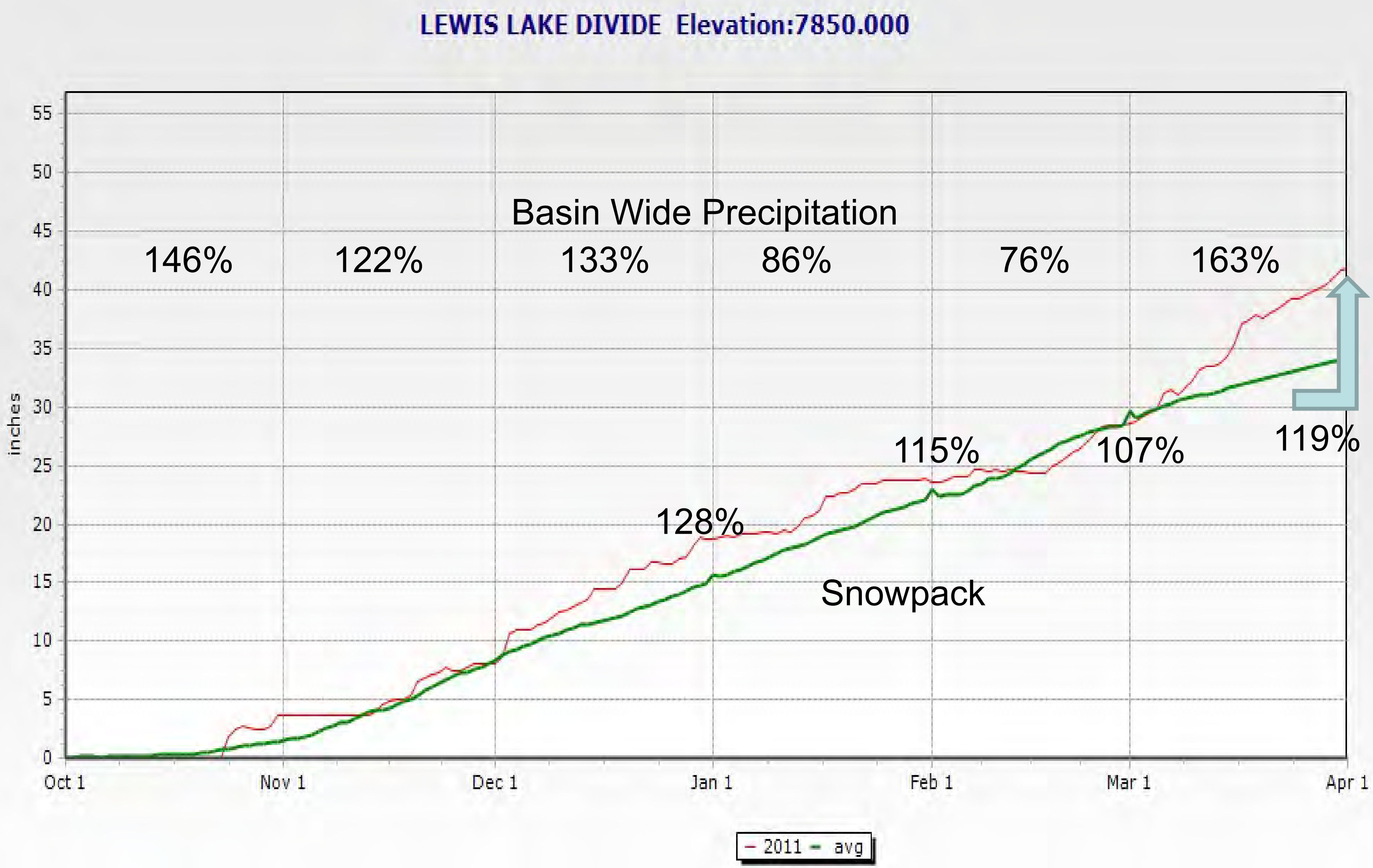
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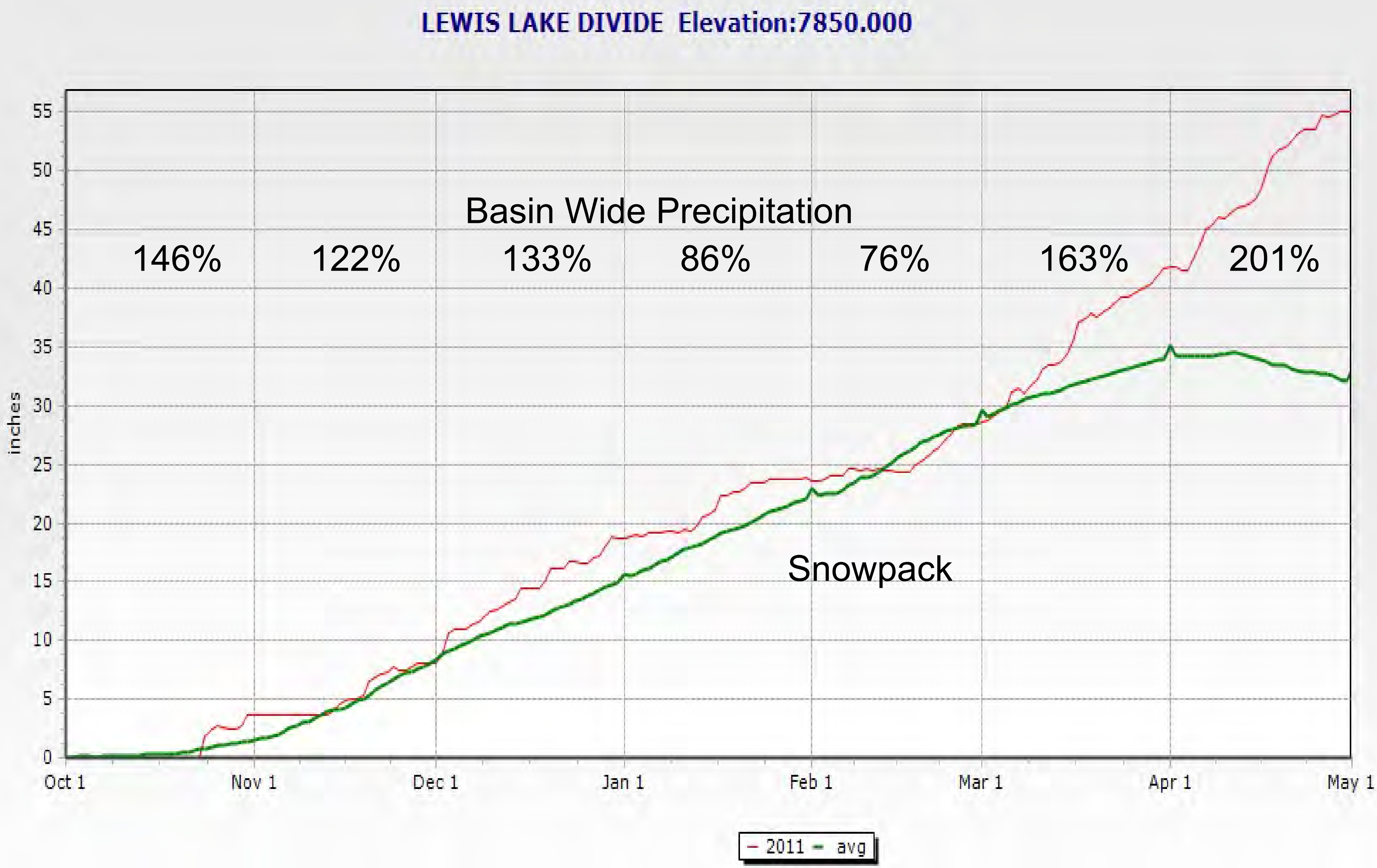

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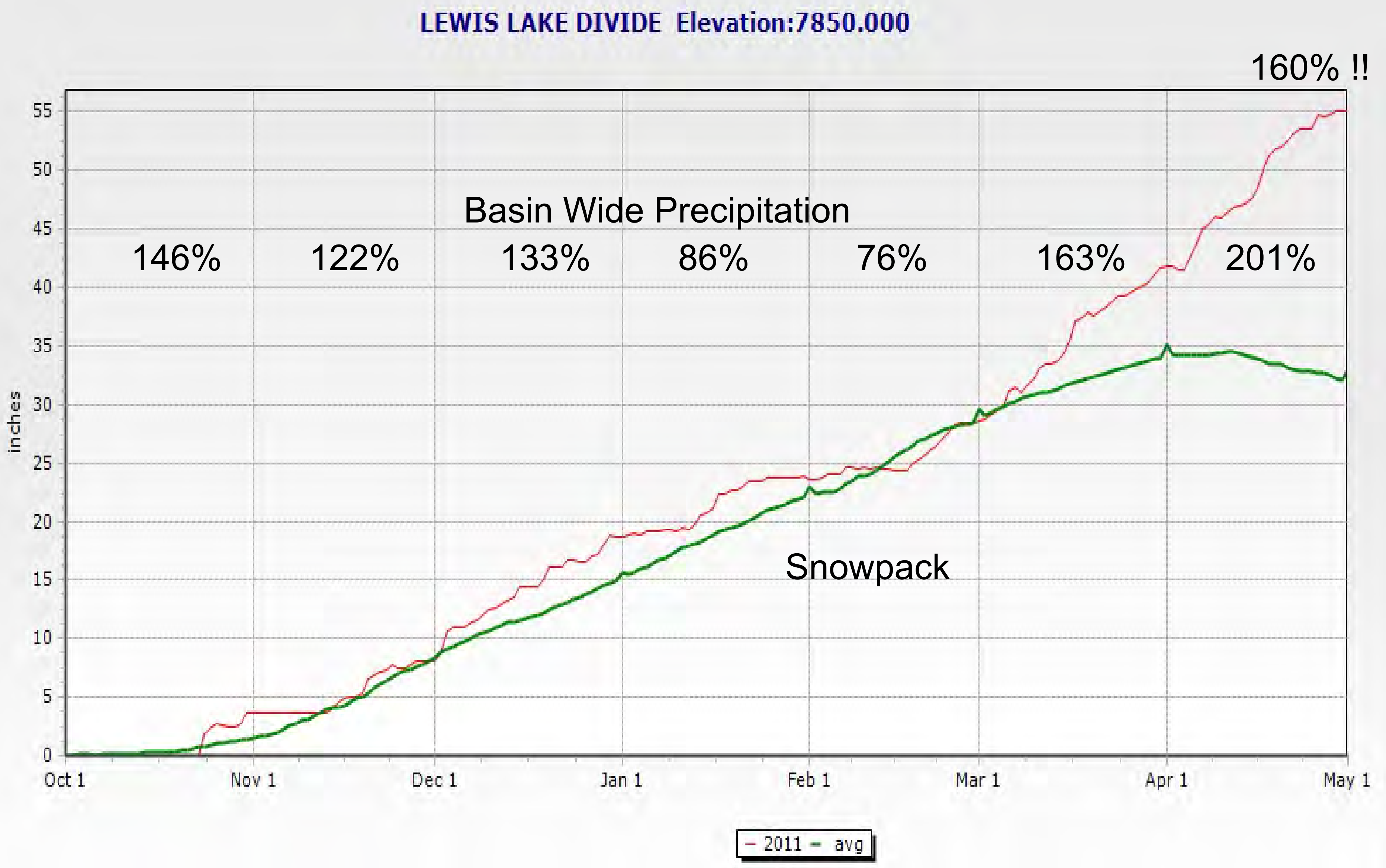

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Basin Wide Precipitation
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2011
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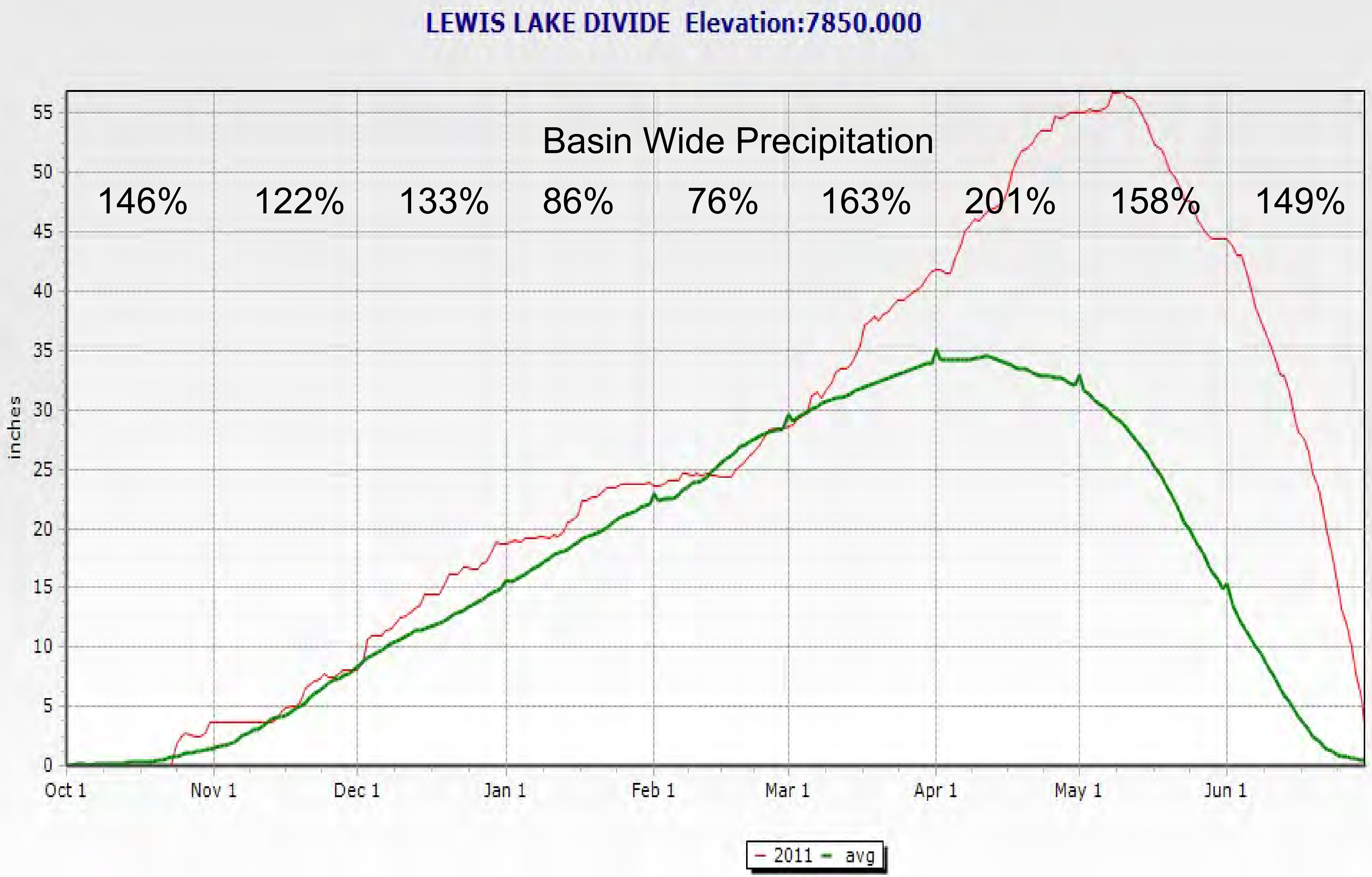


RECLAMATION

RECLAMATION

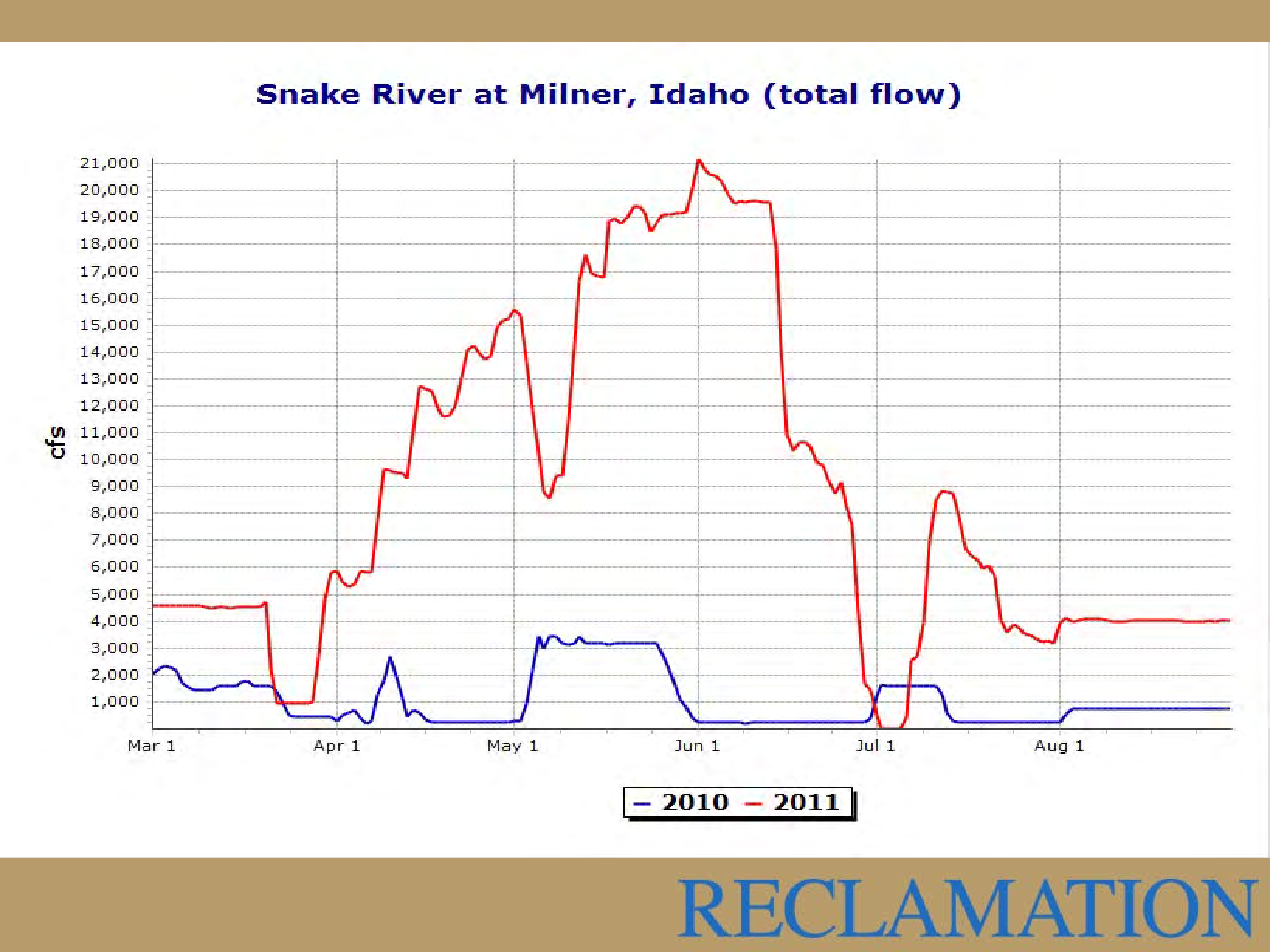
2011 Highlights

- Unprecedented late runoff pattern
- Significant flood control releases April through July
- Highest June-July runoff on record above Milner
- Flood control forced late start to augmentation releases

RECLAMATION

Snake River at Milner, Idaho (total flow)

RECLAMATION


Snake River at Milner, Idaho (total flow)
21,000
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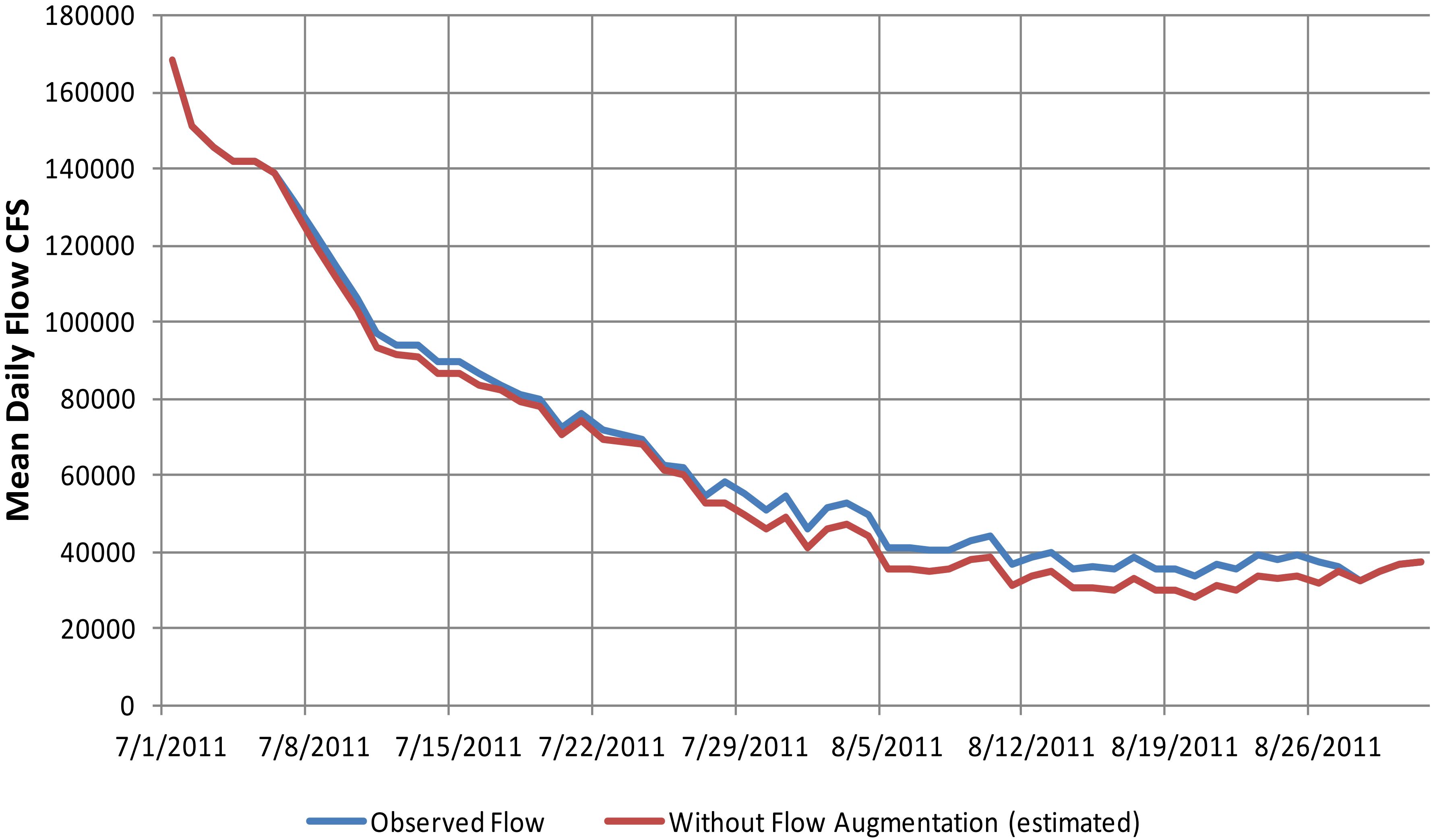
3,000
2,000
1,000
cfs
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
2010
2011
RECLAMATION

System and Source		
Upper Snake		
WD01 rentals	**185000**	
Reclamation Space	**22500**	**Released Jul. 28 – Aug. 26**
Natural Flows		
Idaho	**60000**	
Skyline	**17649**	
Payette		
Reclamation Space	**95000**	
WD65 rentals	**65000**	**Released Jul. 7 – Aug. 27**
Boise		
Lucky Peak	**37551**	
WD63 rentals	**4300**	**Released Jul. 7 – Jul. 19**
Total	**487000**	

RECLAMATION

Snake River at Lower Granite



RECLAMATION

Technical Management Team 2011 Year-End Review

Presented by
Scott English
USACE, Water Management Division

December 7, 2011

Water Quality Overview

- Total Dissolved Gas
- 7Q10 Flows
- Spill Priority List
- Water Temperature

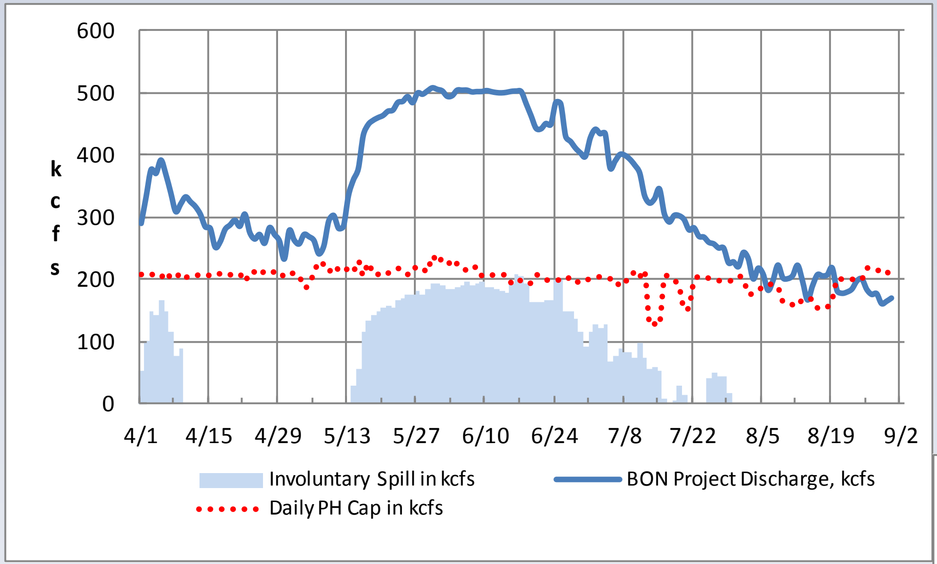
Comparison of TDG Instances

7 Year Average	2011	2010	2009	2008	2007	2006	2005	TYPE	DEFINITION
270	637	166	191	421	5	441	29	**1**	TDG levels exceed the TDG standard due to exceeding powerhouse capacity at run-of-river projects resulting in spill above the BiOp fish spill levels.
14	52	1	1	1	1	45	0	**1a**	Planned and unplanned outages of hydro power equipment including generation unit, intertie line, or powerhouse outages.
2	0	0	1	1	0	13	0	**2**	TDG exceedances due to the operation or mechanical failure of non-generating equipment.
14	64	7	17	11	0	1	1	**2a**	Malfunctioning FMS gauge, resulting in fewer TDG or temperature measurements for setting TDG spill caps.
69	39	60	98	81	93	75	39	**3**	TDG exceedances due to uncertainties when using best professional judgment, SYSTDG model and forecasts.
370	**792**	**234**	**308**	**515**	**99**	**575**	**69**		**Totals**

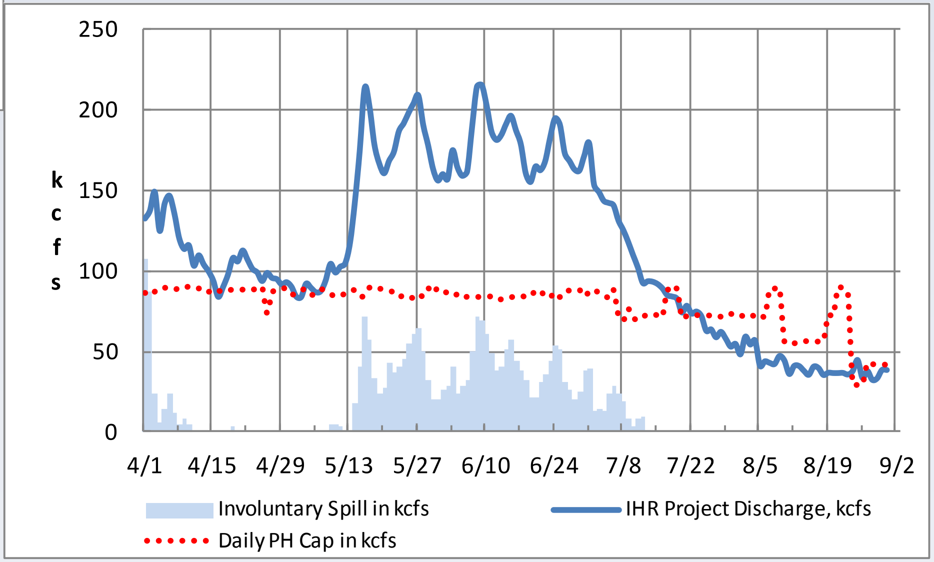
The 2011 TDG instances were primarily Type 1 associated with high flows.

Many TDG Instances were due to involuntary spill conditions

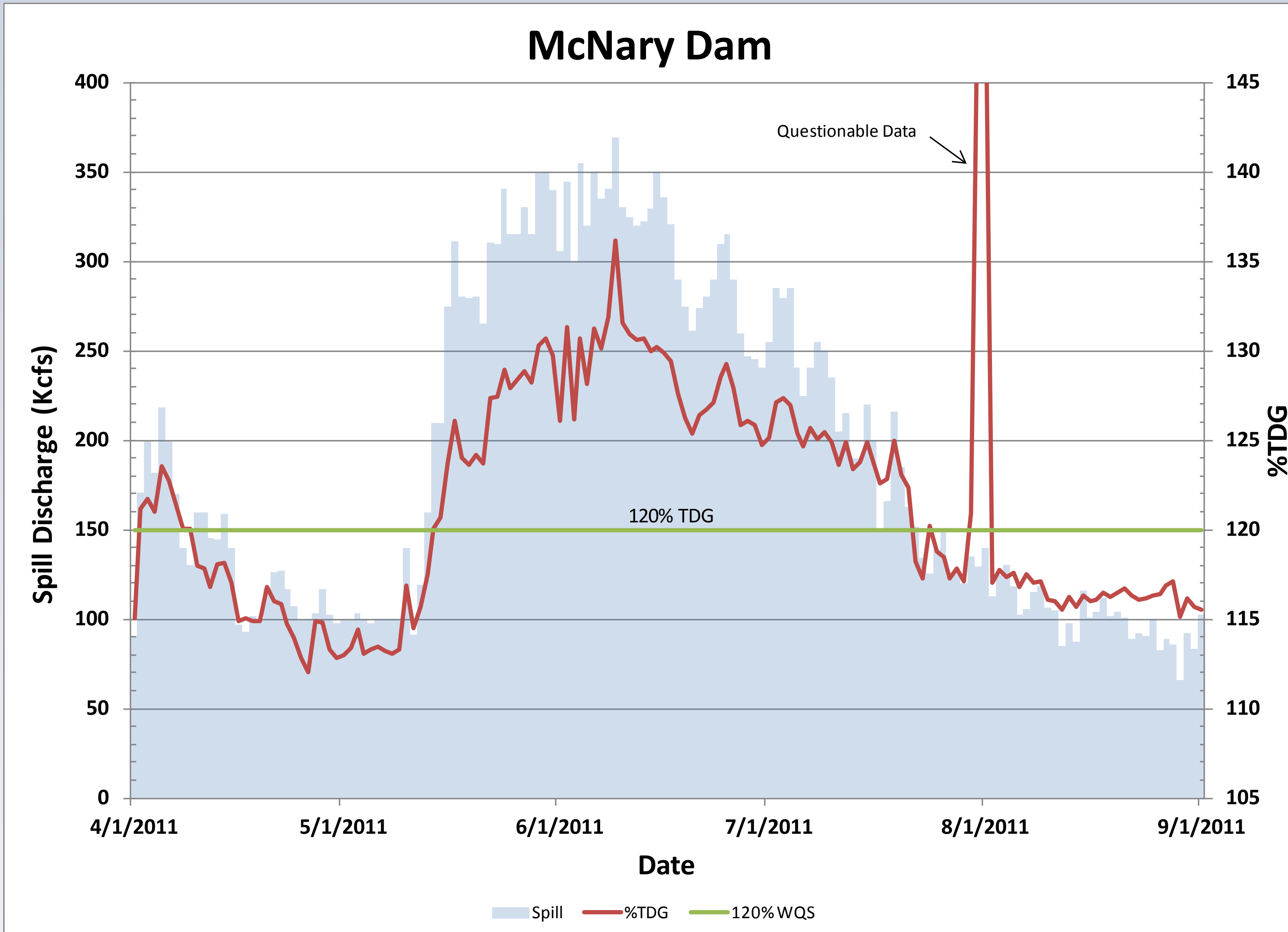
Bonneville Dam



Ice Harbor Dam



Comparing High Spill Discharge with High %TDG



7Q10 Flows

- 7Q10 Flow is the average peak annual flow for seven consecutive days that has a recurrence interval of ten years, and they are established as a threshold for each project in the TDG TMDLs.

- Flow > 7Q10 the ODEQ, WDOE & Colville TDG WQS do not apply.

- 7Q10 flows were exceeded frequently on the mainstem Columbia in 2011.

7Q10 Flows by project

Date	CHJ	MCN	JDA	TDA	BON	LWG	LGS	LMN	IHR
7Q10 Flow Criteria (Kcfs)	**222**	**447**	**454**	**461**	**467**	**214**	**214**	**214**	**214**
5/15/2011	173	386	384	367	377	175	168	174	175
5/16/2011	143	423	439	424	430	203	195	210	214
5/17/2011	160	438	455	442	448	189	183	199	202
5/18/2011	195	422	458	445	454	173	164	173	179
5/19/2011	205	422	464	450	459	159	153	161	167
5/20/2011	218	416	467	451	462	159	147	155	161
5/21/2011	238	443	474	461	469	163	156	162	169
5/22/2011	241	452	477	457	471	171	163	170	174
5/23/2011	216	480	494	472	483	183	173	181	187
5/24/2011	207	473	495	478	485	188	174	189	192
5/25/2011	202	470	491	477	492	196	178	194	198
5/26/2011	212	462	483	462	483	200	183	200	204
5/27/2011	242	482	502	487	498	202	187	207	209
5/28/2011	273	496	508	492	496	182	167	184	191
5/29/2011	274	499	518	497	502	172	159	171	178
5/30/2011	270	481	509	495	507	162	148	158	164
5/31/2011	277	474	512	492	504	157	143	152	156
6/1/2011	259	476	496	487	502	155	143	154	160
6/2/2011	262	468	489	481	493	154	146	152	157
6/3/2011	268	477	498	481	494	170	162	169	175
6/4/2011	273	486	514	498	503	160	153	158	165
6/5/2011	270	478	503	493	503	158	149	155	159
6/6/2011	261	486	505	492	503	162	152	156	162
6/7/2011	233	494	496	482	500	188	177	185	189
6/8/2011	223	510	506	492	500	211	201	215	215
6/9/2011	201	501	506	494	500	206	195	211	216
6/10/2011	223	486	500	495	502	197	189	199	203
6/11/2011	239	484	499	491	500	183	173	180	187
6/12/2011	237	482	489	478	499	179	169	177	182
6/13/2011	220	484	492	482	498	183	173	178	185
6/14/2011	248	495	501	490	499	189	180	189	192
6/15/2011	243	501	507	490	501	189	181	190	197
6/16/2011	242	496	505	493	501	184	174	181	188
6/17/2011	238	478	500	488	500	173	166	173	179
6/18/2011	242	456	477	463	481	159	149	154	161
6/19/2011	234	442	452	440	461	154	145	150	155
6/20/2011	223	437	443	427	441	162	154	159	165
6/21/2011	222	431	442	428	441	159	152	156	163
6/22/2011	221	446	455	441	449	167	155	162	168
6/23/2011	232	453	448	433	448	182	170	178	183
6/24/2011	206	494	497	481	483	192	179	190	195
6/25/2011	207	425	463	452	481	183	173	183	191
6/26/2011	207	434	440	423	429	173	159	167	173
6/27/2011	209	413	416	396	420	164	154	162	168
6/28/2011	205	402	409	394	410	159	148	157	163
6/29/2011	200	401	395	381	402	162	152	158	163
6/30/2011	207	405	405	389	396	172	160	168	172
7/1/2011	213	430	436	418	426	168	161	172	180
7/2/2011	222	433	442	428	440	151	143	148	154
7/3/2011	207	422	421	406	433	145	137	142	149
7/4/2011	197	407	420	409	433	142	134	138	144
7/5/2011	219	381	376	359	378	142	133	137	142
7/6/2011	226	387	384	370	389	139	132	136	141
7/7/2011	224	400	398	386	399	132	124	126	132
7/8/2011	219	395	397	376	398	123	118	120	126
7/9/2011	206	386	388	376	392	115	110	112	118
Total Days	**31**	**30**	**36**	**29**	**31**	**0**	**0**	**1**	**2**

Days when the flows exceeded the 7Q10 threshold and the water quality standards do not apply.

Fixed Monitoring Stations	TDG Instances not applicable
Lower Granite Forebay	0
Lower Granite Tailwater	0
Little Goose Forebay	0
Little Goose Tailwater	0
Lower Monumental Forebay	1
Lower Monumental Tailwater	1
Ice Harbor Forebay	2
Ice Harbor Tailwater	2
Chief Joseph Forebay	29
Chief Joseph Tailwater	28
McNary Forebay	29
McNary Tailwater	30
John Day Forebay	33
John Day Tailwater	36
The Dalles Forebay	29
The Dalles Tailwater	29
Bonneville Forebay	31
Bonneville Tailwater	31
Camas/Washougal	31
Total Number of Exempted Instances	**342**

Many of the TDG Instances were related to damaged monitoring equipment at the Fixed Monitoring Stations.

Bonneville Tailwater FMS, two-days before failure due to high flows

After failure

Repair of the Bonneville Tailwater FMS

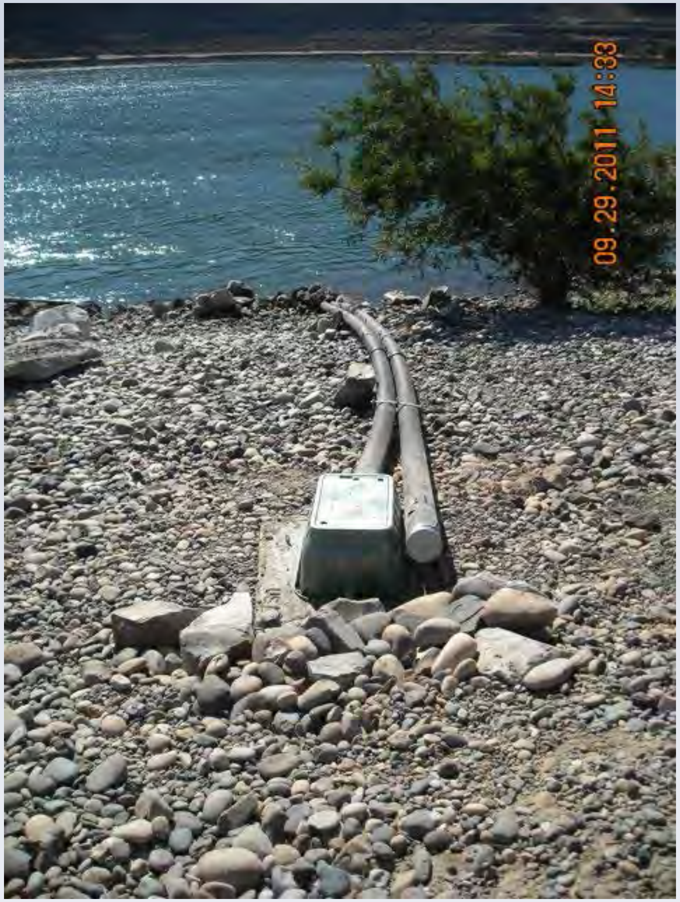
Instrument conduit pair extending into tailrace at CCIW

Replaced FMS at 20-feet higher elevation on a concrete foundation. New electronics box, dual HDPE conduits and new Communications cables to sensors.

Anchors attached to instrument conduits at CCIW

Repair of John Day Dam Tailwater FMS

New concrete foundation and post for instrument electronics higher on bank. New electronics box, dual HDPE conduits, and communications cables.



Spill Priority List

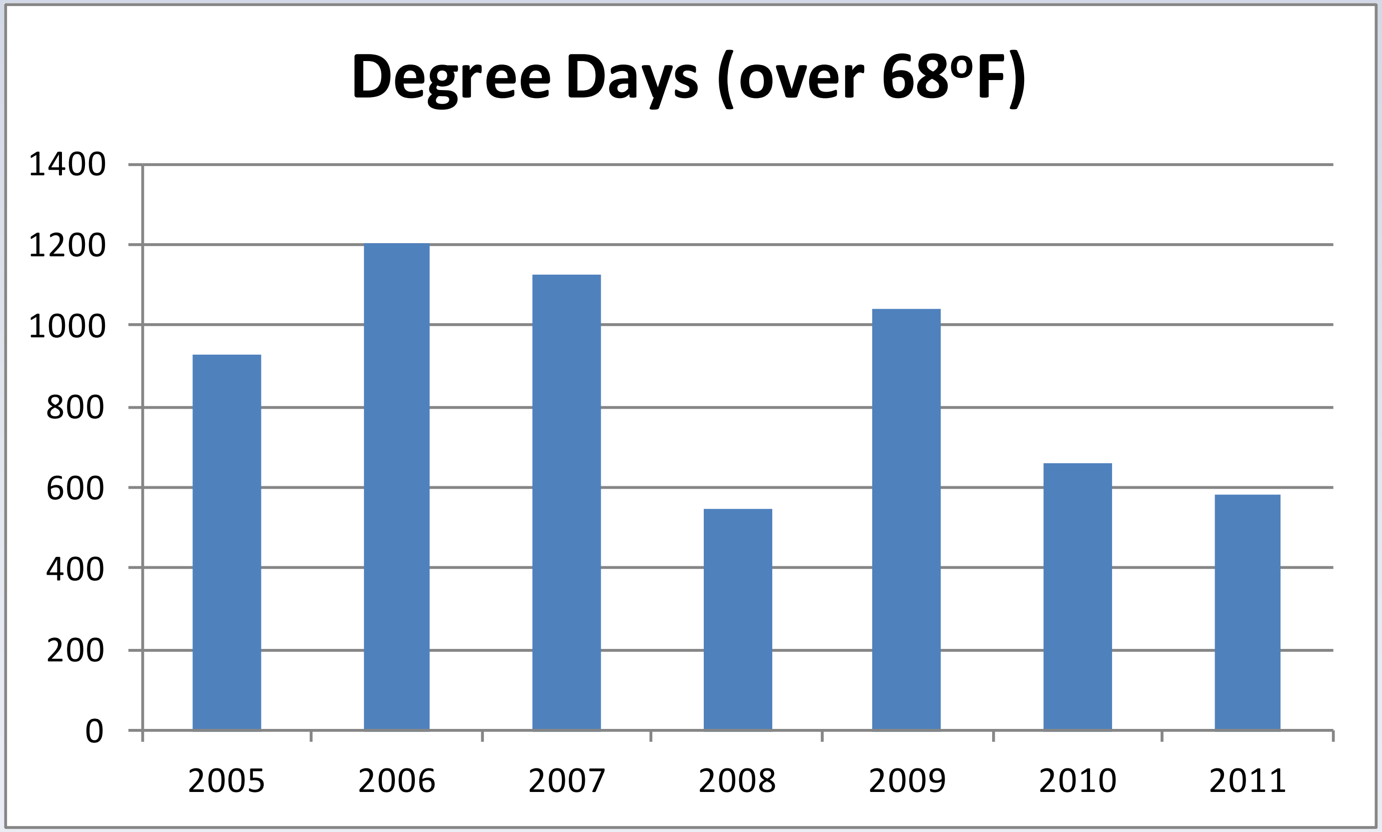
- The Corps revised the Spill Priority List in 2011.

- The modification of the spill priority list allowed the Corps to better manage TDG on a system-wide basis in 2011.

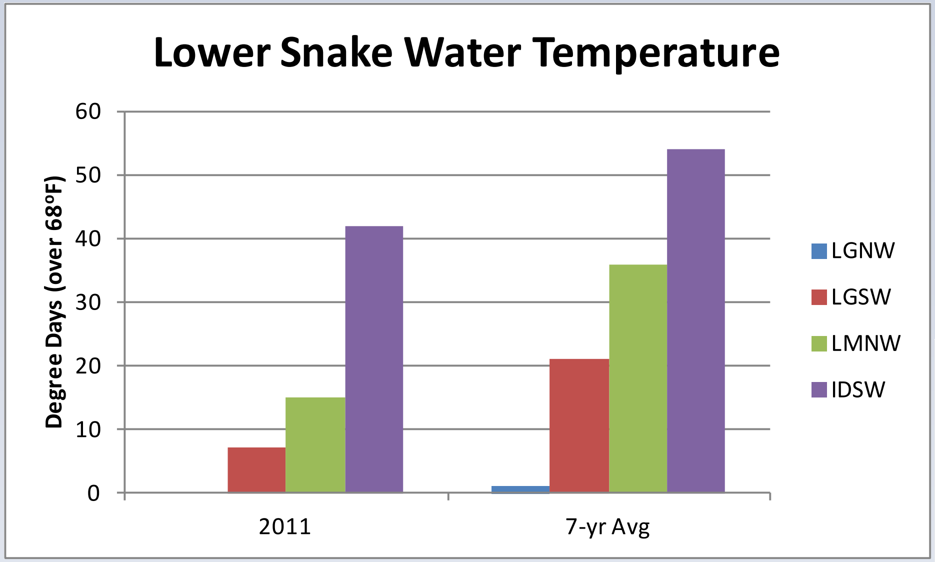
- The realized benefit in 2011 was to minimize areas of high TDG concentration in the Columbia Basin.

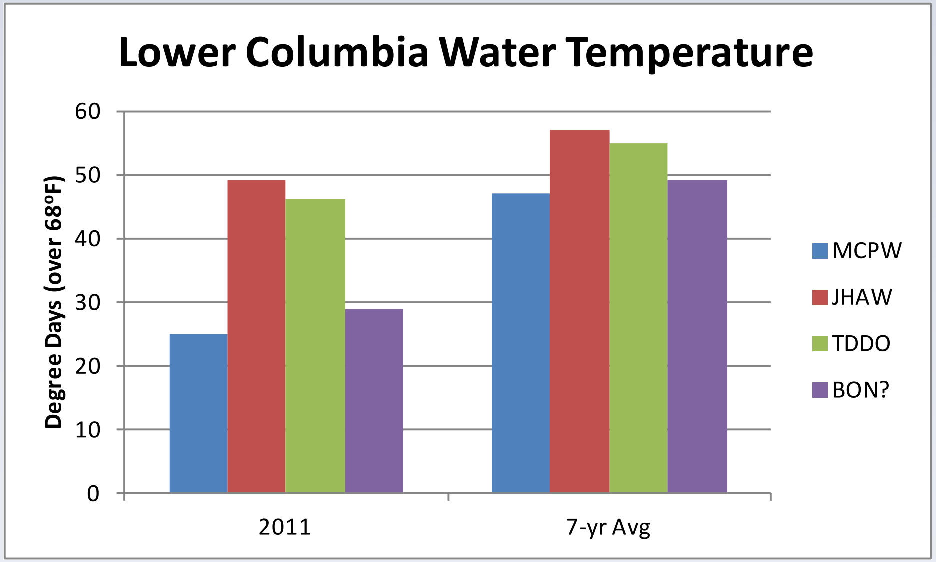
Number of days with 24-hr average over 68°F

Columbia Basin



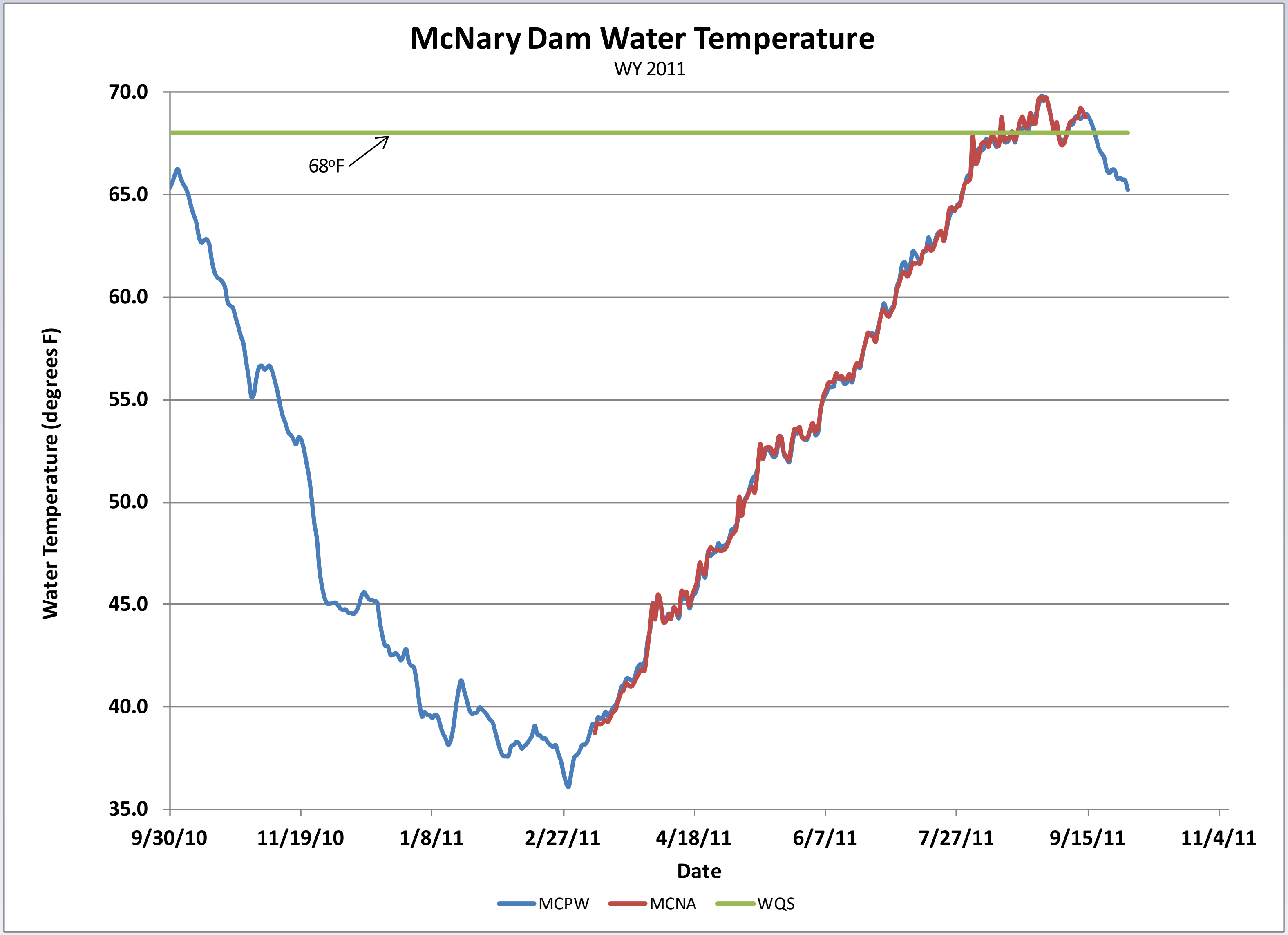
Number of days with 24-hr average over 68ºF





Comparing 2011 with 7-year average.

McNary Dam Water Temperature



QUESTIONS?

Libby Operations Review for 2011

Joel Fenolio
USACE
Seattle District

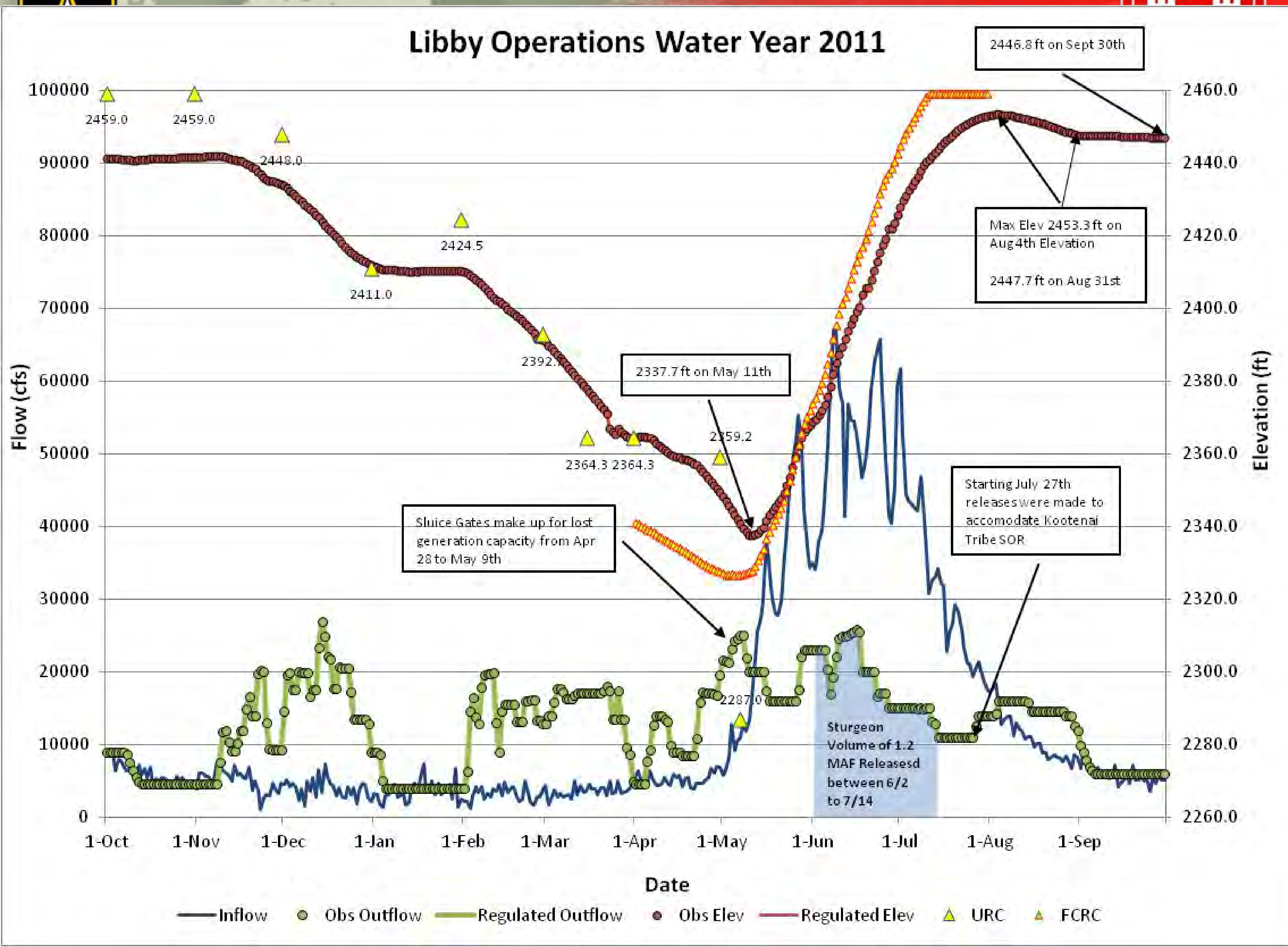
Libby Dam Forecasts by Month

Month Forecast Issued	Apr-Aug Volume Forecast (MAF)	Flood Control Target (ft)
Nov	5775	2448
Dec	6262	2411
Jan	5610	2424.5
Feb	6656	2392.7
Mar	7111	2364.0
Apr	7191	2359.2
May	8165	2287*
June	8099	2287*
Actual	7714	

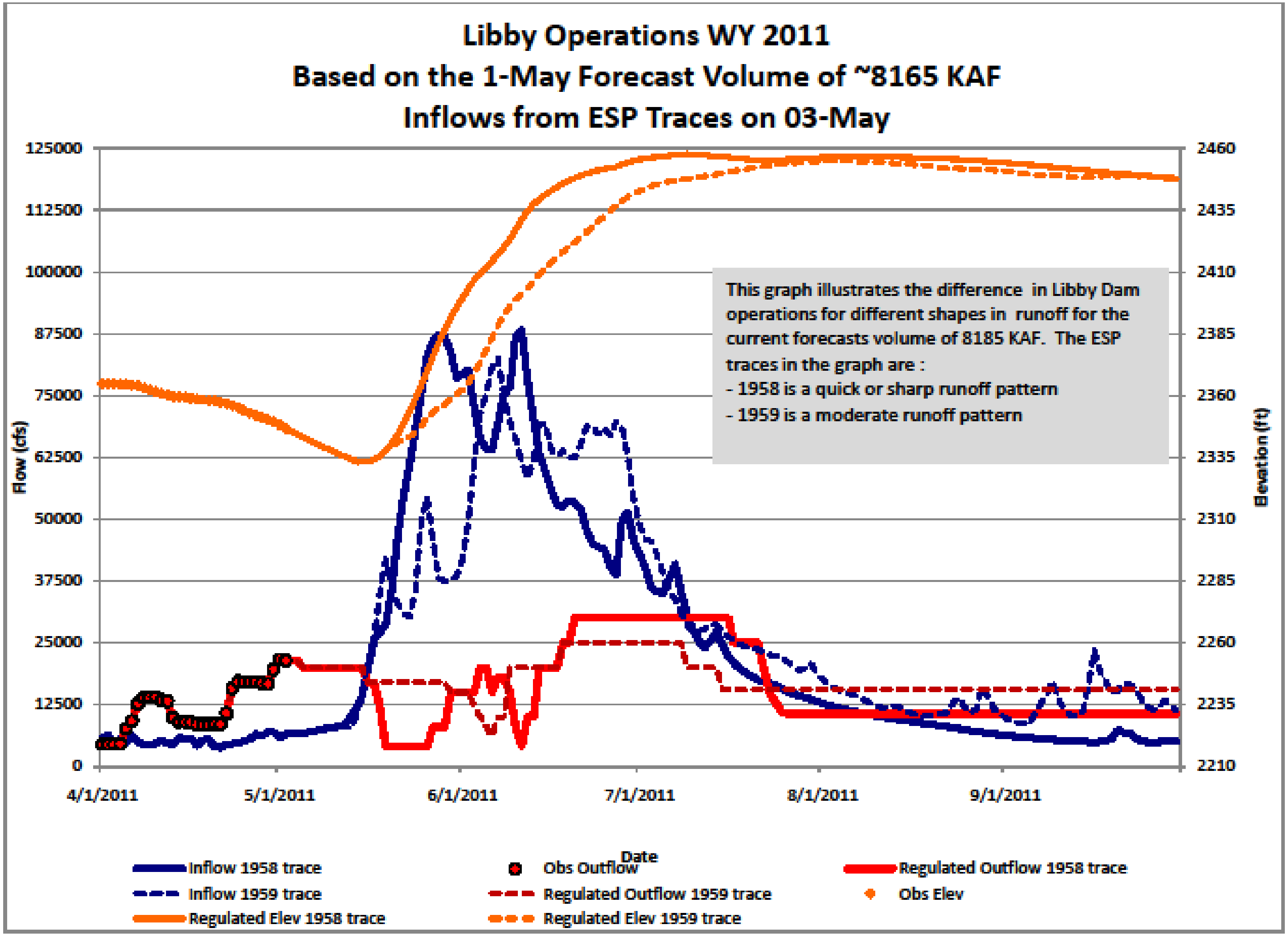
*Apr-Jun once the start of refill is declared the target is used in the VarQ calculation and not an official target. 2287 ft is also the bottom of the active pool

Flood Operations

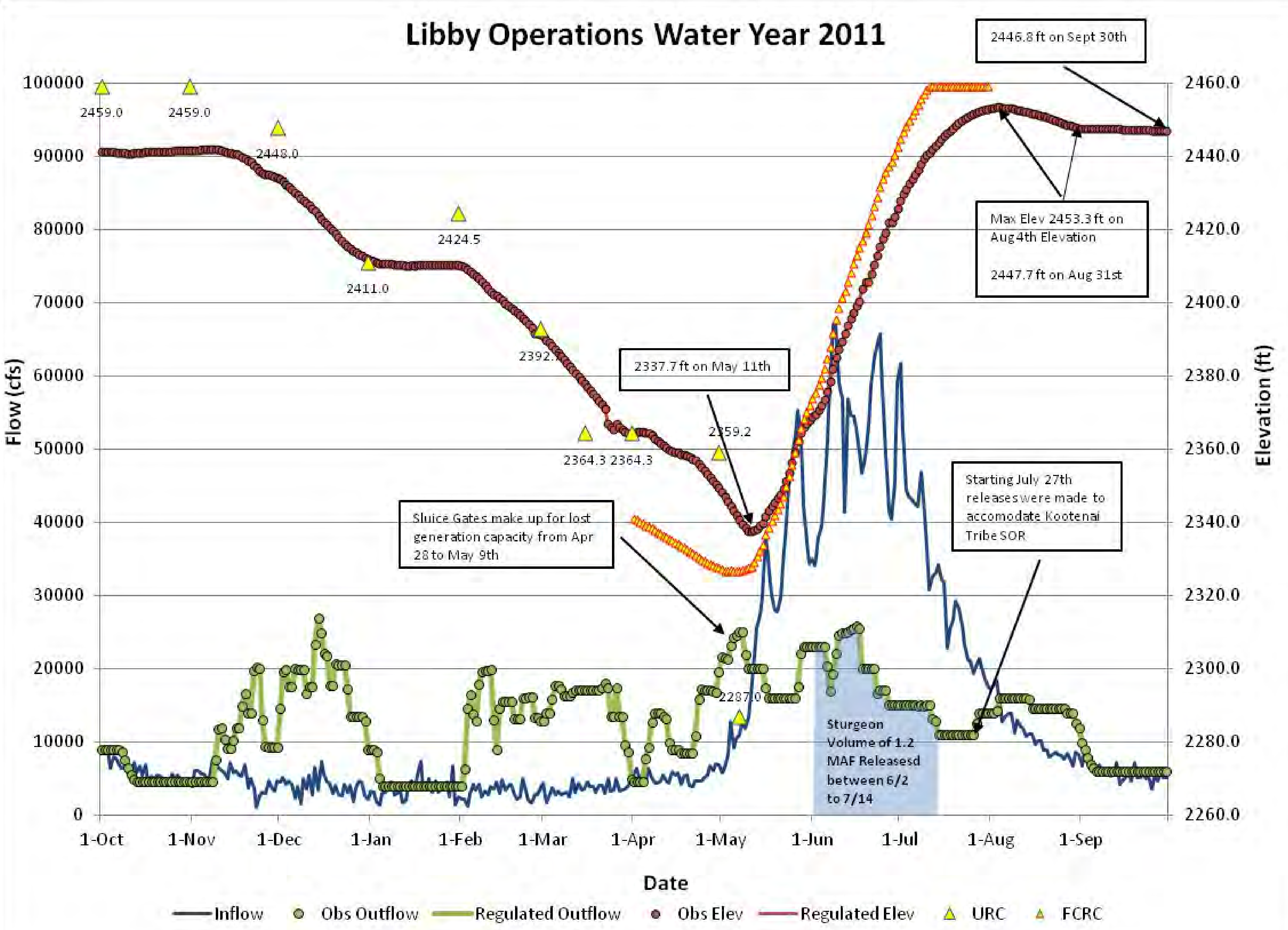
- Flood Ops were driven by:
  - 140% of average snowpack above the dam
  - 180% of average snowpack below the dam
  - The cold spring was pushing the peak downstream of Libby Dam and the inflow peak together (usually 2 weeks apart)



Libby Operations Water Year 2011
2446.8 ft on Sept 30th
Max Elev 2453.3 ft on Aug 4th Elevation
2447.7 ft on Aug 31st
2337.7 ft on May 11th
Sluice Gates make up for lost generation capacity from Apr 28 to May 9th
Starting July 27th releases were made to accomodate Kootenai Tribe SOR
Sturgeon Volume of 1.2 MAF Releasesd between 6/2 to 7/14
2459.0
2459.0
2448.0
2424.5
2411.0
2364.3
2364.3
2359.2
2287.0
Flow (cfs)
Elevation (ft)
Date
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Inflow
Obs Outflow
Regulated Outflow
Obs Elev
Regulated Elev
URC
FCRC



Libby Operations WY 2011
Based on the 1-May Forecast Volume of ~8165 KAF
Inflows from ESP Traces on 03-May
Flow (cfs)
Elevation (ft)
125000
112500
100000
87500
75000
62500
50000
37500
25000
12500
0
2460
2435
2410
2385
2360
2335
2310
2285
2260
2235
2210
4/1/2011
5/1/2011
6/1/2011
7/1/2011
8/1/2011
9/1/2011
Date
This graph illustrates the difference in Libby Dam operations for different shapes in runoff for the current forecasts volume of 8185 KAF. The ESP traces in the graph are :
- 1958 is a quick or sharp runoff pattern
- 1959 is a moderate runoff pattern
Inflow 1958 trace
Inflow 1959 trace
Regulated Elev 1958 trace
Obs Outflow
Regulated Outflow 1959 trace
Regulated Elev 1959 trace
Regulated Outflow 1958 trace
Obs Elev



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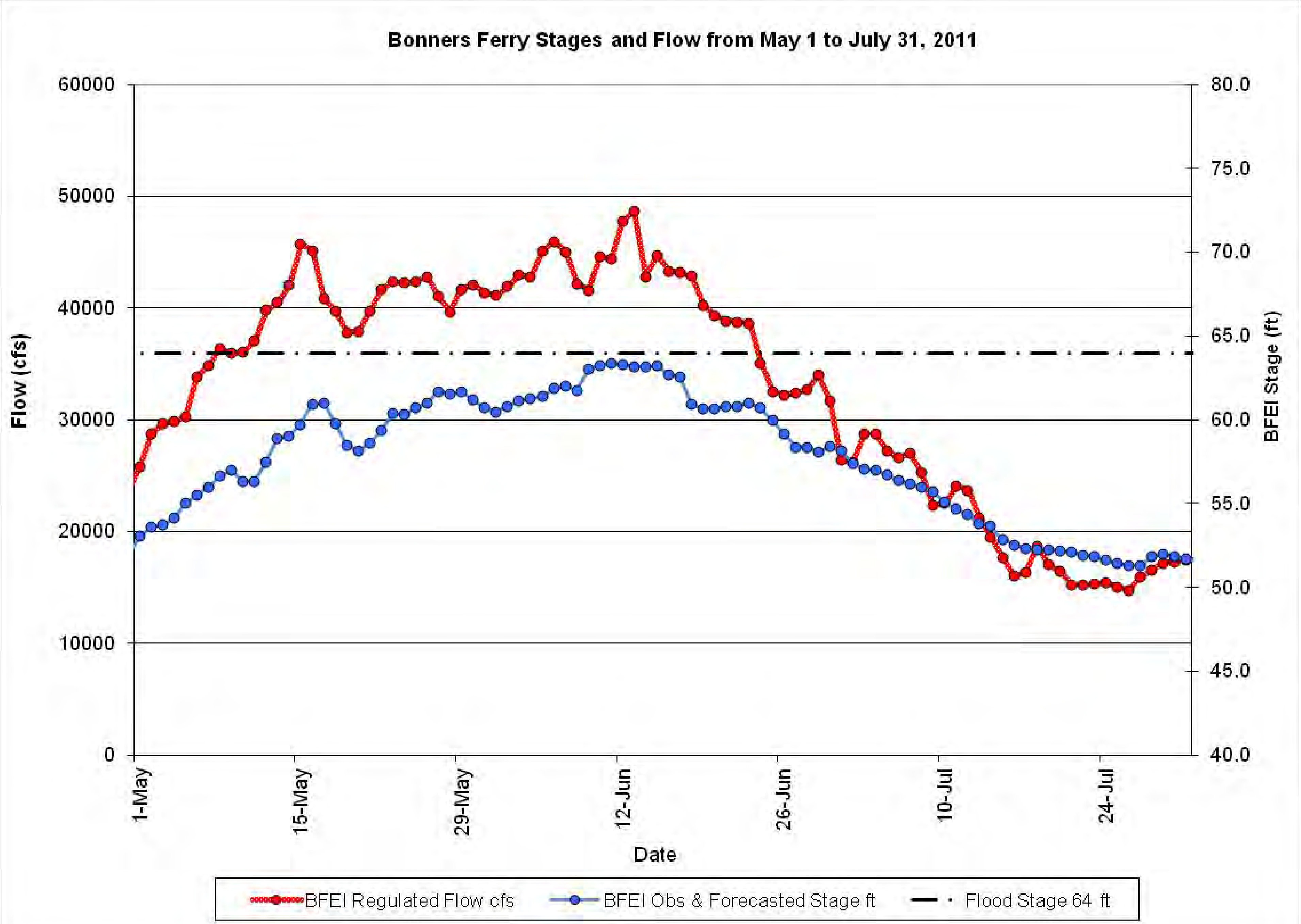
Sturgeon Volume of 1.2 MAF Releasesd between 6/2 to 7/14
2459.0
2459.0
2448.0
2424.5
2411.0
2392.
2364.3
2364.3
2359.2
2287.0
Flow (cfs)
Elevation (ft)
Date
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
2460.0
2440.0
2420.0
2400.0
2380.0
2360.0
2340.0
2320.0
2300.0
2280.0
2260.0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Inflow
Obs Outflow
Regulated Outflow
Obs Elev
Regulated Elev
URC
FCRC

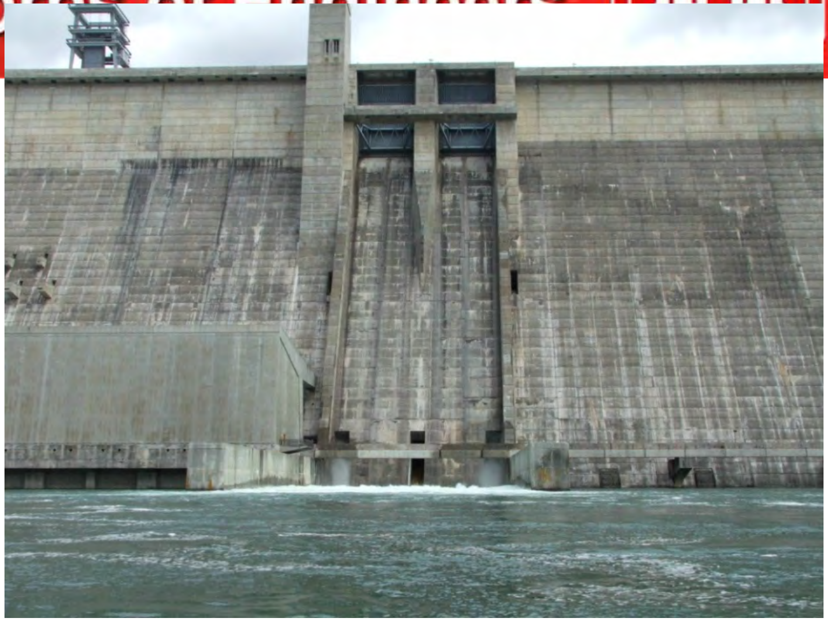


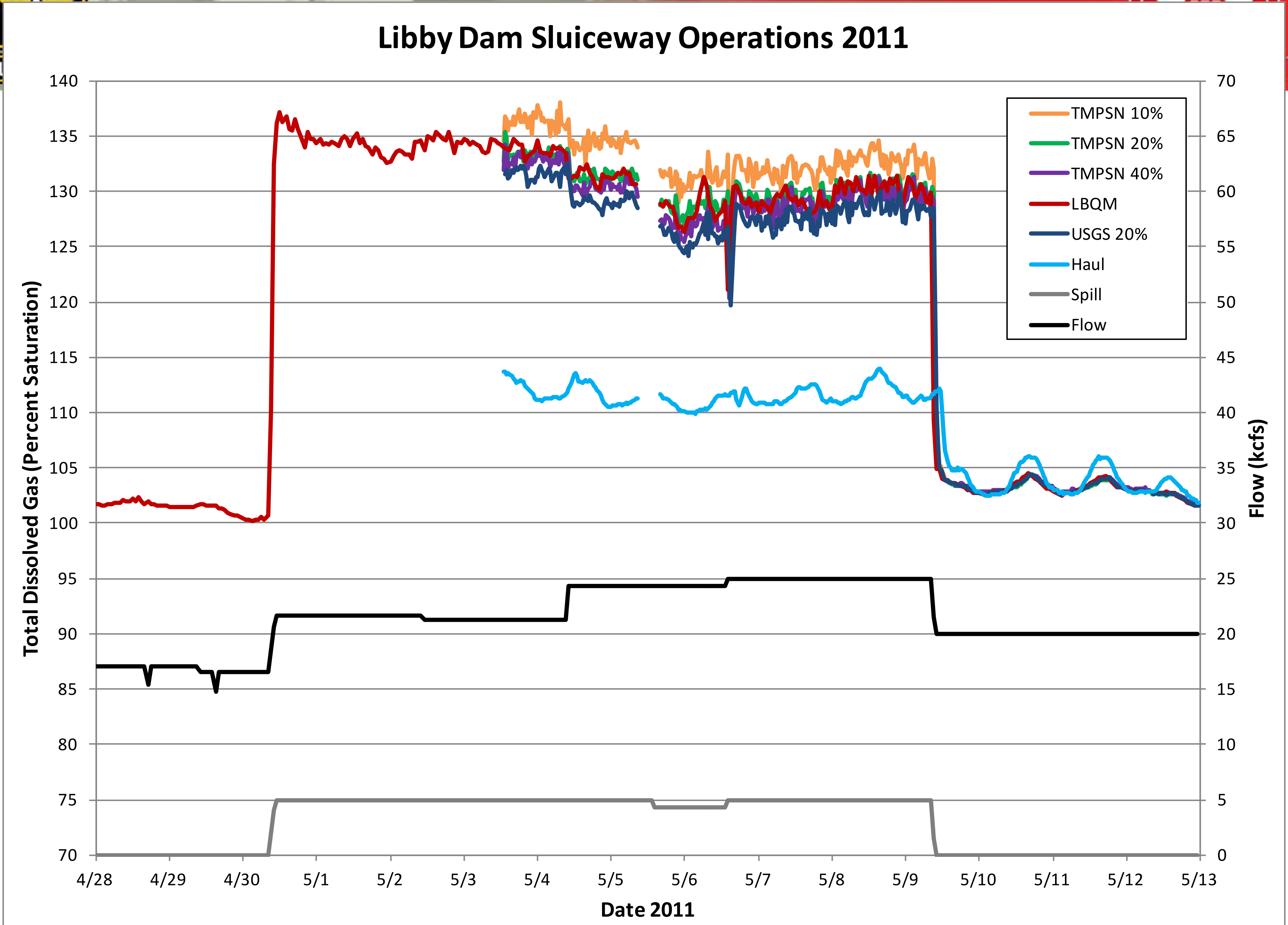
Bonners Ferry Stages and Flow from May 1 to July 31, 2011
Flow (cfs)
BFEI Stage (ft)
60000
50000
40000
30000
20000
10000
0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
1-May
15-May
29-May
12-Jun
26-Jun
10-Jul
24-Jul
Date
BFEI Regulated Flow cfs
BFEI Obs & Forecasted Stage ft
Flood Stage 64 ft

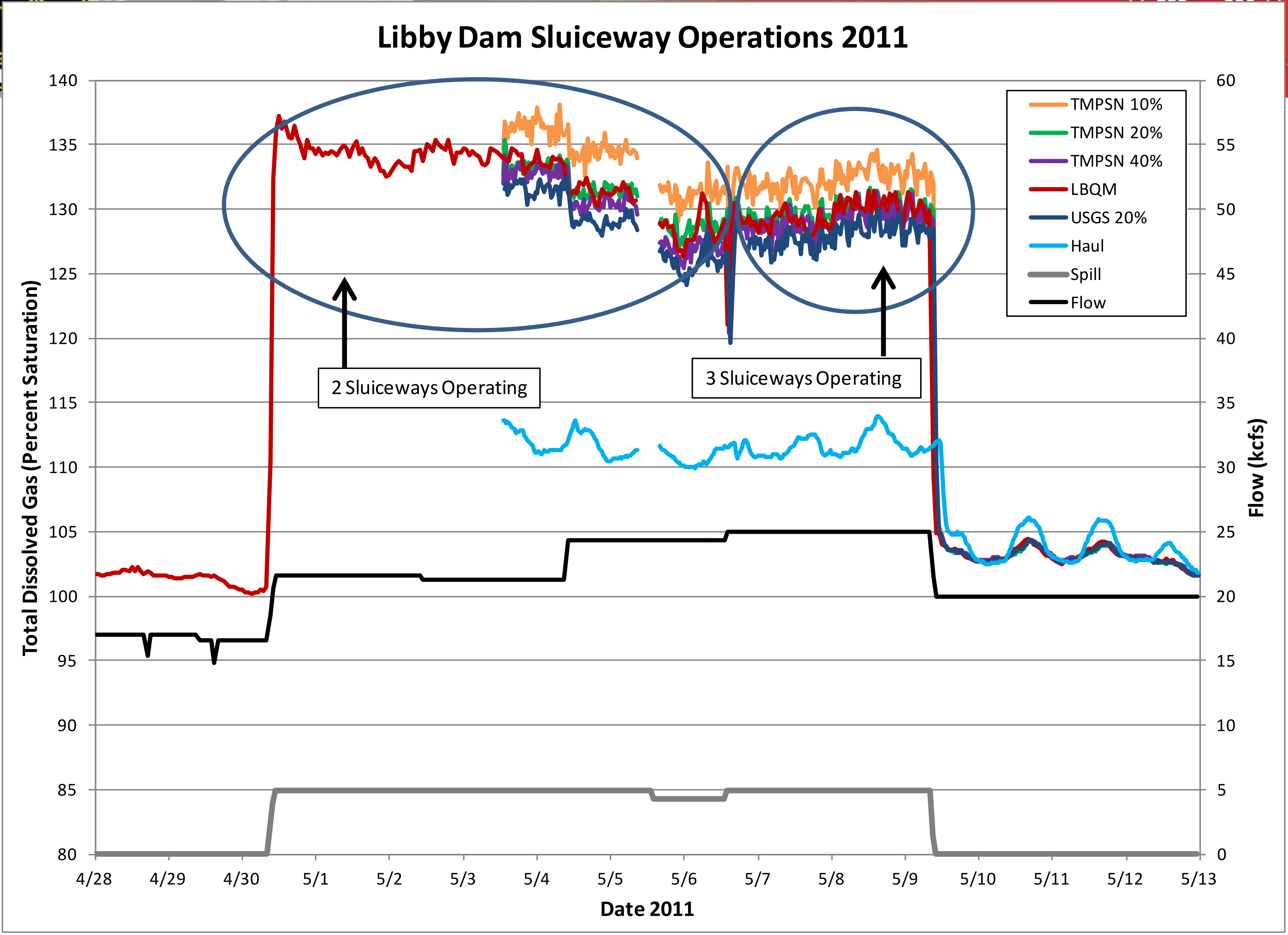

North
Kootenai Falls
Kootenai River
See figure s
for enlargement
Libby Dam
Lake Koocanusa
LIBBY
USGS
TMNSP
LBQM
HAUL
5 Miles
TDG/Temp Sampling Station


North
Libby Dam
Lake Koocanusa
TMPSN 40%
TMPSN 20%
TMPSN 10%
USGS 20%
LBQM
0.5 Miles
TDG Logger Station
Real Time Station

- Sluiceway TDG a factor of discharge per bay and powerhouse flows
- Max TDG at Thompson Bridge of about 138%
- Max TDG at Fixed Monitor Station of about 136%
- Dilution from powerhouse flows
- Fully mixed river stayed below 115%
- Average TDG content in river can be estimated by flow weighting TDG observations from FMS
- 3 bays vs. 2 bays showed small decrease in TDG




Libby Dam Sluiceway Operations 2011
Total Dissolved Gas (Percent Saturation)
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
Flow (kcfs)
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
4/28
4/29
4/30
5/1
5/2
5/3
5/4
5/5
5/6
5/7
5/8
5/9
5/10
5/11
5/12
5/13
Date 2011
TMPSN 10%
TMPSN 20%
TMPSN 40%
LBQM
USGS 20%
Haul
Spill
Flow



Libby Dam Sluiceway Operations 2011
TMPSN 10%
TMPSN 20%
TMPSN 40%
LBQM
USGS 20%
Haul
Spill
Flow
2 Sluiceways Operating
3 Sluiceways Operating
Total Dissolved Gas (Percent Saturation)
Flow (kcfs)
Date 2011
140
135
130
125
120
115
110
105
100
95
90
85
80
60
55
50
45
40
35
30
25
20
15
10
5
0
4/28
4/29
4/30
5/1
5/2
5/3
5/4
5/5
5/6
5/7
5/8
5/9
5/10
5/11
5/12
5/13

Dworshak Reservoir Regulation
Water Year 2011

Stephen Hall P.E., PMP
Senior Reservoir Regulator
Walla Walla District

December 07th, 2011

US Army Corps of Engineers

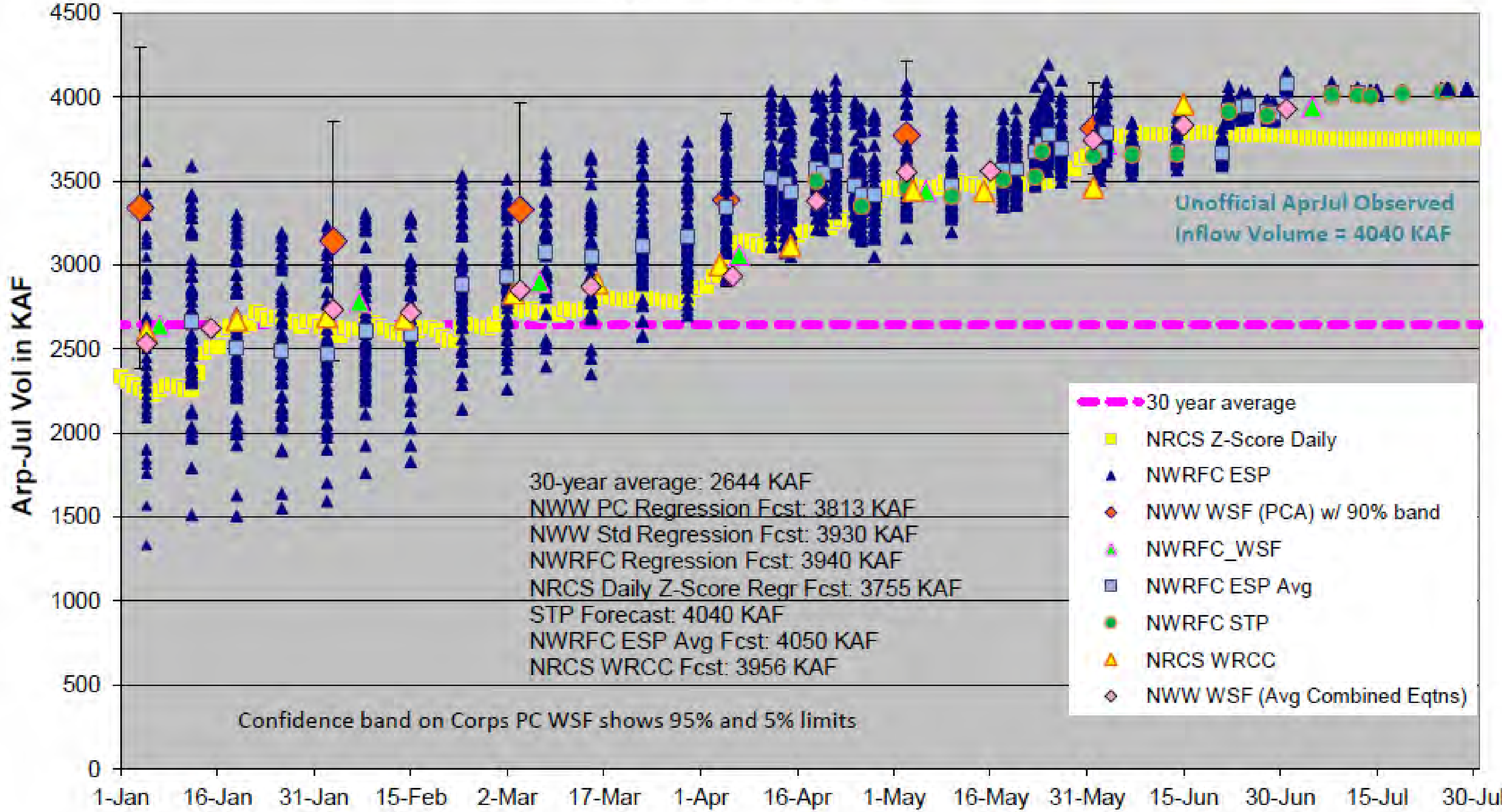
BUILDING STRONG®

Dworshak 2011 Operations Review

- Water Supply Forecast
- Flood Control Space Shift to Grand Coulee
- Fish Flow Augmentation and Transition to Refill
- Final Refill
- Summer Temperature Operations

Dworshak, ID April-July Inflow Volume Forecast Comparison

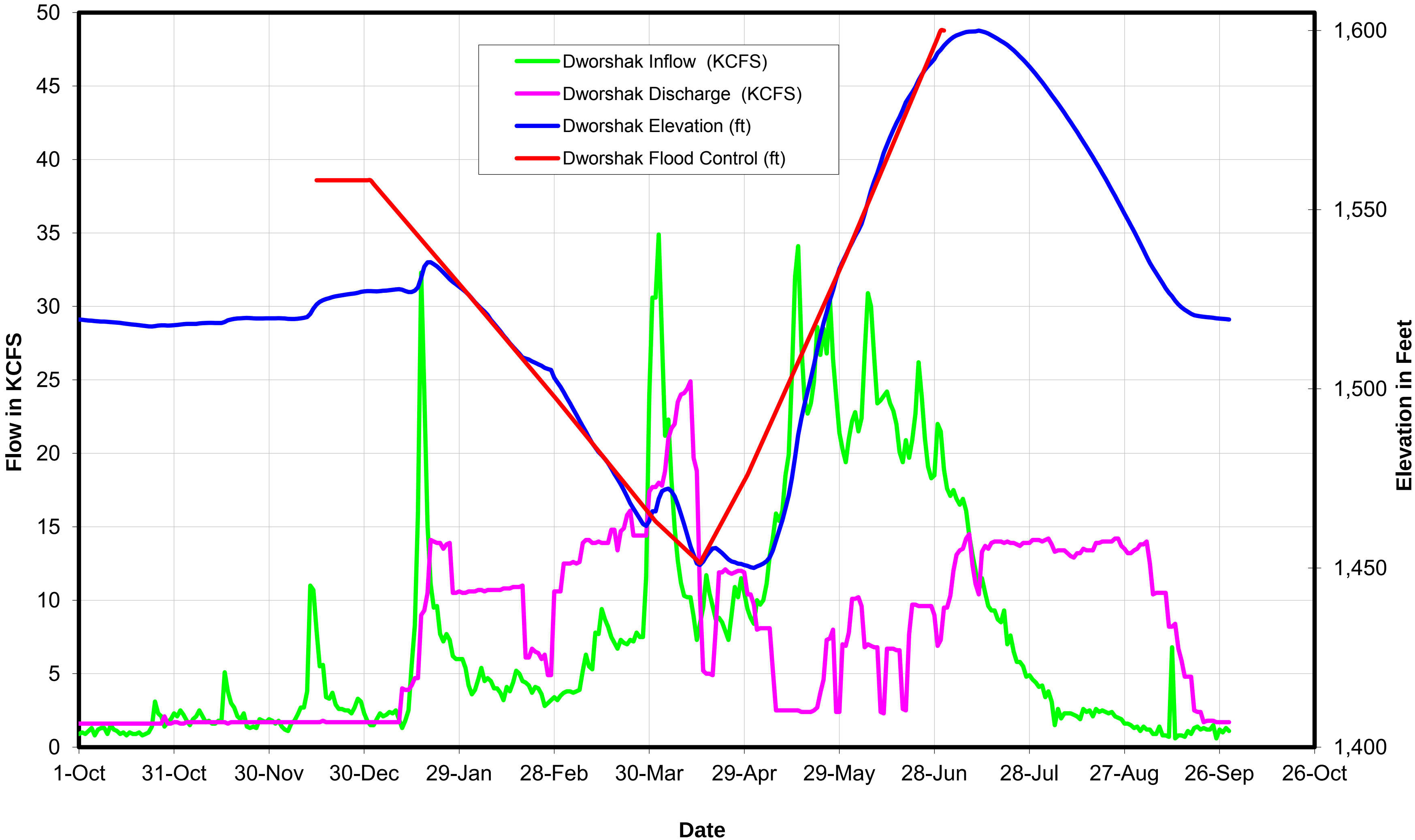
updated 01-Aug-2011

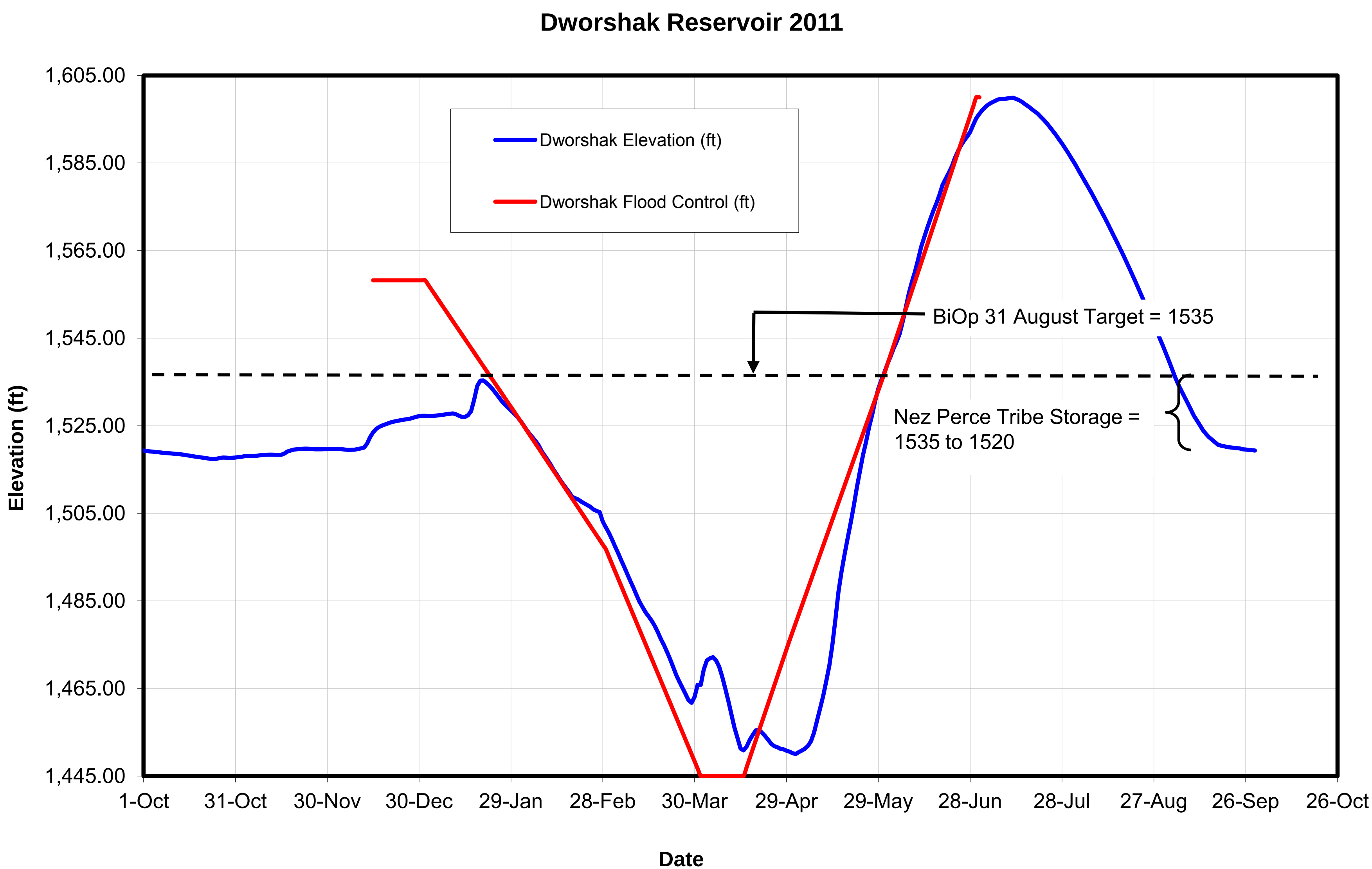


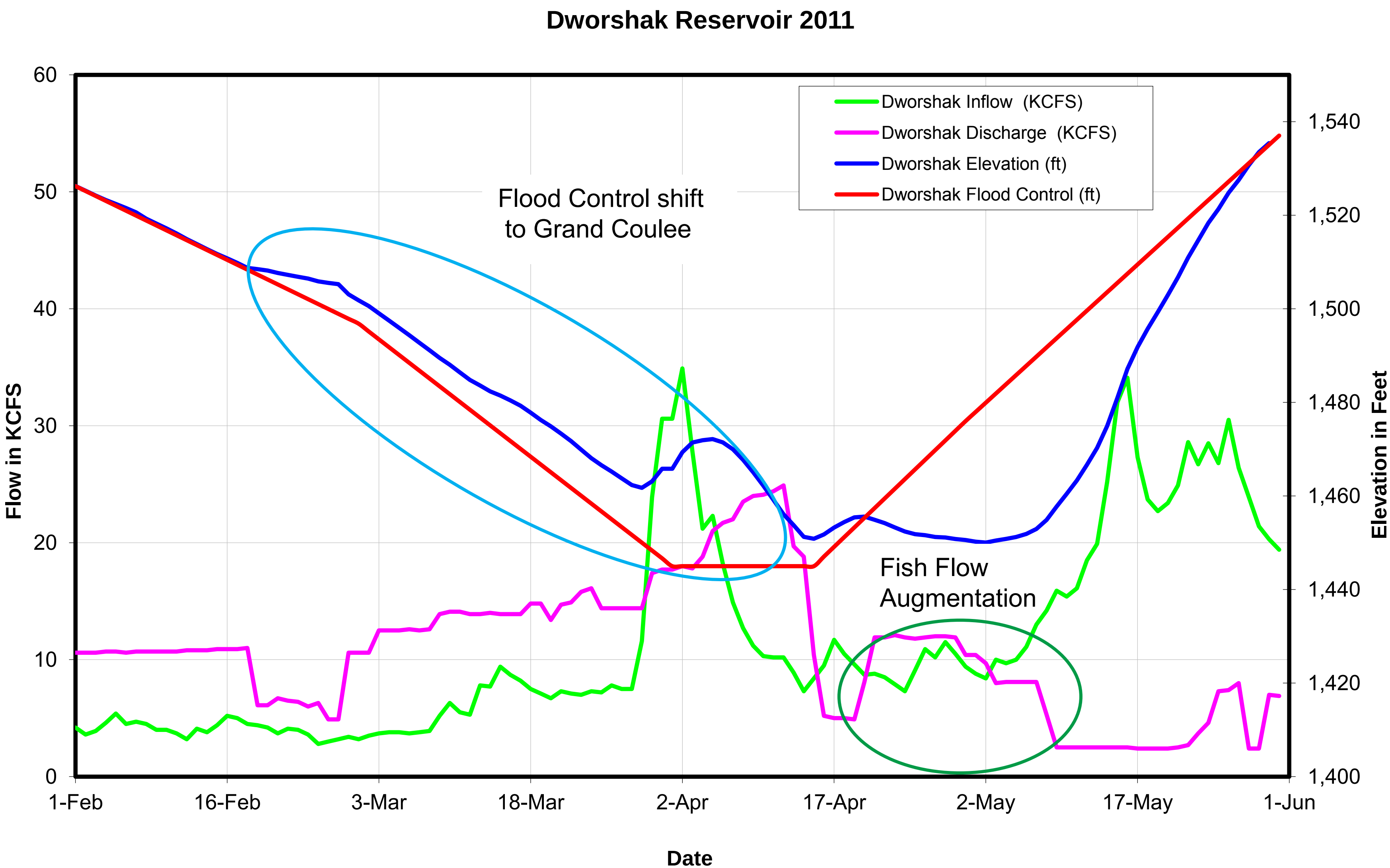
US Army Corps of Engineers
Walla Walla District

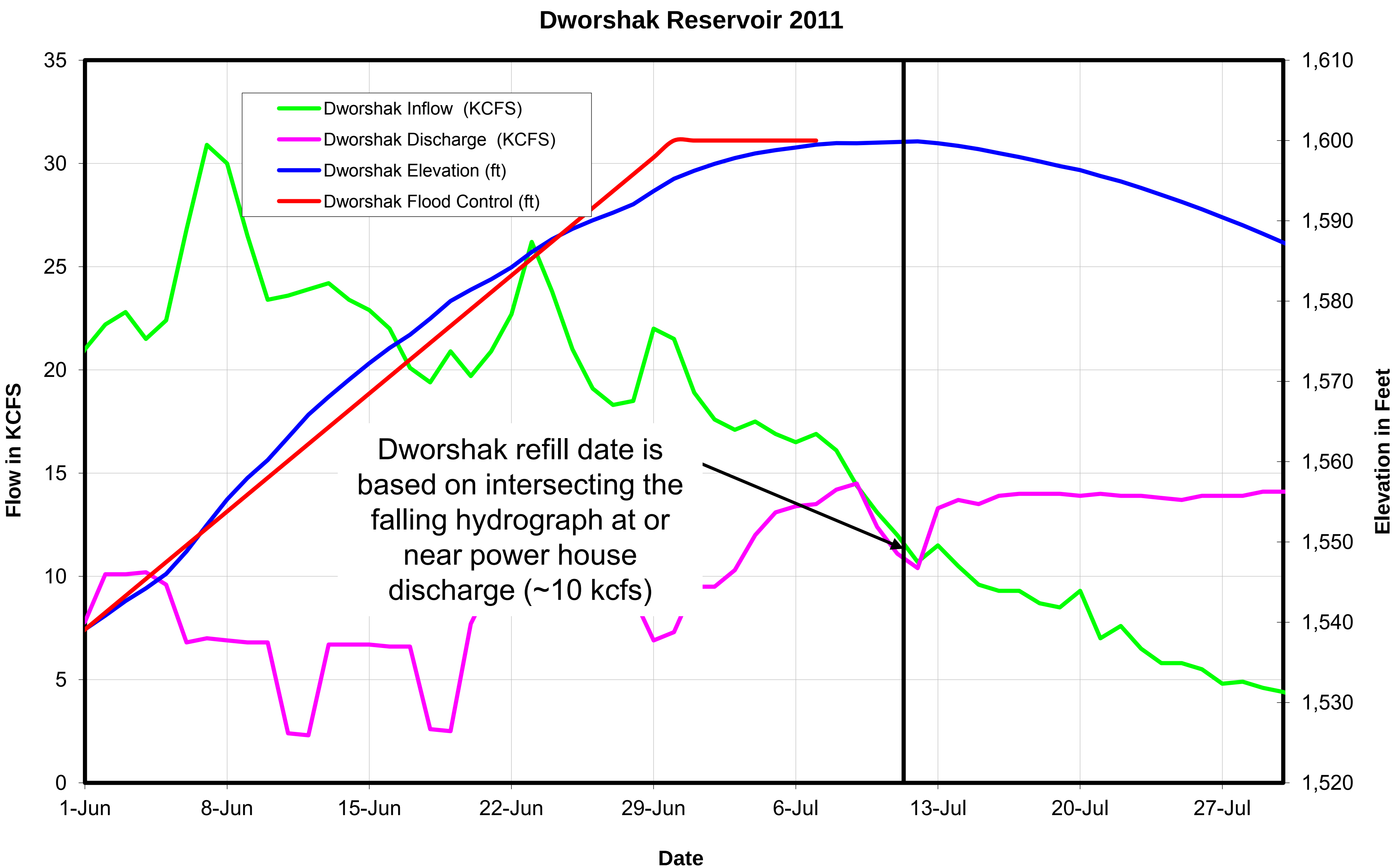
U.S. ARMY

Dworshak Reservoir 2011

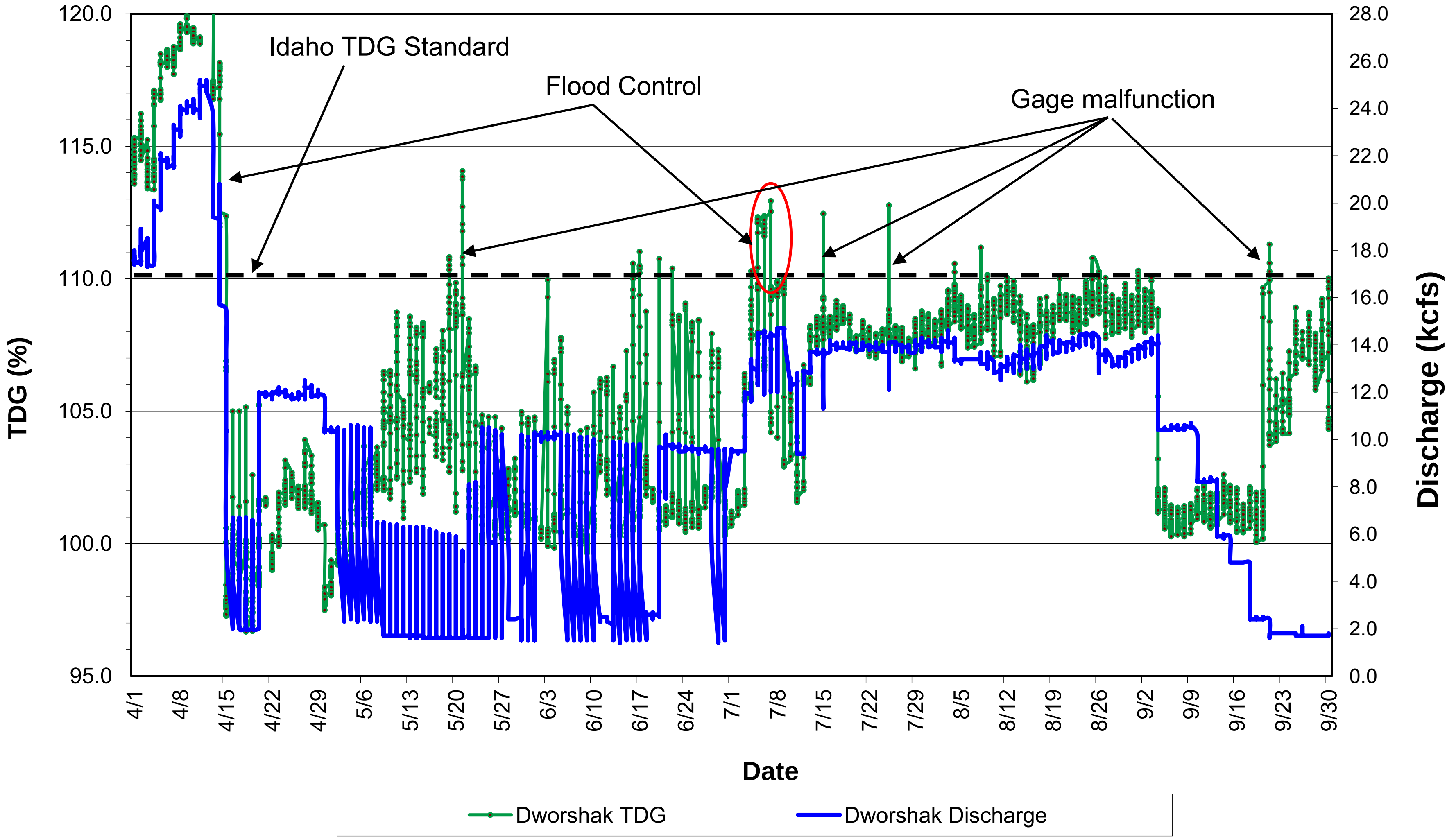



Dworshak Reservoir 2011
Dworshak Elevation (ft)
Dworshak Flood Control (ft)
BiOp 31 August Target = 1535
Nez Perce Tribe Storage =
1535 to 1520
Elevation (ft)
1,605.00
1,585.00
1,565.00
1,545.00
1,525.00
1,505.00
1,485.00
1,465.00
1,445.00
1-Oct
31-Oct
30-Nov
30-Dec
29-Jan
28-Feb
30-Mar
29-Apr
29-May
28-Jun
28-Jul
27-Aug
26-Sep
26-Oct
Date

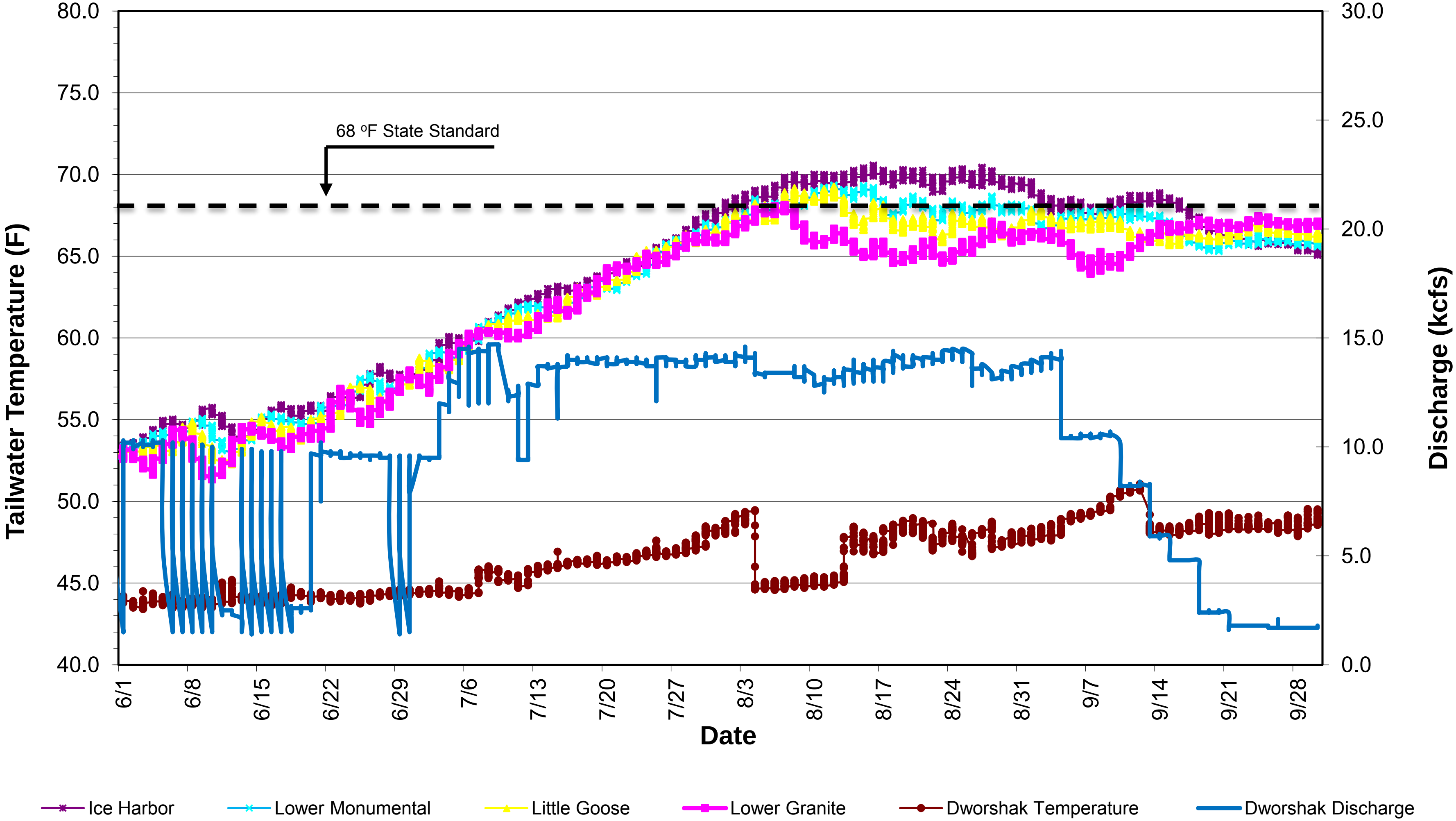

Dworshak Reservoir 2011
Dworshak Inflow (KCFS)
Dworshak Discharge (KCFS)
Dworshak Elevation (ft)
Dworshak Flood Control (ft)
Flood Control shift
to Grand Coulee
Fish Flow
Augmentation
Flow in KCFS
Elevation in Feet
Date
0
10
20
30
40
50
60
1,400
1,420
1,440
1,460
1,480
1,500
1,520
1,540
1-Feb
16-Feb
3-Mar
18-Mar
2-Apr
17-Apr
2-May
17-May
1-Jun


Dworshak Reservoir 2011
Dworshak Inflow (KCFS)
Dworshak Discharge (KCFS)
Dworshak Elevation (ft)
Dworshak Flood Control (ft)
Dworshak refill date is based on intersecting the falling hydrograph at or near power house discharge (~10 kcfs)
Flow in KCFS
Elevation in Feet
Date
0
5
10
15
20
25
30
35
1,520
1,530
1,540
1,550
1,560
1,570
1,580
1,590
1,600
1,610
1-Jun
8-Jun
15-Jun
22-Jun
29-Jun
6-Jul
13-Jul
20-Jul
27-Jul

Dworshak 2011 Total Dissolved Gas



Dworshak Temperature 2011 Augmentation



Average Weekly Temperatures
Lower Granite Dam Forebay, WA

2011

Depth In Feet 1200 hrs	10 Jul	17 Jul	24 Jul	31 Jul	7 Aug	14 Aug	21 Aug	28 Aug	4 Sep	11 Sep	19 Sep	26 Sep
1.6	60.5	62.7	64.8	68.2	69.9	68.7	70.2	72.1	68.8	67.2	67.7	67.1
5	60.1	62.2	64.5	67.8	69.4	68.3	69.6	71.0	68.5	67.0	67.5	66.9
10	60.2	62.3	64.4	67.7	69.3	67.5	69.1	70.1	68.5	67.1	67.6	67.0
16	60.0	62.0	64.1	66.7	69.0	66.7	67.6	69.2	68.3	66.5	67.5	67.0
33	60.2	61.8	64.1	65.7	67.9	65.5	66.3	67.8	67.6	65.7	67.4	66.9
49	60.3	61.8	64.2	65.3	67.2	65.3	65.3	67.0	66.6	65.7	67.1	67.1
66	60.2	61.7	64.1	65.2	67.1	65.2	64.0	64.7	65.2	65.0	67.1	67.2
82	59.6	61.7	63.5	64.9	66.5	64.7	63.3	63.4	64.2	63.3	66.3	66.5
98	60.9	62.5	64.9	65.8	67.8	65.9	64.6	64.7	65.4	63.5	67.0	67.7
102	59.8	61.0	63.0	64.5	66.3	64.6	63.0	62.9	63.6	61.8	64.3	65.1
105	56.6	57.9	59.8	61.4	62.6	62.4	61.7	61.5	62.0	61.0	61.9	63.2

• Denotes missing data   +68°F   67°F to 66°F   65°F to 64°F   63°F to 62°F   <61°F

SILW Max Daily Air Temp	10 Jul	17 Jul	24 Jul	31 Jul	7 Aug	14 Aug	21 Aug	28 Aug	4 Sep	11 Sep	19 Sep	26 Sep
°F	86.8	92.3	101.2	94.7	94.0	88.9	100.1	102.8	91.8	99.3	77.9	76.9

Questions?

TMT Annual Review

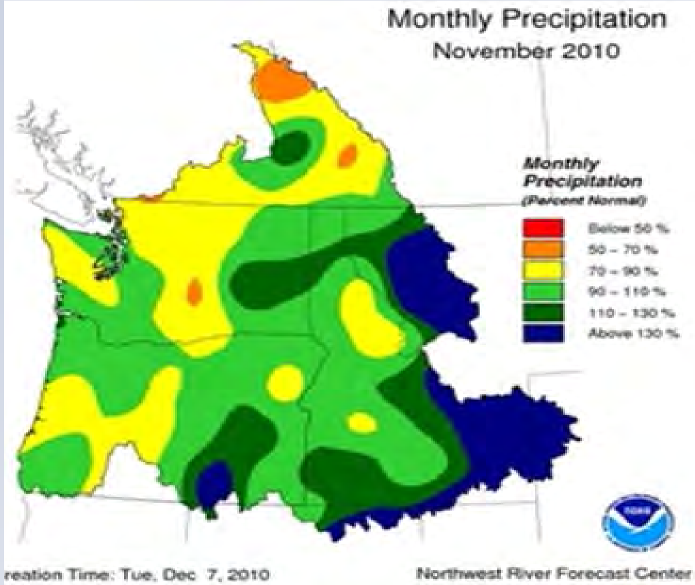
Weather and Water Summary

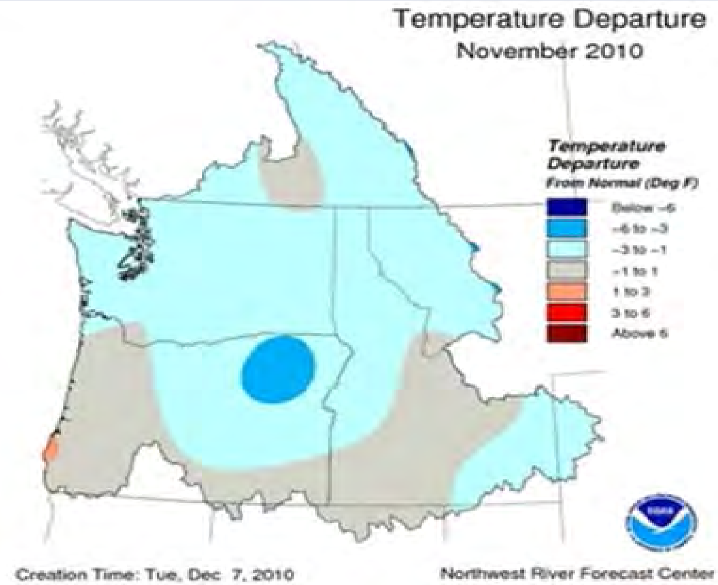
Presented by
Karl Kanbergs
USACE, Water Management Division

December 7, 2011

Season Highlights and Summary

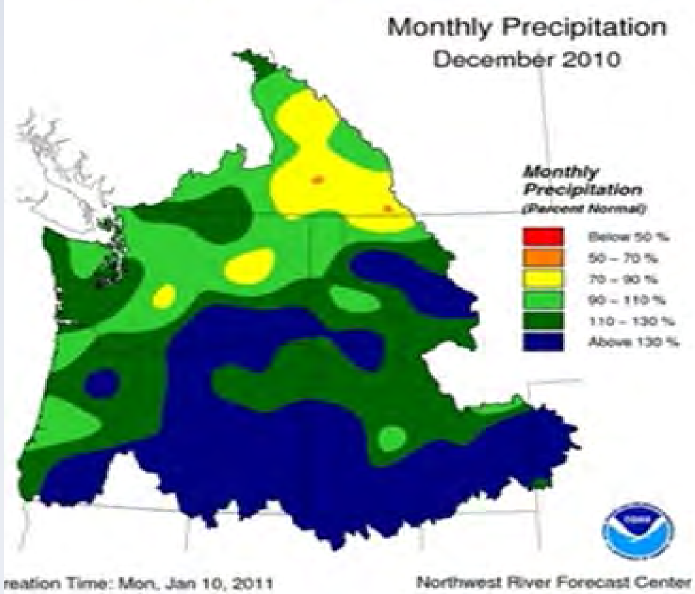
- Fourth wettest year, 1929 – 2011, 127 MAF Apr – Aug volume at the Dalles. La Nina Conditions.
- Marked by a rising water supply forecast and a very wet, cool and protracted spring
- No system winter flooding but some record tributary flooding on west and east side, and a tornado!
- The Vancouver gage was up to 1.4 ft. above flood stage for more than three weeks but did not reach moderate or major flood stage. Portland gage below flood stage for the whole time
- No late season heavy rain events in the Cascades -- along with gradual Columbia Basin snow melt, avoided major system flooding

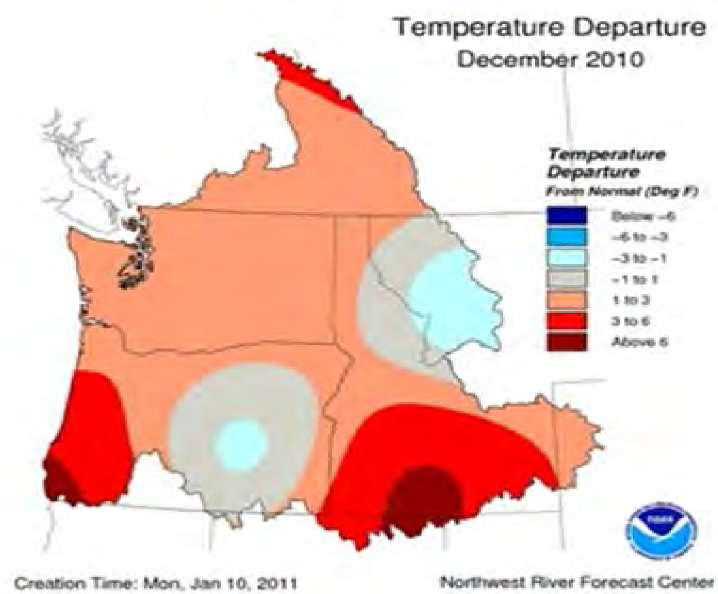


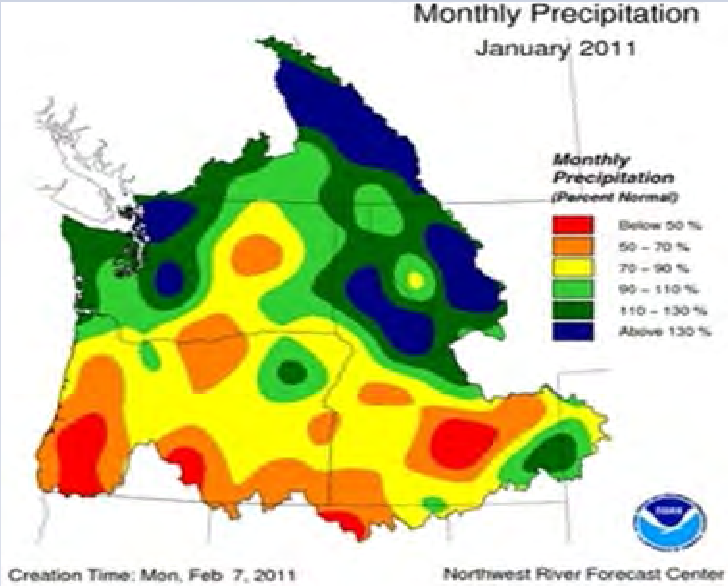


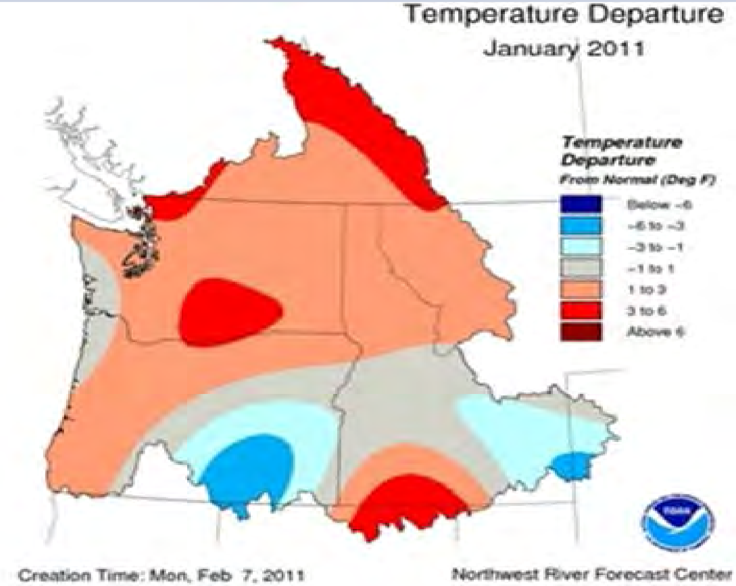
December Precipitation

December Temperature



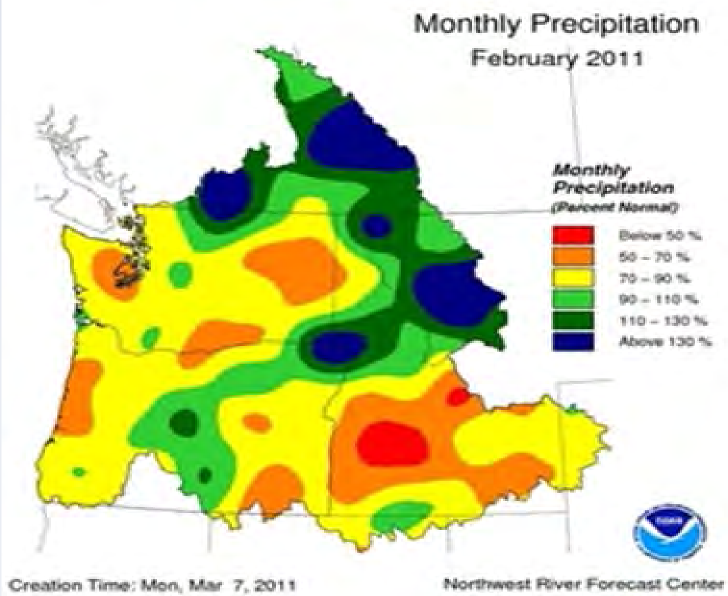


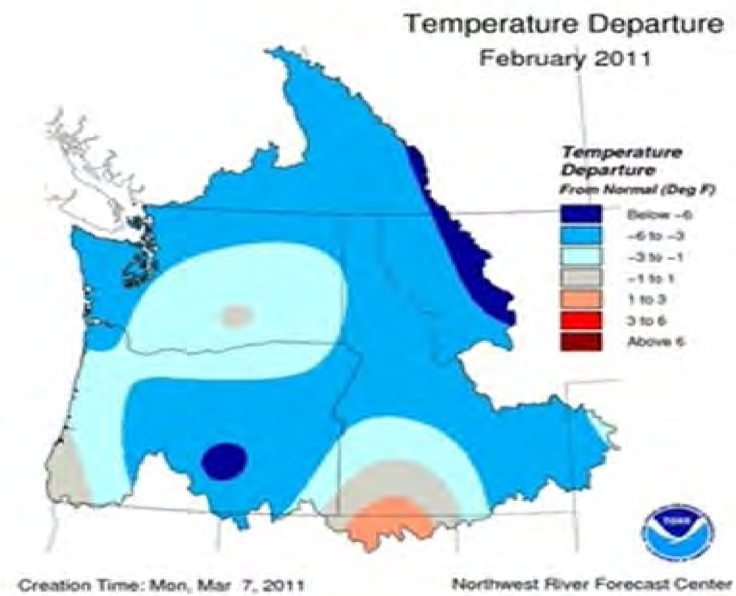


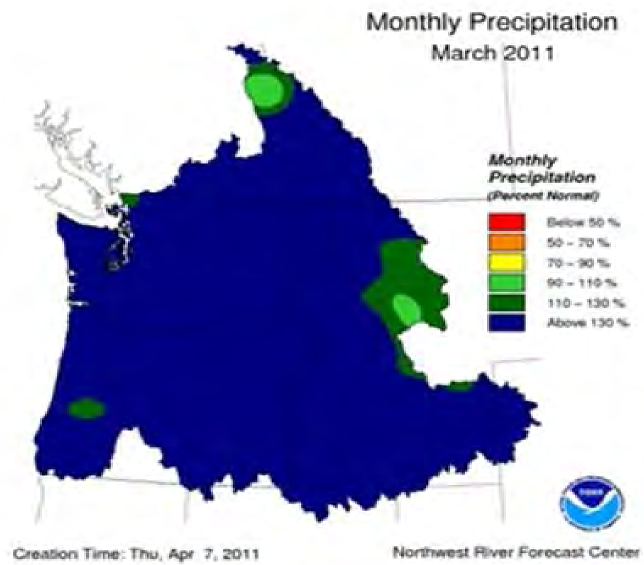


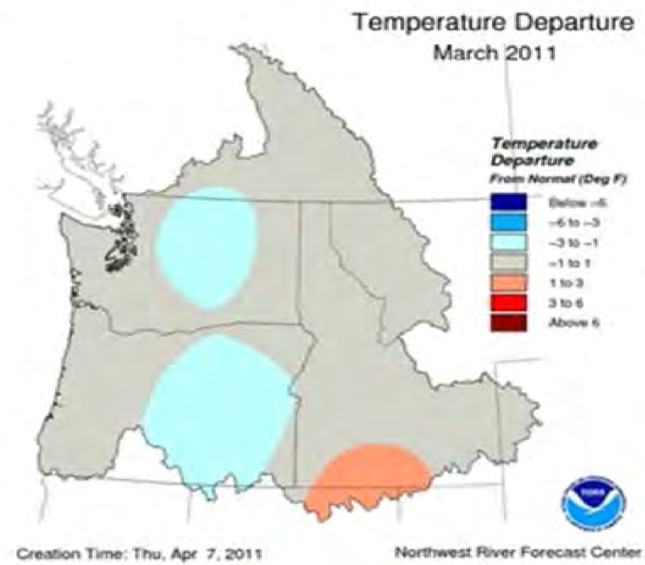
February Precipitation

February Temperature



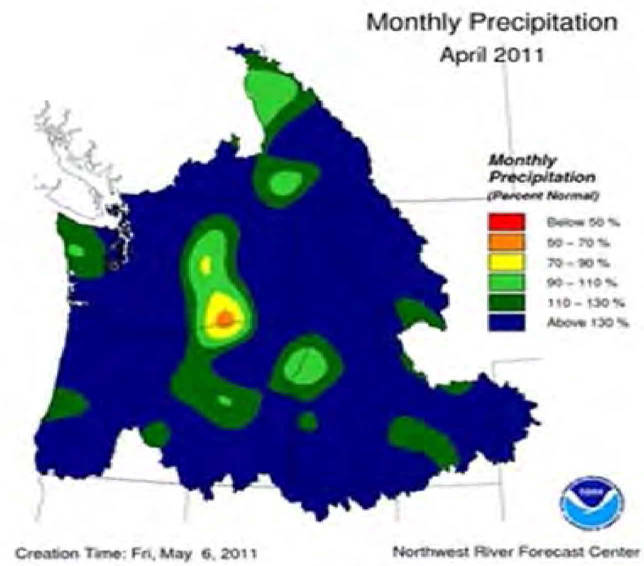


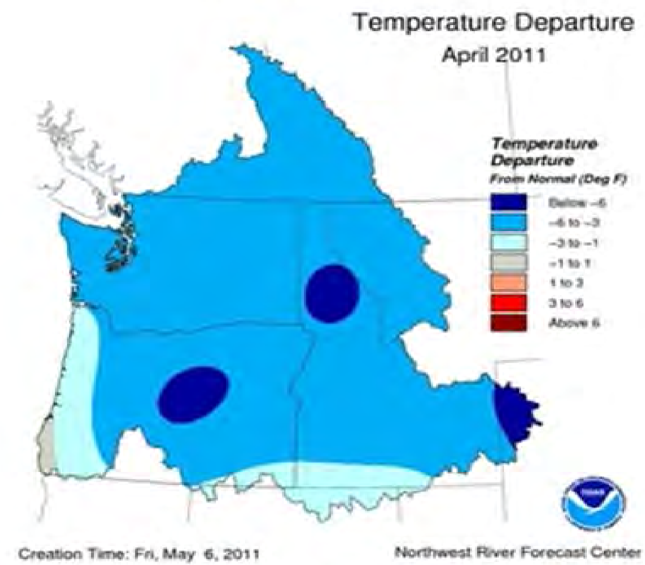


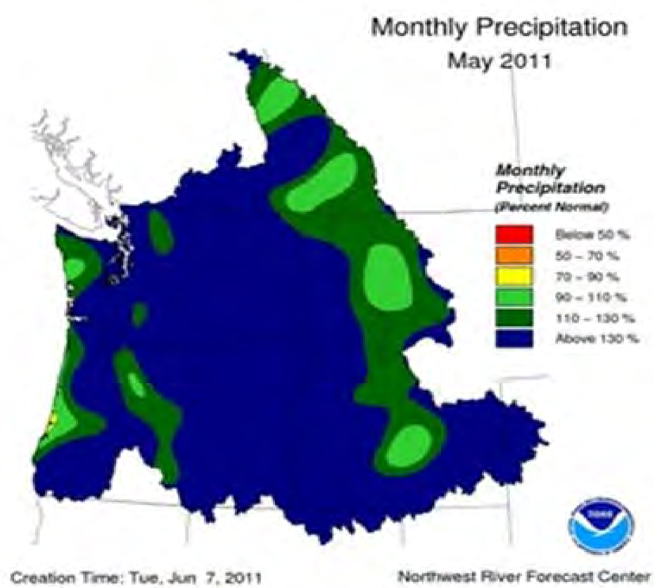


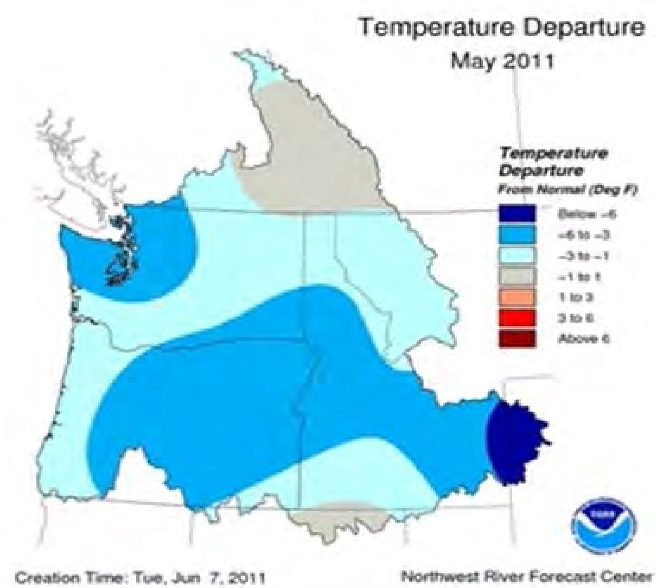
April Precipitation

April Temperature



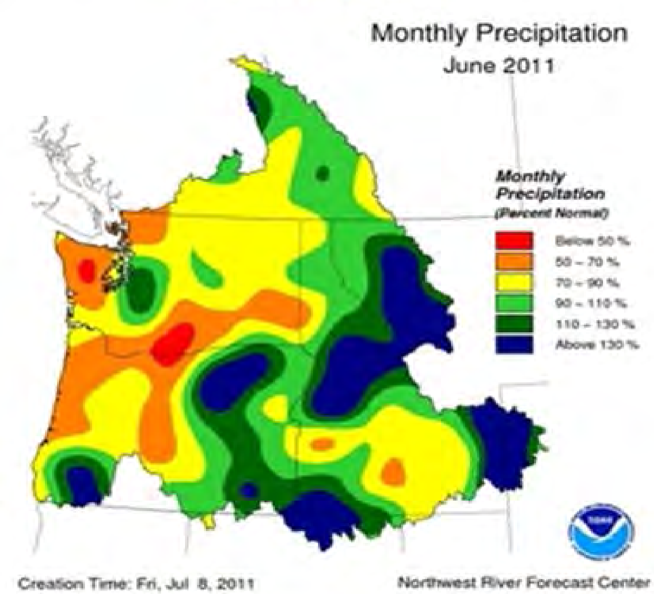


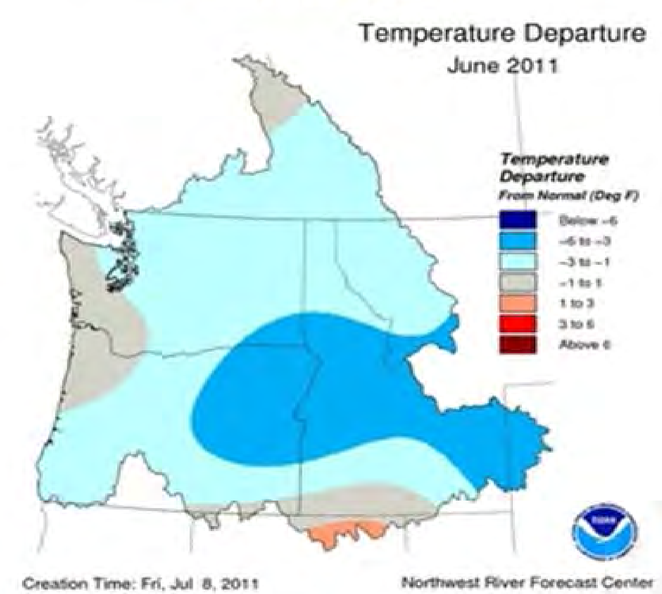


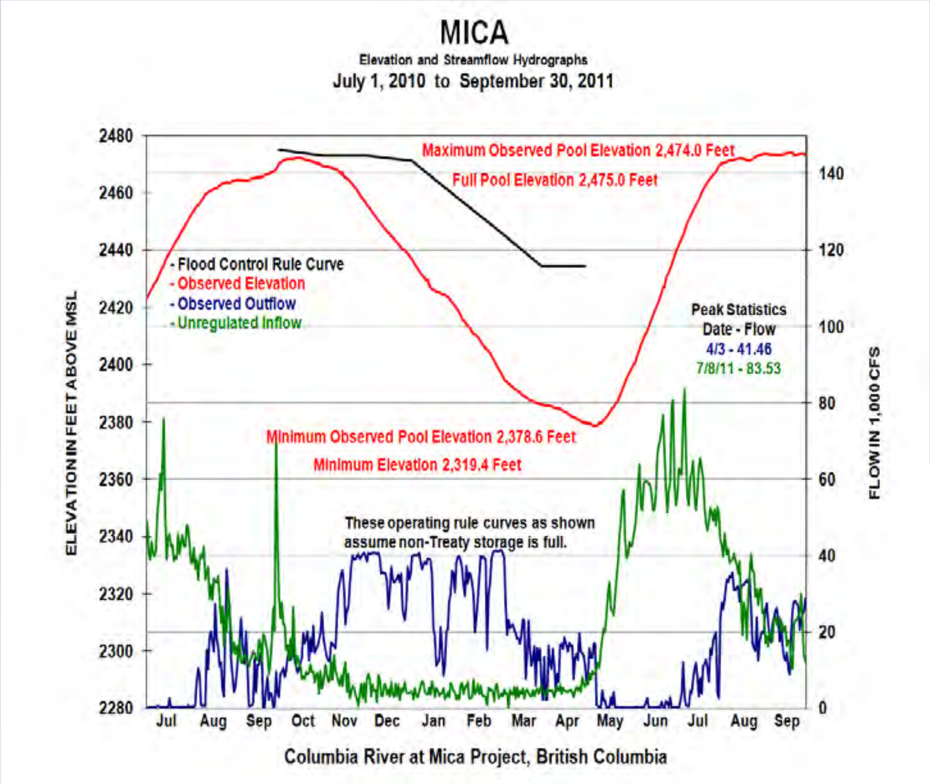


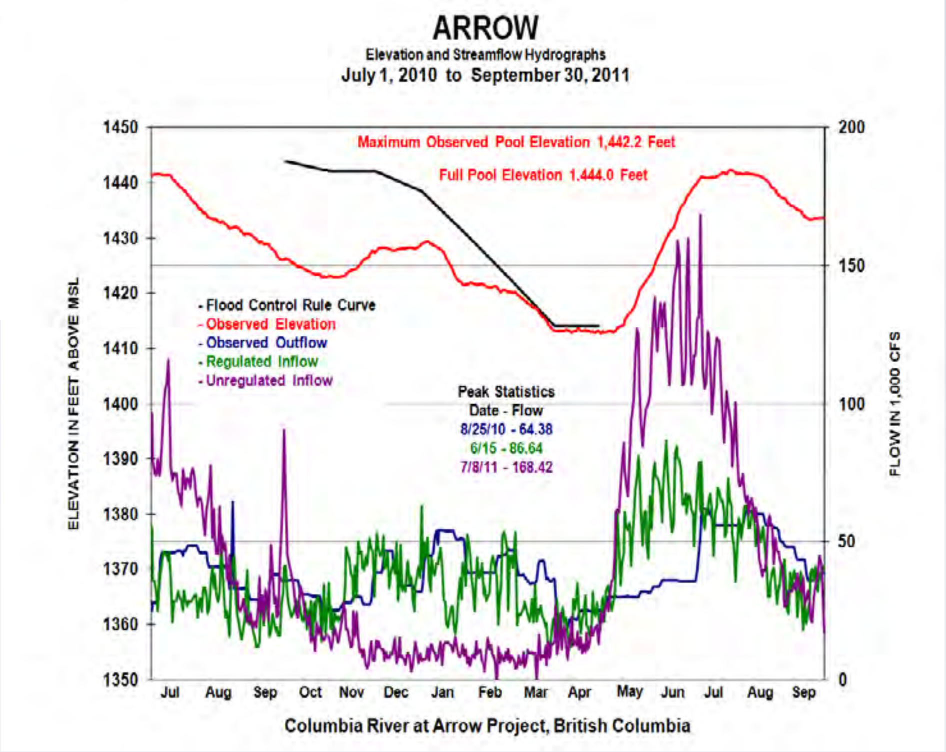
June Precipitation

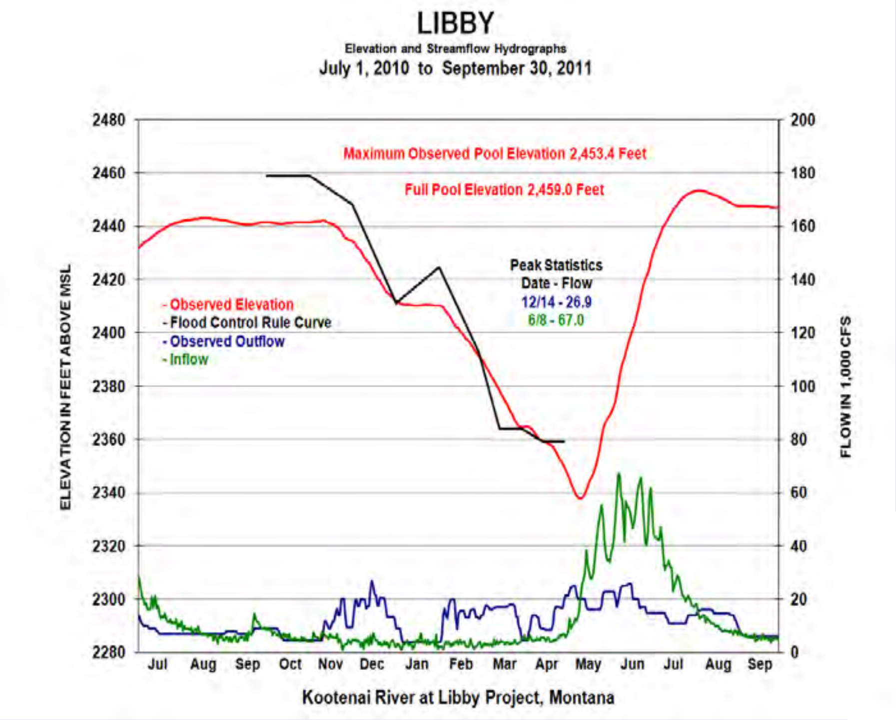
June Temperature



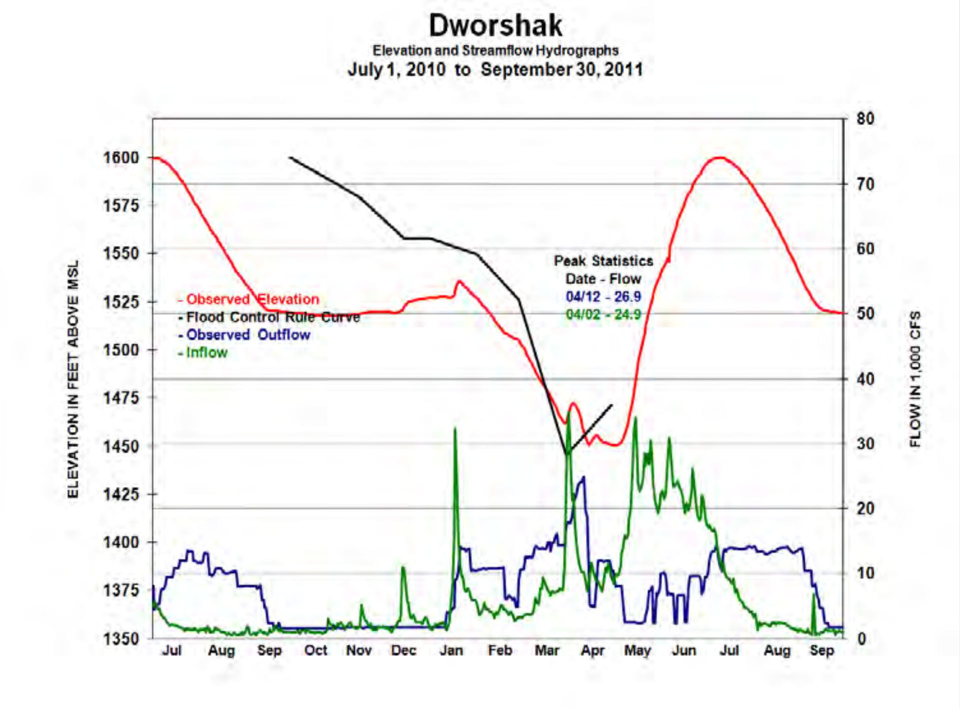



MICA
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Maximum Observed Pool Elevation 2,474.0 Feet
Full Pool Elevation 2,475.0 Feet
- Flood Control Rule Curve
- Observed Elevation
- Observed Outflow
- Unregulated Inflow
Peak Statistics
Date - Flow
4/3 - 41.46
7/8/11 - 83.53
Minimum Observed Pool Elevation 2,378.6 Feet
Minimum Elevation 2,319.4 Feet
These operating rule curves as shown assume non-Treaty storage is full.
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Columbia River at Mica Project, British Columbia

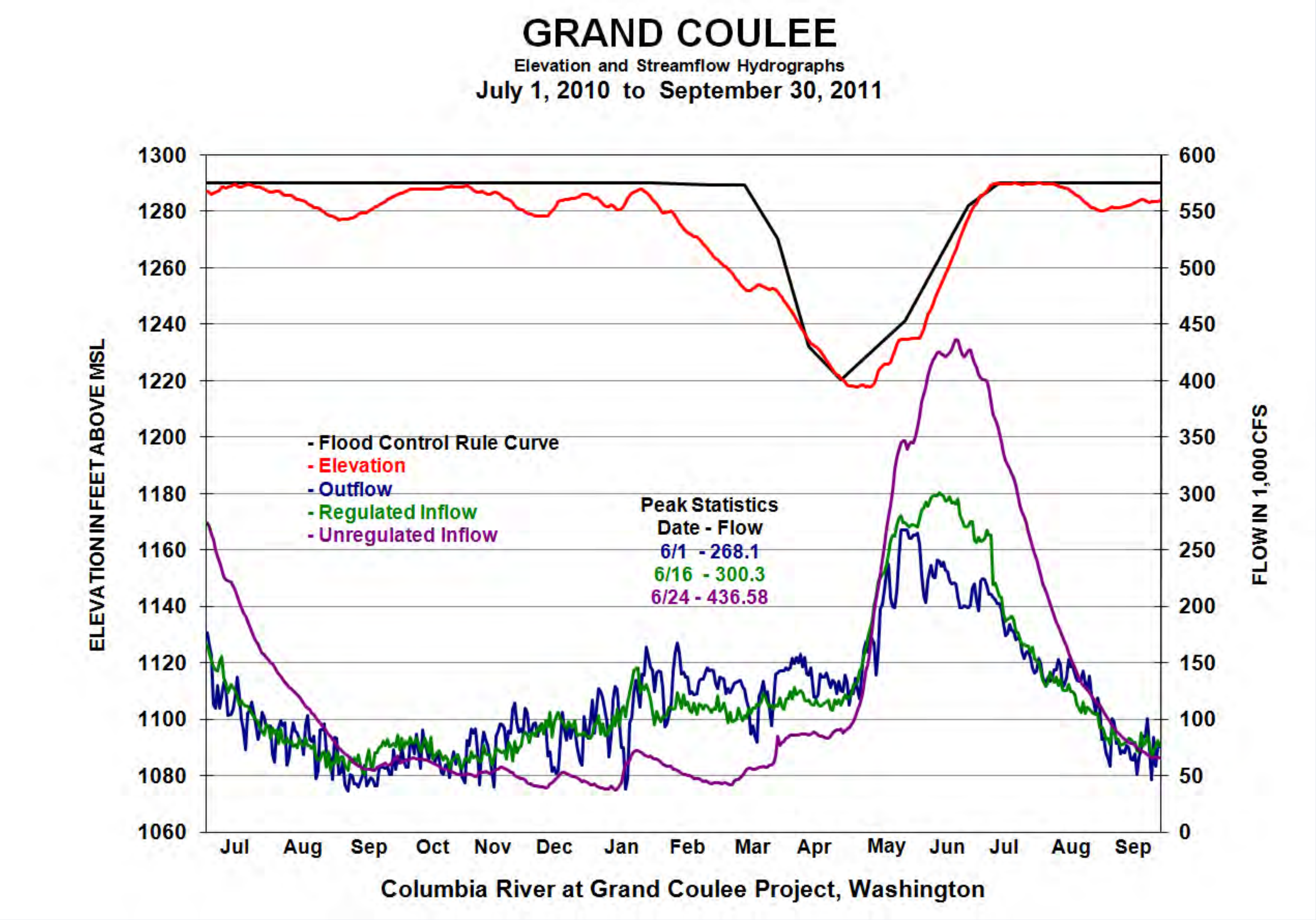

ARROW
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Maximum Observed Pool Elevation 1,442.2 Feet
Full Pool Elevation 1,444.0 Feet
- Flood Control Rule Curve
- Observed Elevation
- Observed Outflow
- Regulated Inflow
- Unregulated Inflow
Peak Statistics
Date - Flow
8/25/10 - 64.38
6/15 - 86.64
7/8/11 - 168.42
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Columbia River at Arrow Project, British Columbia

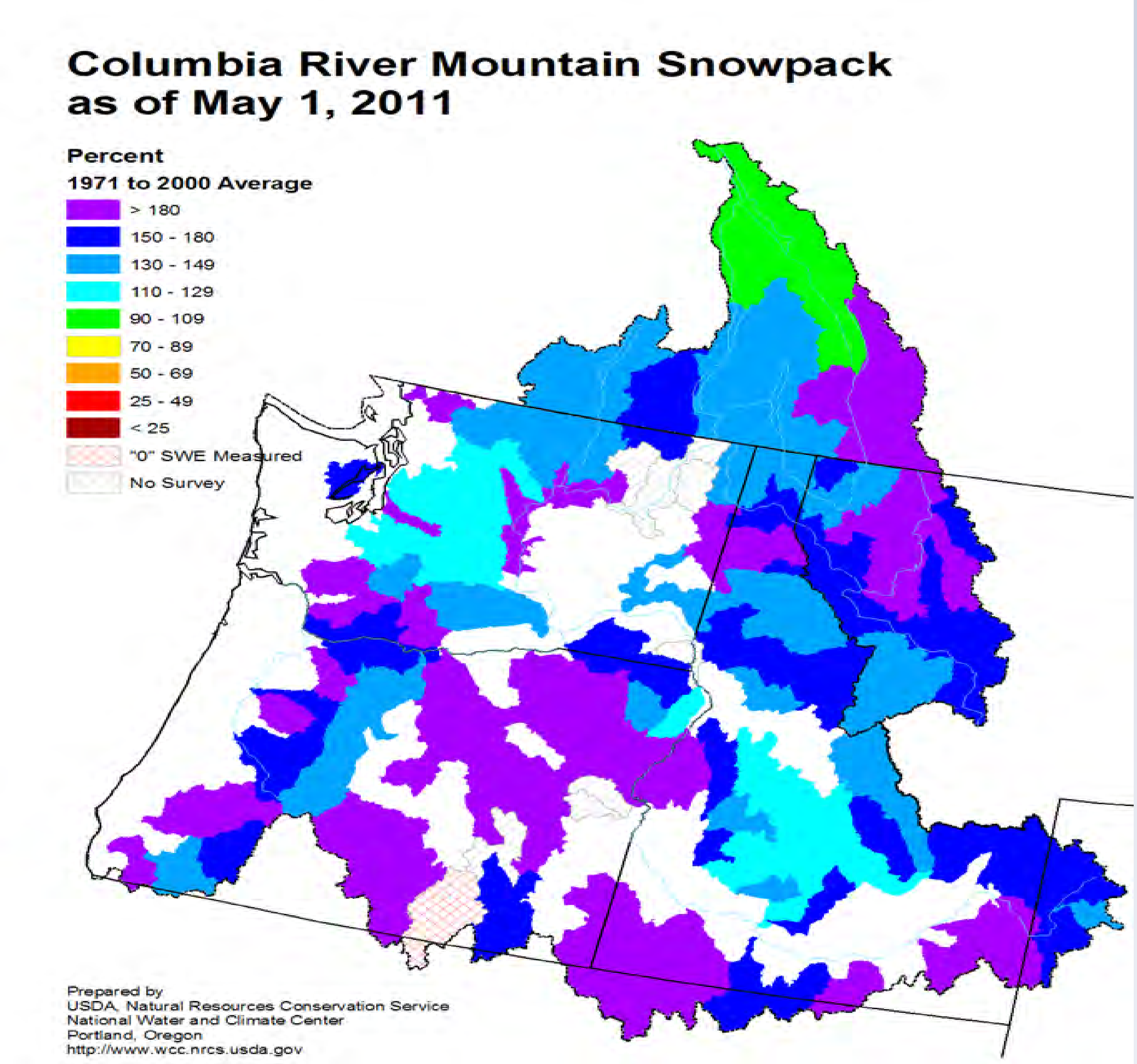


LIBBY
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Maximum Observed Pool Elevation 2,453.4 Feet
Full Pool Elevation 2,459.0 Feet
Peak Statistics
Date - Flow
12/14 - 26.9
6/8 - 67.0
- Observed Elevation
- Flood Control Rule Curve
- Observed Outflow
- Inflow
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Kootenai River at Libby Project, Montana



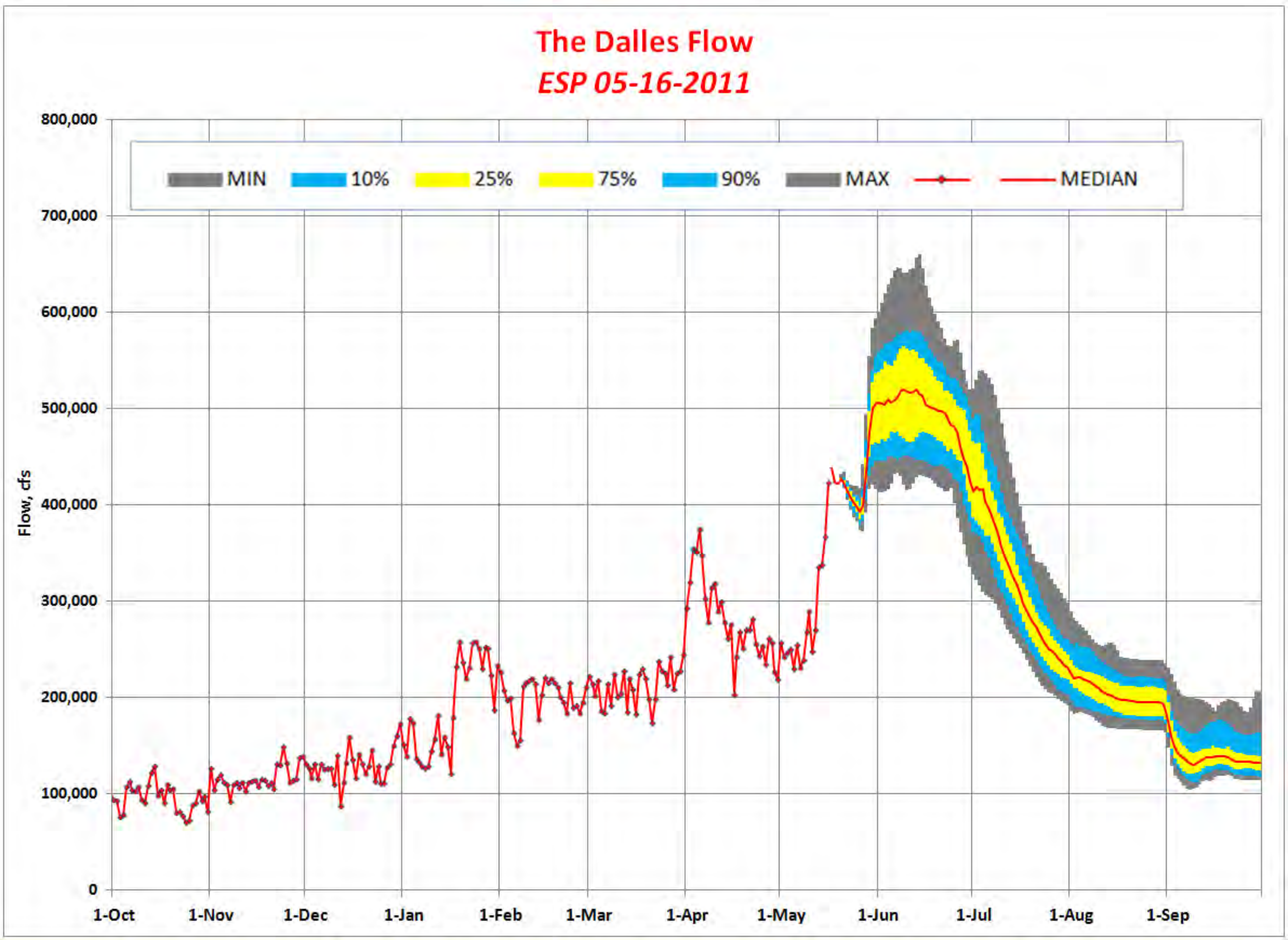
Dworshak
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Peak Statistics
Date - Flow
04/12 - 26.9
04/02 - 24.9
- Observed Elevation
- Flood Control Rule Curve
- Observed Outflow
- Inflow
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

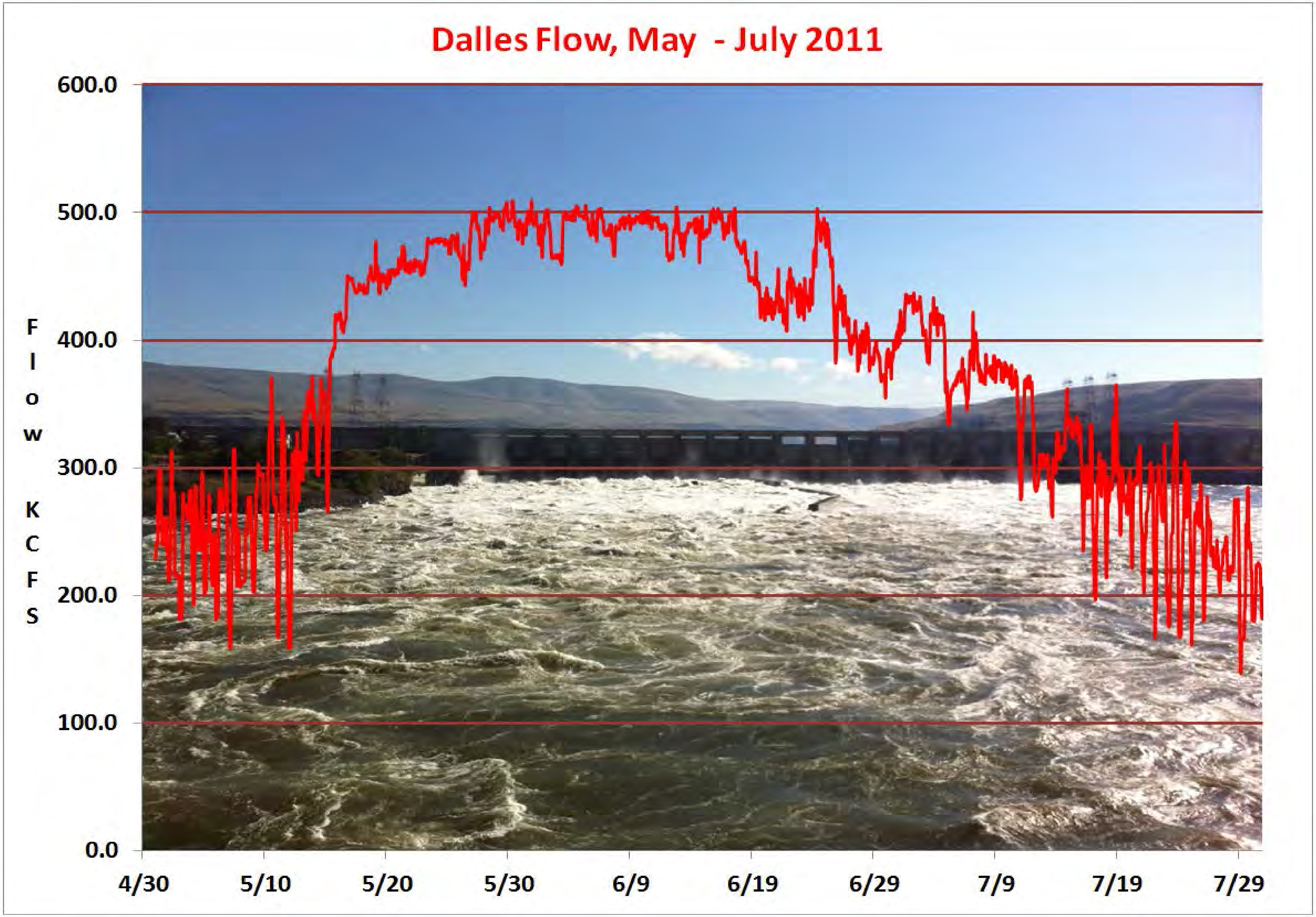

GRAND COULEE
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
1300
1280
1260
1240
1220
1200
1180
1160
1140
1120
1100
1080
1060
600
550
500
450
400
350
300
250
200
150
100
50
0
- Flood Control Rule Curve
- Elevation
- Outflow
- Regulated Inflow
- Unregulated Inflow
Peak Statistics
Date - Flow
6/1 - 268.1
6/16 - 300.3
6/24 - 436.58
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Columbia River at Grand Coulee Project, Washington

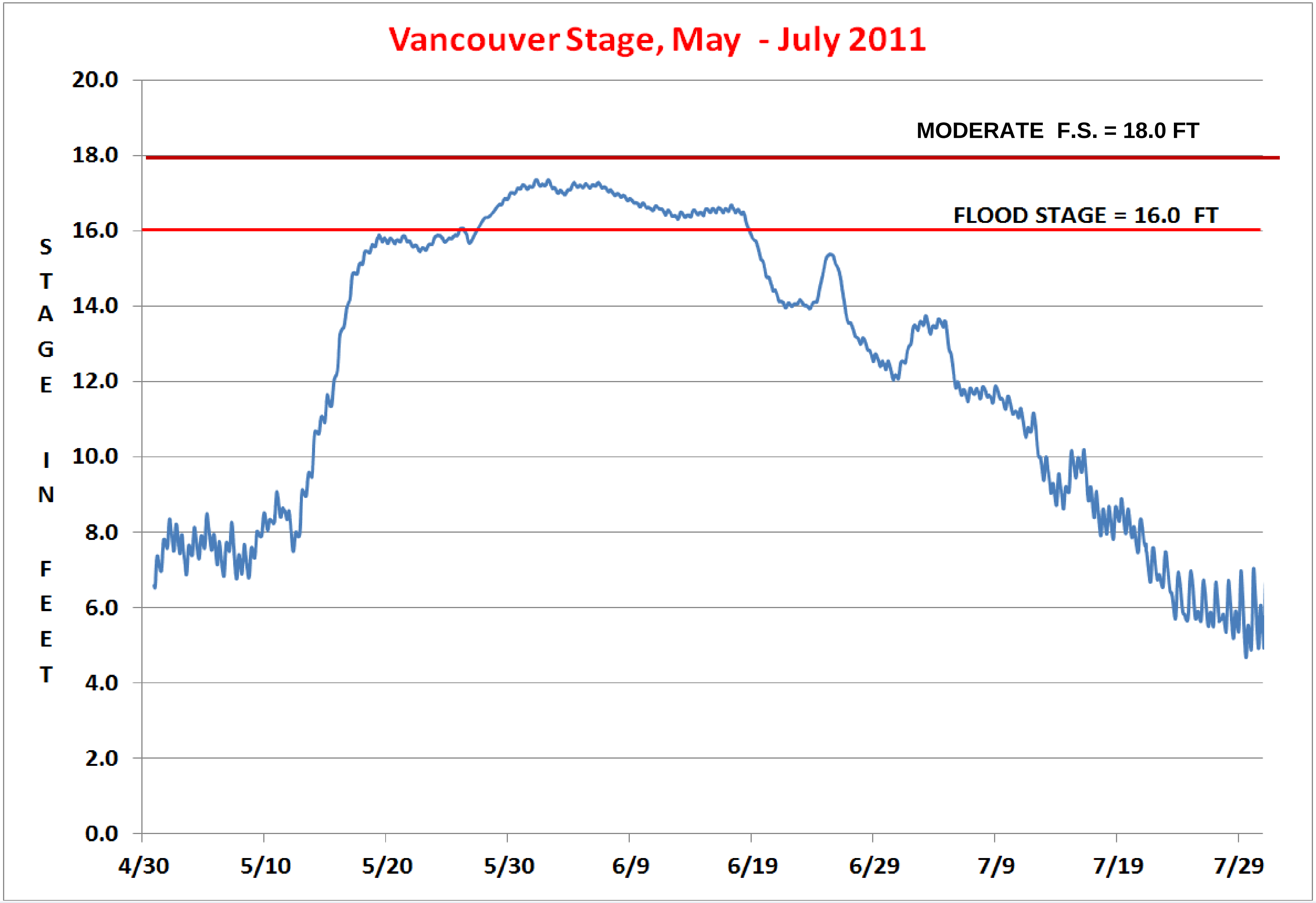

Columbia River Mountain Snowpack
as of May 1, 2011
Percent
1971 to 2000 Average
> 180
150 - 180
130 - 149
110 - 129
90 - 109
70 - 89
50 - 69
25 - 49
< 25
"0" SWE Measured
No Survey
Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

System Refill

- General goal to regulate The Dalles to non-damaging levels of about 450,000 cfs and major floods to 600,000 cfs.
- System refill accomplished by using all available forecasts, knowledge of available space and remaining snow and calculated Initial Control Flow (ICF) which is adjusted through time. May 01 ICF at 440 kcfs, adjusted to 480 kcfs later in May.
- With the high but steady runoff a practical way to regulate was to adjust Coulee refill and regulate to flows at The Dalles and Bonneville so as to not exceed moderate flood stage at the Vancouver gage (band between 16.0 and 18.0 feet).
- Operation was set so as to avoid a fill and spill at Grand Coulee or other major storage projects if a sudden increase in runoff were to occur.


The Dalles Flow
ESP 05-16-2011
MIN
10%
25%
75%
90%
MAX
MEDIAN
Flow, cfs
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep


Dalles Flow, May - July 2011
Flow KCFS
600.0
500.0
400.0
300.0
200.0
100.0
0.0
4/30
5/10
5/20
5/30
6/9
6/19
6/29
7/9
7/19
7/29


Vancouver Stage, May - July 2011
MODERATE F.S. = 18.0 FT
FLOOD STAGE = 16.0 FT
STAGE IN FEET
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
4/30
5/10
5/20
5/30
6/9
6/19
6/29
7/9
7/19
7/29

Spring and Summer Seasonal Flow Objectives

- Priest Rapids: 10 Apr – 30 June, objective was 135 kcfs, average was 232 kcfs
- Lower Granite Spring: 03 Apr – 20 June, objective was 100 kcfs, average was 138 kcfs
- Lower Granite Summer: 21 June – 31 August, objective was 54 kcfs, average was 81 kcfs
- McNary Spring: 10 Apr – 30 June, objective was 260 kcfs, average was 377 kcfs
- McNary Summer: 01 Jul – 31 August, objective was 200 kcfs, average was 262 kcfs

High Flow Impact Summary (Highlights)

- Localized flooding Areas around Sauvie Island, including some access roads, Deschutes State Park Campground. Waterfront Park at The Dalles, Eastside Esplanade, Portland, Waterfront Renaissance Trail, Vancouver, Marina at Lewis River near confluence with Columbia, camping losses and fishing losses
- Loss of Treaty Fishing
- Debris issues on fish screens
- Sheet pilings intended to isolate salvage area of the derelict barge "Davy Crocket" were overtopped
- Bank mitigation/stabilization projects flooded
- Docks within McNary pool threatened. Multiple occurrences.
- Operator of irrigation pumps at Port of Benton reported water had reached up to pumps
- Hatchery construction and intakes by Chief Joseph Dam threatened
- High flows from GCL (in combination with unit outages) create high TDG and cause problems at fish farm
- General wear and tear on spill gates and stilling basins and other structures (BON fish ladder, etc)
- Sediment build-up/gravel bar migration as high water recedes potentially affecting navigation channel and the house boat community near I-5 bridge
- Recreational fishing impacts due to deep drawdown of reservoirs

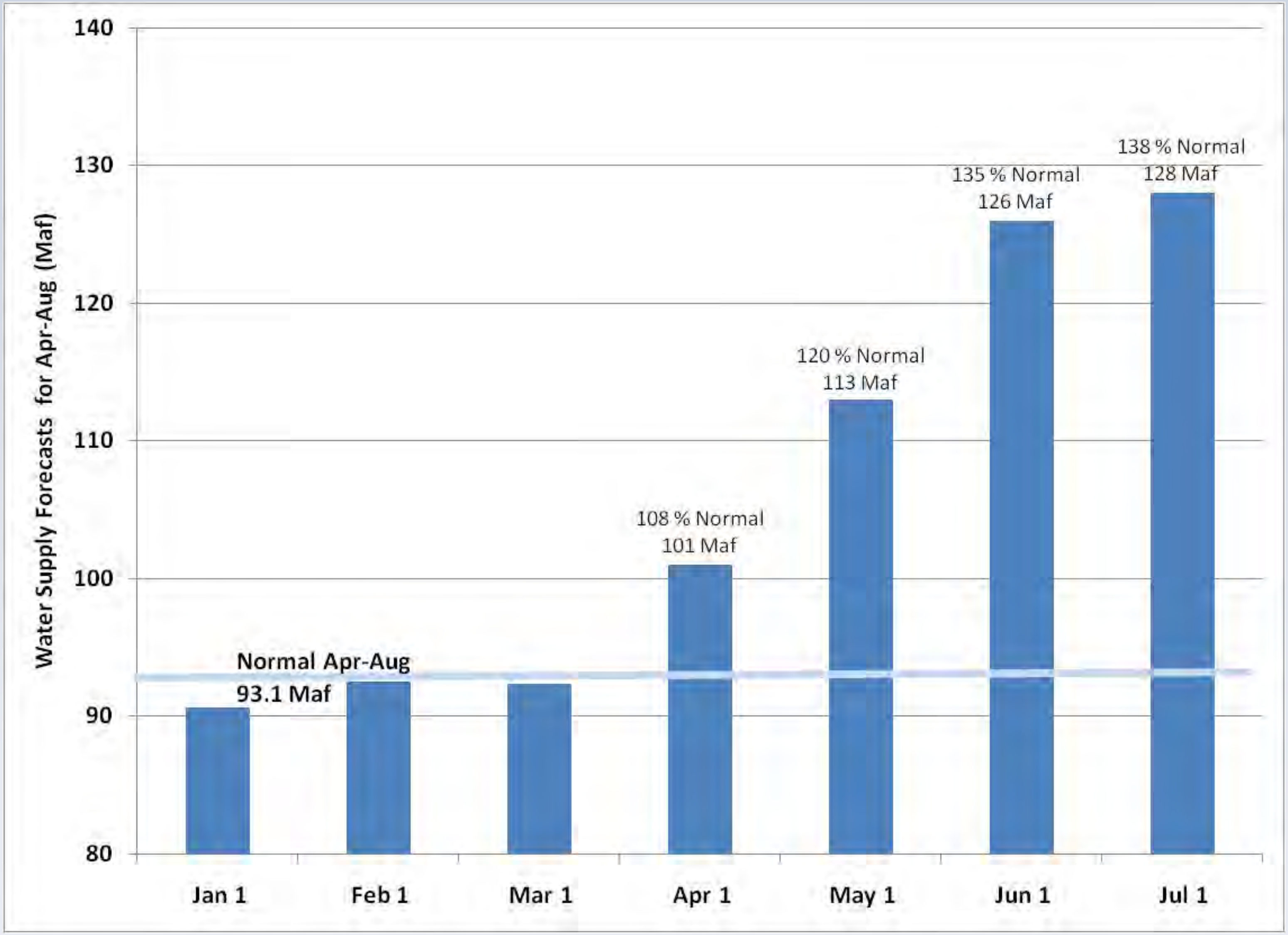
TMT Annual Review

2011 High Water Overview

Presented by
Kasi Rodgers
USACE, Water Management Division

December 7, 2011

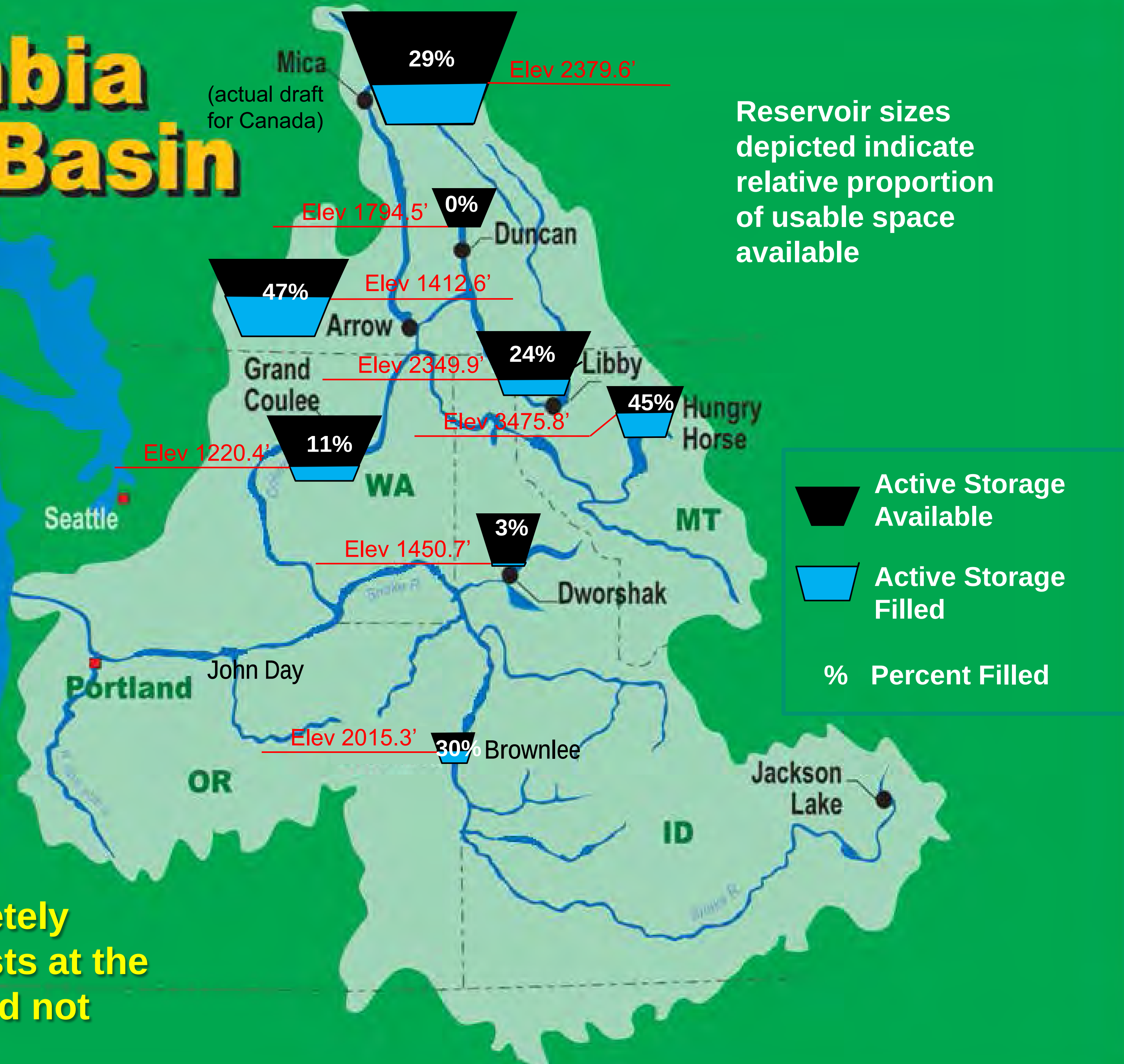
2011 Water Supply Forecast at The Dalles (Apr – Aug)



Columbia River Basin

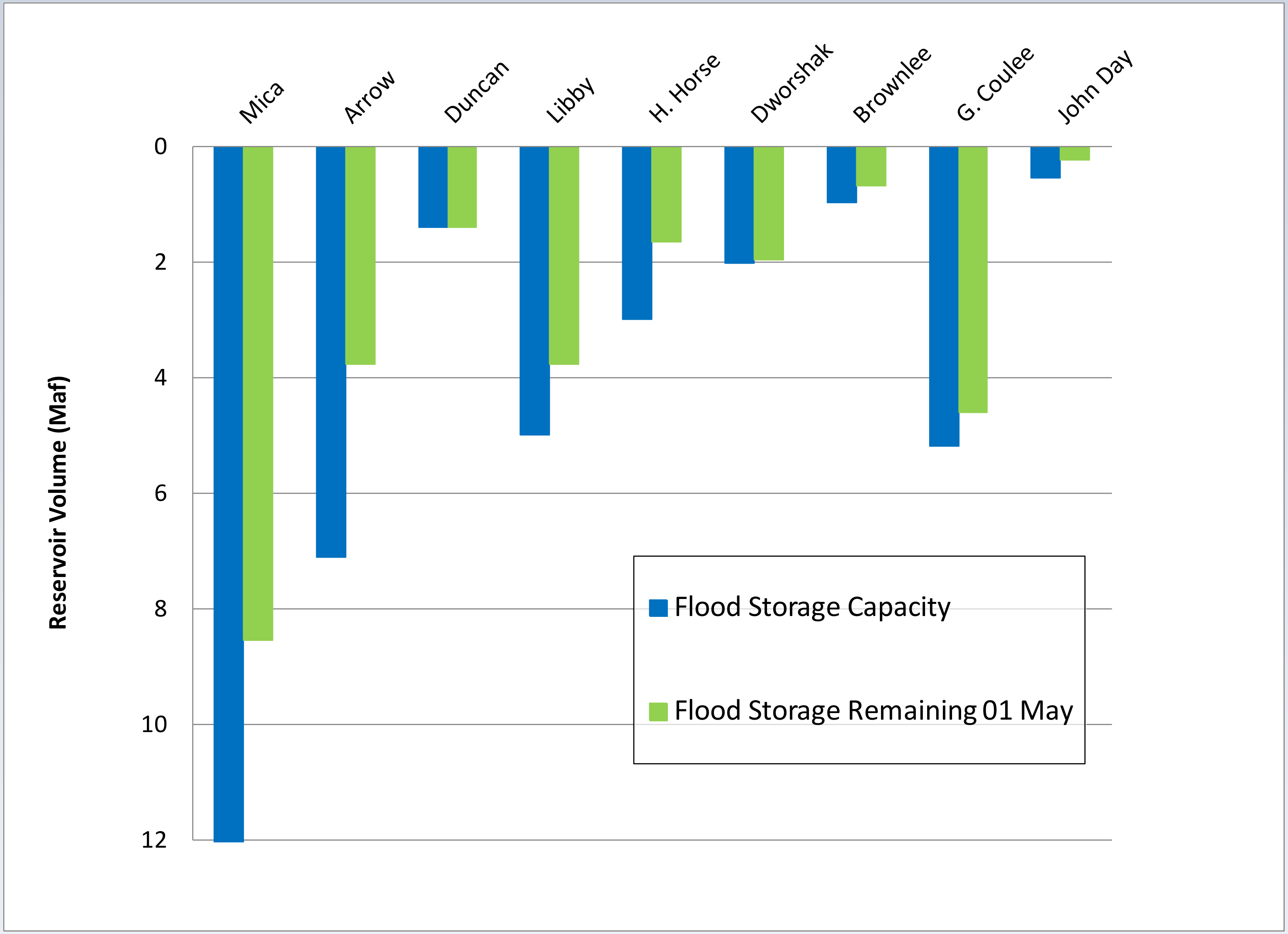
Apr 30th

Reservoir sizes depicted indicate relative proportion of usable space available



Note: Not all U.S. reservoirs completely drafted as forecasts at the time of drafting did not warrant such.

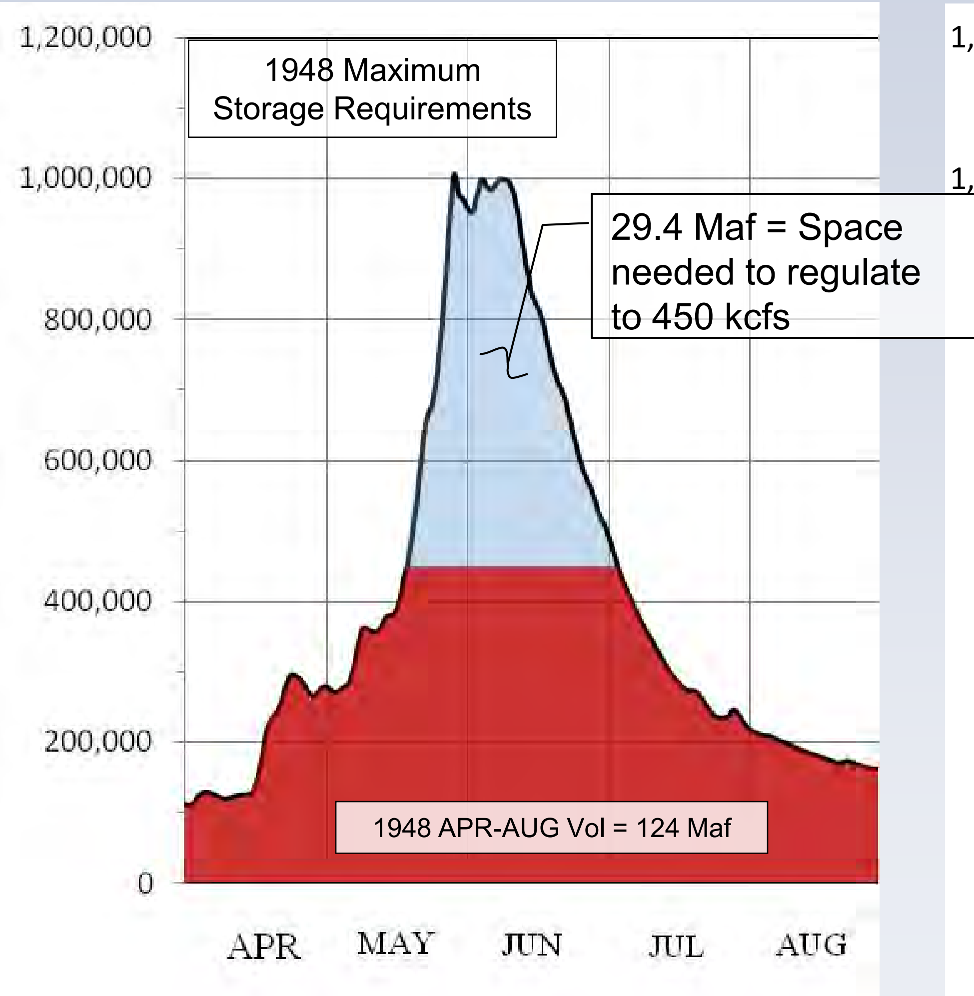
Reservoir Space Available for Flood Risk Mgmt

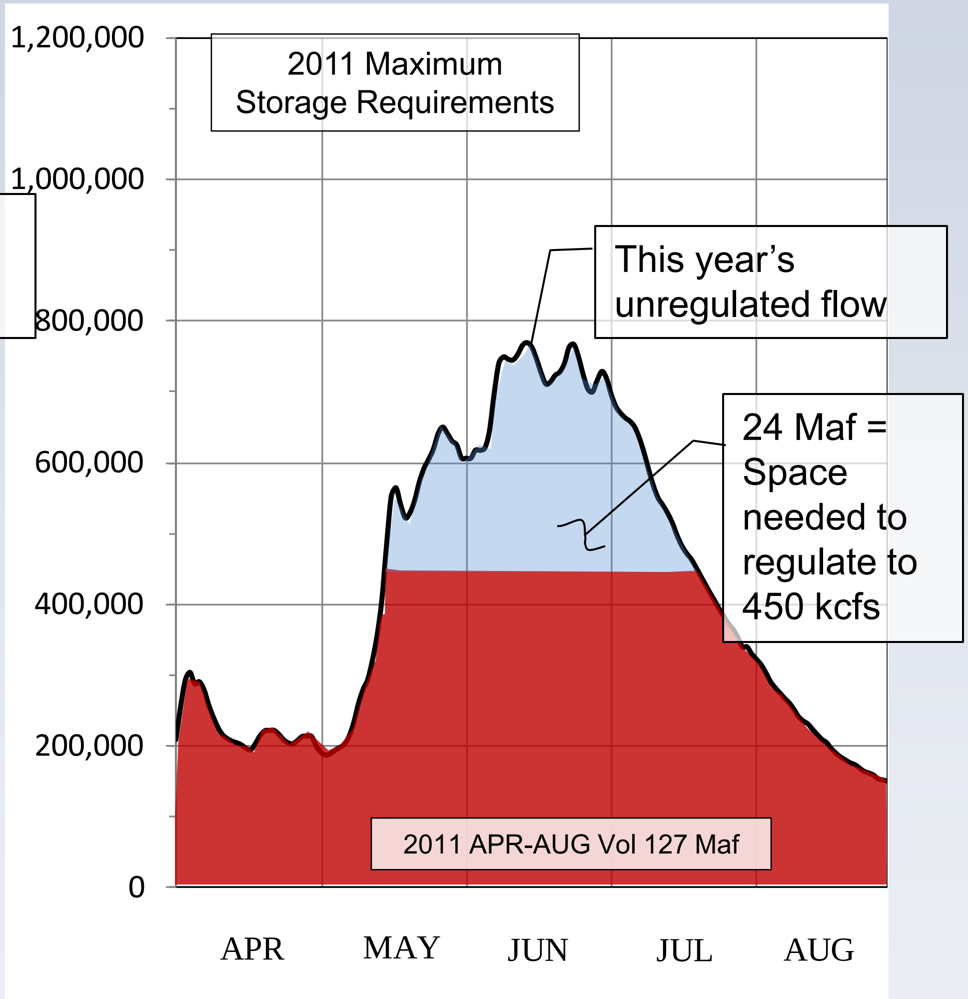


The year in comparison

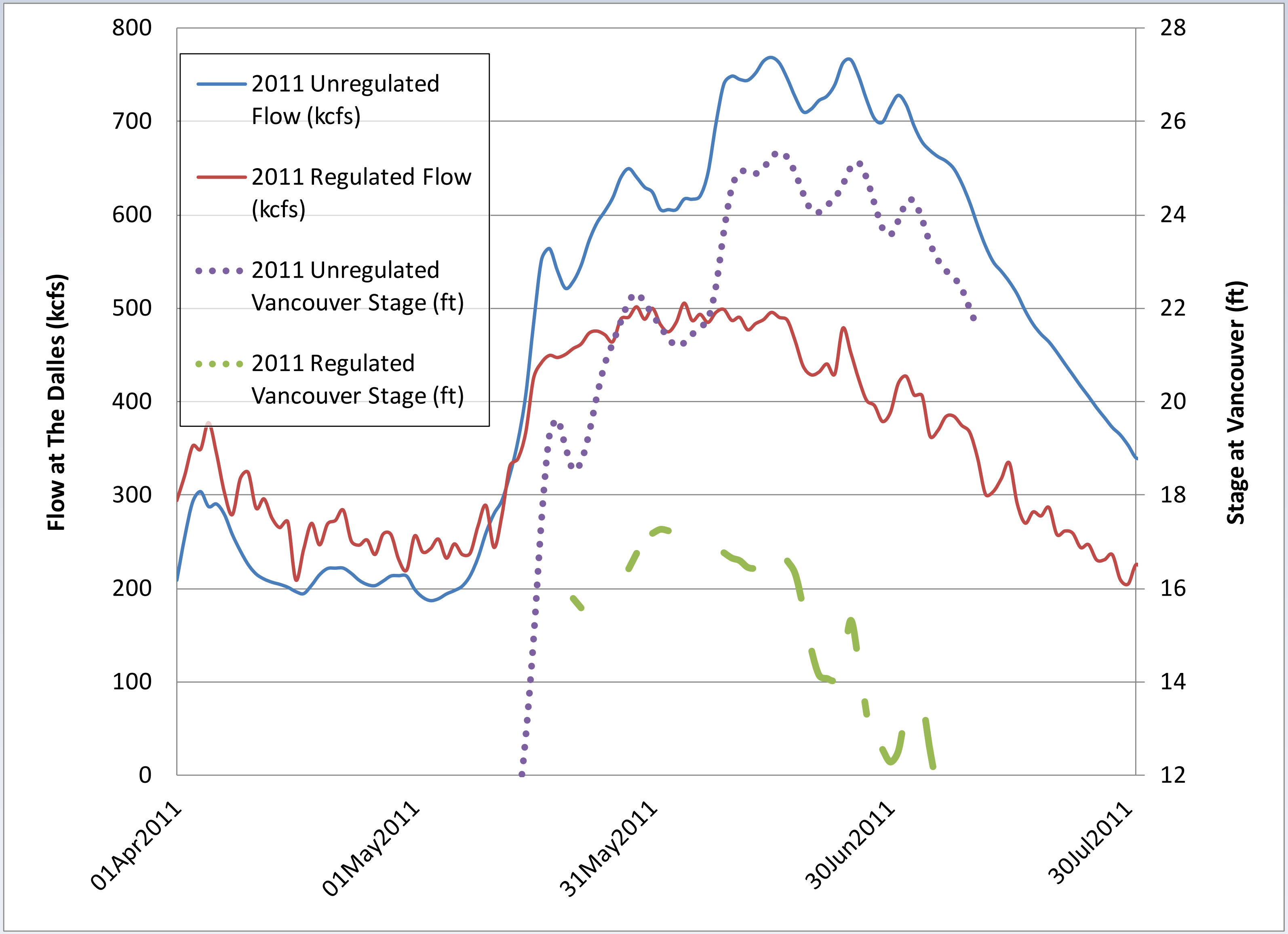
Rank	Year (1929 to 2011)	Apr-Aug TDA Runoff Volume (Maf)
1	1974	134
2	1997	133
3	1972	129
4	2011	127
5	1956	126
6	1948	124
7	1971	121
8	1982	115
9	1950	114
10	1976	114

Large year, but shape matters!

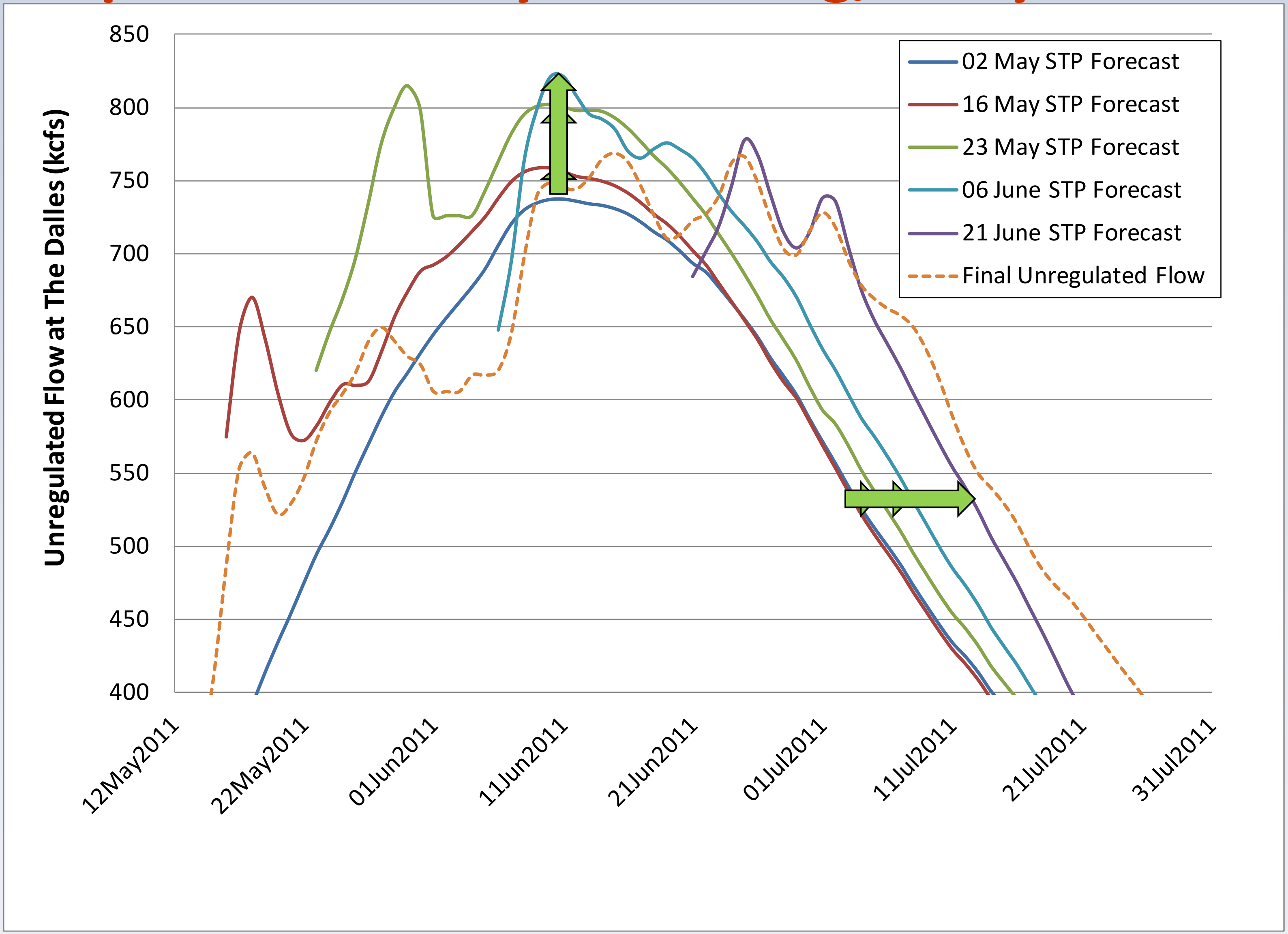




Flow at The Dalles and Stage at Vancouver 2011



A depiction of this year's rising/delayed forecasts



Flight Pictures, 03 June 2011

Bonneville

Flight Pictures, 03 June 2011

The Davy Crockett

Flight Pictures, 03 June 2011

Confluence with Willamette River

Flood Pictures, 24 May 2011

Vancouver, WA

Photo Source: AP News

Flight Pictures, 03 June 2011

Vancouver Lake

Flight Pictures, 03 June 2011

Lewis River

Flood Pictures, 30 May 2011

Riverfront Park at The Dalles

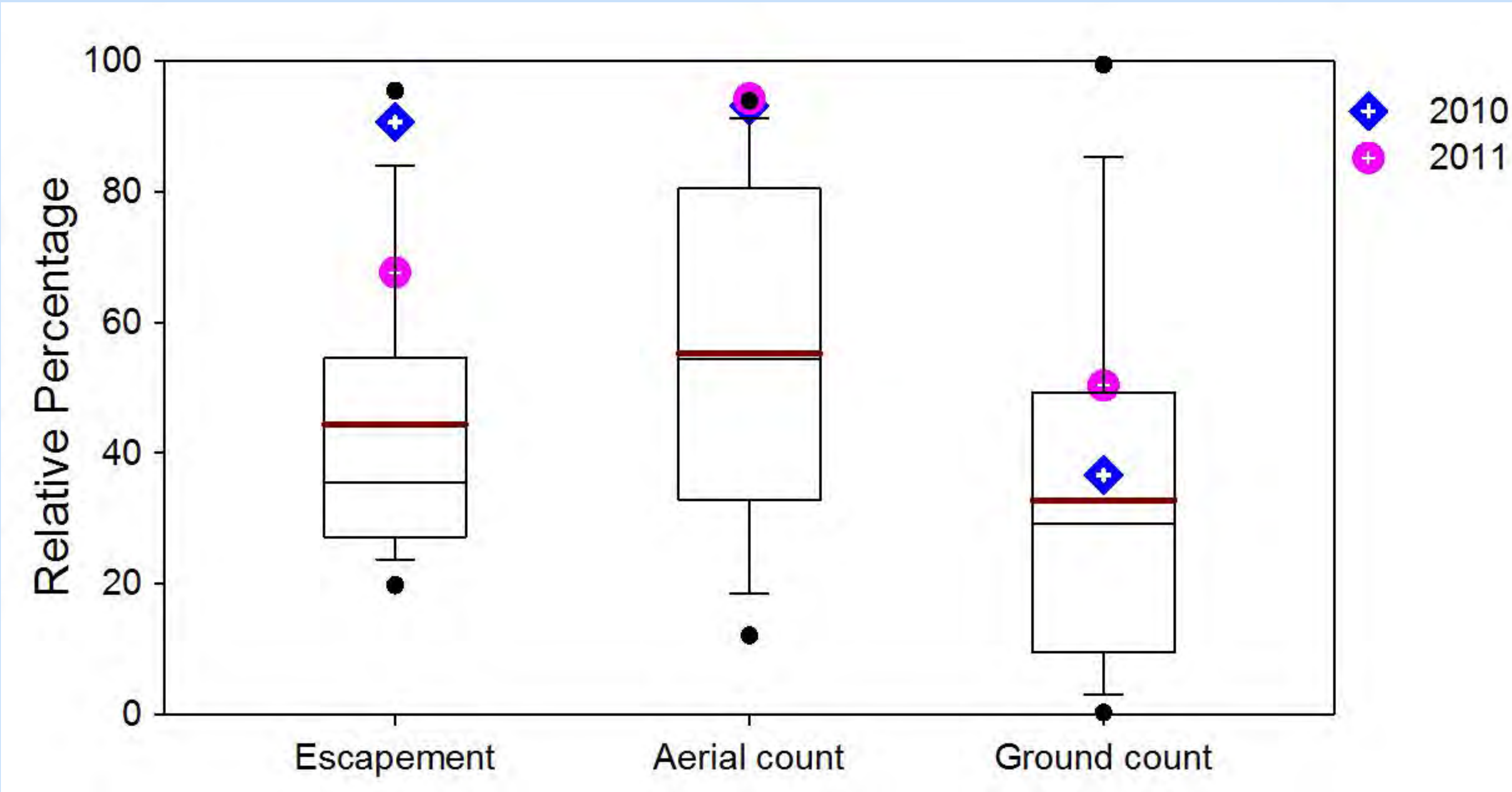
Photo Source: Sonya Dodge

Hanford Reach Fall Chinook Protection Program 2010-2011

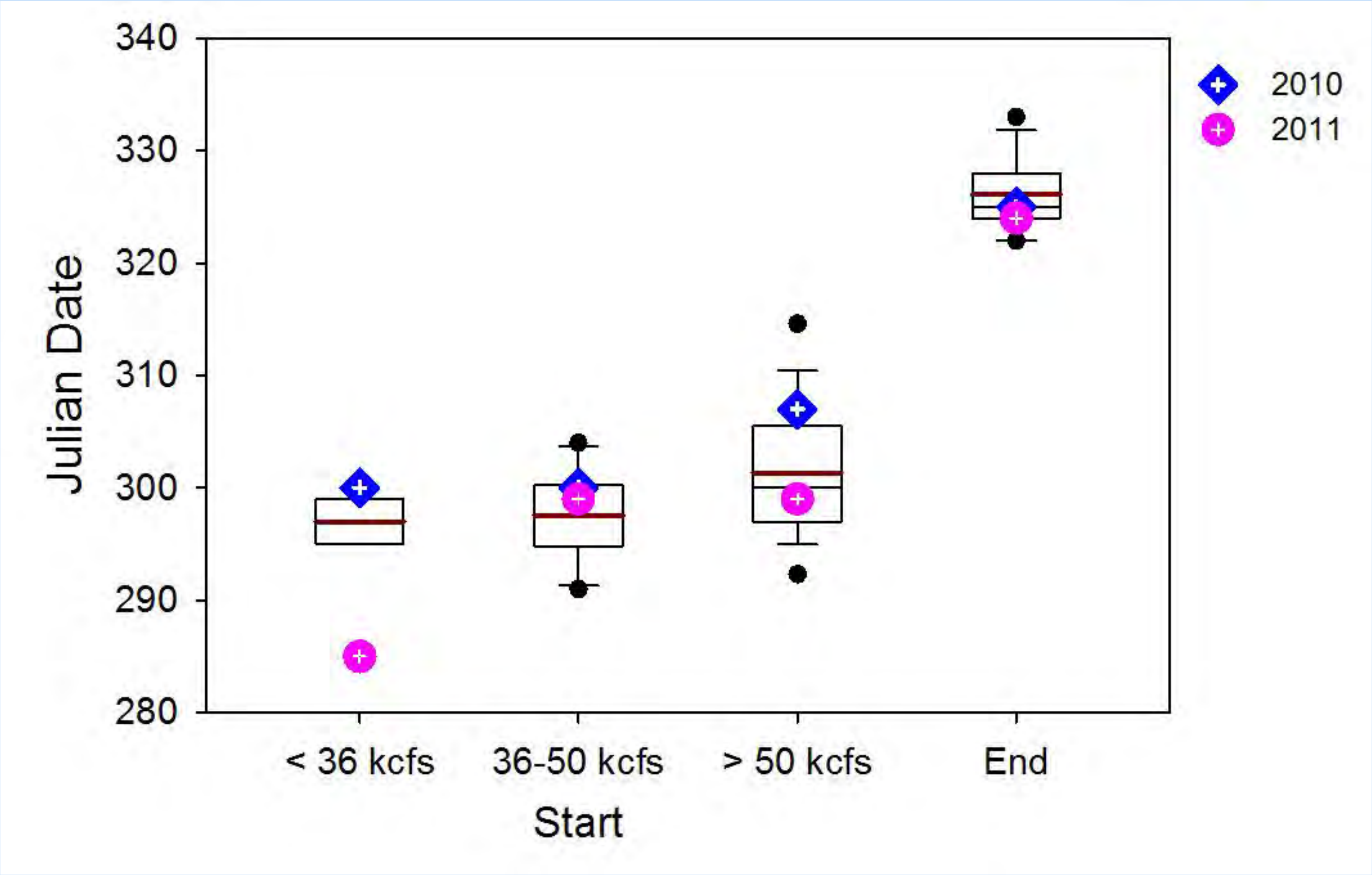
December 7, 2011
Portland, OR

Grant County
PUBLIC UTILITY DISTRICT
Excellence in Service and Leadership

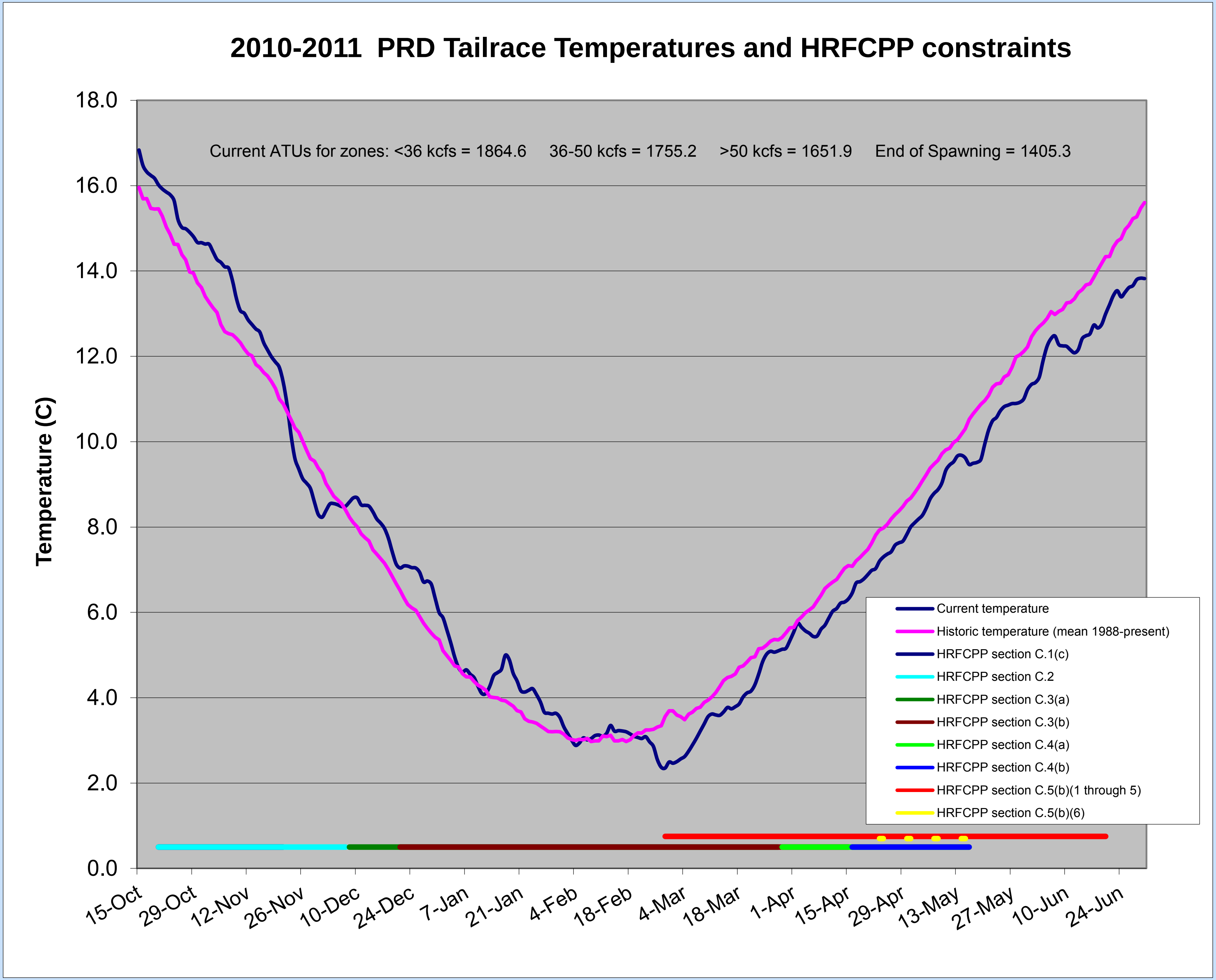
Hanford Reach Fall Chinook 2010 & 2011



Spawning Period 2010 & 2011

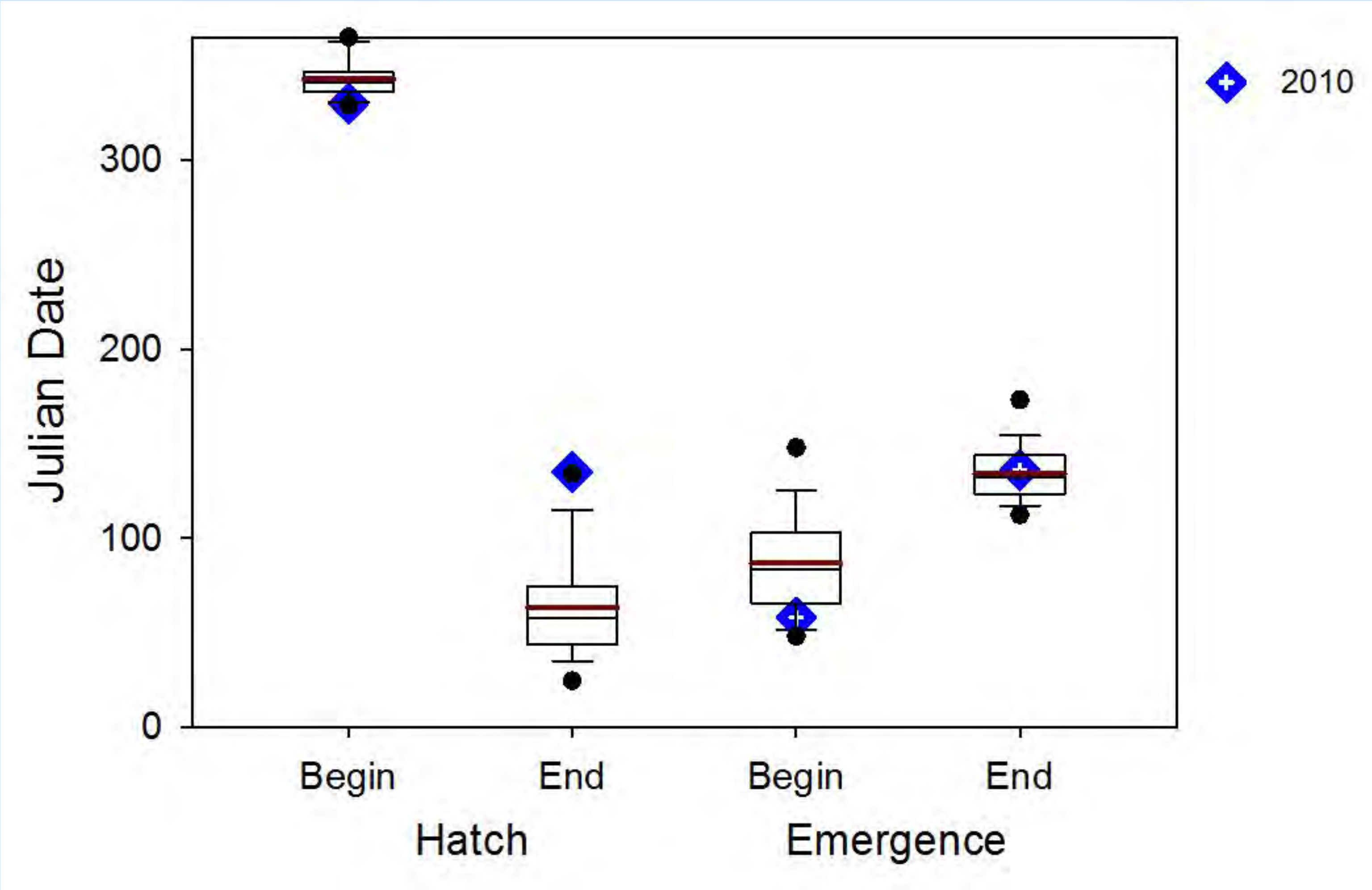


- Critical Elevation – 65 kcfs



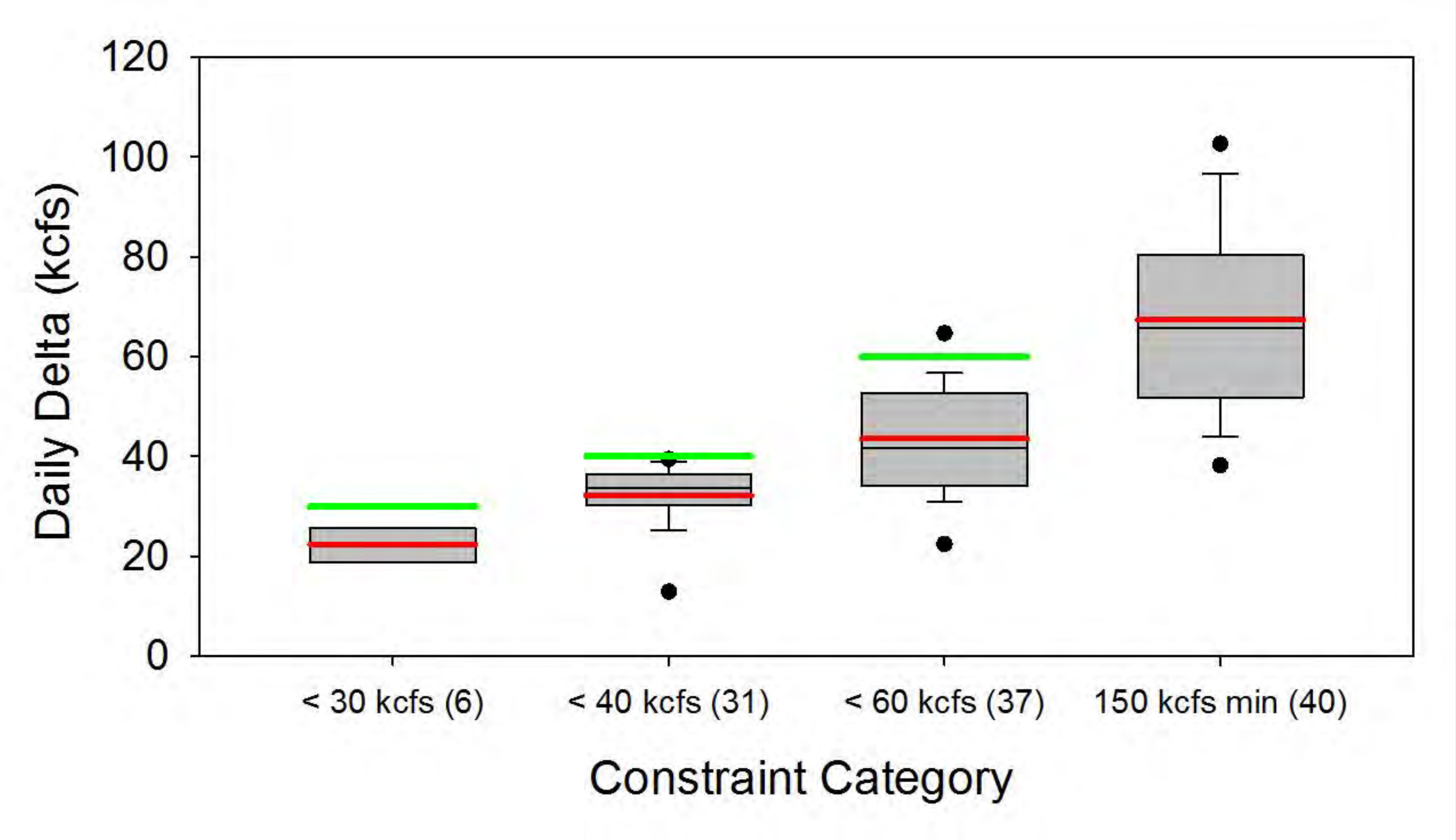
2010-2011 PRD Tailrace Temperatures and HRFCPP constraints
Current ATUs for zones: <36 kcfs = 1864.6 36-50 kcfs = 1755.2 >50 kcfs = 1651.9 End of Spawning = 1405.3
Temperature (C)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
15-Oct
29-Oct
12-Nov
26-Nov
10-Dec
24-Dec
7-Jan
21-Jan
4-Feb
18-Feb
4-Mar
18-Mar
1-Apr
15-Apr
29-Apr
13-May
27-May
10-Jun
24-Jun
Current temperature
Historic temperature (mean 1988-present)
HRFCPP section C.1(c)
HRFCPP section C.2
HRFCPP section C.3(a)
HRFCPP section C.3(b)
HRFCPP section C.4(a)
HRFCPP section C.4(b)
HRFCPP section C.5(b)(1 through 5)
HRFCPP section C.5(b)(6)

Hatching and Emergence



- Weekend protections – April 23
- End – June 20

Priest Rapids Dam discharge daily deltas 2011 Rearing Period



- Mean PRD discharge = 196.7 kcfs
- Mean daily delta = 47.7 kcfs

Emergence and Rearing Period operations - 2011

- Met Criteria
  - 111 of 114 targets (97%)
  - HRFCPPA mean 86%
- Exceedances
  - Two were less than 1 kcfs
  - One planned to support ongoing studies

Ongoing studies - HRFCCPA

- Entrapment
  - 799 sites – 203 with entrapments
  - 573 entrapments – 61 with Chinook
  - Collection efficiency – 89%
  - Chinook per entrapment – 1.4
- Stranding
  - 388 sites – 374 plots
  - Sample area – 22,997 m^2
  - Chinook collected - 41

Ongoing studies – 401 WQC

- Productivity assessment
- Fallback assessment
- Egg-to-fry survival
- Hydrodynamic model synthesis
- Production simulation model (IBM)

Questions?

Grant County
PUBLIC UTILITY DISTRICT
Excellence in Service and Leadership

Hanford Reach Fall Chinook Protection Program 2010-2011

December 7, 2011
Portland, OR

Grant County
PUBLIC UTILITY DISTRICT
Excellence in Service and Leadership

Spawning Period 2010

- Initiation of spawning
  - <36 kcfs – October 27
  - 36-50 kcfs – October 27
  - >50 kcfs – November 3
- End of spawning
  - November 21

- Redd counts
  - Vernita Bar ground survey – 189
  - Hanford Reach aerial survey – 8,817
- Critical Elevation – 65 kcfs

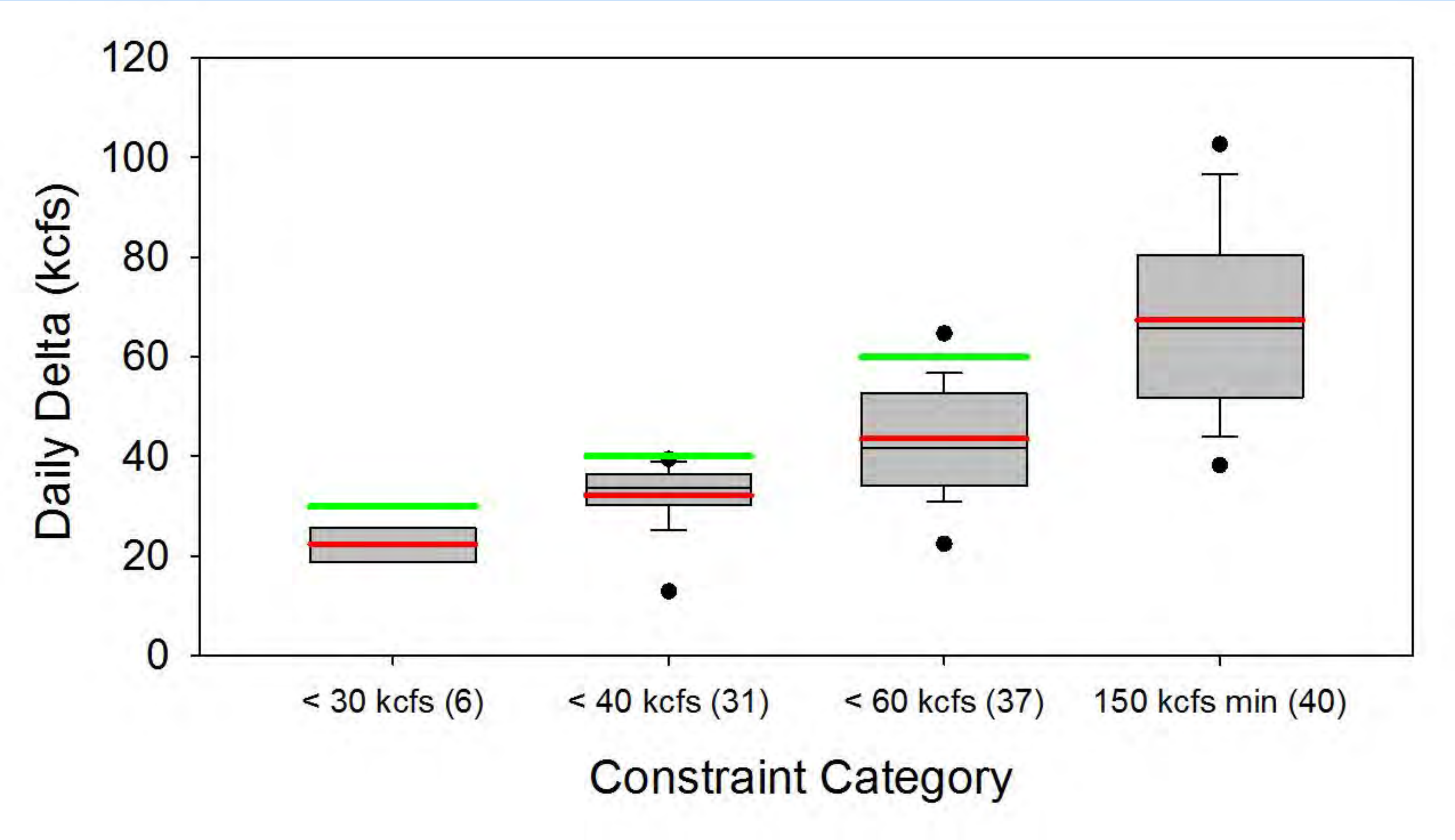
HRFCPP Critical dates 2010-11

- Hatching
  - Begin – November 26
  - End – May 15
- Emergence
  - Begin – February 27
  - End – May 16
- Rearing Period
  - Weekend protections – April 23
  - End – June 20

Emergence and Rearing Period operations - 2011

- Mean PRD discharge = 196.7 kcfs
- Mean daily delta = 47.7 kcfs
- Daily delta distribution
    - < 20 kcfs = 5
    - 20-40 kcfs = 50
    - 40-60 kcfs = 31
    - 60-80 kcfs = 17
    - > 80 kcfs = 11

Priest Rapids Dam discharge daily deltas for 2011 Rearing Period



Emergence and Rearing Period operations - 2011

- Met Criteria
  - 111 of 114 targets (97%)
  - HRFCPPA mean 86%
- Exceedances
  - Two were less than 1 kcfs
  - One planned to support ongoing studies

Spawning Period 2011

- Initiation of spawning
  - <36 kcfs – October 12
  - 36-50 kcfs – October 26
  - >50 kcfs – October 26
- End of spawning
  - November 20
- Redd counts
  - Vernita Bar ground survey – 243
  - Hanford Reach aerial survey – 8,915
- Critical Elevation – 65 kcfs

Ongoing studies - HRFCCPA

- Entrapment
  - 799 sites – 203 with entrapments
  - 573 entrapments – 61 with Chinook
  - Collection efficiency – 89%
  - Chinook per entrapment – 1.4
- Stranding
  - 388 sites – 374 plots
  - Sample area – 22,997 m^2
  - Chinook collected - 41

Ongoing studies – 401 WQC

- Productivity assessment
- Fallback assessment
- Egg-to-fry survival
- Hydrodynamic model synthesis
- Production simulation model (IBM)

Questions?

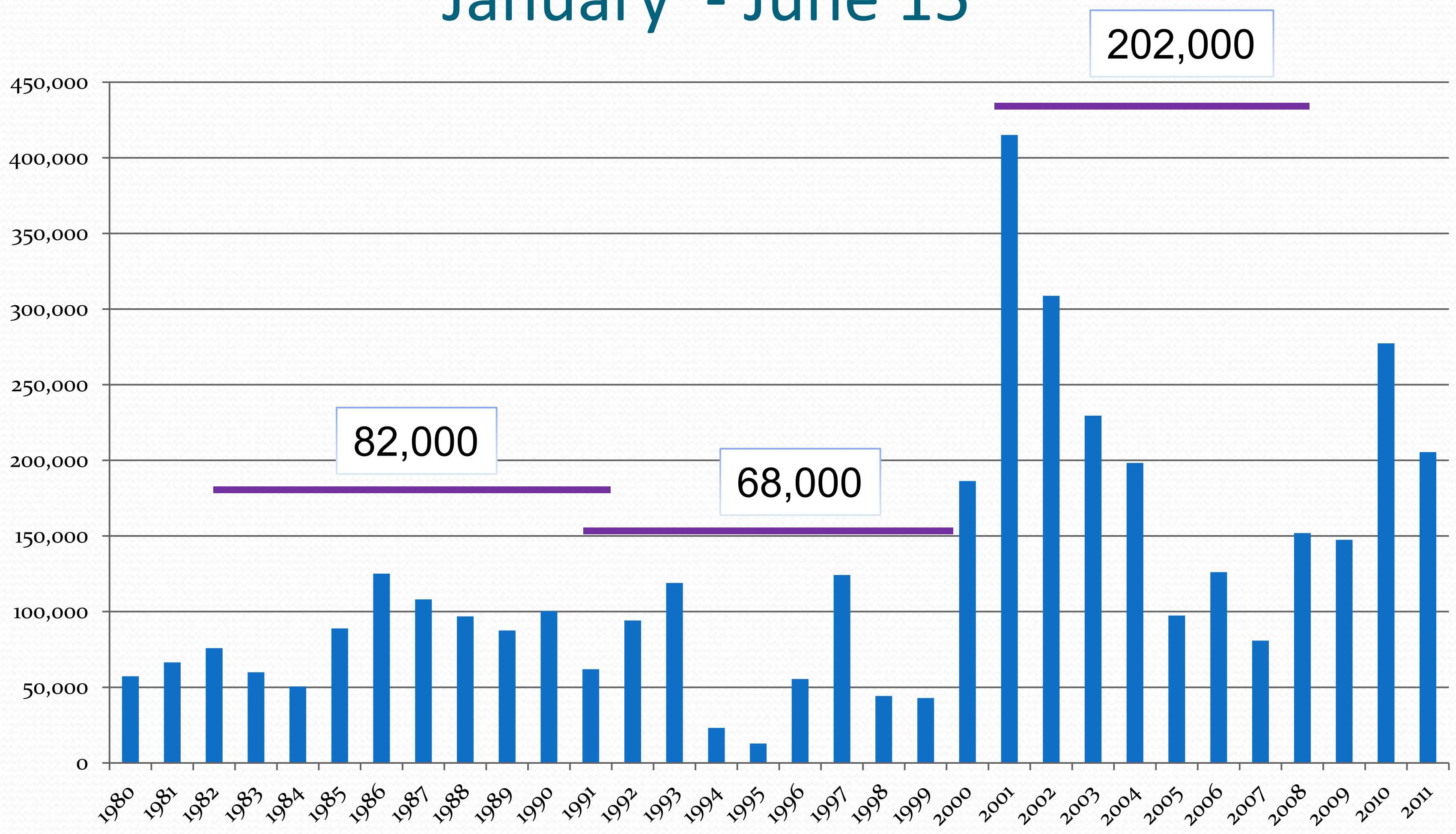
Grant County
PUBLIC UTILITY DISTRICT
Excellence in Service and Leadership

Columbia River Salmon and Steelhead Returns

TMT – December 7, 2011

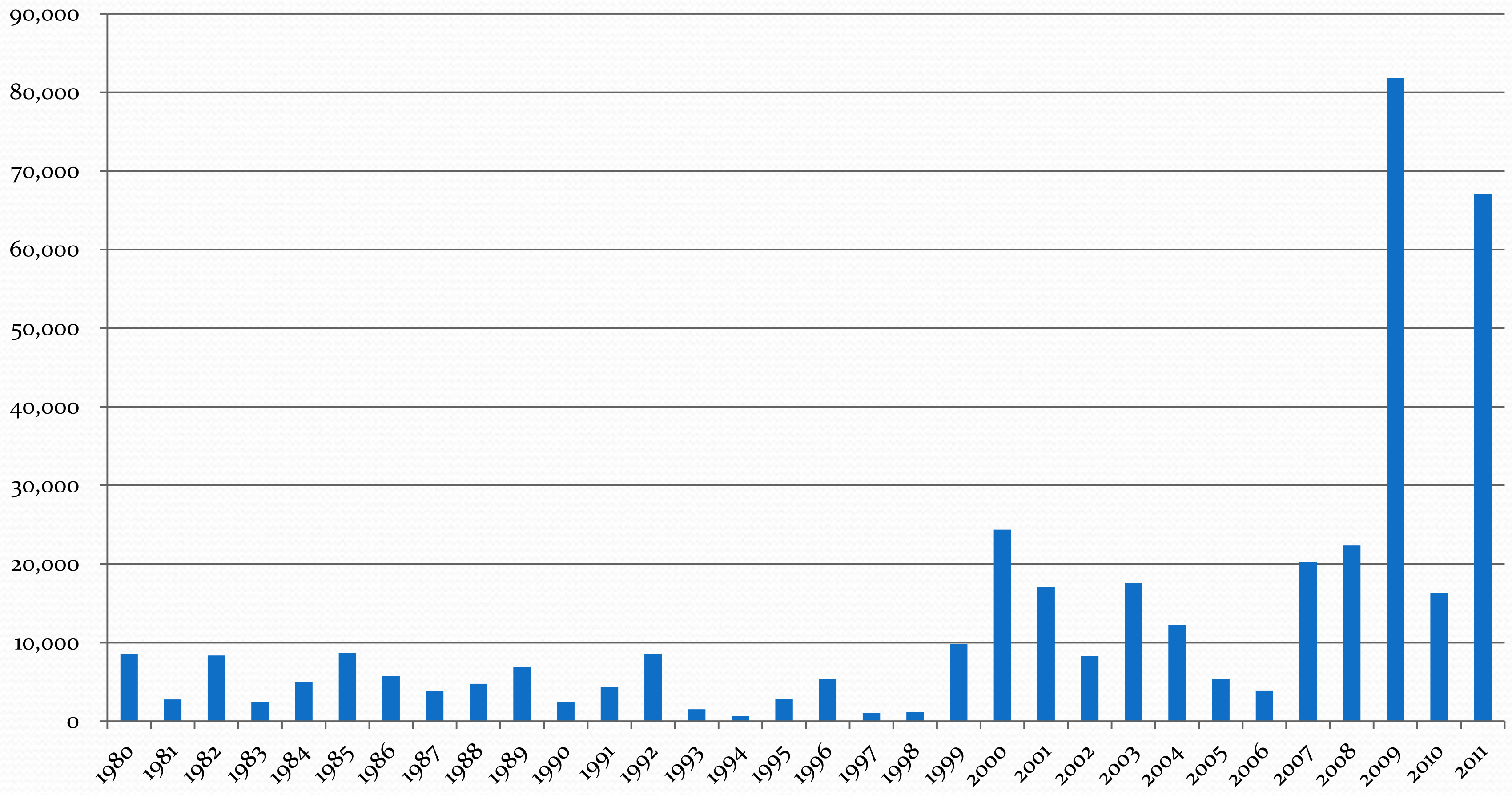
Cindy LeFleur
Washington Department of Fish and Wildlife

Bonneville Dam Counts of Adult Spring Chinook January - June 15

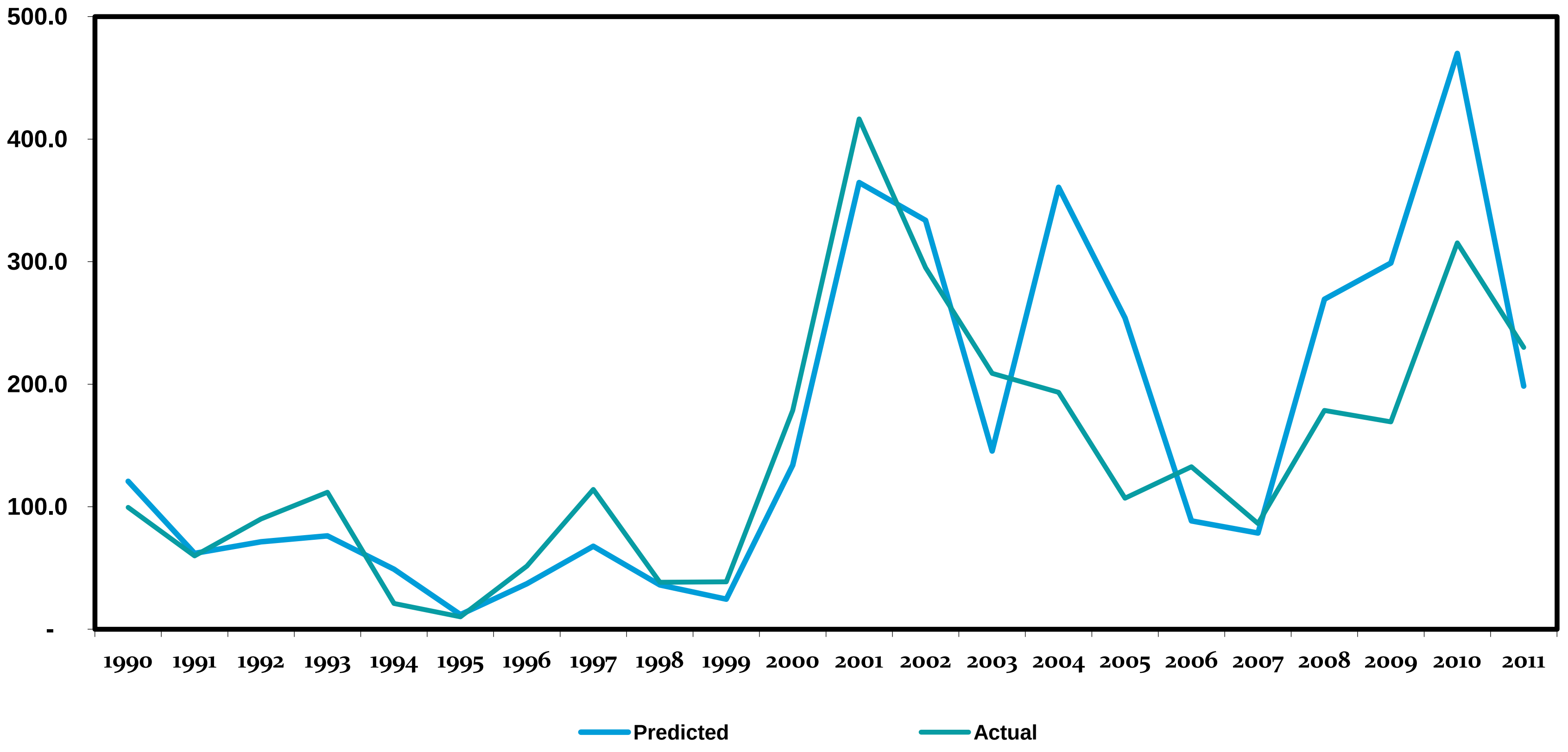


Bonneville Dam Counts of Jack Spring Chinook

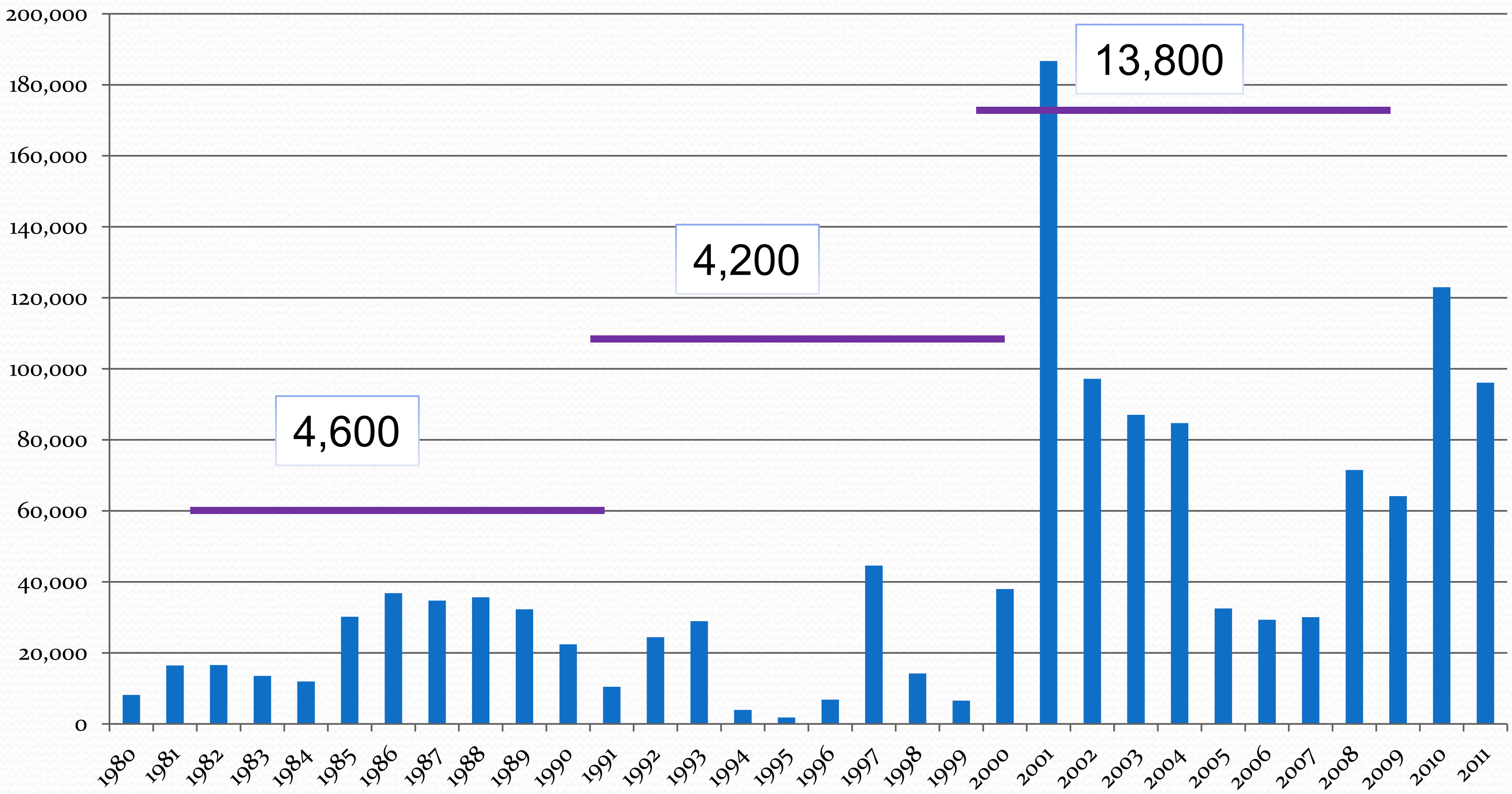
January - June 15



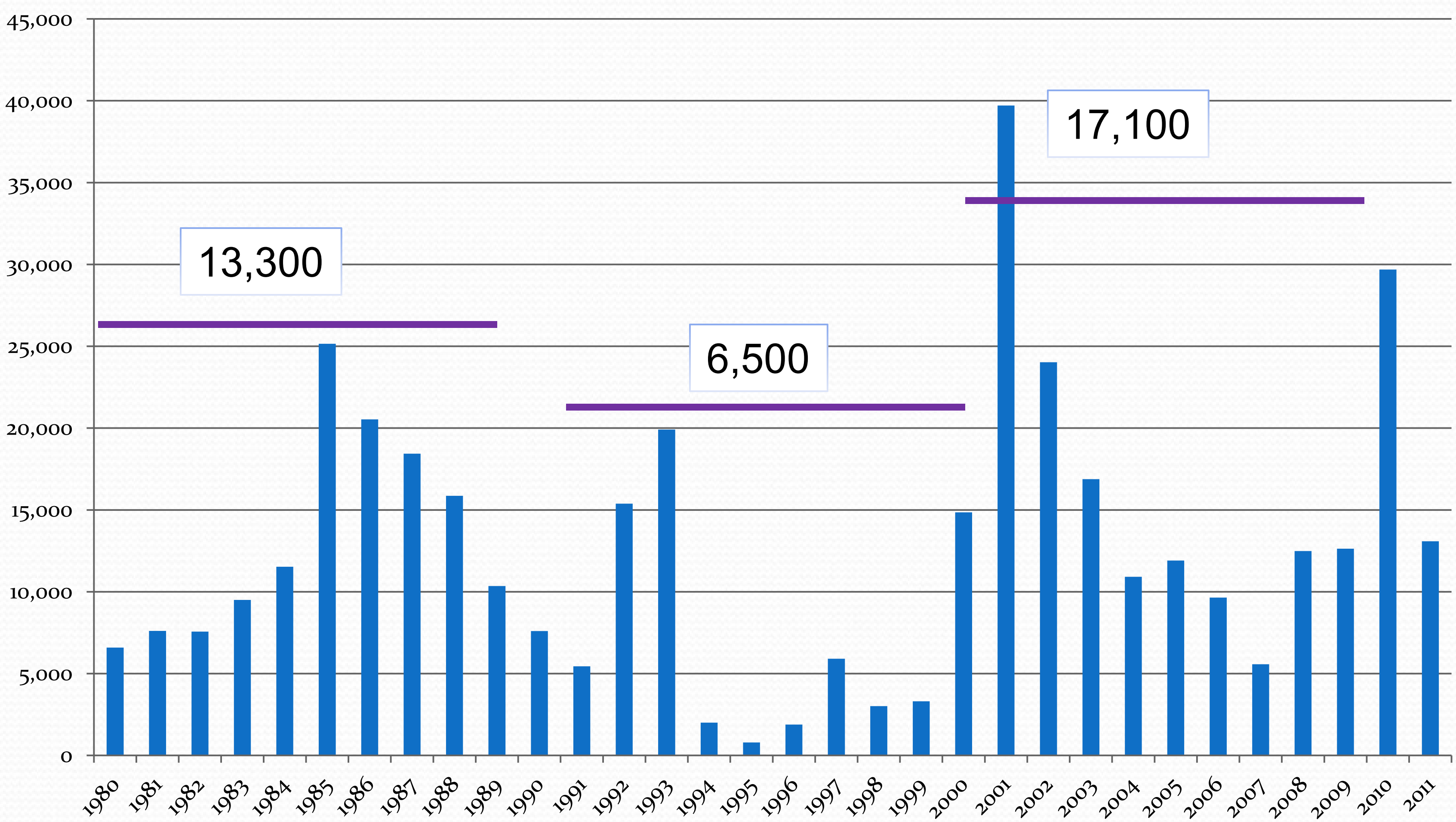
Predicted versus Actual Returns of Adult Upriver Spring Chinook to the Columbia River



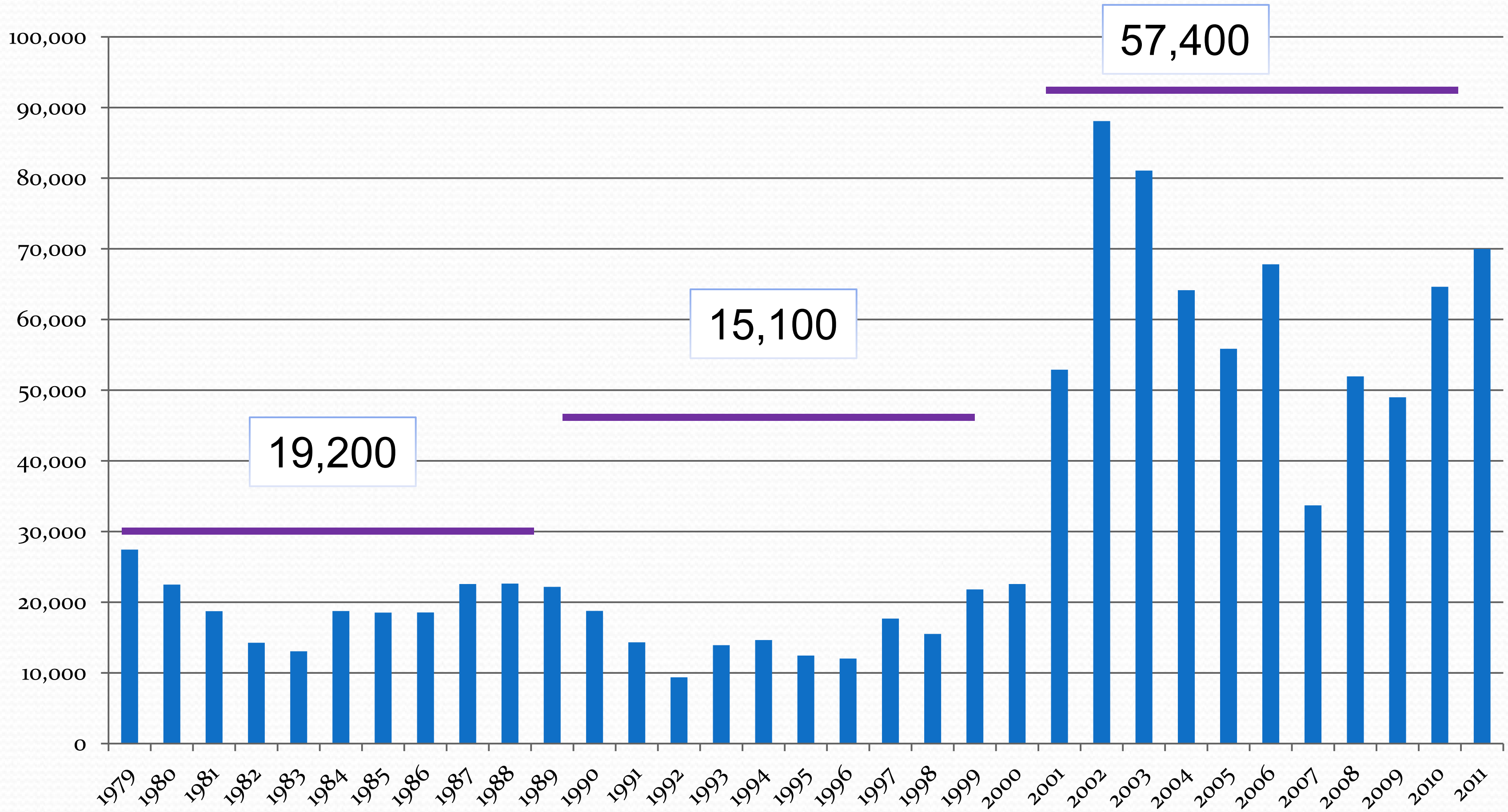
Lower Granite Dam Counts of Adult Spring/Summer Chinook



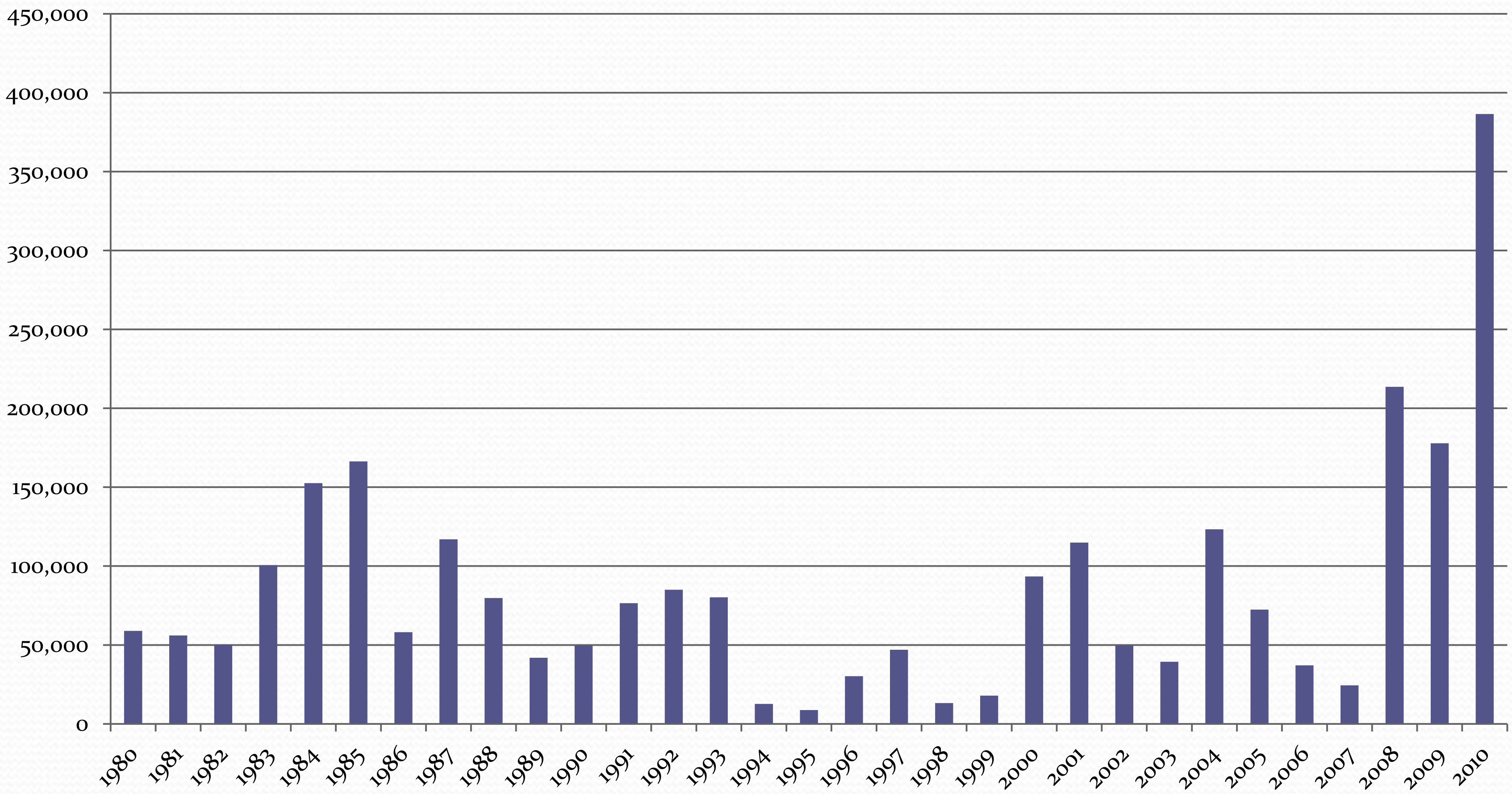
Rock Island Dam Counts of Adult Spring Chinook



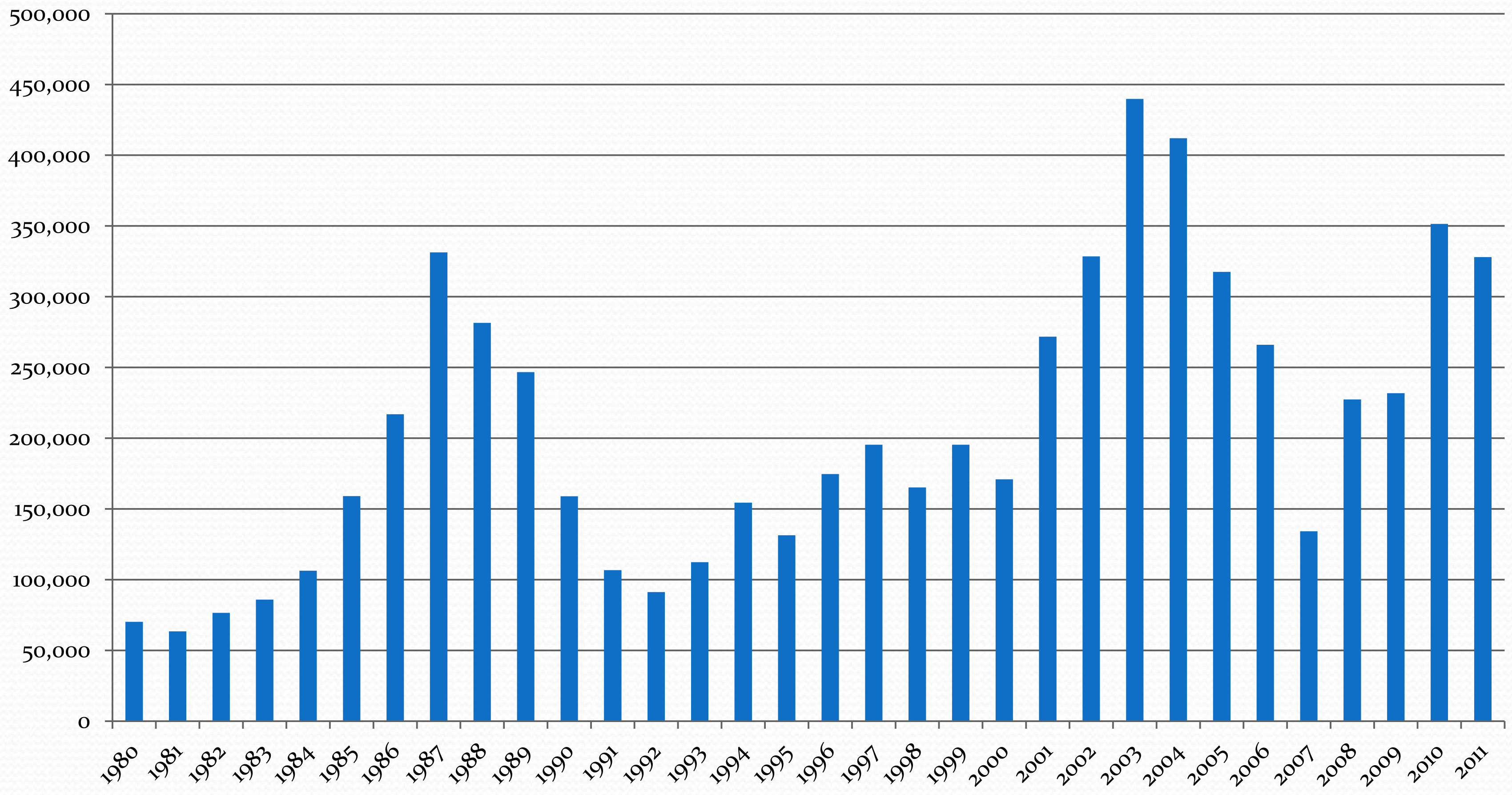
Bonneville Dam Counts of Adult Summer Chinook
June 16 – July 31



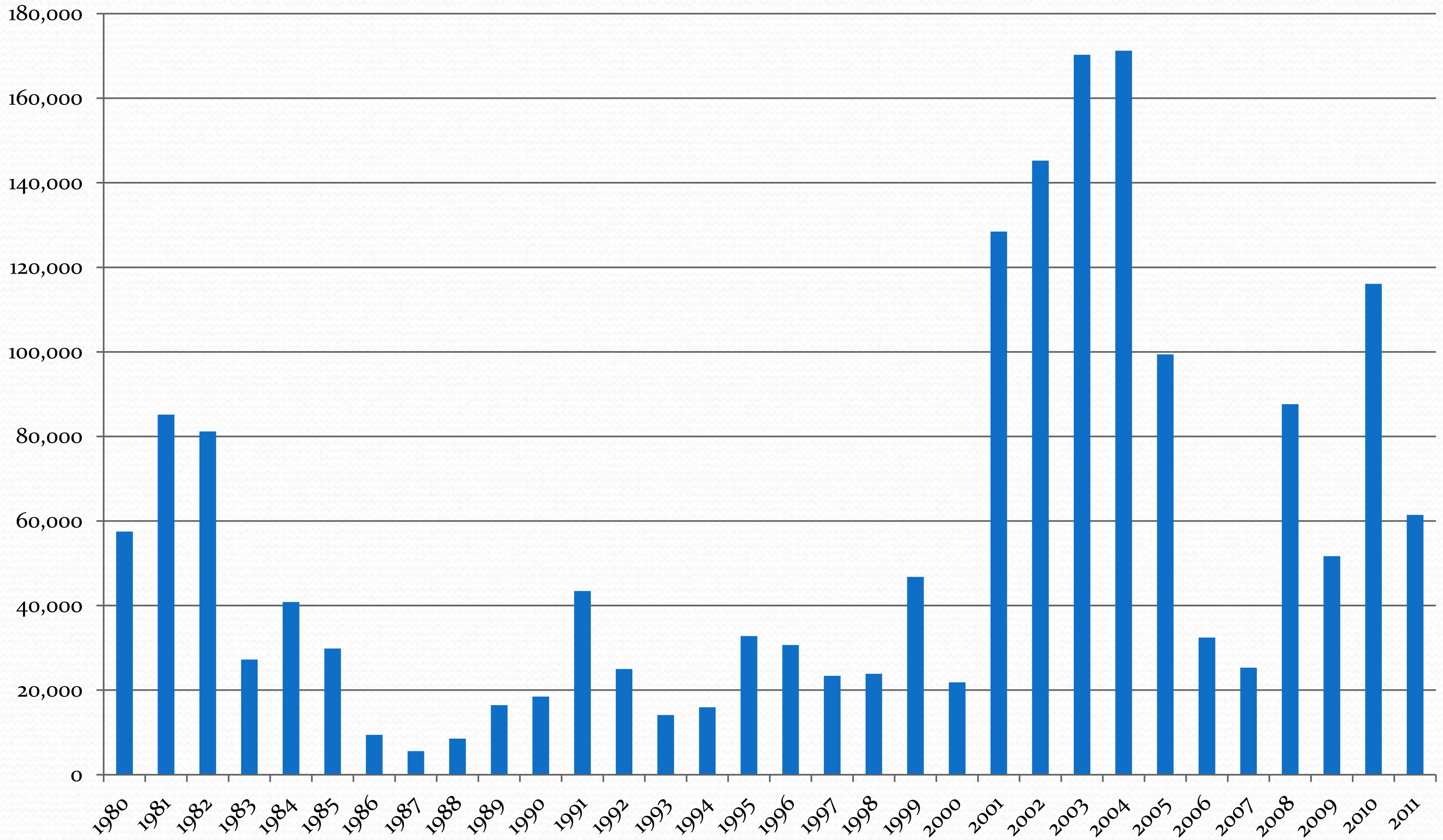
Bonneville Dam Counts of Sockeye



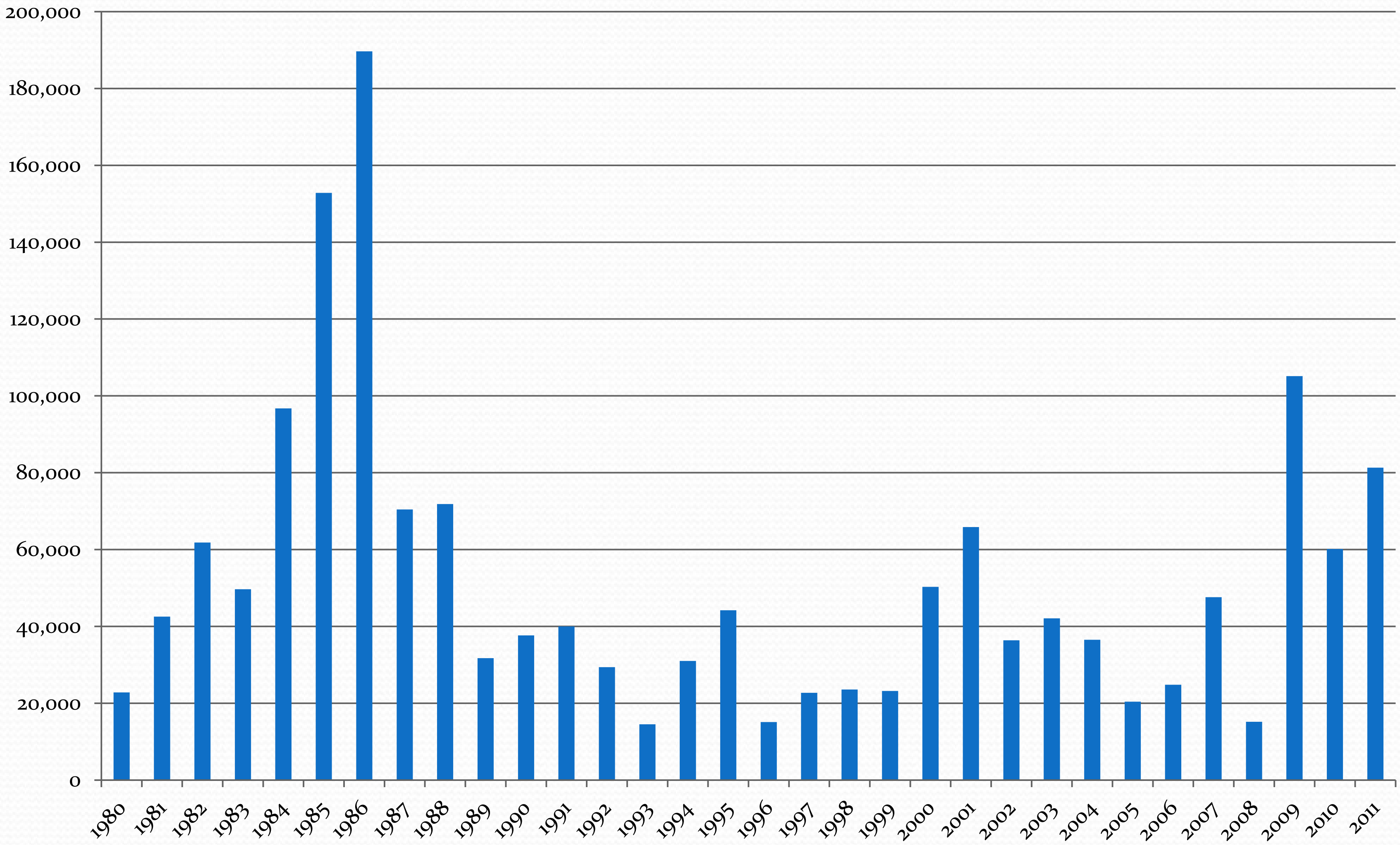
Upriver Bright Stock Adult
Fall Chinook Returns To Bonneville Dam



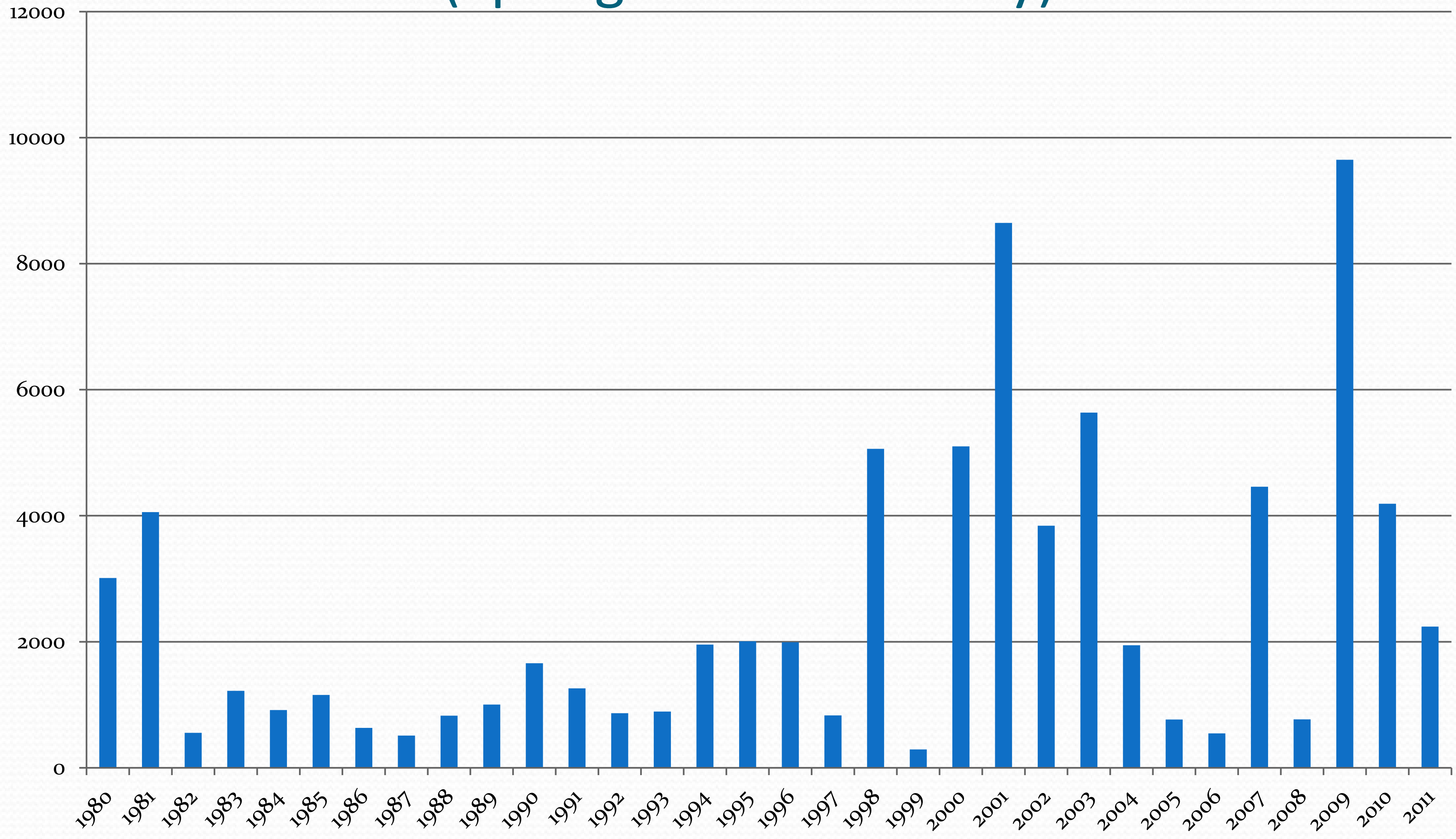
Bonneville Pool Hatchery Stock Adult Fall Chinook Returns to Bonneville Dam



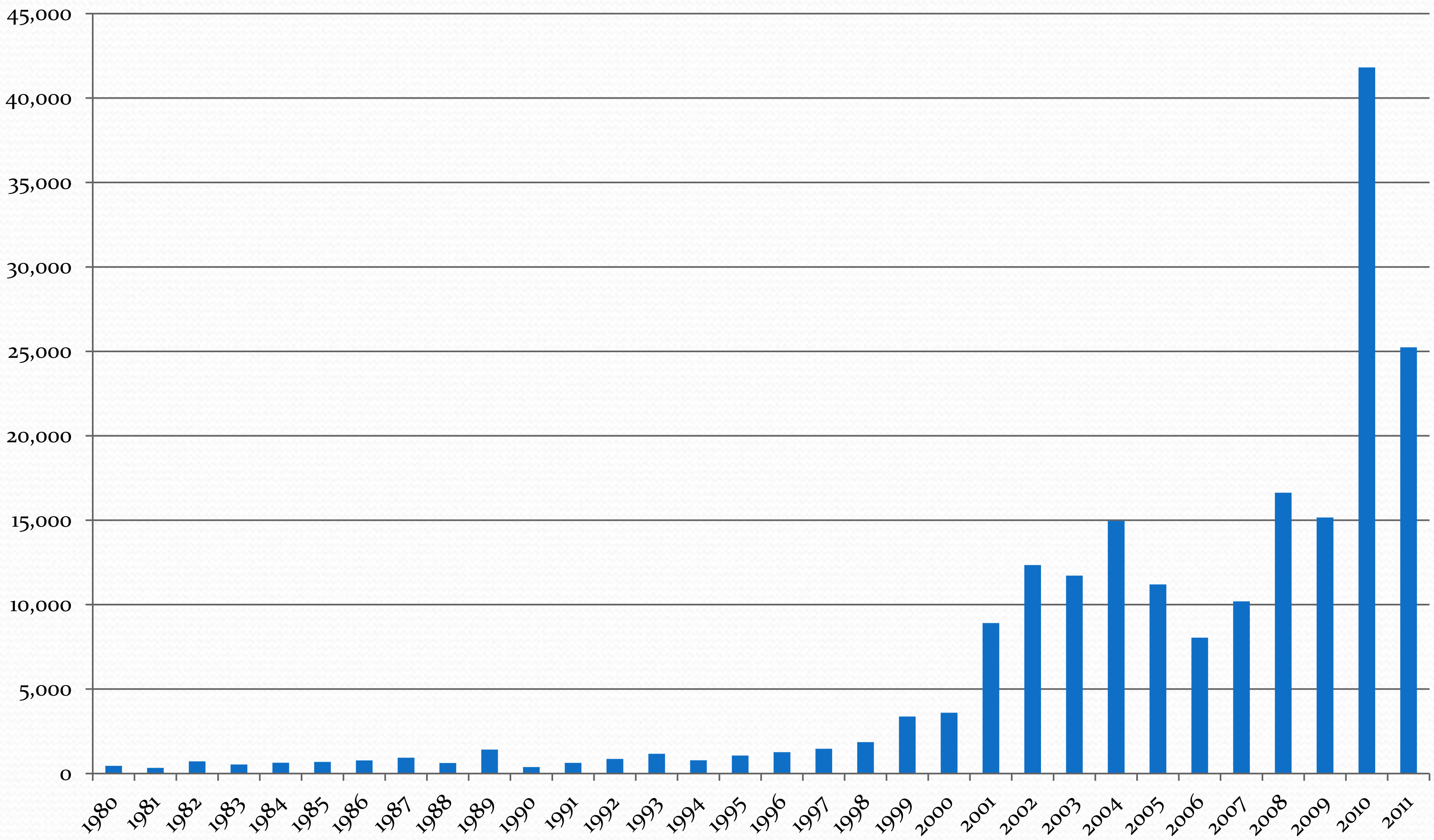
Bonneville Dam Counts of Bright Jack Fall Chinook



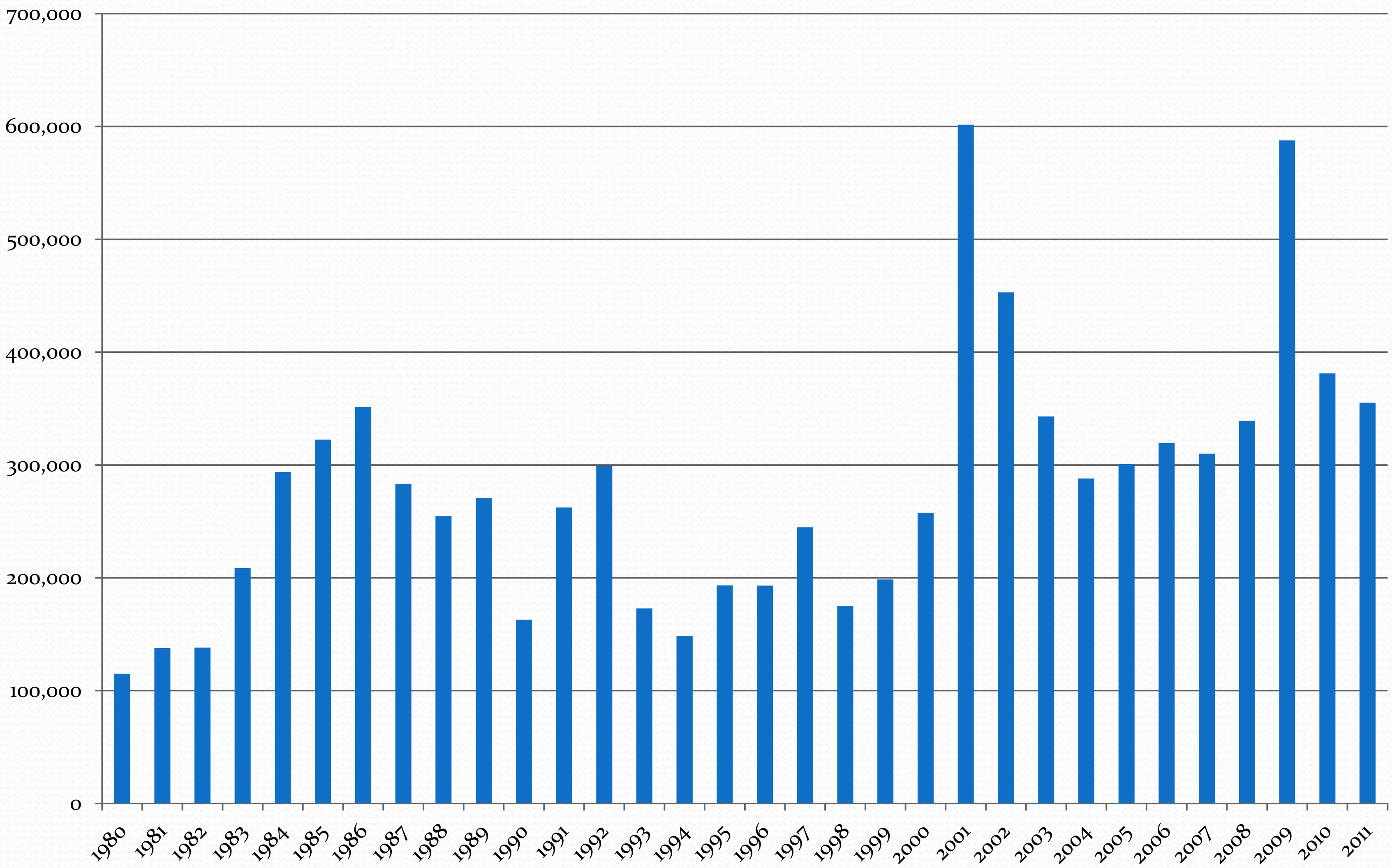
Bonneville Dam Counts of Tule Jack Fall Chinook (Spring Creek Hatchery)



Lower Granite Dam Counts of Adult Fall Chinook

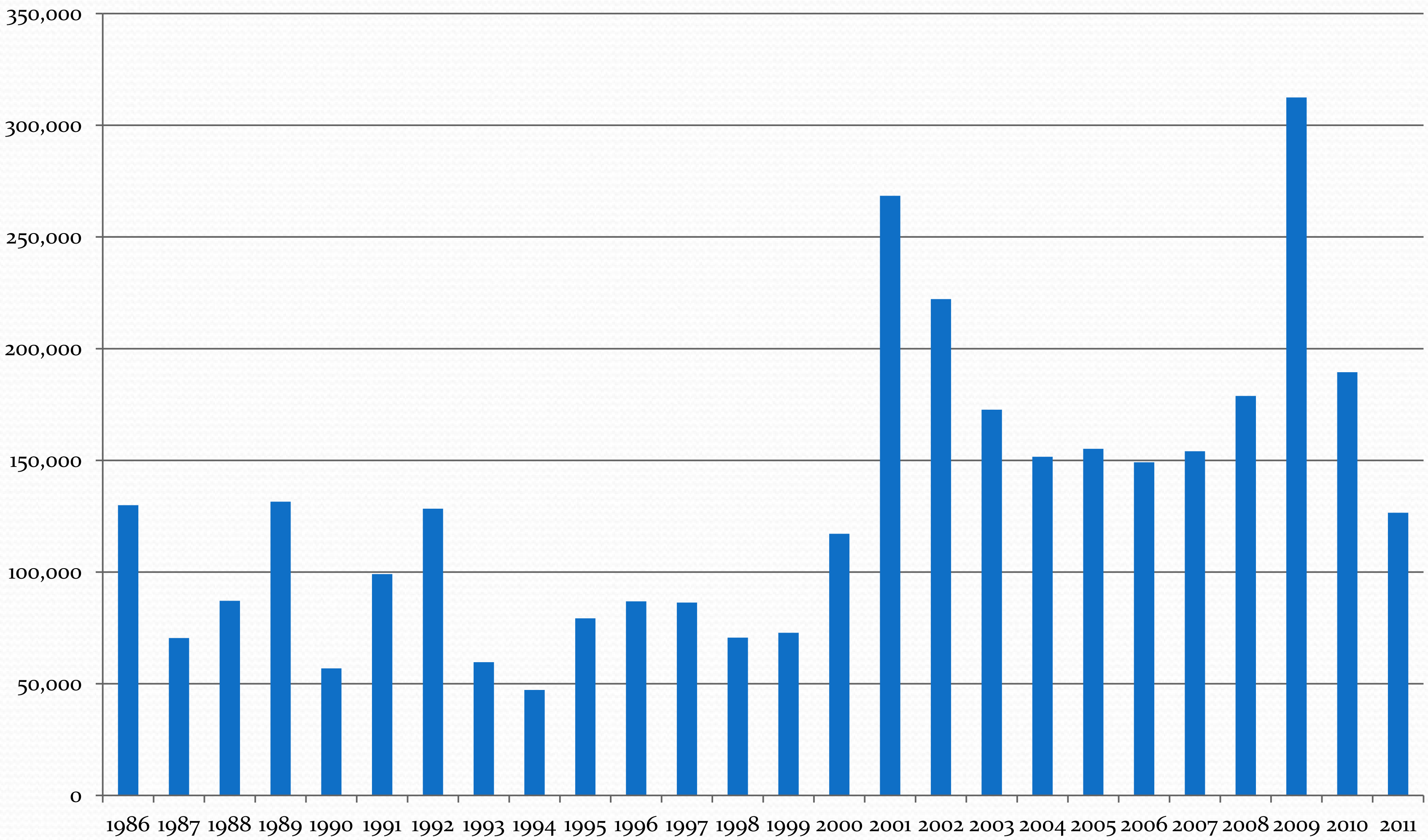


Bonneville Dam Counts of Summer Steelhead



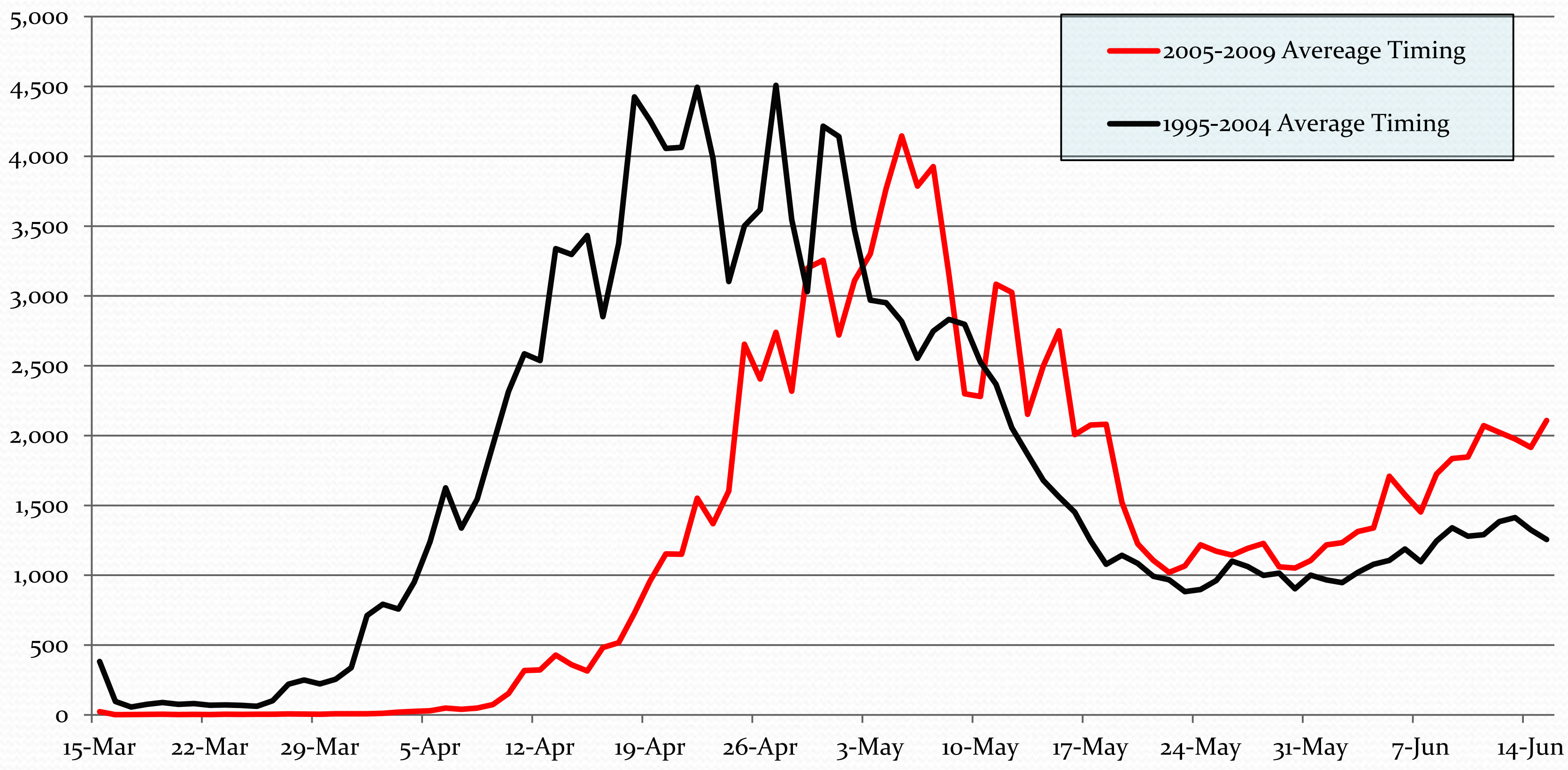
Lower Granite Dam Counts of Summer Steelhead

June 1 – November 5



Questions?

Run Timing of Spring Chinook at Bonneville Dam (March 15-June 15)



Hatchery Subyearling Chinook Survival LGR to McN

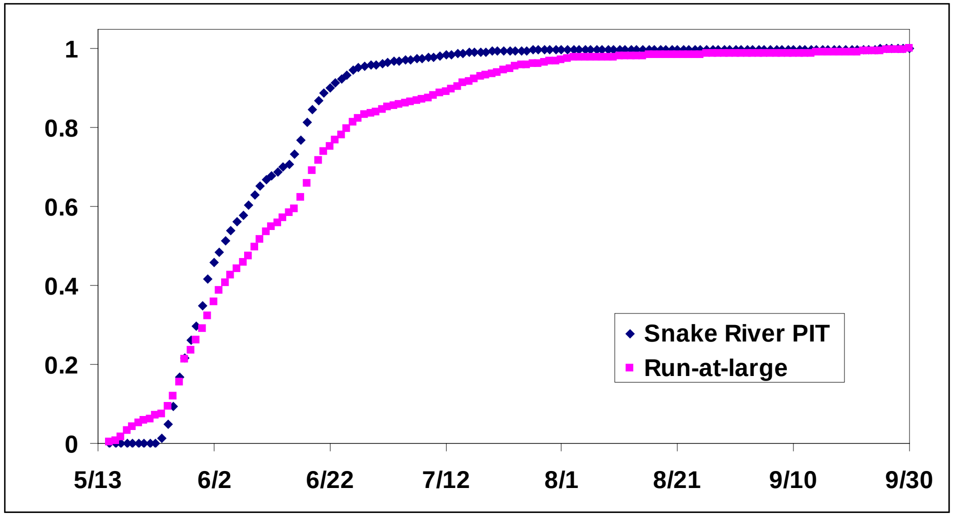
Jerry McCann

Fish Passage Center

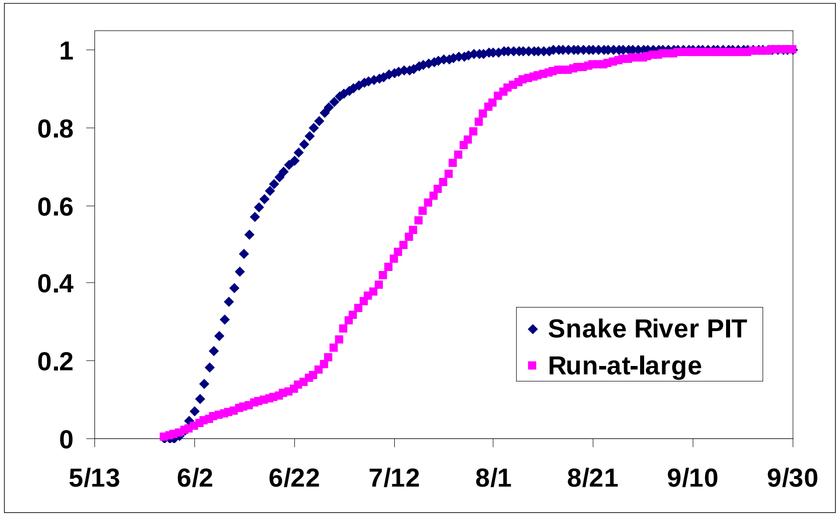
Subyearling Releases included in Survival Estimate and Transport Proportion estimate

- 4 cohorts based on LGR passage date
  5/20-6/2, 6/3-6/16, 6/17-6/30, 7/1-7/15
- Release groups included
  CJRAP,GRAND1,PLAP,SNAKE3,SNAKE4 ,BCCAP,CEFLAF,LUGUAF,
  NLVP,NPTH
- PIT Release dates between 5/22 and 7/6

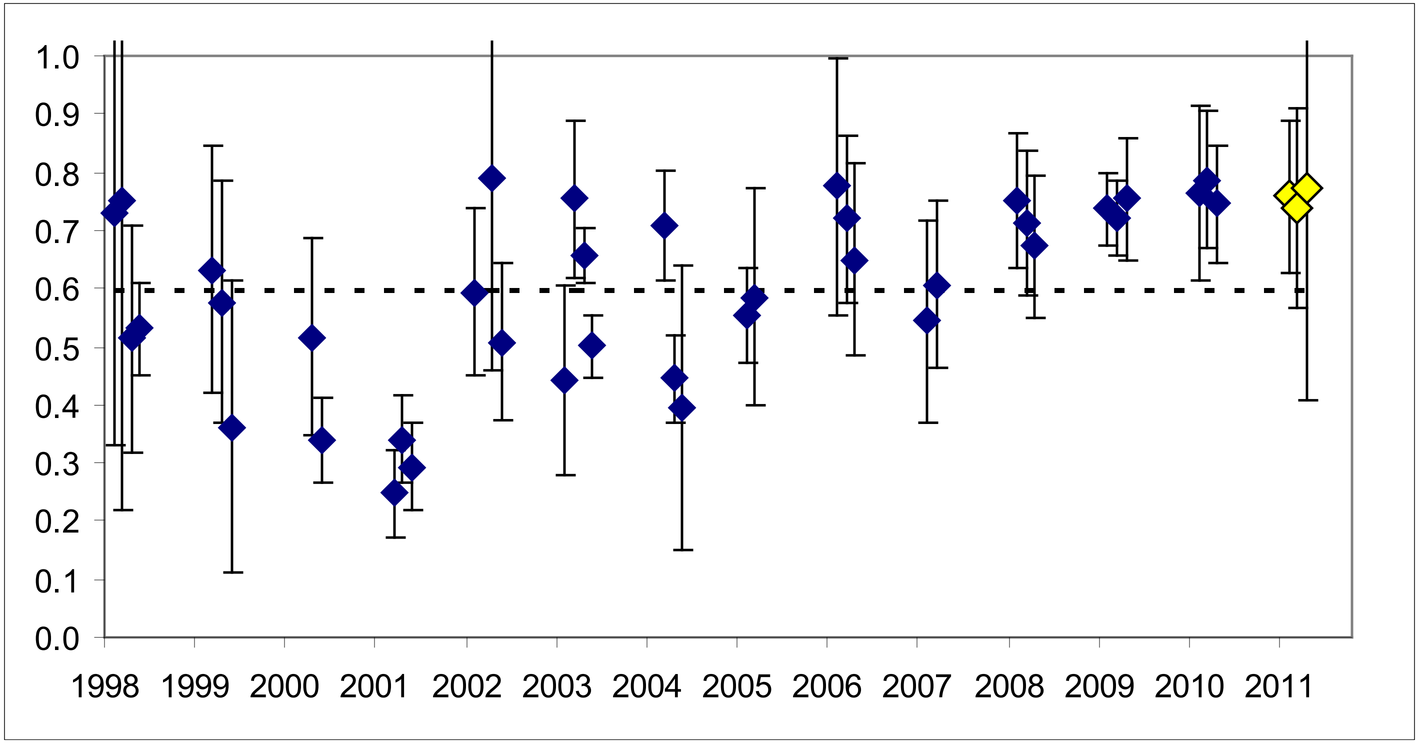
LGR Timing



McNary Timing

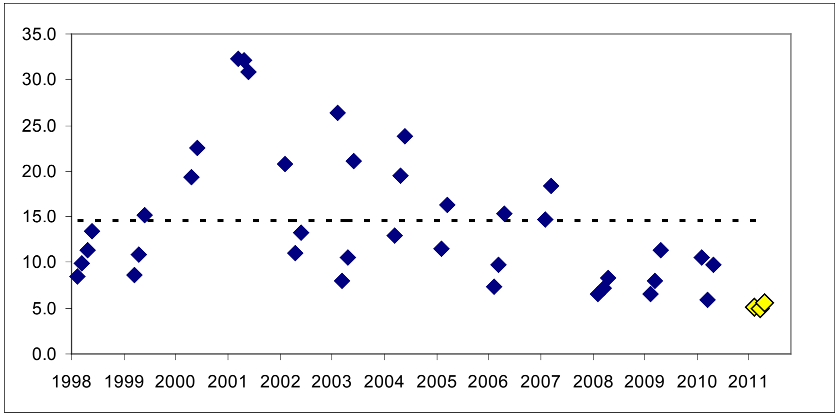


Hatchery subyearling Chinook Survival LGR to McN

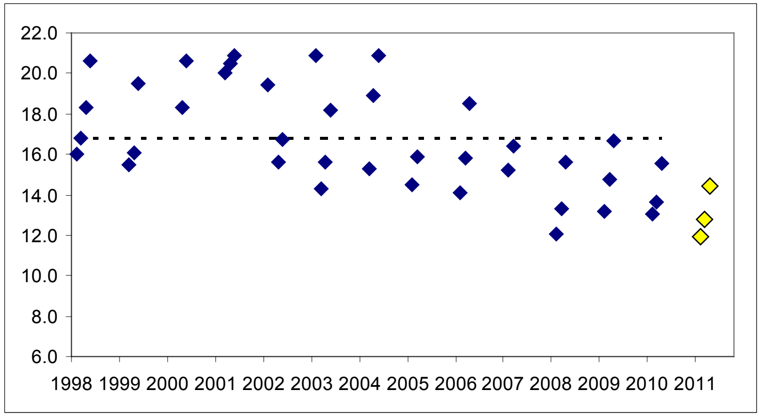


Environmental Conditions

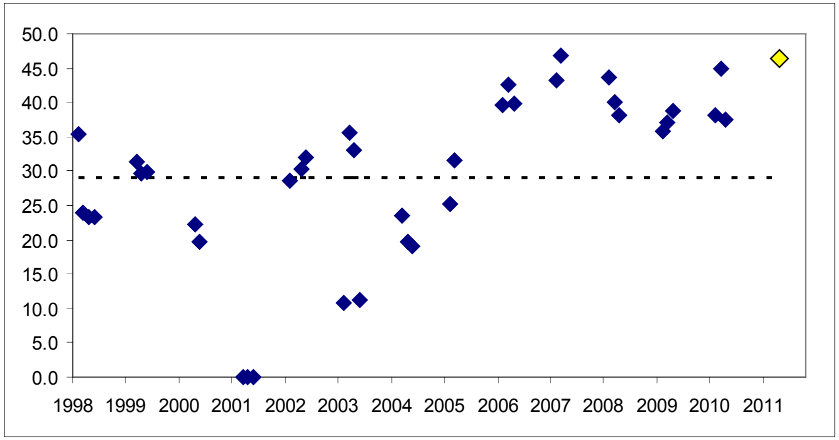
Water Transit Time



Avg Temp C



Avg Spill Proportion



Transport Proportions

	Transport Proportion by Migration Year							
	2011	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**
Subyearling Chinook	**0.49 (H)** -.-- (W)	0.56 (H) 0.49 (W)	0.51 (H) 0.45(W)	0.58 (H) 0.46(W)	0.35 (H) 0.35(W)	0.52 (H) 0. 56(W)	0.81	0.97

Site	**2011**	**2010**	**2009**
LGR	0.19	0.15	0.17
LGS	0.20	0.31	0.28
LMN	0.20	0.26	0.15
MCN	0.12	0.16	0.23

Collection for Transportation began on July 20 at McNary Dam
An estimated 97% of cumulative Snake River Ch0 13H PIT passed by that date.

COLUMBIA RIVER REGIONAL FORUM

TECHNICAL MANAGEMENT TEAM

Year End Review

December 7, 2011

FACILITATORS' SUMMARY NOTES
Facilitator: Robin Gumpert
Notes: Donna Silverberg

The following notes are a summary of the year-end review meeting and are intended to point out future actions or issues that may need further discussion at upcoming meetings. These notes are not intended to be the "record" of the meeting, only a reminder for TMT members.

Conditions Review

Weather and Water: Karl Kanbergs, USACE, reported that 2010-11 saw a high water year, the fourth wettest in the 1929-2011 period, with a La Nina in place. Some unusual weather events in the area included flooding in Sandy and a tornado in Aumsville, and weather gauges were at flood stage all Spring. A gradual Columbia Basin melt helped avoid a major flooding event. Snow pack in the Basin was also well above average. The system was adjusted to avoid going above flood stage and to avoid a fill and spill situation at Grand Coulee. The COE was able to keep flows high and water moving through the system. Spring/summer flow objectives were met and exceeded for the year.

High flow impacts included:

- Localized flooding around Sauvie Island, The Dalles, and waterfront areas. Flooded trail, issues at a Lewis River marina, loss of treaty fishing early in the season, lots of debris on the fish screens, pilings and problems with the Coast Guard, docks floating off at McNary, threatened hatchery intakes, high TDG and impacts to fish farms, spill gates and erosion, sediment build up, and impacts on recreational fishing when drafted low (ramps too low). The Action Agencies worked well in a coordinated fashion to avoid major issues.
- TMT member comment: Spill at Grand Coulee impacted the whole river, not just the fish farm. Benthic and others in the lake were killed.

Flood Control Summary: Kassi Rogers, USACE, reported on flood control operations. A rising forecast in March and April didn't suggest the magnitude of the season. In fact, the April – August runoff was the fourth largest in history. Shape was very important: unregulated flow went longer into the year than had been forecasted.

Participant Question:

- Though 1948 was a similar water year, not as much storage was available then. Do you have observed January-July or April-August water supply information? USACE response: We use the Jan-July period for system operations, but we can find and share information for the April-August period for anyone interested.

Water Quality: Scott English, USACE, reported on water quality conditions. TDG, as would be expected with a high water year, had large numbers of Type 1 events associated with high river flows. Scott shared information on 7Q10 flows, which is a threshold volume for each project that moves it out of regular water quality standards exceedance reporting. This year saw numbers of these events this year. Water was so high and strong, many of the measuring meters were damaged or destroyed.

- Question: Are 7Q10 flows included in your report on # of exceedances? Response: No, which means that actual exceedances were higher than those reported. The spill priority list was revised again this year to enable better management of TDG throughout the system. As result, we were able to minimize the number of days with exceedances outside of the 7Q10 events.

Scott also shared that temperatures were managed well, with zero exceedances reported this year.

Fish Passage: Paul Wagner, NOAA, reported on juvenile fish passage.

- Lower Granite saw early runs and a faster recession of numbers. Steelhead hatchery fish count for 80% of the steelhead numbers—and had an early release of juveniles. Sockeye also were a bit early this year (again, due to the hatchery and responding to flows).
- McNary Chinook were on the early side and followed 10-year timing—just in higher numbers. Steelhead were on the earlier side than the peak of flows (unlike the other early fish). Paul said we don't have an explanation for this. Sockeye at McNary followed an early peak and moved through quickly.
- At Bonneville, there was not much action after May when debris filled the screens and they were pulled—as such the data doesn't reflect what actually happened at the project. The fish followed the flow up to this time for Chinook, steelhead and sockeye.
- Lower Granite subyearling Chinook followed a normal pattern. This was mostly all hatchery fish. This followed a 10 year average for timing.
- McNary subyearling Chinook also had a protracted run and was the most unusual of run timing observations this year.

Participant question: at Falco Rock, were any non- native species observed, in particular northern pike, which might have been spilled downstream? Response: The Fish Passage Center will check in to this.

Cindy LeFleur reported on adult salmon and steelhead returns. This year we under predicted (198,000 predicted with 220,000 returned). Summer fish had a better year than spring, but all numbers looked good. Summer Chinook saw the third highest return. 187,000 sockeye returned—about half compared to 2010, but still a good number.

Fall fish: The Upper river brights are continuing with strong returns as seen in recent years. Spring Creek hatchery fish are seeing a down grade this year. Jacks are looking good for next year's numbers. Lower Granite is also seeing a very good return, though not as good as last year's massive numbers. Bonneville steelhead numbers also are looking good.

Overall, Cindy said the pattern we are seeing is still on the upside as we have been moving over the last ten years. We expect downward trends at some point, and, it's nice to see we are still on the upside.

- Participant Question: You said that jacks are good predictors. Why? Response: The sin curve is still correct; even though the actual numbers were off for a time, we can link the higher numbers together.

Brandon Chockley, Fish Passage Center, reported on adult run timing, noting that the original question had been why are fish showing up later than they used to; prior to 2001, counting started later. Now, year round counts are done at Bonneville. The analysis presented compares to the March 15 year so data can be read as 'apples to apples'.

The average 10%, 50% and 90% passage rates are later than they used to be. Why is this happening? The Fish Passage Center asked whether there are there environmental variables that correlate. Since we don't have data on the environment before 2000, we looked at average temperature and flow during March 15-April 1 to describe conditions the fish may be encountering. A significant relationship has been found between average temperature and the passage date: as temperatures rise, we see earlier run timing. We have not seen any significant relationship between flow and 10% passage timing.

Participant Questions:

- It looked like jacks haven't changed. Is this true? Response: The shift in run timing might be less severe, but still there has been some change. The question really is what biological impact does it have on the fish.
- Has anyone looked at sea lion presence? Response/**Action**: Brandon asked the USACE to send that data to him and he will fold it into his presentation for next year's TMT review.

Reservoir Operations

Libby: Joel Fenolio, USACE Seattle, reported on Libby operations, noting that the big snow pack/water year impacted Libby operations; the COE watched unregulated streams and trace data very closely to anticipate the refill expected from snowpack. They managed to hit all targets within ranges and see this as very successful. The project even met the sturgeon depth criteria. Joel added that they also saw TDG levels during a sluice gate operation reach 138% immediately below the project, and 115% lower in the river.

Hungry Horse: John Roache, Reclamation, reported that Hungry Horse hit a new record of 175% of average water volume for the May-September period. He shared pictures depicting high snow pack in the area late in to the year. The shape of resulted in the Flathead River not exceeding flood stage all season.

Grand Coulee: John Roache also reported on Grand Coulee operations. Because of space in Canada, Grand Coulee wasn't as impacted by the high water volumes this year, although impacts were felt. Grand Coulee played a big role in system flood control. A bigger issue was the TDG that resulted from involuntary spill at Grand Coulee Dam. Peak spill was around 102 kcfs which resulted in peak downstream gas levels of around 143-144%. This led to fish kill at the commercial net pens located in Lake Rufus Woods approximately 20 miles downstream of Grand Coulee Dam. Spill went from mid-May to late July—unusually long. Drum gates spill occurred when there was high enough elevation, and this lowered TDG levels. The flood control draft at GCL was the largest since 1999.

John reported that Grand Coulee maintenance on the third powerhouse overhaul will require a number of units to be out at any given time over the next several years. Reclamation will try to reduce the number of outages during the spring in order to reduce spill. Units are in need of rehab now to avoid future failure. John added that last year's maintenance was required to keep everything on track for the Third Power Plant overhaul.

Grand Coulee was at power plant hydraulic capacity, around 160 kcfs with the units that were available, this past spring. Reclamation is hoping to have a higher hydraulic capacity this spring by trying to schedule fewer outages during this time period.

Dworshak: Steve Hall USACE, Walla Walla reported on Dworshak operations. Again, a lot of snow in the basin this year led to shifted flood control space to Grand Coulee. Overall, flood control targets were met though the BiOp target of 1535 feet was a bit delayed. The project maxed out discharges to get flows out for flood control. This was not the best operation for TDG but was required due to the conditions. There was a change in fish flows at the project this year as a result of a TMT request for flow augmentation. Runoff came very late and was very high at Dworshak. The project did not hit a record for maximum accumulation, but did hit a record for length of snow pack. TDG got up to 120% with forced flood control releases during inflow periods. The remainder of the year went well from a TDG perspective. Temperatures in the Snake River were very low this year. Most operations this year were not for temperature, rather for flood control/flow augmentation. There were some surface level higher temperatures at the Lower Granite pool, but cool water was maintained in middle and lower levels of the reservoir.

Upper Snake Flow Augmentation: Ted Day, Reclamation, reported on Upper Snake flow augmentation. The challenge this year was not about having the water, but getting it out. The goal is to get 487 KAF of extra water out of the system through Brownlee during the April-August period, through work with state and tribal water laws and treaties. Reclamation relies on willing buyer/seller principles to do this.

Ted reiterated the high water year with additional facts about the year: Even though it was a very large water supply year, no major flooding occurred in the Upper Snake. There was a very late runoff (unprecedented) which had Reclamation running the Snake River near flood stage for several months. June/July held the highest runoff on record (100 years). There was about 2.7 MAF of flood control releases this year. Ted concluded by saying that the system is looking good for next year with a lot of carryover from this year's operations.

Lessons Learned from the above?

TMT Year End Review participants offered their thoughts on lessons learned from this year's reservoir operations:

- Operators get a good deal of credit for managing an impressive year—looks like they really had their eye on the ball—Libby forecast was right on and others managed very well by USACE (especially at Dworshak). Very good responsiveness and attention to needs and ideas.
- Had a challenging year—and still need to sort out how to improve TDG levels throughout the system.
- Adaptive change in spill priority list to have positive impact on fish and other needs was very good.
- Operating to flood stage at Vancouver does not seem to have created any negative impacts.
- To know how well we did, we will need to see what impacts this massive water year and our operations have on fish survival in the future.

Review of Specific Operations:

BON Dam Operations Leading up to Condit Dam Breach: Lisa Wright, USACE, reported (and shared a time lapse video) of the Condit Dam breach and Bonneville operations put in place to support it. She noted an enormous amount of coordination between partners to prepare for the 100-year flood of the White Salmon River. This included fish relocation efforts, "trash rodeo", Underwood tribal fishing site, Bonneville debris entrainment and addressing visibility issues.

Participant question: Do they expect the sandbar that has built up as a result of the dam breach to remain, or will it scour out? Response: We didn't anticipate it would form so it depends. We are hoping for another year like last year to move it out. Recreationists are hoping it will stay!

Hanford Reach Operations: Russell Langshaw, Grant County PUD, reported on Hanford Reach operations. Hanford Reach had very high escapements, high aerial counts, and high ground counts. Spawning was protracted this year. Hatching started earlier than usual and ended a little late—emergence happened on about average. This was a very good year for hitting targets (97%).

On-going studies on entrapment and stranding showed lower than usual entrapment and stranding this year. It is estimated that there were 30-60 million fry in the area for the year. There are also continuing studies related to productivity assessment, fallback assessment, egg-to-fry survival, hydrodynamic model synthesis, and a production simulation model (IBM). All studies should be completed early next year.

Participant Questions/Comments:

- Only 61 Chinook were found; what were the other 512 fish? Response: Bass, pike minnow etc.
- This currently looks to be the highest productivity region on the west coast. The studies should help us answer the question of why it the conditions are so good with the hopes that it can help management of other areas.

Performance Standard Testing: Brad Eppard, USACE, reported. Studies this year looked at performance standard compliance to support survival rates in the lower Columbia. Due to high water levels, researchers canceled the summer tests because they felt the information would not be good enough. Those tests will be conducted this coming year. The study looked at the survival estimates at lower river dams. Spillway efficiency was lower this year than in the past—even though they moved through the system more quickly as a result of high flows. Fish were able to meet or exceed performance standards until mid-May (except at Bonneville where the high flows impacted performance).

- Participant Comment: We should try to smooth out our ability to hit the standards on the high flow years. Response: A paper about study guidelines will be out soon — and we are hoping for a discussion on this after the Feb 2, 2012 SRWG meeting.

Juvenile Survival for 2011: Bill Muir, NMFS Science Center, reported on juvenile survival, beginning with the caveat that to do the estimates, we rely on pit tags at Bonneville and given the water year, fewer tags were detected because screens at BON were lifted due to debris issues. NMFS was not able to estimate survival after mid-May due to mechanical issues in the system. What we do know is that there is a bit higher level of survival than the average mean, and we saw some of the fastest travel time since the beginning of our study on survival estimates. Bill added that we continue to see lower survival below Ice Harbor where tern and other predators are increasing in numbers.

Juvenile Snake River Fall Chinook Survival: Jerry McCann, Fish Passage Center, reported. High survival and fast movement was seen in 2011. The water transit time, cool temperatures and average spill proportion served as the trifecta for these fish this year.

Chum Habitat Improvement: Paul Wagner, NMFS, reported. Hamilton Creek improvement has led to the best chum habitat anywhere, he said. A new channel was created, and this year saw hundreds of pairs of fish spawning in the newly graveled 500 feet of channel. Field crews are seeing complete utilization of the new area (except one area that has grass grown and impacted. Maintenance is critical in an area that we have created—we need to maintain it as Mother Nature would). It isn’t a wild channel—so we will have to keep it going. We are seeing high survival because it is a ‘safe’ area—no predation, good temperature, etc. Including the ground welling aspect that occurs at the site has received a very good response from the fish.

Lower Granite Dam Minimum Operating Pool: Doug Baus, USACE, reported on Lower Granite MOP+ operations to meet multiple objectives at Lower Granite including safe navigation and BiOp requirements. For navigation, the authorized depth is 14 feet. When operating at MOP, we didn't have that depth due to siltation in the channel. In March, USACE received an SOR from the Towboaters' Association requesting a MOP + 2 operation. With coordination at TMT, the Action Agencies implemented a variable MOP + operation April 3-August 31.

Participant Questions/Comments:

- Will this happen again this year? Response: We will discuss this at TMT very soon.
- Will USACE prepare a new stepwise approach this year due to the change in siltation that occurred this past year so we are able to coordinate on this earlier than later? Response: Yes, that is the intent.

Overall TMT Year End Review Lessons Learned:

- This is a good opportunity to look back and learn from the constraints we have to live with as we work hard throughout the year. It gives us a chance to look and learn together.
- One thing we didn't touch on is any gas bubble trauma that resulted this year. One nagging question for me is whether there is anything we could do to help, are there any changes that could be made, etc?
    - Grant County PUD will be having a coordination meeting to review their approaches to operations and where there might be changes. This year, due to the high flows, there was not a lot that could be done, but they are looking for any changes that could help in the future.
- Bill Muir's (Juvenile Fish Survival) presentation about survival was really revealing; I would have expected better survival rates than we saw. We have been working to get the fish by the dams faster—this year we saw that could have happened but it doesn't look like it had a big impact on survival.
    - On the other hand, in the past we did see a relationship between flow and survival. Also in the past before the new flow regime we had more spill with more flow. Now we have proportions that had us passing more fish through powerhouses than in the past. That spill wasn't in play is likely a contributing factor.
    - This does point out that we need to increase our flushing abilities in high flow years so fish can use the safe passage routes to increase the fish survival rates.
- If we look at Joel Feniolio's (Libby Operations) presentation, August operations were "bumpy" at Libby— we could do a better job of that in the future. Our focus on an end of September elevation target has made it bumpy—we need to find a way to do better operations without fixating on the very small benefit for fish.
    - Would like to know if the biological data might support focusing on flow that is too high that would allow us to be smoother at the end with the operations. Any

suggestions about this will require this coming from the biological community, not the action agencies.

- It seems that a conversation about the expected water year, expected outages at Grand Coulee and what we could do to manage better might be useful at TMT.

Columbia River Regional Forum

TECHNICAL MANAGEMENT TEAM – OFFICIAL MINUTES

2011 Annual Review of Lessons Learned
December 7, 2011
Notes: Pat Vivian

1. Introduction

The 2011 TMT year-end review was chaired by Doug Baus (COE) and facilitated by Robin Gumpert (DS Consulting). Representatives of the COE, Washington, Montana, the Colville Tribe, NPCC, NOAA, BPA, BOR, USFWS, Idaho and others participated. This summary is an official record of the proceedings, not a verbatim transcript.

Today's annual review was a retrospective on specific conditions and operations that TMT coordinated in 2011. The purpose of the review is to look for lessons learned that can be applied to river management in 2012 and beyond. The presentations were accompanied by slide shows which are posted to the TMT web page.

2. Conditions Review *(What were the water, weather and fish conditions that existed throughout the year? How did this year compare to others? Is there something we can learn from this? Is there anything unique that bears sharing?)*

2a. Weather and Water Summary. Karl Kanbergs, COE, reported that 2011 was the fourth wettest water year using 1929-2011 data, with 127 MAF in April-August volume at The Dalles. The wet, protracted spring and cool summer of 2011 was typical of La Nina conditions.

Despite some record or near-record tributary flows in January, the region experienced no system-wide winter floods. During the spring freshet the Vancouver gage, a major flood control point on the Columbia, rose to 1.4 feet above flood stage for more than 3 weeks, but the Portland gage remained below moderate or major flood stage the whole time. A lack of late season rain in the Cascades and gradual snowmelt in the Columbia basin helped prevent widespread and major flood impacts.

Kanbergs showed TMT a series of slides depicting precipitation and temperatures month by month, starting with November and December 2010. Unusually wet conditions began in November with early snows in the upper Snake and a record cold snap west of the Cascades. In December, a low pressure zone offshore brought mild conditions, with rain on the southern and eastern side of the region. The "pineapple express" storm of January 2011 was typical of La Nina. In the second half of February, snowpack started to develop on the east side of the Columbia basin. Cold, progressive storm systems continued through April, with snowpack steadily building. The cool conditions lasted into May and June, and snowpack remained intact well into summer.

Kanbergs showed TMT plots of conditions at individual projects, including comparison of unregulated flows and controlled flows. System refill occurred in May and June 2011, with several projects (Dworshak, Libby, Grand Coulee) having drafted deep in anticipation of a big water year.

Refill strategy was challenging this year. The overriding water management goal in any year is to regulate flows at The Dalles to non-damaging levels of around 450 kcfs in an average year and 600 kcfs in a high water year. With this in mind, the initial controlled flow is set to reflect the amount of water remaining in the system and adjusted over time to achieve refill. In late May, the COE reset the initial ICF of 440 kcfs to nearly 500 kcfs to keep the water moving. This year, flows at Bonneville and The Dalles were regulated so as not to exceed moderate flood stage of 16-18 feet at the Vancouver gage (the recorded peak was 17.4 feet), thereby avoiding major flooding in Portland. Local flood impacts were noted at Sauvie Island, at the Waterfront Park in The Dalles, along the east side esplanade in downtown Portland, and along the waterfront in Vancouver, Washington, among other locations. The high flows and a lot of voluntary spill resulted in extremely high TDG values below some projects. There were also negative impacts on treaty and recreational fishing, fish passage due to debris and TDG issues, and other river-related activities and construction projects.

All BiOp spring & summer seasonal flow objectives were met by wide margins:

- Priest Rapids, spring (April 10-June 30): Objective 135 kcfs, average 232 kcfs
- Lower Granite, spring (April 3-June 20): Objective 100 kcfs, average 138 kcfs
- Lower Granite, summer (June 21-Aug. 31): Objective 54 kcfs, average 81 kcfs
- McNary, summer (July 1-Aug. 31): Objective 200 kcfs, average 262 kcfs

<u>Questions and comments:</u>

- Spill below Grand Coulee Dam impacted the whole river below the dam, not just the fish farm below Grand Coulee (Sheri Sears, Colville Tribe).

2b. System Flood Control Summary. The critical water management period in 2011 was April through June, Kasi Rodgers, COE, reported. Flows were above normal in April, challenging storage capacity. A graph of reservoir storage space as of April 30 showed that Mica Dam in Canada had 29% of its space available. The Canadian dams drafted to lower elevations this year than expected in terms of treaty space.

This year was the fourth wettest since 1929, with flows exceeding those of 1948, the year Vanport north of Portland was destroyed. The shape of the runoff was a major factor this year in preventing flooding. The COE faced a challenge when it became clear that the ICF of 450 kcfs would be exceeded. It also became clear, as flood control continued, that the reservoirs wouldn’t refill by their refill dates. Without the regulation the dams provided, Vancouver flood stage would have been about 10 feet higher, resulting in major flood damage.

<u>Questions and comments:</u>

- Q: What was the observed January-July runoff volume at The Dalles and the observed April-July runoff volume at Lower Granite? (Jim Ruff, NPCC) A: These were approximately 133% of normal. The COE will provide exact numbers after today's meeting.

2c. Water Quality. Scott English, COE, reported on the four major parameters of water quality management in 2011: TDG levels, 7Q10 flows, the spill priority list, and water temperatures.

A comparison of instances in which TDG levels exceeded the state standards of 115% in the forebay and 120% in the tailrace showed that many such instances this year were due to involuntary spill. English presented a graph using McNary Dam as an example of the strong correlation between high flows and high TDG levels.

There were many TDG exemptions in 2011 due to flows that passed the 7Q10 threshold. This is the point at which flows are so high water quality standards no longer apply. The 7Q10 threshold equals the average annual peak flow for 7 consecutive days that has a recurrence interval of 10 years, computed for each project. This year there were 637 TDG exemptions due to 7Q10 flows.

Many TDG instances were related to damaged monitoring equipment at the Bonneville tailwater and John Day tailwater fixed monitoring stations. In 2011 the COE revised the spill priority list in an effort to improve TDG management on a systemwide basis. English's presentation concluded with a graph of water temperatures at McNary and Lower Granite, which stayed below the 68 degrees F limit until mid September.

2d. Fish Passage. ***<u>Juvenile summary</u>:*** Paul Wagner, NOAA, showed TMT juvenile passage data for 2011 based on passage indices, in relation to 10 years of passage timing data.

Flows at Rock Island Dam, a key point on the mid Columbia, were nearly double the BiOp objective of 135 kcfs this year. Yearling chinook arrived at Rock Island a bit earlier than the 10 year average, and steelhead followed a similar pattern of arriving well before flows receded. Sockeye, which tend to arrive later than steelhead or spring chinook, also were early this year.

<u>Yearling chinook</u> in 2011 passed Lower Granite Dam later than the 10-year average window of April 15-May 21. By the time flows peaked on the Snake River, chinook passage was already done. A spike in Lower Granite steelhead passage was attributed to a large hatchery release. Hatchery and wild steelhead timing this year was nearly identical. Lower Granite sockeye, which are largely hatchery fish, tend to follow flows quickly but move later than spring chinook or steelhead. NOAA's sockeye data also include some kokanee, which tend to ride flood control releases out of Dworshak reservoir.

McNary yearling spring chinook passage was early this year and followed the 10-year average closely. McNary steelhead passage was also early. McNary sockeye passage from the Okanogan basin followed the 10-year peak and finished quickly.

Monitoring of Bonneville yearling chinook passage was blocked from May 22-July 20 when fish screens had to be pulled due to high flows and debris. This incident was reminiscent of 2008, when the screens were pulled for the same reason. Passage data showing a big drop at this time do not reflect actual conditions. The same was true of steelhead and sockeye passage.

Lower Granite subyearling chinook followed the typical 10-year pattern. This run consists of more than 80% hatchery fish. McNary subyearling chinook passage was more prolonged than usual this year; large numbers were still passing the project in July and August. Bonneville subyearling chinook enjoyed a similarly prolonged run into summer but not as prolonged as McNary.

Questions and comments:

- Q: Were any nonnative species, particularly northern pike, found at smolt monitoring facilities in the mid Columbia? These voracious predators are out of control on the Pend Oreille below Albeni Falls (Jim Ruff, NPCC). A: The Fish Passage Center is not aware of any northern pike in the mid Columbia.

Adult summary: Cindy LeFleur, Washington, reported on 2011 adult returns in the context of returns dating back to 1980. She started with spring and summer returns, then moved to fall.

The adult spring chinook count (those that pass from January to June 15) for Bonneville Dam was 221,000 at the Columbia River mouth, which exceeded the prediction of 189,000 fish. The Bonneville return of spring chinook jacks was 67,000, close to the 30-year record of 80,000 jacks in 2009. This is indicative of a strong spring chinook adult return in 2012.

Spring and summer chinook counts at Lower Granite Dam were 95,000 this year. Lower Granite is a significant cutoff point for Snake River ESU populations such as spring and summer chinook (much as Rock Island is the index dam for upper Columbia spring chinook). Summer chinook (those that pass from June 16 to July 31) returns to Bonneville in 2011 were the third highest on record at 81,000 fish. Bonneville sockeye returns came in at 187,000, which augurs well for a strong sockeye return in 2012.

A preliminary estimate of upriver bright fall chinook returns is 330,000 fish; the final count is due in February. This count continues a recent trend of strong returns to the Snake River and Hanford Reach. Bonneville returns of bright fall chinook jacks numbered 80,000 fish, a good sign for the return of next year’s 3-year-olds. Bonneville dam counts of tule jack fall chinook were just over 2,000 fish. The fall chinook return at Lower Granite was 25,000 fish, not the gigantic peak of 2010 but a healthy return.

Bonneville Dam summer steelhead returns are still strong as they have been for the past decade. The summer 2011 steelhead return at Lower Granite was 171,000.

Questions and comments:

- Q: How indicative is the jack count of high returns in 2012, given the moderate spring chinook return of 2010 after the record-setting 2009 jack count? (Jim Litchfield, Montana). A: The 80,000 spring chinook jacks of 2009 didn't produce what 80,000 jacks should have, but they still produced a lot of fish. WDFW believes some of their siblings will return next year.

Adult run timing: Brandon Chockley, FPC, gave a presentation. In response to late adult spring chinook returns to Bonneville Dam, the FPC was asked to analyze 3 years of passage data. The resulting study of adult run timing looked at returns from March 15 to May 31. The reason for ending the counts on May 31 is to standardize the counts, as the FPC and WDFW definitions of spring chinook differ. FPC counts include all fish that pass from January 1 to May 31, while WDFW counts include all fish that pass from January 1 to June 15. Fish longer than 22 inches are counted as adults; those smaller than 22 inches are considered jacks.

The FPC adult database goes back to 1977, which allows daily counts to be used in estimating the 10%, 50% and 90% passage dates for each year. The methodology changed significantly in 2001. Until then, adult counts were from March 15 through mid November only. Since 2001, adults have been counted year-round.

Chockley used historical daily counts to estimate the 10%, 50% and 90% passage dates for each year. Adults and jacks were counted separately and their timing in the past 12 years compared to that of earlier years (1977-99). A comparison of the 10%, 50% and 90% passage dates for all years was made. April 28, 2010, the date adult spring chinook arrived at Bonneville, was the second latest arrival date on record (the latest was in 2006).

The average 10% passage date for the most recent 12 years is later than it was previously. This comparision is based on March 15-May 31 data only. For the historic record, the average 10% passage date is April 10, compared to April 17 for the past 12 years.

The same basic pattern holds true for 50% and 90% passage dates, with all occurring later in 2011 than in past years. This year the average 50% passage date was May 6, the third latest on record. The average 50% passage date for 1977-99 was April 29, compared to April 25 for the past 12 years. The 90% passage date was May 16 in both 2011 and in 2010, compared to May 14 for the historic record and May 18 for the past 12 years.

These data indicate a trend toward later passage in recent years. A review of environmental variables at Bonneville combined the adult and jack returns to get the 10% passage date. To depict the conditions spring chinook encounter when they get to Bonneville Dam, the FPC used average temperature and average flows from March 15-April 1 as variables. A review of these data shows that the spring chinook jacks and adult runs have arrived at Bonneville later in the past 12 years than in previous years. In general, run timing was later in 2011 than in every other year than 2006, the latest on record.

Changes in flow volumes didn't seem to affect run timing. However, in all 3 years studied, there was a significant relationship between average water temperatures and passage dates. Higher temperatures from March 15-April 1 were strongly associated with earlier passage dates, while cooler temperatures were associated with delayed passage.

Chockley summarized the study's major findings:

- In recent years, run timing for spring chinook adults and jacks has been later than the historic record.

- Average 10%, 50% and 90% passage dates for spring chinook adults were 4-7 days later in recent years than for the historic record.

- Spring chinook jacks tend to return later than adults.

- Temperatures affect run timing. Cooler temperatures are associated with adult delays.

- Inflows don't appear to affect spring chinook adult run timing.

Chockley did a similar analysis for the March 15-April 15 timeframe and the differences were insignificant. Timing dates didn't change much, and lower temperatures were still associated with later passage.

Questions and comments:

- Q: Has anyone looked at sea lion presence in relation to run timing? (Paul Wagner, NOAA) A: The number of sea lions at Bonneville Dam was down this year, but they ate more spring chinook because the run arrived later. (Jim Ruff, NPCC)

3. Reservoir Operations Review

3a. Libby Operations. Joel Fenolio, COE Seattle, gave a retrospective of Libby operations this year. Refill this year ended up being more than 2 MAF of inflow volume. Forecasts from November 2010 to January 2011 were around average, but they increased in February and again in April and May. The unprecedented 1 MAF jump from the April to May 2011 inflow projection was attributed to snow accumulation during April. Flood control operations during April-June brought the June 30 flood control elevation target down from 2360 feet to 2287 feet.

Like other projects in the Columbia basin, Libby experienced a big snow year in 2011. Snowpack above the dam was 140% of average and 180% of average below it. The chilly, lingering spring pushed peak inflows at Libby closer to downstream inflows; typically they are about two weeks apart. This created a "perfect storm" in terms of trying to operate Libby for flood control management at Bonners Ferry while still managing to refill the reservoir.

The other central issue in 2011 besides refill was drafting to BiOp flow objectives. With unit 5 out of service from March to May, the sluice gates at Libby were pressed into service for the first time in 30 years in an effort to reach the 2335-foot elevation target for June 30. When releases from Libby dropped from 20 kcfs to 16 kcfs, the Kootenai Lake elevation rose high enough to create a backwater effect between the lake and Bonners Ferry. At this point, the reservoir went into refill mode.

On June 2, the 1.2 MAF sturgeon operation began and continued until June 14, based on the May water supply forecast. The project then went to flat summer flows. Reservoir elevation maxed out at 2453.3 feet on August 4, less than 6 feet from full. Given the challenges of balancing refill with flood control this year, it was considered a successful refill.

On August 31 the reservoir elevation dropped to 2447.7 feet in response to SOR 2011-04 from the Kootenai Tribe requesting a reservoir elevation of 2449 feet or lower by the end of September. Reservoir elevation was 2446.8 feet on September 30.

This year the sluice gate spill operation at Libby provided an opportunity to measure TDG levels produced by spilling through the sluice gates. The COE positioned a number of monitoring stations at Libby during this operation and learned that:

- Spill through three bays instead of two decreased TDG levels in the tailrace.

- Spill through the sluice gates produced a significant decrease in TDG at the mixed-river station about 8 miles downstream of Libby.

- With three gates spilling, the maximum TDG reading was 138% at the mixed river station downstream.

- Spill of 5 kcfs through one of the sluiceways produced TDG percentage saturation readings in the mid-130s below the dam. The mixed-river station readings went down to 115% when three sluiceways were used.

<u>Questions and comments:</u>

- Q: What was the reason for suppressing the elevation of Kootenai Lake? (Paul Wagner, NOAA) A: Elevation 1755 feet is considered flood stage at Bonners Ferry, but damages have been reported at elevations as low as 1752 feet. The COE and the Kootenai Tribe coordinated this operation closely in an effort to minimize flood damage.

3b. Hungry Horse Operations. The same story – wet year, big snowpack – was repeated at Hungry Horse, John Roache, BOR, reported. The forecast started out average, rose to 153% of normal in April and May, and to a record-setting 175% of normal for the 2011 water year. January-July volume was 158% of normal, and the reservoir released about 3 MAF during that time, with a maximum of 2 kcfs spill through the hollow jet valves in April.

Although this was a record water year with lots of minor tributary flooding, mainstem flows at Columbia Falls never reached flood stage. The challenges this year were offset by the delay in runoff, such that the BOR was able to control flows by releasing 8 kcfs and delaying refill to 3560 feet elevation into August. The reservoir then drafted down to 10 feet below full by end September. During June there were two cutbacks in Hungry Horse discharges for local flood control.

Generation at Hungry Horse is limited by transmission capacity to about 9 kcfs through the powerhouse. Any excess has to be spilled. Spill through the hollow jet valves is an option at any forebay elevation with a maximum capacity of about 13.5 kcfs. The “glory hole” spillway has a 12-foot operating range, elevation 3548 feet to 3560 feet.

<u>Questions and comments</u>:

- Q: What is the purpose of the “glory hole”? (Jim Ruff, NPCC) A: It serves as an emergency spillway when flows exceed the release capacity of the dam plus the hollow jet valves.

- Q: How much could Hungry Horse generate without the transmission restrictions? (Charles Morrill, Washington) A: Four units could handle about 12 kcfs. At present the powerhouse is limited to around 9 kcfs.

3c. Grand Coulee Operations. John Roache, BOR, reported. At Grand Coulee, the April 30 target elevation is typically its deepest draft point. The April-August forecast for The Dalles rose by 10% from March to April, which reduced the April 30 flood control elevation to 1220 feet. Refill began on about May 15.

The deepest draft point for Grand Coulee was elevation 1217 feet during early May . The average April 30 target elevation is around 1244 feet. Elevation 1217 feet was the deepest flood control draft since 1999, the reservoir drafted to elevation 1208 feet (the bottom) in 1997.

The initial controlled flow that allows refill to begin is based on available upstream storage. In April, the ICF at The Dalles was 376 kcfs. The ICF increased to 439 kcfs in early May and then to around 500 kcfs when refill began. Refill occurred in the second week of July. Once refill began, Grand Coulee became a major player in system flood control. Refill to elevation 1290 feet occurred in the second week of July. Peak spill this year was 102 kcfs, and TDG saturation readings reached 143-144% at the gage 6 miles downstream of Grand Coulee. The biggest documented impact of all this spill were on the net pen operation below Grand Coulee, which had a high incidence of GBT and fish kills. The net pens are located about 20 miles downstream of Grand Coulee Dam

Despite the high levels of spill and resulting TDG readings at Coulee in 2011, it appears that Chief Joseph Dam downstream is effectively stripping some of the gas from the system. When TDG readings were in the low 140s below Grand Coulee, readings were 123-124% directly below Chief Joseph Dam and 128-129% at the mixed-river station.

If the reservoir elevation drops below 1265.5 feet, Grand Coulee must spill through the outlet tubes rather than the drum gates. The two rows of outlet tubes presently in use at Grand Coulee are at 1150 and 1050 feet elevation.
Because spill through the outlet tubes raises gas levels, spilling through the drum gates is the preferred method. Powerhouse capacity can be a limiting factor at Coulee. Powerhouse hydraulic capacity at Grand Coulee is around 260 KAF if all 24 units are available, but during peak flows this year the powerhouse capacity was around 160 kcfs due to unit maintenance.

Prior to and during the high flows this year, the BOR looked at every option for reducing TDG saturation levels below the dam. However, high gas this year was unavoidable due to the sheer volume of flows and required unit maintenance.
There was discussion of opening the third row of outlet tubes at elevation 950 feet, which have been blocked with concrete due to the proximity of power cables. Re-opening the lower level outlet tubes could be a way of controlling future TDG levels; Roache said that Reclamation will be investigating this option.

<u>Questions and comments:</u>

- Q: Will Grand Coulee 3rd powerhouse capacity be limited for a number of years? (Paul Wagner) A: Yes, the needed repairs and upgrades will take multiple 3rd powerhouse units out of service simultaneously. BOR and BPA are making a coordinated effort to avoid scheduling any of the outages in spring and to pass as much hydraulic capacity as possible during the flood control/refill season.

- Q: Has wind generation affected TDG levels at Grand Coulee? (Sheri Sears, Colville Tribe) A: Wind generation did not affect Grand Coulee in 2011 because all spill there was forced, not voluntary. The intent of the Action Agencies is to not voluntarily exceed the state standards for TDG saturation.

3d. Dworshak Spring/Summer Operations. Steve Hall, COE Walla Walla, reported on the 2011 water supply forecast and the flood control shift to Grand Coulee. He also discussed fish flow augmentation, the transition to refill, and summer temperature management at Dworshak in 2011.

The operation at Dworshak tracked close to the upper rule curve for flood control. During the flood control shift to Grand Coulee, the COE filed a deviation request to refrain from drafting Dworshak to its bottom elevation in April. There wasn't much snow on the ground yet, and the COE didn't want to jeopardize refill. Dworshak was a bit late in reaching its August 31 BiOp target of 1535 feet.

A large release of 25 kcfs for flood control in April maxed out discharges. There were also 10 days of fish flow augmentation in spring, at TMT's request. Refill at Dworshak typically occurs around June 30, but runoff occurred so late that Dworshak didn't refill until July 15.

Not only was runoff this year very late, it was very high. From June 1 on, the basin accumulated record snowpack. High discharges for flood control resulted in TDG saturation levels of around 120% in summer. (For the rest of the year, TDG levels remained under 110%.) When the project refilled on July 13, discharges were at maximum levels.

Temperatures exceeded 68 degrees F occasionally from July 31 to September 4. Although there were high temperatures near the surface of Lower Granite pool, Dworshak reservoir held a large mass of cold water throughout the season.

3e. Upper Snake Flow Augmentation. Ted Day, BOR, gave a presentation. This year there were lots of flood control challenges and unknown conditions in the upper Snake River. Luckily, there was no major flooding.

There was no problem finding 487 KAF of flow augmentation above Brownlee Dam during April-August, as required by the BiOp. Reclamation must work within the framework of state water laws and the Nez Perce Agreement in providing flow augmentation water. This water comes from multiple sources and consists of uncontracted storage, rentals from irrigators, and natural flow water rights that are left instream rather than diverted.

The Upper Snake is defined as above Brownlee Dam. The sources and volumes of flow augmentation from the sub-basins within the Upper Snake are variable each year, depending on water supply and availability. The Snake River above Milner area relies heavily on rentals from the Upper Snake rental pool. The volumes provided from this rental pool are determined by a chart based on water supply (as per the Nez Perce Agreement), and can vary from 0 KAF in a very dry year to 200 KAF in wet years. Combined with about 22 KAF of uncontracted water, the Upper Snake above Milner typically provides around 150 to 200 KAF of the 487 KAF flow augmentation target required under the BiOp. The Payette basin typically supplies about 90 KAF from uncontracted space, and an additional 60-70 KAF from irrigation rentals. The Boise basin typically supplies another 40 KAF (mostly from uncontracted space). In addition, Natural flow water rights left instream in Idaho (60 KAF) and Oregon (17.6 KAF) supply flow augmentation. This year, the upper Snake contributed 207 KAF (most of that in August); the Payette, 160 KAF (July 7-August 27); and the Boise, 42 KAF (July 7-19), with the remainder supplied by the natural flow water rights left instream.

The upper Snake had above average precipitation in fall 2010, with an early snowpack that was well established by January 1. April was the biggest snow accumulation month of the year – and snowpacks were160% of average on May 1, which set a record and created flood threats. Luckily, these conditions did not result in major flooding. The late runoff of 2011 was unprecedented, with all projects operating for flood control into July. This forced a late start to flow augmentation releases.

3f. Lessons Learned from the 2011 Reservoir Conditions and Operations Review

- The operators of federal projects should get credit for good management of flood control and fish objectives – Paul Wagner, NOAA.

- This was a challenging year. One major lesson learned is that more focus is needed on managing TDG levels throughout the system – Sheri Sears, Colville Tribe.

- There were no major impacts from operating to flood stage at Vancouver with a 16-18 foot band below Bonneville Dam – Karl Kanbergs, COE.

- Spill priorities need to be adapted to meet water quality standards and other fish needs – Charles Morrill, Washington

4. Review of Specific Operations

4a. Bonneville Dam Operations Leading Up to the Condit Dam Breach. Lisa Wright, COE, gave a presentation on the October 26, 2011, breaching of Condit Dam on the White Salmon River, about 22 river miles above Bonneville Dam. Pacific Power had Condit destroyed because that alternative will cost less than building the fish ladders that would be required for FERC relicensing. The White Salmon working group was formed as part of the settlement agreement regarding the breaching of Condit Dam. Partners included USFWS, the Yakama nation, CRITFC, BPA and the COE.

Four special operations at Bonneville Dam were coordinated at TMT this year in preparation for the breaching process. The first operation was capture and transport of adult tule fall chinook to spawning grounds upstream of Condit. Three days a week, from August 30-October 5, Bonneville pool operated to a target elevation of 74.5 feet so the fish could be collected and transported.

The second operation was a “trash rodeo” on September 17 – 50 volunteers removed 40 cubic yards of trash, 12 abandoned boats and a variety of noxious weeds from the White Salmon River. The trash removal activities required a steady elevation of 74 feet in the Bonneville pool.

The third special operation was requested by CRITFC on behalf of the Underwood Tribal fishing site. From October 26-28, for the breaching and three days afterward, the Bonneville pool operated to a minimum elevation of 71.5 feet in an effort to limit accumulation of sediment in the Columbia. This operation was canceled after one day because it was no longer necessary.

The fourth special operation, coordinated through FPOM, prioritized the use of the Bonneville 1st powerhouse for 4 weeks beginning the day of the breach. The purpose of this was to allow sediment to settle above Bonneville rather than becoming entrained in its fish ladders and generating units.

The estimated volume of sediment released by the destruction of Condit Dam is 2.5 million cubic yards. Some of this sediment has formed a new sandbar in the Columbia near Bonneville Dam.

Impacts so far of the Condit Dam breach have been decreased visibility, from 10 feet to 4 feet, for a few days during the 2011 chum spawning surveys at Ives Island complex. The breaching affected tribal fishing operations, which depend on a 1.5-foot operating range in the Bonneville forebay.

There were additional constraints on Bonneville operation this fall. In September, TMT coordinated an emergency repair of the Bradford Island B-branch fish ladder, which was damaged by high spring flows. In October, there was an emergency repair of the Washington shore fish ladder. All in all, it was a busy year for dam operators at Bonneville, who implemented 250% as many teletypes as usual this year. Careful coordination of all these requirements led to a operation at Bonneville that balanced all the needs of the region.

Questions and comments:

- Q: Is the sandbar that formed below Bonneville Dam expected to remain? A: That will depend on weather and precipitation. The current approach is to let nature take its course. Pacificorp would be obligated to dredge the river channel if sedimentation affects navigation.

4b. Hanford Reach Operations. Russel Langshaw, Grant PUD, reported on the 2011 operation of Priest Rapids Dam to provide protection flows in Hanford Reach.

During the operation, daytime discharges from Priest Rapids Dam were 55 kcfs, which kept fish from spawning at high elevations. Deep-water redd spawning (below the 36 kcfs elevation) started on October 12, 2011; in 2010 it started on October 27. Despite the early start this year, spawning was prolonged. Hatching followed the same pattern of starting early and ending late, while emergence began early and ended on time.

This year, abundant flows contributed to a highly successful operation. Weekend protection minimum flows started on April 23 and continued for four consecutive weekends. Rearing protections ended on June 20. Actual minimum flows were approximately 70% higher than they were required to be, and the 20 kcfs constraint associated with flows of less than 80 kcfs was never triggered.

In 2011 there were 6 constraints at 30 kcfs, 31 constraints at 40 kcfs, and 37 constraints at 60 kcfs. Mean daily discharge was 196.7 kcfs. The mean daily delta was 47.7 kcfs, which is typical.

The 2011 operation met 111 of 114 constraint targets, a 97% success rate, placing the year well above average. The program’s mean success rate for meeting its flow constraints is 86% for the years since 2004, when the Hanford Reach fall chinook protection agreement was made. One of the two exceedances this year was a planned operation for an egg-to-fry survival study.

The year 2011 was the first of three consecutive monitoring seasons that Grant PUD will estimate fry losses to entrapment and stranding in Hanford Reach. An estimated 30-60 million fry were in the Hanford reach in 2011. Entrapment occurs when flows drop, creating an isolated pool. Stranding occurs when flows drop and fish are stranded on level ground. Both the entrapment and stranding rates for 2011 were lower than expected. Entrapment rates are usually higher than stranding rates. Of the 799 sites surveyed, 203 had entrapments, and of the 573 fish found there, 61 were chinook. At 388 sites in 23,000 square meters, a total of 41 chinook fry were found stranded. The data analysis from this study is ongoing.

Grant PUD is also doing ongoing studies of productivity and timing in Hanford reach, as well as a fallback assessment to determine whether fallback affects the ability to evaluate productivity. Preliminary results of the egg-to-fry survival study indicate that 64-80% of the eggs deposited in the gravel of Hanford Reach survive. It is estimated that every spawner in Hanford Reach creates 7-15 adults – the highest productivity rate on the west coast.

<u>Questions and comments:</u>

- Q: Why is productivity in Hanford Reach so high? (Laura Hamilton, COE). A: There are two hypotheses. Water filters continuously through the gravel, which keeps eggs from suffocating, and flow fluctuations in the reach keep salmon predators moving on.

4c. Performance Standards Testing. Brad Eppard, COE Portland, gave a presentation on the performance standards compliance tests for the lower river in 2011. The tests were designed to evaluate specified flows:

- John Day – 30% and 40% spill in spring, and either 30% or 40% spill in summer
- The Dalles – 40% flat spill in spring and summer
- Bonneville – 100 kcfs flat spill in spring, and either 95 kcfs flat spill or 85k spill to the gas cap in summer

However, releases in summer 2011 were curtailed for flood control to the extent that these flow targets could not be met. In mid May, SRWG participants agreed to cancel the summer study and save the tags for 2012. On May 17, knowing it would be the last opportunity to schedule a block of 30% spill at John Day, TMT coordinated two back-to-back blocks of 30% spill for data collection. After that, flows were too high to maintain 40% flat spill.

Results of the spring study were:

- John Day – Prescribed operations were met until May 16, with five 2-day blocks on 30% spill and four 2-day blocks of 40% spill. During these short blocks, precision requirements were met and survival requirements were exceeded. Dam survival was an estimated 96% for yearling chinook at 30% spill and almost 98% for juvenile steelhead at 40% spill. The number of fish passing the spillway was lower this year than in past years. A surprise finding was that fewer fish passed the spillway at high flows this year than in the past.

- The Dalles – The prescribed 40% spill test continued until May 16. Performance standards were exceeded for both species. Yearling chinook had a very high survival rate of 97.2%. Juvenile steelhead survival has improved with the new spill wall – 99% at 40% spill and 99.8% for the whole season.

- Bonneville – Prescribed operations were met for 14 of the 30 days in the study period. The spring compliance test at 100 kcfs spill around the clock continued until 10 pm on May 13 when flows surged. Average spill for the season was 181 kcfs. Dam survival for yearling chinook at 100 kcfs spill was just below the 96% performance standard at 95.8%. Juvenile steelhead met the 96% survival standard.

<u>Questions and comments:</u>

- Q: Is there concern about the limited ability to meet prescribed spill levels this year for performance testing? (Russ Kiefer, Idaho) A: AFEP has not discussed this yet and plans to do so at its next meeting on February 2, 2012. In preparation for that meeting, Eppard will ask SRWG members to spotlight any data they'd like to discuss.

4d. Juvenile Survival for 2011. Bill Muir, NMFS, presented travel time estimates for PIT-tagged fish which are mostly from the Snake River. For survival estimates in the lower Columbia River basin, Muir looked at PIT tag estimates from John Day tailrace to Bonneville tailrace.

There were 280,000 detections at Bonneville in 2010 and only 60,000 detections in 2011. Detections at the estuary trawl were also down from 31,000 in 2010 to 13,000 in 2011, due to high flows and disturbances caused by debris in the river. Flows were too high in the last half of May to estimate survival from PIT tag detections in the lower river, but JSATs testing showed differences of only a few percentage points in survival rates from early to late in the passage season.

Survival estimates of yearling chinook passing from Snake River hatcheries to Lower Granite Dam were 63.4% in 2011, which surpassed the long-term average of 61.3%. Spring chinook and steelhead traveling from Lower Granite to Bonneville had some of the fastest travel times in the system.

Survival estimates for combined hatchery and wild yearling chinook were lower in all reaches this year compared to the past decade. For steelhead the opposite was true: survival rates were higher in almost all reaches this year than in the past decade.

A dip in survival rates from Ice Harbor to McNary reflects heavy predation by Caspian terns and seagulls. Chinook survival rates this year were very similar from Lower Monumental to Ice Harbor and from Ice Harbor to McNary. From Lower Granite to McNary, yearling chinook survival was 74.6% for combined hatchery and wild fish, compared to 73% long term survival. Steelhead survival in this reach was 69.3%, higher than in the Snake River and a bit higher than the long-term average of 63.6%.

From McNary to Bonneville, combined yearling chinook survival this year was 69.6%, a little higher than the long term average of 68.7%. Steelhead survival at 86.6% was higher than the long term average of 63.5%.

Snake River sockeye typically have low survival – the long term average is 13.5%. For 2011, it was 12.6%. Sockeye released as smolts in spring had improved survival at an estimated 72%, compared to the long term average of 47.3%. From Lower Granite to McNary, Snake River smolts migrating in spring had 66% survival, surpassing the 60.2% long-term average.

Preliminary survival estimates for transported fish in 2011 are based on PIT tag data for the entire population transported. The estimates are 35% for wild chinook, 41% for hatchery chinook, 36% for steelhead, and 38% for hatchery steelhead. These numbers are similar to survival rates over the past 5 years, in which the beginning of transport has been delayed until late April or early May.

Ocean conditions were not bad in 2011, but not as good as those in 2008. This year ranked number 8 out of 14 years in terms of salmon survival rates in the ocean.

In 2012 we can expect a continued La Nina trend of wet, cool weather and cool ocean conditions which favor good salmon returns. Relatively high spring flows are expected, which would improve the marine survival of salmon, especially steelhead.

Questions and comments:

- Q: Do error bands factor in difficulties with sampling? (Jim Litchfield, Montana) A: Yes and no for the periods this year the COE was able to estimate survival. However, JSATs data for these periods indicate that the high flows of 2011 didn't affect survival.

- Q: What ocean conditions are expected in 2012? (Paul Wagner) A: This information is not yet available.

- Q: When will information on sockeye transport survival be available? (Jim Litchfield) A: That information was presented at the recent AFEP review.

4e. Juvenile Snake River Fall Chinook Survival. Jerry McCann, FPC, presented survival estimates and transport rates for hatchery subyearling chinook transported from Lower Granite Dam from July 1-15, 2011. Four PIT tagged cohorts were released between May 22-July 6, and the arrival of these fish at Lower Granite and McNary dams was compared to the timing of the run at large.

Of the hatchery subyearling chinook that reached Lower Granite, 49% were destined for transport. Survival estimates for hatchery subyearling chinook passing from Lower Granite to McNary were the highest seen since the advent of summer spill in recent years.

The high survival rates of 2011 are attributed to three positive influences:

- Faster travel times in June
- An unusually high proportion of spill to flows
- Cooler temperatures than normal

Questions and comments:

- Q: Has there been any investigation of the beneficial effects of new surface passage routes on survival? A: In 2010, fish travel times were found to be more rapid than water transit times.

4f. Hamilton Springs Chum Habitat Improvement. Paul Wagner, NOAA, gave a presentation on rehabilitation of the Hamilton Springs spawning channel in 2011. The area, previously clogged with vegetation and sediment, drew about 100 spawning pairs of chum in fall 2011. Previously the fish spawned only at the entrance to the channel; now they use all 500 linear feet, all of it groundwater-fed. The artificial channel has already exceeded expectations as far as the number of fish spawning there. Apparently the spawners are attracted to spring-fed areas. The rehabilitated channel has an estimated 80% egg-to-fry survival rate, which rivals the productivity of Hanford Reach. This habitat improvement project was partially funded by mitigation funds for the Bonneville estuary.

Questions and comments:

- Q: Is there a process for funding regular maintenance of the spawning channel? (Dave Wills, USFWS) A: Clearly there's a need for that. The current design lends itself to ongoing maintenance.

- Q: What was the result of attempts to revive spawning at Duncan Creek? A: The Duncan Creek renovation was not as successful as Hamilton Springs, due to fish access issues. Also, if the dam at Duncan Creek washes out, there may be no funding available to replace it.

4g. Lower Granite Dam Minimum Operating Pool. Doug Baus, COE TMT chair, reported on the 2011 MOP operation at Lower Granite, which differed from that of years past. This year, the federal authorization to provide a 14-foot navigation depth at the confluence of the Snake and Clearwater rivers came into conflict with implementing MOP operations at Lower Granite as specified in the BiOp.

In spring 2011, survey data of sediment buildup in the channel indicated that the MOP elevation range of 733-734 feet would be too low to maintain the navigation safety authorization of 14 feet depth. On March 30, TMT discussed SOR 2011-01, submitted to the COE by the Pacific Northwest Waterways Association and the ports of Clarkston and Lewiston. The SOR requested a variable MOP+2 operation to provide adequate depth in the federal channel. After analyzing the request, the COE concluded that MOP+2 through the entire fish passage season was unnecessary. A variable MOP operation was implemented from April 3-August 31 as follows:

- Inflow >= 120 kcfs 733.0-734.0 feet (MOP)
- Inflow >= 80 kcfs and < 120 kcfs 734.0-735.0 feet (MOP+1)
- Inflow >= 50 kcfs and < 80 kcfs 734.5-735.5 feet (MOP+1.5)
- Inflow < 50 kcfs 735.0-736.0 feet (MOP+2)

The intent of the variable MOP operation was to minimize the duration of higher MOP elevations during the fish passage season.

Baus provided data correlating the variable MOP operations of 2011 with fish passage index counts. There were significant differences on how the variable MOP operation impacted various (chinook, steelhead, and sub-yearling chinook) fish passage indices. The variable MOP + 2 operation was a unique opportunity to work with regional partners to develop creative solutions to balance the needs of various requirements.

Questions and comments:

- Q: Will there be a variable MOP operation at Lower Granite in 2012? (Paul Wagner) A: This is a topic for TMT to discuss.

- Q: How much sedimentation is present now in the Lower Granite navigation channel? Would be it possible to increase MOP operations prior to dredging? A: The COE assumes there will be additional sedimentation but has not decided how to move forward in light of that assumption.

- Q: Is the COE looking at increasing MOP? (Charles Morrill, Washington) A: The COE will coordinate with the region when information is available regarding MOP operations in 2012.

4h. Lessons Learned from the Review of Specific Operations

- TMT needs to identify constraints individually and bring them together – Charles Morrill, Washington

- Could any change in operations on the mid Columbia have lessened the impacts of high TDG in the system? We need to better understand and correlate spill patterns with other operations and TDG levels. A retrospective on this would be useful, with a focus on finding opportunities to adjust operations in response to high flow events and TDG saturation levels – Paul Wagner

- It is surprising that such a huge water year didn't translate into substantially improved in-river survival rates – Jim Litchfield

- There is evidence that arrival time in the Bonneville estuary is very important – Bill Muir, NOAA

- This year, we ran more fish through the powerhouses more often than we have historically. This could be a factor in survival rates. We need to reevaluate the relationship between flows and travel times, now that surface passage structures and a new spill program are in place – Russ Kiefer

- We can do a better job of managing Libby than we did in August 2011. There was too much emphasis on end-of-month elevations – Jim Litchfield

- As TMT takes pains to avoid flows that are too low, it would be useful to know whether there's a biological threshold at which flows are too high – Tony Norris

- TMT should be ready to seize unique opportunities to make changes that improve conditions for fish passage, power production and project operation – Russ Kiefer

- How will powerhouse limitations at Grand Coulee affect spill next year? We need to look at the type of water year expected and the potential effects of planned outages – Paul Wagner

- We can build on our success this year in using Chief Joseph Dam to manage TDG saturation from Grand Coulee – Laura Hamilton

Name	***Affiliation***
Charles Morrill	Washington
Cindy LeFleur	Washington
Sheri Sears	Colville
Jim Litchfield	Montana
Kevin Shaefer	COE Seattle
Jim Ruff	NPCC
Richelle Beck	Grant PUD
Lisa Wright	COE
Laura Hamilton	COE
Doug Baus	COE
Kim Johnson	COE
Paul Wagner	NOAA
Tony Norris	BPA
John Roache	BOR
Joel Fenolio	COE Seattle
Russ Kiefer	Idaho
David Wills	USFWS
Ted Day	BOR
Karl Kanbergs	COE
Steve Hall	COE
Scott English	COE
Barry Espenson	CBB
Glen Trager	Iberdrola
Bill Proctor	COE
Brandon Chockley	FPC
Margaret Filardo	FPC
Dave Benner	FPC
Jerry McCann	FPC
Russel Langshaw	Grant PUD
Kasi Rodgers	COE
Brad Eppard	COE
Bill Muir	NMFS

COLUMBIA RIVER REGIONAL FORUM

TECHNICAL MANAGEMENT TEAM

Year End Review

December 7, 2011

FACILITATORS' SUMMARY NOTES
Facilitator: Robin Gumpert
Notes: Donna Silverberg

The following notes are a summary of the year-end review meeting and are intended to point out future actions or issues that may need further discussion at upcoming meetings. These notes are not intended to be the "record" of the meeting, only a reminder for TMT members.

Conditions Review

Weather and Water: Karl Kanbergs, USACE, reported that 2010-11 saw a high water year, the fourth wettest in the 1929-2011 period, with a La Nina in place. Some unusual weather events in the area included flooding in Sandy and a tornado in Aumsville, and weather gauges were at flood stage all Spring. A gradual Columbia Basin melt helped avoid a major flooding event. Snow pack in the Basin was also well above average. The system was adjusted to avoid going above flood stage and to avoid a fill and spill situation at Grand Coulee. The COE was able to keep flows high and water moving through the system. Spring/summer flow objectives were met and exceeded for the year.

High flow impacts included:

- Localized flooding around Sauvie Island, The Dalles, and waterfront areas. Flooded trail, issues at a Lewis River marina, loss of treaty fishing early in the season, lots of debris on the fish screens, pilings and problems with the Coast Guard, docks floating off at McNary, threatened hatchery intakes, high TDG and impacts to fish farms, spill gates and erosion, sediment build up, and impacts on recreational fishing when drafted low (ramps too low). The Action Agencies worked well in a coordinated fashion to avoid major issues.
- TMT member comment: Spill at Grand Coulee impacted the whole river, not just the fish farm. Benthic and others in the lake were killed.

Flood Control Summary: Kassi Rogers, USACE, reported on flood control operations. A rising forecast in March and April didn't suggest the magnitude of the season. In fact, the April – August runoff was the fourth largest in history. Shape was very important: unregulated flow went longer into the year than had been forecasted.

Participant Question:

- Though 1948 was a similar water year, not as much storage was available then. Do you have observed January-July or April-August water supply information? USACE response: We use the Jan-July period for system operations, but we can find and share information for the April-August period for anyone interested.

Water Quality: Scott English, USACE, reported on water quality conditions. TDG, as would be expected with a high water year, had large numbers of Type 1 events associated with high river flows. Scott shared information on 7Q10 flows, which is a threshold volume for each project that moves it out of regular water quality standards exceedance reporting. This year saw numbers of these events this year. Water was so high and strong, many of the measuring meters were damaged or destroyed.

- Question: Are 7Q10 flows included in your report on # of exceedances? Response: No, which means that actual exceedances were higher than those reported. The spill priority list was revised again this year to enable better management of TDG throughout the system. As result, we were able to minimize the number of days with exceedances outside of the 7Q10 events.

Scott also shared that temperatures were managed well, with zero exceedances reported this year.

Fish Passage: Paul Wagner, NOAA, reported on juvenile fish passage.

- Lower Granite saw early runs and a faster recession of numbers. Steelhead hatchery fish count for 80% of the steelhead numbers—and had an early release of juveniles. Sockeye also were a bit early this year (again, due to the hatchery and responding to flows).
- McNary Chinook were on the early side and followed 10-year timing—just in higher numbers. Steelhead were on the earlier side than the peak of flows (unlike the other early fish). Paul said we don't have an explanation for this. Sockeye at McNary followed an early peak and moved through quickly.
- At Bonneville, there was not much action after May when debris filled the screens and they were pulled—as such the data doesn't reflect what actually happened at the project. The fish followed the flow up to this time for Chinook, steelhead and sockeye.
- Lower Granite subyearling Chinook followed a normal pattern. This was mostly all hatchery fish. This followed a 10 year average for timing.
- McNary subyearling Chinook also had a protracted run and was the most unusual of run timing observations this year.

Participant question: at Falco Rock, were any non- native species observed, in particular northern pike, which might have been spilled downstream? Response: The Fish Passage Center will check in to this.

Cindy LeFleur reported on adult salmon and steelhead returns. This year we under predicted (198,000 predicted with 220,000 returned). Summer fish had a better year than spring, but all numbers looked good. Summer Chinook saw the third highest return. 187,000 sockeye returned—about half compared to 2010, but still a good number.

Fall fish: The Upper river brights are continuing with strong returns as seen in recent years. Spring Creek hatchery fish are seeing a down grade this year. Jacks are looking good for next year's numbers. Lower Granite is also seeing a very good return, though not as good as last year's massive numbers. Bonneville steelhead numbers also are looking good.

Overall, Cindy said the pattern we are seeing is still on the upside as we have been moving over the last ten years. We expect downward trends at some point, and, it's nice to see we are still on the upside.

- Participant Question: You said that jacks are good predictors. Why? <u>Response</u>: The sin curve is still correct; even though the actual numbers were off for a time, we can link the higher numbers together.

Brandon Chockley, Fish Passage Center, reported on adult run timing, noting that the original question had been why are fish showing up later than they used to; prior to 2001, counting started later. Now, year round counts are done at Bonneville. The analysis presented compares to the March 15 year so data can be read as 'apples to apples'.

The average 10%, 50% and 90% passage rates are later than they used to be. Why is this happening? The Fish Passage Center asked whether there are there environmental variables that correlate. Since we don't have data on the environment before 2000, we looked at average temperature and flow during March 15-April 1 to describe conditions the fish may be encountering. A significant relationship has been found between average temperature and the passage date: as temperatures rise, we see earlier run timing. We have not seen any significant relationship between flow and 10% passage timing.

Participant Questions:

- It looked like jacks haven't changed. Is this true? <u>Response</u>: The shift in run timing might be less severe, but still there has been some change. The question really is what biological impact does it have on the fish.
- Has anyone looked at sea lion presence? <u>Response</u>/**<u>Action</u>**: Brandon asked the USACE to send that data to him and he will fold it into his presentation for next year's TMT review.

<u>Reservoir Operations</u>

<u>Libby</u>: Joel Fenolio, USACE Seattle, reported on Libby operations, noting that the big snow pack/water year impacted Libby operations; the COE watched unregulated streams and trace data very closely to anticipate the refill expected from snowpack. They managed to hit all targets within ranges and see this as very successful. The project even met the sturgeon depth criteria. Joel added that they also saw TDG levels during a sluice gate operation reach 138% immediately below the project, and 115% lower in the river.

<u>Hungry Horse</u>: John Roache, Reclamation, reported that Hungry Horse hit a new record of 175% of average water volume for the May-September period. He shared pictures depicting high snow pack in the area late in to the year. The shape of resulted in the Flathead River not exceeding flood stage all season.

Grand Coulee: John Roache also reported on Grand Coulee operations. Because of space in Canada, Grand Coulee wasn't as impacted by the high water volumes this year, although impacts were felt. Grand Coulee played a big role in system flood control. A bigger issue was the TDG that resulted from involuntary spill at Grand Coulee Dam. Peak spill was around 102 kcfs which resulted in peak downstream gas levels of around 143-144%. This led to fish kill at the commercial net pens located in Lake Rufus Woods approximately 20 miles downstream of Grand Coulee Dam. Spill went from mid-May to late July—unusually long. Drum gates spill occurred when there was high enough elevation, and this lowered TDG levels. The flood control draft at GCL was the largest since 1999.

John reported that Grand Coulee maintenance on the third powerhouse overhaul will require a number of units to be out at any given time over the next several years. Reclamation will try to reduce the number of outages during the spring in order to reduce spill. Units are in need of rehab now to avoid future failure. John added that last year's maintenance was required to keep everything on track for the Third Power Plant overhaul.

Grand Coulee was at power plant hydraulic capacity, around 160 kcfs with the units that were available, this past spring. Reclamation is hoping to have a higher hydraulic capacity this spring by trying to schedule fewer outages during this time period.

Dworshak: Steve Hall USACE, Walla Walla reported on Dworshak operations. Again, a lot of snow in the basin this year led to shifted flood control space to Grand Coulee. Overall, flood control targets were met though the BiOp target of 1535 feet was a bit delayed. The project maxed out discharges to get flows out for flood control. This was not the best operation for TDG but was required due to the conditions. There was a change in fish flows at the project this year as a result of a TMT request for flow augmentation. Runoff came very late and was very high at Dworshak. The project did not hit a record for maximum accumulation, but did hit a record for length of snow pack. TDG got up to 120% with forced flood control releases during inflow periods. The remainder of the year went well from a TDG perspective. Temperatures in the Snake River were very low this year. Most operations this year were not for temperature, rather for flood control/flow augmentation. There were some surface level higher temperatures at the Lower Granite pool, but cool water was maintained in middle and lower levels of the reservoir.

Upper Snake Flow Augmentation: Ted Day, Reclamation, reported on Upper Snake flow augmentation. The challenge this year was not about having the water, but getting it out. The goal is to get 487 KAF of extra water out of the system through Brownlee during the April-August period, through work with state and tribal water laws and treaties. Reclamation relies on willing buyer/seller principles to do this.

Ted reiterated the high water year with additional facts about the year: Even though it was a very large water supply year, no major flooding occurred in the Upper Snake. There was a very late runoff (unprecedented) which had Reclamation running the Snake River near flood stage for several months. June/July held the highest runoff on record (100 years). There was about 2.7 MAF of flood control releases this year. Ted concluded by saying that the system is looking good for next year with a lot of carryover from this year's operations.

Lessons Learned from the above?

TMT Year End Review participants offered their thoughts on lessons learned from this year's reservoir operations:

- Operators get a good deal of credit for managing an impressive year—looks like they really had their eye on the ball—Libby forecast was right on and others managed very well by USACE (especially at Dworshak). Very good responsiveness and attention to needs and ideas.
- Had a challenging year—and still need to sort out how to improve TDG levels throughout the system.
- Adaptive change in spill priority list to have positive impact on fish and other needs was very good.
- Operating to flood stage at Vancouver does not seem to have created any negative impacts.
- To know how well we did, we will need to see what impacts this massive water year and our operations have on fish survival in the future.

Review of Specific Operations:

BON Dam Operations Leading up to Condit Dam Breach: Lisa Wright, USACE, reported (and shared a time lapse video) of the Condit Dam breach and Bonneville operations put in place to support it. She noted an enormous amount of coordination between partners to prepare for the 100-year flood of the White Salmon River. This included fish relocation efforts, "trash rodeo", Underwood tribal fishing site, Bonneville debris entrainment and addressing visibility issues.

Participant question: Do they expect the sandbar that has built up as a result of the dam breach to remain, or will it scour out? Response: We didn't anticipate it would form so it depends. We are hoping for another year like last year to move it out. Recreationists are hoping it will stay!

Hanford Reach Operations: Russell Langshaw, Grant County PUD, reported on Hanford Reach operations. Hanford Reach had very high escapements, high aerial counts, and high ground counts. Spawning was protracted this year. Hatching started earlier than usual and ended a little late—emergence happened on about average. This was a very good year for hitting targets (97%).

On-going studies on entrapment and stranding showed lower than usual entrapment and stranding this year. It is estimated that there were 30-60 million fry in the area for the year. There are also continuing studies related to productivity assessment, fallback assessment, egg-to-fry survival, hydrodynamic model synthesis, and a production simulation model (IBM). All studies should be completed early next year.

Participant Questions/Comments:

- Only 61 Chinook were found; what were the other 512 fish? Response: Bass, pike minnow etc.
- This currently looks to be the highest productivity region on the west coast. The studies should help us answer the question of why it the conditions are so good with the hopes that it can help management of other areas.

Performance Standard Testing: Brad Eppard, USACE, reported. Studies this year looked at performance standard compliance to support survival rates in the lower Columbia. Due to high water levels, researchers canceled the summer tests because they felt the information would not be good enough. Those tests will be conducted this coming year. The study looked at the survival estimates at lower river dams. Spillway efficiency was lower this year than in the past—even though they moved through the system more quickly as a result of high flows. Fish were able to meet or exceed performance standards until mid-May (except at Bonneville where the high flows impacted performance).

- Participant Comment: We should try to smooth out our ability to hit the standards on the high flow years. Response: A paper about study guidelines will be out soon — and we are hoping for a discussion on this after the Feb 2, 2012 SRWG meeting.

Juvenile Survival for 2011: Bill Muir, NMFS Science Center, reported on juvenile survival, beginning with the caveat that to do the estimates, we rely on pit tags at Bonneville and given the water year, fewer tags were detected because screens at BON were lifted due to debris issues. NMFS was not able to estimate survival after mid-May due to mechanical issues in the system. What we do know is that there is a bit higher level of survival than the average mean, and we saw some of the fastest travel time since the beginning of our study on survival estimates. Bill added that we continue to see lower survival below Ice Harbor where tern and other predators are increasing in numbers.

Juvenile Snake River Fall Chinook Survival: Jerry McCann, Fish Passage Center, reported. High survival and fast movement was seen in 2011. The water transit time, cool temperatures and average spill proportion served as the trifecta for these fish this year.

Chum Habitat Improvement: Paul Wagner, NMFS, reported. Hamilton Creek improvement has led to the best chum habitat anywhere, he said. A new channel was created, and this year saw hundreds of pairs of fish spawning in the newly graveled 500 feet of channel. Field crews are seeing complete utilization of the new area (except one area that has grass grown and impacted. Maintenance is critical in an area that we have created—we need to maintain it as Mother Nature would). It isn’t a wild channel—so we will have to keep it going. We are seeing high survival because it is a ‘safe’ area—no predation, good temperature, etc. Including the ground welling aspect that occurs at the site has received a very good response from the fish.

Lower Granite Dam Minimum Operating Pool: Doug Baus, USACE, reported on Lower Granite MOP+ operations to meet multiple objectives at Lower Granite including safe navigation and BiOp requirements. For navigation, the authorized depth is 14 feet. When operating at MOP, we didn't have that depth due to siltation in the channel. In March, USACE received an SOR from the Towboaters' Association requesting a MOP + 2 operation. With coordination at TMT, the Action Agencies implemented a variable MOP + operation April 3-August 31.

Participant Questions/Comments:

- Will this happen again this year? Response: We will discuss this at TMT very soon.
- Will USACE prepare a new stepwise approach this year due to the change in siltation that occurred this past year so we are able to coordinate on this earlier than later? Response: Yes, that is the intent.

Overall TMT Year End Review Lessons Learned:

- This is a good opportunity to look back and learn from the constraints we have to live with as we work hard throughout the year. It gives us a chance to look and learn together.
- One thing we didn't touch on is any gas bubble trauma that resulted this year. One nagging question for me is whether there is anything we could do to help, are there any changes that could be made, etc?
    - Grant County PUD will be having a coordination meeting to review their approaches to operations and where there might be changes. This year, due to the high flows, there was not a lot that could be done, but they are looking for any changes that could help in the future.
- Bill Muir's (Juvenile Fish Survival) presentation about survival was really revealing; I would have expected better survival rates than we saw. We have been working to get the fish by the dams faster—this year we saw that could have happened but it doesn't look like it had a big impact on survival.
    - On the other hand, in the past we did see a relationship between flow and survival. Also in the past before the new flow regime we had more spill with more flow. Now we have proportions that had us passing more fish through powerhouses than in the past. That spill wasn't in play is likely a contributing factor.
    - This does point out that we need to increase our flushing abilities in high flow years so fish can use the safe passage routes to increase the fish survival rates.
- If we look at Joel Feniolio's (Libby Operations) presentation, August operations were "bumpy" at Libby— we could do a better job of that in the future. Our focus on an end of September elevation target has made it bumpy—we need to find a way to do better operations without fixating on the very small benefit for fish.
    - Would like to know if the biological data might support focusing on flow that is too high that would allow us to be smoother at the end with the operations. Any

suggestions about this will require this coming from the biological community, not the action agencies.

- It seems that a conversation about the expected water year, expected outages at Grand Coulee and what we could do to manage better might be useful at TMT.

Columbia River Regional Forum

TECHNICAL MANAGEMENT TEAM – OFFICIAL MINUTES

<u>2011 Annual Review of Lessons Learned</u>
December 7, 2011
Notes: Pat Vivian

1. Introduction

The 2011 TMT year-end review was chaired by Doug Baus (COE) and facilitated by Robin Gumpert (DS Consulting). Representatives of the COE, Washington, Montana, the Colville Tribe, NPCC, NOAA, BPA, BOR, USFWS, Idaho and others participated. This summary is an official record of the proceedings, not a verbatim transcript.

Today's annual review was a retrospective on specific conditions and operations that TMT coordinated in 2011. The purpose of the review is to look for lessons learned that can be applied to river management in 2012 and beyond. The presentations were accompanied by slide shows which are posted to the TMT web page.

2. Conditions Review *(What were the water, weather and fish conditions that existed throughout the year? How did this year compare to others? Is there something we can learn from this? Is there anything unique that bears sharing?)*

2a. Weather and Water Summary. Karl Kanbergs, COE, reported that 2011 was the fourth wettest water year using 1929-2011 data, with 127 MAF in April-August volume at The Dalles. The wet, protracted spring and cool summer of 2011 was typical of La Nina conditions.

Despite some record or near-record tributary flows in January, the region experienced no system-wide winter floods. During the spring freshet the Vancouver gage, a major flood control point on the Columbia, rose to 1.4 feet above flood stage for more than 3 weeks, but the Portland gage remained below moderate or major flood stage the whole time. A lack of late season rain in the Cascades and gradual snowmelt in the Columbia basin helped prevent widespread and major flood impacts.

Kanbergs showed TMT a series of slides depicting precipitation and temperatures month by month, starting with November and December 2010. Unusually wet conditions began in November with early snows in the upper Snake and a record cold snap west of the Cascades. In December, a low pressure zone offshore brought mild conditions, with rain on the southern and eastern side of the region. The "pineapple express" storm of January 2011 was typical of La Nina. In the second half of February, snowpack started to develop on the east side of the Columbia basin. Cold, progressive storm systems continued through April, with snowpack steadily building. The cool conditions lasted into May and June, and snowpack remained intact well into summer.

Kanbergs showed TMT plots of conditions at individual projects, including comparison of unregulated flows and controlled flows. System refill occurred in May and June 2011, with several projects (Dworshak, Libby, Grand Coulee) having drafted deep in anticipation of a big water year.
Refill strategy was challenging this year. The overriding water management goal in any year is to regulate flows at The Dalles to non-damaging levels of around 450 kcfs in an average year and 600 kcfs in a high water year. With this in mind, the initial controlled flow is set to reflect the amount of water remaining in the system and adjusted over time to achieve refill. In late May, the COE reset the initial ICF of 440 kcfs to nearly 500 kcfs to keep the water moving. This year, flows at Bonneville and The Dalles were regulated so as not to exceed moderate flood stage of 16-18 feet at the Vancouver gage (the recorded peak was 17.4 feet), thereby avoiding major flooding in Portland. Local flood impacts were noted at Sauvie Island, at the Waterfront Park in The Dalles, along the east side esplanade in downtown Portland, and along the waterfront in Vancouver, Washington, among other locations. The high flows and a lot of voluntary spill resulted in extremely high TDG values below some projects. There were also negative impacts on treaty and recreational fishing, fish passage due to debris and TDG issues, and other river-related activities and construction projects.
All BiOp spring & summer seasonal flow objectives were met by wide margins:

- Priest Rapids, spring (April 10-June 30): Objective 135 kcfs, average 232 kcfs
- Lower Granite, spring (April 3-June 20): Objective 100 kcfs, average 138 kcfs
- Lower Granite, summer (June 21-Aug. 31): Objective 54 kcfs, average 81 kcfs
- McNary, summer (July 1-Aug. 31): Objective 200 kcfs, average 262 kcfs

Questions and comments:

- Spill below Grand Coulee Dam impacted the whole river below the dam, not just the fish farm below Grand Coulee (Sheri Sears, Colville Tribe).

2b. System Flood Control Summary. The critical water management period in 2011 was April through June, Kasi Rodgers, COE, reported. Flows were above normal in April, challenging storage capacity. A graph of reservoir storage space as of April 30 showed that Mica Dam in Canada had 29% of its space available. The Canadian dams drafted to lower elevations this year than expected in terms of treaty space.

This year was the fourth wettest since 1929, with flows exceeding those of 1948, the year Vanport north of Portland was destroyed. The shape of the runoff was a major factor this year in preventing flooding. The COE faced a challenge when it became clear that the ICF of 450 kcfs would be exceeded. It also became clear, as flood control continued, that the reservoirs wouldn't refill by their refill dates. Without the regulation the dams provided, Vancouver flood stage would have been about 10 feet higher, resulting in major flood damage.

Questions and comments:

- Q: What was the observed January-July runoff volume at The Dalles and the observed April-July runoff volume at Lower Granite? (Jim Ruff, NPCC) A: These were approximately 133% of normal. The COE will provide exact numbers after today's meeting.

2c. Water Quality. Scott English, COE, reported on the four major parameters of water quality management in 2011: TDG levels, 7Q10 flows, the spill priority list, and water temperatures.

A comparison of instances in which TDG levels exceeded the state standards of 115% in the forebay and 120% in the tailrace showed that many such instances this year were due to involuntary spill. English presented a graph using McNary Dam as an example of the strong correlation between high flows and high TDG levels.

There were many TDG exemptions in 2011 due to flows that passed the 7Q10 threshold. This is the point at which flows are so high water quality standards no longer apply. The 7Q10 threshold equals the average annual peak flow for 7 consecutive days that has a recurrence interval of 10 years, computed for each project. This year there were 637 TDG exemptions due to 7Q10 flows.

Many TDG instances were related to damaged monitoring equipment at the Bonneville tailwater and John Day tailwater fixed monitoring stations. In 2011 the COE revised the spill priority list in an effort to improve TDG management on a systemwide basis. English's presentation concluded with a graph of water temperatures at McNary and Lower Granite, which stayed below the 68 degrees F limit until mid September.

2d. Fish Passage. ***<u>Juvenile summary</u>:*** Paul Wagner, NOAA, showed TMT juvenile passage data for 2011 based on passage indices, in relation to 10 years of passage timing data.

Flows at Rock Island Dam, a key point on the mid Columbia, were nearly double the BiOp objective of 135 kcfs this year. Yearling chinook arrived at Rock Island a bit earlier than the 10 year average, and steelhead followed a similar pattern of arriving well before flows receded. Sockeye, which tend to arrive later than steelhead or spring chinook, also were early this year.

<u>Yearling chinook</u> in 2011 passed Lower Granite Dam later than the 10-year average window of April 15-May 21. By the time flows peaked on the Snake River, chinook passage was already done. A spike in Lower Granite steelhead passage was attributed to a large hatchery release. Hatchery and wild steelhead timing this year was nearly identical. Lower Granite sockeye, which are largely hatchery fish, tend to follow flows quickly but move later than spring chinook or steelhead. NOAA's sockeye data also include some kokanee, which tend to ride flood control releases out of Dworshak reservoir.

McNary yearling spring chinook passage was early this year and followed the 10-year average closely. McNary steelhead passage was also early. McNary sockeye passage from the Okanogan basin followed the 10-year peak and finished quickly.

Monitoring of Bonneville yearling chinook passage was blocked from May 22-July 20 when fish screens had to be pulled due to high flows and debris. This incident was reminiscent of 2008, when the screens were pulled for the same reason. Passage data showing a big drop at this time do not reflect actual conditions. The same was true of steelhead and sockeye passage.

Lower Granite subyearling chinook followed the typical 10-year pattern. This run consists of more than 80% hatchery fish. McNary subyearling chinook passage was more prolonged than usual this year; large numbers were still passing the project in July and August. Bonneville subyearling chinook enjoyed a similarly prolonged run into summer but not as prolonged as McNary.

Questions and comments:

- Q: Were any nonnative species, particularly northern pike, found at smolt monitoring facilities in the mid Columbia? These voracious predators are out of control on the Pend Oreille below Albeni Falls (Jim Ruff, NPCC). A: The Fish Passage Center is not aware of any northern pike in the mid Columbia.

Adult summary: Cindy LeFleur, Washington, reported on 2011 adult returns in the context of returns dating back to 1980. She started with spring and summer returns, then moved to fall.

The adult spring chinook count (those that pass from January to June 15) for Bonneville Dam was 221,000 at the Columbia River mouth, which exceeded the prediction of 189,000 fish. The Bonneville return of spring chinook jacks was 67,000, close to the 30-year record of 80,000 jacks in 2009. This is indicative of a strong spring chinook adult return in 2012.

Spring and summer chinook counts at Lower Granite Dam were 95,000 this year. Lower Granite is a significant cutoff point for Snake River ESU populations such as spring and summer chinook (much as Rock Island is the index dam for upper Columbia spring chinook). Summer chinook (those that pass from June 16 to July 31) returns to Bonneville in 2011 were the third highest on record at 81,000 fish. Bonneville sockeye returns came in at 187,000, which augurs well for a strong sockeye return in 2012.

A preliminary estimate of upriver bright fall chinook returns is 330,000 fish; the final count is due in February. This count continues a recent trend of strong returns to the Snake River and Hanford Reach. Bonneville returns of bright fall chinook jacks numbered 80,000 fish, a good sign for the return of next year’s 3-year-olds. Bonneville dam counts of tule jack fall chinook were just over 2,000 fish. The fall chinook return at Lower Granite was 25,000 fish, not the gigantic peak of 2010 but a healthy return.

Bonneville Dam summer steelhead returns are still strong as they have been for the past decade. The summer 2011 steelhead return at Lower Granite was 171,000.

Questions and comments:

- Q: How indicative is the jack count of high returns in 2012, given the moderate spring chinook return of 2010 after the record-setting 2009 jack count? (Jim Litchfield, Montana). A: The 80,000 spring chinook jacks of 2009 didn't produce what 80,000 jacks should have, but they still produced a lot of fish. WDFW believes some of their siblings will return next year.

Adult run timing: Brandon Chockley, FPC, gave a presentation. In response to late adult spring chinook returns to Bonneville Dam, the FPC was asked to analyze 3 years of passage data. The resulting study of adult run timing looked at returns from March 15 to May 31. The reason for ending the counts on May 31 is to standardize the counts, as the FPC and WDFW definitions of spring chinook differ. FPC counts include all fish that pass from January 1 to May 31, while WDFW counts include all fish that pass from January 1 to June 15. Fish longer than 22 inches are counted as adults; those smaller than 22 inches are considered jacks.

The FPC adult database goes back to 1977, which allows daily counts to be used in estimating the 10%, 50% and 90% passage dates for each year. The methodology changed significantly in 2001. Until then, adult counts were from March 15 through mid November only. Since 2001, adults have been counted year-round.

Chockley used historical daily counts to estimate the 10%, 50% and 90% passage dates for each year. Adults and jacks were counted separately and their timing in the past 12 years compared to that of earlier years (1977-99). A comparison of the 10%, 50% and 90% passage dates for all years was made. April 28, 2010, the date adult spring chinook arrived at Bonneville, was the second latest arrival date on record (the latest was in 2006).

The average 10% passage date for the most recent 12 years is later than it was previously. This comparision is based on March 15-May 31 data only. For the historic record, the average 10% passage date is April 10, compared to April 17 for the past 12 years.

The same basic pattern holds true for 50% and 90% passage dates, with all occurring later in 2011 than in past years. This year the average 50% passage date was May 6, the third latest on record. The average 50% passage date for 1977-99 was April 29, compared to April 25 for the past 12 years. The 90% passage date was May 16 in both 2011 and in 2010, compared to May 14 for the historic record and May 18 for the past 12 years.

These data indicate a trend toward later passage in recent years. A review of environmental variables at Bonneville combined the adult and jack returns to get the 10% passage date. To depict the conditions spring chinook encounter when they get to Bonneville Dam, the FPC used average temperature and average flows from March 15-April 1 as variables. A review of these data shows that the spring chinook jacks and adult runs have arrived at Bonneville later in the past 12 years than in previous years. In general, run timing was later in 2011 than in every other year than 2006, the latest on record.

Changes in flow volumes didn't seem to affect run timing. However, in all 3 years studied, there was a significant relationship between average water temperatures and passage dates. Higher temperatures from March 15-April 1 were strongly associated with earlier passage dates, while cooler temperatures were associated with delayed passage.

Chockley summarized the study's major findings:

- In recent years, run timing for spring chinook adults and jacks has been later than the historic record.

- Average 10%, 50% and 90% passage dates for spring chinook adults were 4-7 days later in recent years than for the historic record.

- Spring chinook jacks tend to return later than adults.

- Temperatures affect run timing. Cooler temperatures are associated with adult delays.

- Inflows don't appear to affect spring chinook adult run timing.

Chockley did a similar analysis for the March 15-April 15 timeframe and the differences were insignificant. Timing dates didn't change much, and lower temperatures were still associated with later passage.

Questions and comments:

- Q: Has anyone looked at sea lion presence in relation to run timing? (Paul Wagner, NOAA) A: The number of sea lions at Bonneville Dam was down this year, but they ate more spring chinook because the run arrived later. (Jim Ruff, NPCC)

3. Reservoir Operations Review

3a. Libby Operations. Joel Fenolio, COE Seattle, gave a retrospective of Libby operations this year. Refill this year ended up being more than 2 MAF of inflow volume. Forecasts from November 2010 to January 2011 were around average, but they increased in February and again in April and May. The unprecedented 1 MAF jump from the April to May 2011 inflow projection was attributed to snow accumulation during April. Flood control operations during April-June brought the June 30 flood control elevation target down from 2360 feet to 2287 feet.

Like other projects in the Columbia basin, Libby experienced a big snow year in 2011. Snowpack above the dam was 140% of average and 180% of average below it. The chilly, lingering spring pushed peak inflows at Libby closer to downstream inflows; typically they are about two weeks apart. This created a “perfect storm” in terms of trying to operate Libby for flood control management at Bonners Ferry while still managing to refill the reservoir.

The other central issue in 2011 besides refill was drafting to BiOp flow objectives. With unit 5 out of service from March to May, the sluice gates at Libby were pressed into service for the first time in 30 years in an effort to reach the 2335-foot elevation target for June 30. When releases from Libby dropped from 20 kcfs to 16 kcfs, the Kootenai Lake elevation rose high enough to create a backwater effect between the lake and Bonners Ferry. At this point, the reservoir went into refill mode.

On June 2, the 1.2 MAF sturgeon operation began and continued until June 14, based on the May water supply forecast. The project then went to flat summer flows. Reservoir elevation maxed out at 2453.3 feet on August 4, less than 6 feet from full. Given the challenges of balancing refill with flood control this year, it was considered a successful refill.

On August 31 the reservoir elevation dropped to 2447.7 feet in response to SOR 2011-04 from the Kootenai Tribe requesting a reservoir elevation of 2449 feet or lower by the end of September. Reservoir elevation was 2446.8 feet on September 30.

This year the sluice gate spill operation at Libby provided an opportunity to measure TDG levels produced by spilling through the sluice gates. The COE positioned a number of monitoring stations at Libby during this operation and learned that:

- Spill through three bays instead of two decreased TDG levels in the tailrace.

- Spill through the sluice gates produced a significant decrease in TDG at the mixed-river station about 8 miles downstream of Libby.

- With three gates spilling, the maximum TDG reading was 138% at the mixed river station downstream.

- Spill of 5 kcfs through one of the sluiceways produced TDG percentage saturation readings in the mid-130s below the dam. The mixed-river station readings went down to 115% when three sluiceways were used.

<u>Questions and comments:</u>

- Q: What was the reason for suppressing the elevation of Kootenai Lake? (Paul Wagner, NOAA) A: Elevation 1755 feet is considered flood stage at Bonners Ferry, but damages have been reported at elevations as low as 1752 feet. The COE and the Kootenai Tribe coordinated this operation closely in an effort to minimize flood damage.

3b. Hungry Horse Operations. The same story – wet year, big snowpack – was repeated at Hungry Horse, John Roache, BOR, reported. The forecast started out average, rose to 153% of normal in April and May, and to a record-setting 175% of normal for the 2011 water year. January-July volume was 158% of normal, and the reservoir released about 3 MAF during that time, with a maximum of 2 kcfs spill through the hollow jet valves in April.

Although this was a record water year with lots of minor tributary flooding, mainstem flows at Columbia Falls never reached flood stage. The challenges this year were offset by the delay in runoff, such that the BOR was able to control flows by releasing 8 kcfs and delaying refill to 3560 feet elevation into August. The reservoir then drafted down to 10 feet below full by end September. During June there were two cutbacks in Hungry Horse discharges for local flood control.

Generation at Hungry Horse is limited by transmission capacity to about 9 kcfs through the powerhouse. Any excess has to be spilled. Spill through the hollow jet valves is an option at any forebay elevation with a maximum capacity of about 13.5 kcfs. The "glory hole" spillway has a 12-foot operating range, elevation 3548 feet to 3560 feet.

Questions and comments:

- Q: What is the purpose of the "glory hole"? (Jim Ruff, NPCC) A: It serves as an emergency spillway when flows exceed the release capacity of the dam plus the hollow jet valves.

- Q: How much could Hungry Horse generate without the transmission restrictions? (Charles Morrill, Washington) A: Four units could handle about 12 kcfs. At present the powerhouse is limited to around 9 kcfs.

3c. Grand Coulee Operations. John Roache, BOR, reported. At Grand Coulee, the April 30 target elevation is typically its deepest draft point. The April-August forecast for The Dalles rose by 10% from March to April, which reduced the April 30 flood control elevation to 1220 feet. Refill began on about May 15.

The deepest draft point for Grand Coulee was elevation 1217 feet during early May . The average April 30 target elevation is around 1244 feet. Elevation 1217 feet was the deepest flood control draft since 1999, the reservoir drafted to elevation 1208 feet (the bottom) in 1997.

The initial controlled flow that allows refill to begin is based on available upstream storage. In April, the ICF at The Dalles was 376 kcfs. The ICF increased to 439 kcfs in early May and then to around 500 kcfs when refill began. Refill occurred in the second week of July. Once refill began, Grand Coulee became a major player in system flood control. Refill to elevation 1290 feet occurred in the second week of July. Peak spill this year was 102 kcfs, and TDG saturation readings reached 143-144% at the gage 6 miles downstream of Grand Coulee. The biggest documented impact of all this spill were on the net pen operation below Grand Coulee, which had a high incidence of GBT and fish kills. The net pens are located about 20 miles downstream of Grand Coulee Dam

Despite the high levels of spill and resulting TDG readings at Coulee in 2011, it appears that Chief Joseph Dam downstream is effectively stripping some of the gas from the system. When TDG readings were in the low 140s below Grand Coulee, readings were 123-124% directly below Chief Joseph Dam and 128-129% at the mixed-river station.

If the reservoir elevation drops below 1265.5 feet, Grand Coulee must spill through the outlet tubes rather than the drum gates. The two rows of outlet tubes presently in use at Grand Coulee are at 1150 and 1050 feet elevation.
Because spill through the outlet tubes raises gas levels, spilling through the drum gates is the preferred method. Powerhouse capacity can be a limiting factor at Coulee. Powerhouse hydraulic capacity at Grand Coulee is around 260 KAF if all 24 units are available, but during peak flows this year the powerhouse capacity was around 160 kcfs due to unit maintenance.

Prior to and during the high flows this year, the BOR looked at every option for reducing TDG saturation levels below the dam. However, high gas this year was unavoidable due to the sheer volume of flows and required unit maintenance.
There was discussion of opening the third row of outlet tubes at elevation 950 feet, which have been blocked with concrete due to the proximity of power cables. Re-opening the lower level outlet tubes could be a way of controlling future TDG levels; Roache said that Reclamation will be investigating this option.

Questions and comments:

- Q: Will Grand Coulee 3rd powerhouse capacity be limited for a number of years? (Paul Wagner) A: Yes, the needed repairs and upgrades will take multiple 3rd powerhouse units out of service simultaneously. BOR and BPA are making a coordinated effort to avoid scheduling any of the outages in spring and to pass as much hydraulic capacity as possible during the flood control/refill season.

- Q: Has wind generation affected TDG levels at Grand Coulee? (Sheri Sears, Colville Tribe) A: Wind generation did not affect Grand Coulee in 2011 because all spill there was forced, not voluntary. The intent of the Action Agencies is to not voluntarily exceed the state standards for TDG saturation.

3d. Dworshak Spring/Summer Operations. Steve Hall, COE Walla Walla, reported on the 2011 water supply forecast and the flood control shift to Grand Coulee. He also discussed fish flow augmentation, the transition to refill, and summer temperature management at Dworshak in 2011.

The operation at Dworshak tracked close to the upper rule curve for flood control. During the flood control shift to Grand Coulee, the COE filed a deviation request to refrain from drafting Dworshak to its bottom elevation in April. There wasn't much snow on the ground yet, and the COE didn't want to jeopardize refill. Dworshak was a bit late in reaching its August 31 BiOp target of 1535 feet.

A large release of 25 kcfs for flood control in April maxed out discharges. There were also 10 days of fish flow augmentation in spring, at TMT's request. Refill at Dworshak typically occurs around June 30, but runoff occurred so late that Dworshak didn't refill until July 15.

Not only was runoff this year very late, it was very high. From June 1 on, the basin accumulated record snowpack. High discharges for flood control resulted in TDG saturation levels of around 120% in summer. (For the rest of the year, TDG levels remained under 110%.) When the project refilled on July 13, discharges were at maximum levels.

Temperatures exceeded 68 degrees F occasionally from July 31 to September 4. Although there were high temperatures near the surface of Lower Granite pool, Dworshak reservoir held a large mass of cold water throughout the season.

3e. Upper Snake Flow Augmentation. Ted Day, BOR, gave a presentation. This year there were lots of flood control challenges and unknown conditions in the upper Snake River. Luckily, there was no major flooding.

There was no problem finding 487 KAF of flow augmentation above Brownlee Dam during April-August, as required by the BiOp. Reclamation must work within the framework of state water laws and the Nez Perce Agreement in providing flow augmentation water. This water comes from multiple sources and consists of uncontracted storage, rentals from irrigators, and natural flow water rights that are left instream rather than diverted.

The Upper Snake is defined as above Brownlee Dam. The sources and volumes of flow augmentation from the sub-basins within the Upper Snake are variable each year, depending on water supply and availability. The Snake River above Milner area relies heavily on rentals from the Upper Snake rental pool. The volumes provided from this rental pool are determined by a chart based on water supply (as per the Nez Perce Agreement), and can vary from 0 KAF in a very dry year to 200 KAF in wet years. Combined with about 22 KAF of uncontracted water, the Upper Snake above Milner typically provides around 150 to 200 KAF of the 487 KAF flow augmentation target required under the BiOp. The Payette basin typically supplies about 90 KAF from uncontracted space, and an additional 60-70 KAF from irrigation rentals. The Boise basin typically supplies another 40 KAF (mostly from uncontracted space). In addition, Natural flow water rights left instream in Idaho (60 KAF) and Oregon (17.6 KAF) supply flow augmentation. This year, the upper Snake contributed 207 KAF (most of that in August); the Payette, 160 KAF (July 7-August 27); and the Boise, 42 KAF (July 7-19), with the remainder supplied by the natural flow water rights left instream.

The upper Snake had above average precipitation in fall 2010, with an early snowpack that was well established by January 1. April was the biggest snow accumulation month of the year – and snowpacks were160% of average on May 1, which set a record and created flood threats. Luckily, these conditions did not result in major flooding. The late runoff of 2011 was unprecedented, with all projects operating for flood control into July. This forced a late start to flow augmentation releases.

3f. Lessons Learned from the 2011 Reservoir Conditions and Operations Review

- The operators of federal projects should get credit for good management of flood control and fish objectives – Paul Wagner, NOAA.

- This was a challenging year. One major lesson learned is that more focus is needed on managing TDG levels throughout the system – Sheri Sears, Colville Tribe.

- There were no major impacts from operating to flood stage at Vancouver with a 16-18 foot band below Bonneville Dam – Karl Kanbergs, COE.

- Spill priorities need to be adapted to meet water quality standards and other fish needs – Charles Morrill, Washington

4. Review of Specific Operations

4a. Bonneville Dam Operations Leading Up to the Condit Dam Breach. Lisa Wright, COE, gave a presentation on the October 26, 2011, breaching of Condit Dam on the White Salmon River, about 22 river miles above Bonneville Dam. Pacific Power had Condit destroyed because that alternative will cost less than building the fish ladders that would be required for FERC relicensing. The White Salmon working group was formed as part of the settlement agreement regarding the breaching of Condit Dam. Partners included USFWS, the Yakama Nation, NOAA, USGS, USFS, WDFW, and PacifiCorp.

Four special operations at Bonneville Dam were coordinated at TMT this year in preparation for the breaching process. The first operation was capture and transport of adult tule fall chinook to spawning grounds upstream of Condit. Three days a week, from August 30-October 5, Bonneville pool operated to a target elevation of 74.5 feet so the fish could be collected and transported.

The second operation was a “trash rodeo” on September 17 – 50 volunteers removed 40 cubic yards of trash, 12 abandoned boats and a variety of noxious weeds from the White Salmon River. The trash removal activities required a steady elevation of 74 feet in the Bonneville pool.

The third special operation was requested by CRITFC on behalf of the Underwood Tribal fishing site. From October 26-28, for the breaching and three days afterward, the Bonneville pool operated to a minimum elevation of 71.5 feet in an effort to limit accumulation of sediment in the Columbia. This operation was canceled after one day because it was no longer necessary.

The fourth special operation, coordinated through FPOM, prioritized the use of the Bonneville 1st powerhouse for 4 weeks beginning the day of the breach. The purpose of this was to allow sediment to settle above Bonneville rather than becoming entrained in its fish ladders and generating units.

The estimated volume of sediment released by the destruction of Condit Dam is 2.5 million cubic yards. Some of this sediment has formed a new sandbar in the Columbia near Bonneville Dam.

Impacts so far of the Condit Dam breach have been decreased visibility, from 10 feet to 4 feet, for a few days during the 2011 chum spawning surveys at Ives Island complex. The breaching affected tribal fishing operations, which depend on a 1.5-foot operating range in the Bonneville forebay.

There were additional constraints on Bonneville operation this fall. In September, TMT coordinated an emergency repair of the Bradford Island B-branch fish ladder, which was damaged by high spring flows. In October, there was an emergency repair of the Washington shore fish ladder. All in all, it was a busy year for dam operators at Bonneville, who implemented 250% as many teletypes as usual this year. Careful coordination of all these requirements led to a operation at Bonneville that balanced all the needs of the region.

<u>Questions and comments</u>:

- Q: Is the sandbar that formed below Bonneville Dam expected to remain? A: That will depend on weather and precipitation. The current approach is to let nature take its course. Pacificorp would be obligated to dredge the river channel if sedimentation affects navigation.

4b. Hanford Reach Operations. Russel Langshaw, Grant PUD, reported on the 2011 operation of Priest Rapids Dam to provide protection flows in Hanford Reach.

During the operation, daytime discharges from Priest Rapids Dam were 55 kcfs, which kept fish from spawning at high elevations. Deep-water redd spawning (below the 36 kcfs elevation) started on October 12, 2011; in 2010 it started on October 27. Despite the early start this year, spawning was prolonged. Hatching followed the same pattern of starting early and ending late, while emergence began early and ended on time.

This year, abundant flows contributed to a highly successful operation. Weekend protection minimum flows started on April 23 and continued for four consecutive weekends. Rearing protections ended on June 20. Actual minimum flows were approximately 70% higher than they were required to be, and the 20 kcfs constraint associated with flows of less than 80 kcfs was never triggered.

In 2011 there were 6 constraints at 30 kcfs, 31 constraints at 40 kcfs, and 37 constraints at 60 kcfs. Mean daily discharge was 196.7 kcfs. The mean daily delta was 47.7 kcfs, which is typical.

The 2011 operation met 111 of 114 constraint targets, a 97% success rate, placing the year well above average. The program's mean success rate for meeting its flow constraints is 86% for the years since 2004, when the Hanford Reach fall chinook protection agreement was made. One of the two exceedances this year was a planned operation for an egg-to-fry survival study.

The year 2011 was the first of three consecutive monitoring seasons that Grant PUD will estimate fry losses to entrapment and stranding in Hanford Reach. An estimated 30-60 million fry were in the Hanford reach in 2011. Entrapment occurs when flows drop, creating an isolated pool. Stranding occurs when flows drop and fish are stranded on level ground. Both the entrapment and stranding rates for 2011 were lower than expected. Entrapment rates are usually higher than stranding rates. Of the 799 sites surveyed, 203 had entrapments, and of the 573 fish found there, 61 were chinook. At 388 sites in 23,000 square meters, a total of 41 chinook fry were found stranded. The data analysis from this study is ongoing.

Grant PUD is also doing ongoing studies of productivity and timing in Hanford reach, as well as a fallback assessment to determine whether fallback affects the ability to evaluate productivity. Preliminary results of the egg-to-fry survival study indicate that 64-80% of the eggs deposited in the gravel of Hanford Reach survive. It is estimated that every spawner in Hanford Reach creates 7-15 adults – the highest productivity rate on the west coast.

<u>Questions and comments:</u>

- Q: Why is productivity in Hanford Reach so high? (Laura Hamilton, COE). A: There are two hypotheses. Water filters continuously through the gravel, which keeps eggs from suffocating, and flow fluctuations in the reach keep salmon predators moving on.

4c. Performance Standards Testing. Brad Eppard, COE Portland, gave a presentation on the performance standards compliance tests for the lower river in 2011. The tests were designed to evaluate specified flows:

- John Day – 30% and 40% spill in spring, and either 30% or 40% spill in summer
- The Dalles – 40% flat spill in spring and summer
- Bonneville – 100 kcfs flat spill in spring, and either 95 kcfs flat spill or 85k spill to the gas cap in summer

However, releases in summer 2011 were curtailed for flood control to the extent that these flow targets could not be met. In mid May, SRWG participants agreed to cancel the summer study and save the tags for 2012. On May 17, knowing it would be the last opportunity to schedule a block of 30% spill at John Day, TMT coordinated two back-to-back blocks of 30% spill for data collection. After that, flows were too high to maintain 40% flat spill.

Results of the spring study were:

- John Day – Prescribed operations were met until May 16, with five 2-day blocks on 30% spill and four 2-day blocks of 40% spill. During these short blocks, precision requirements were met and survival requirements were exceeded. Dam survival was an estimated 96% for yearling chinook at 30% spill and almost 98% for juvenile steelhead at 40% spill. The number of fish passing the spillway was lower this year than in past years. A surprise finding was that fewer fish passed the spillway at high flows this year than in the past.

- The Dalles – The prescribed 40% spill test continued until May 16. Performance standards were exceeded for both species. Yearling chinook had a very high survival rate of 97.2%. Juvenile steelhead survival has improved with the new spill wall – 99% at 40% spill and 99.8% for the whole season.

- Bonneville – Prescribed operations were met for 14 of the 30 days in the study period. The spring compliance test at 100 kcfs spill around the clock continued until 10 pm on May 13 when flows surged. Average spill for the season was 181 kcfs. Dam survival for yearling chinook at 100 kcfs spill was just below the 96% performance standard at 95.8%. Juvenile steelhead met the 96% survival standard.

<u>Questions and comments:</u>

- Q: Is there concern about the limited ability to meet prescribed spill levels this year for performance testing? (Russ Kiefer, Idaho) A: AFEP has not discussed this yet and plans to do so at its next meeting on February 2, 2012. In preparation for that meeting, Eppard will ask SRWG members to spotlight any data they'd like to discuss.

4d. Juvenile Survival for 2011. Bill Muir, NMFS, presented travel time estimates for PIT-tagged fish which are mostly from the Snake River. For survival estimates in the lower Columbia River basin, Muir looked at PIT tag estimates from John Day tailrace to Bonneville tailrace.

There were 280,000 detections at Bonneville in 2010 and only 60,000 detections in 2011. Detections at the estuary trawl were also down from 31,000 in 2010 to 13,000 in 2011, due to high flows and disturbances caused by debris in the river. Flows were too high in the last half of May to estimate survival from PIT tag detections in the lower river, but JSATs testing showed differences of only a few percentage points in survival rates from early to late in the passage season.

Survival estimates of yearling chinook passing from Snake River hatcheries to Lower Granite Dam were 63.4% in 2011, which surpassed the long-term average of 61.3%. Spring chinook and steelhead traveling from Lower Granite to Bonneville had some of the fastest travel times in the system.

Survival estimates for combined hatchery and wild yearling chinook were lower in all reaches this year compared to the past decade. For steelhead the opposite was true: survival rates were higher in almost all reaches this year than in the past decade.

A dip in survival rates from Ice Harbor to McNary reflects heavy predation by Caspian terns and seagulls. Chinook survival rates this year were very similar from Lower Monumental to Ice Harbor and from Ice Harbor to McNary. From Lower Granite to McNary, yearling chinook survival was 74.6% for combined hatchery and wild fish, compared to 73% long term survival. Steelhead survival in this reach was 69.3%, higher than in the Snake River and a bit higher than the long-term average of 63.6%.

From McNary to Bonneville, combined yearling chinook survival this year was 69.6%, a little higher than the long term average of 68.7%. Steelhead survival at 86.6% was higher than the long term average of 63.5%.

Snake River sockeye typically have low survival – the long term average is 13.5%. For 2011, it was 12.6%. Sockeye released as smolts in spring had improved survival at an estimated 72%, compared to the long term average of 47.3%. From Lower Granite to McNary, Snake River smolts migrating in spring had 66% survival, surpassing the 60.2% long-term average.

Preliminary survival estimates for transported fish in 2011 are based on PIT tag data for the entire population transported. The estimates are 35% for wild chinook, 41% for hatchery chinook, 36% for steelhead, and 38% for hatchery steelhead. These numbers are similar to survival rates over the past 5 years, in which the beginning of transport has been delayed until late April or early May.

Ocean conditions were not bad in 2011, but not as good as those in 2008. This year ranked number 8 out of 14 years in terms of salmon survival rates in the ocean.

In 2012 we can expect a continued La Nina trend of wet, cool weather and cool ocean conditions which favor good salmon returns. Relatively high spring flows are expected, which would improve the marine survival of salmon, especially steelhead.

Questions and comments:

- Q: Do error bands factor in difficulties with sampling? (Jim Litchfield, Montana) A: Yes and no for the periods this year the COE was able to estimate survival. However, JSATs data for these periods indicate that the high flows of 2011 didn't affect survival.

- Q: What ocean conditions are expected in 2012? (Paul Wagner) A: This information is not yet available.

- Q: When will information on sockeye transport survival be available? (Jim Litchfield) A: That information was presented at the recent AFEP review.

4e. Juvenile Snake River Fall Chinook Survival. Jerry McCann, FPC, presented survival estimates and transport rates for hatchery subyearling chinook transported from Lower Granite Dam from July 1-15, 2011. Four PIT tagged cohorts were released between May 22-July 6, and the arrival of these fish at Lower Granite and McNary dams was compared to the timing of the run at large.

Of the hatchery subyearling chinook that reached Lower Granite, 49% were destined for transport. Survival estimates for hatchery subyearling chinook passing from Lower Granite to McNary were the highest seen since the advent of summer spill in recent years.

The high survival rates of 2011 are attributed to three positive influences:

- Faster travel times in June
- An unusually high proportion of spill to flows
- Cooler temperatures than normal

Questions and comments:

- Q: Has there been any investigation of the beneficial effects of new surface passage routes on survival? A: In 2010, fish travel times were found to be more rapid than water transit times.

4f. Hamilton Springs Chum Habitat Improvement. Paul Wagner, NOAA, gave a presentation on rehabilitation of the Hamilton Springs spawning channel in 2011. The area, previously clogged with vegetation and sediment, drew about 100 spawning pairs of chum in fall 2011. Previously the fish spawned only at the entrance to the channel; now they use all 500 linear feet, all of it groundwater-fed. The artificial channel has already exceeded expectations as far as the number of fish spawning there. Apparently the spawners are attracted to spring-fed areas. The rehabilitated channel has an estimated 80% egg-to-fry survival rate, which rivals the productivity of Hanford Reach. This habitat improvement project was partially funded by mitigation funds for the Bonneville estuary.

Questions and comments:

- Q: Is there a process for funding regular maintenance of the spawning channel? (Dave Wills, USFWS) A: Clearly there's a need for that. The current design lends itself to ongoing maintenance.

- Q: What was the result of attempts to revive spawning at Duncan Creek? A: The Duncan Creek renovation was not as successful as Hamilton Springs, due to fish access issues. Also, if the dam at Duncan Creek washes out, there may be no funding available to replace it.

4g. Lower Granite Dam Minimum Operating Pool. Doug Baus, COE TMT chair, reported on the 2011 MOP operation at Lower Granite, which differed from that of years past. This year, the federal authorization to provide a 14-foot navigation depth at the confluence of the Snake and Clearwater rivers came into conflict with implementing MOP operations at Lower Granite as specified in the BiOp.

In spring 2011, survey data of sediment buildup in the channel indicated that the MOP elevation range of 733-734 feet would be too low to maintain the navigation safety authorization of 14 feet depth. On March 30, TMT discussed SOR 2011-01, submitted to the COE by the Pacific Northwest Waterways Association and the ports of Clarkston and Lewiston. The SOR requested a variable MOP+2 operation to provide adequate depth in the federal channel. After analyzing the request, the COE concluded that MOP+2 through the entire fish passage season was unnecessary. A variable MOP operation was implemented from April 3-August 31 as follows:

- Inflow >= 120 kcfs — 733.0-734.0 feet (MOP)
- Inflow >= 80 kcfs and < 120 kcfs — 734.0-735.0 feet (MOP+1)
- Inflow >= 50 kcfs and < 80 kcfs — 734.5-735.5 feet (MOP+1.5)
- Inflow < 50 kcfs — 735.0-736.0 feet (MOP+2)

The intent of the variable MOP operation was to minimize the duration of higher MOP elevations during the fish passage season.

Baus provided data correlating the variable MOP operations of 2011 with fish passage index counts. There were significant differences on how the variable MOP operation impacted various (chinook, steelhead, and sub-yearling chinook) fish passage indices. The variable MOP + 2 operation was a unique opportunity to work with regional partners to develop creative solutions to balance the needs of various requirements.

Questions and comments:

- Q: Will there be a variable MOP operation at Lower Granite in 2012? (Paul Wagner) A: This is a topic for TMT to discuss.

- Q: How much sedimentation is present now in the Lower Granite navigation channel? Would be it possible to increase MOP operations prior to dredging? A: The COE assumes there will be additional sedimentation but has not decided how to move forward in light of that assumption.

- Q: Is the COE looking at increasing MOP? (Charles Morrill, Washington) A: The COE will coordinate with the region when information is available regarding MOP operations in 2012.

4h. Lessons Learned from the Review of Specific Operations

- TMT needs to identify constraints individually and bring them together – Charles Morrill, Washington

- Could any change in operations on the mid Columbia have lessened the impacts of high TDG in the system? We need to better understand and correlate spill patterns with other operations and TDG levels. A retrospective on this would be useful, with a focus on finding opportunities to adjust operations in response to high flow events and TDG saturation levels – Paul Wagner

- It is surprising that such a huge water year didn’t translate into substantially improved in-river survival rates – Jim Litchfield

- There is evidence that arrival time in the Bonneville estuary is very important – Bill Muir, NOAA

- This year, we ran more fish through the powerhouses more often than we have historically. This could be a factor in survival rates. We need to reevaluate the relationship between flows and travel times, now that surface passage structures and a new spill program are in place – Russ Kiefer

- We can do a better job of managing Libby than we did in August 2011. There was too much emphasis on end-of-month elevations – Jim Litchfield

- As TMT takes pains to avoid flows that are too low, it would be useful to know whether there’s a biological threshold at which flows are too high – Tony Norris

- TMT should be ready to seize unique opportunities to make changes that improve conditions for fish passage, power production and project operation – Russ Kiefer

- How will powerhouse limitations at Grand Coulee affect spill next year? We need to look at the type of water year expected and the potential effects of planned outages – Paul Wagner

- We can build on our success this year in using Chief Joseph Dam to manage TDG saturation from Grand Coulee – Laura Hamilton

Name	***Affiliation***
Charles Morrill	Washington
Cindy LeFleur	Washington
Sheri Sears	Colville
Jim Litchfield	Montana
Kevin Shaefer	COE Seattle
Jim Ruff	NPCC
Richelle Beck	Grant PUD
Lisa Wright	COE
Laura Hamilton	COE
Doug Baus	COE
Kim Johnson	COE
Paul Wagner	NOAA
Tony Norris	BPA
John Roache	BOR
Joel Fenolio	COE Seattle
Russ Kiefer	Idaho
David Wills	USFWS
Ted Day	BOR
Karl Kanbergs	COE
Steve Hall	COE
Scott English	COE
Barry Espenson	CBB
Glen Trager	Iberdrola
Bill Proctor	COE
Brandon Chockley	FPC
Margaret Filardo	FPC
Dave Benner	FPC
Jerry McCann	FPC
Russel Langshaw	Grant PUD
Kasi Rodgers	COE
Brad Eppard	COE
Bill Muir	NMFS

Survival and Travel Time of Migrating Salmonid Smolts in the Snake and Lower Columbia Rivers

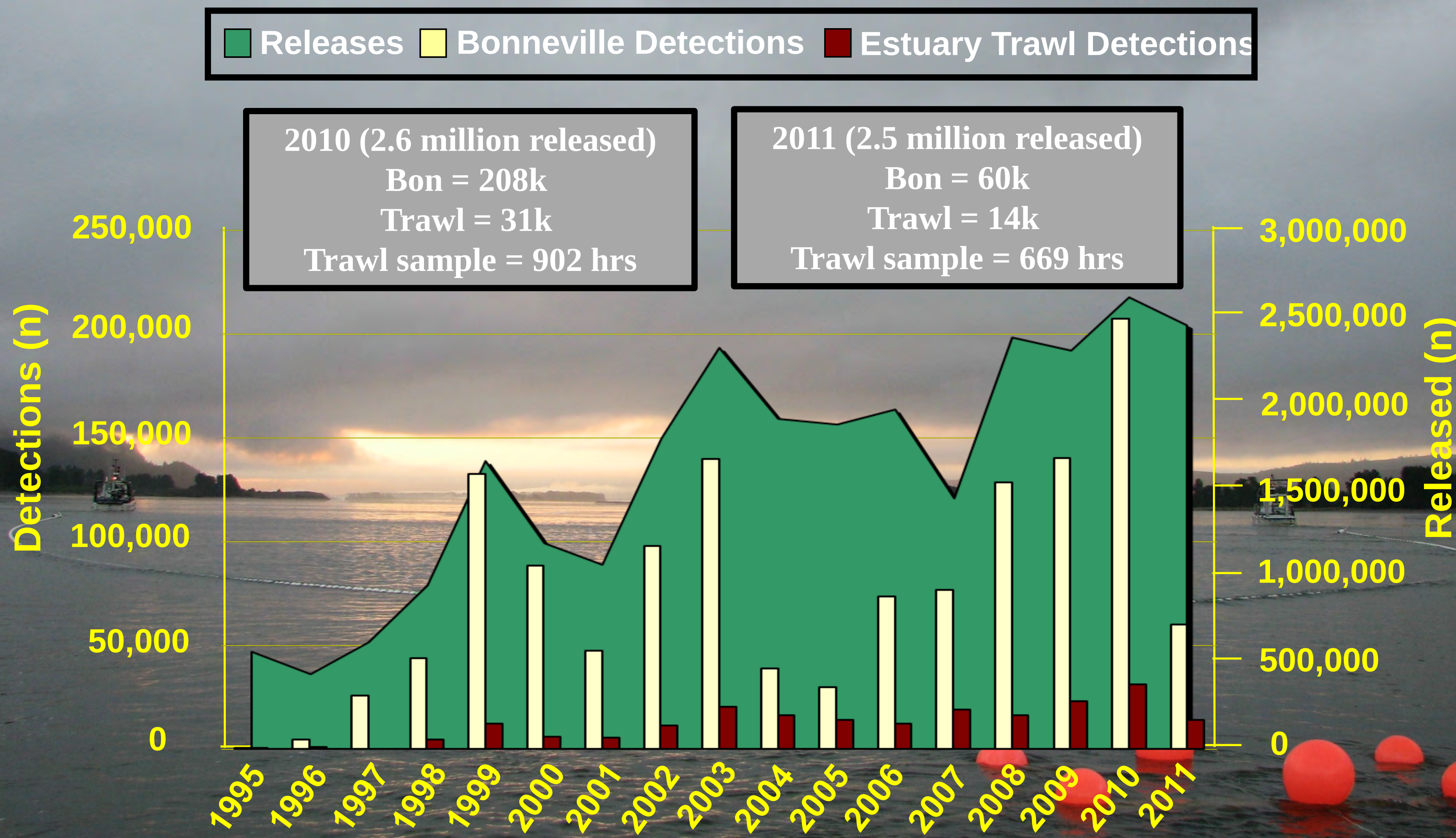
Preliminary 2011 Data

Technical Management Team
Year End Review
December 7, 2011

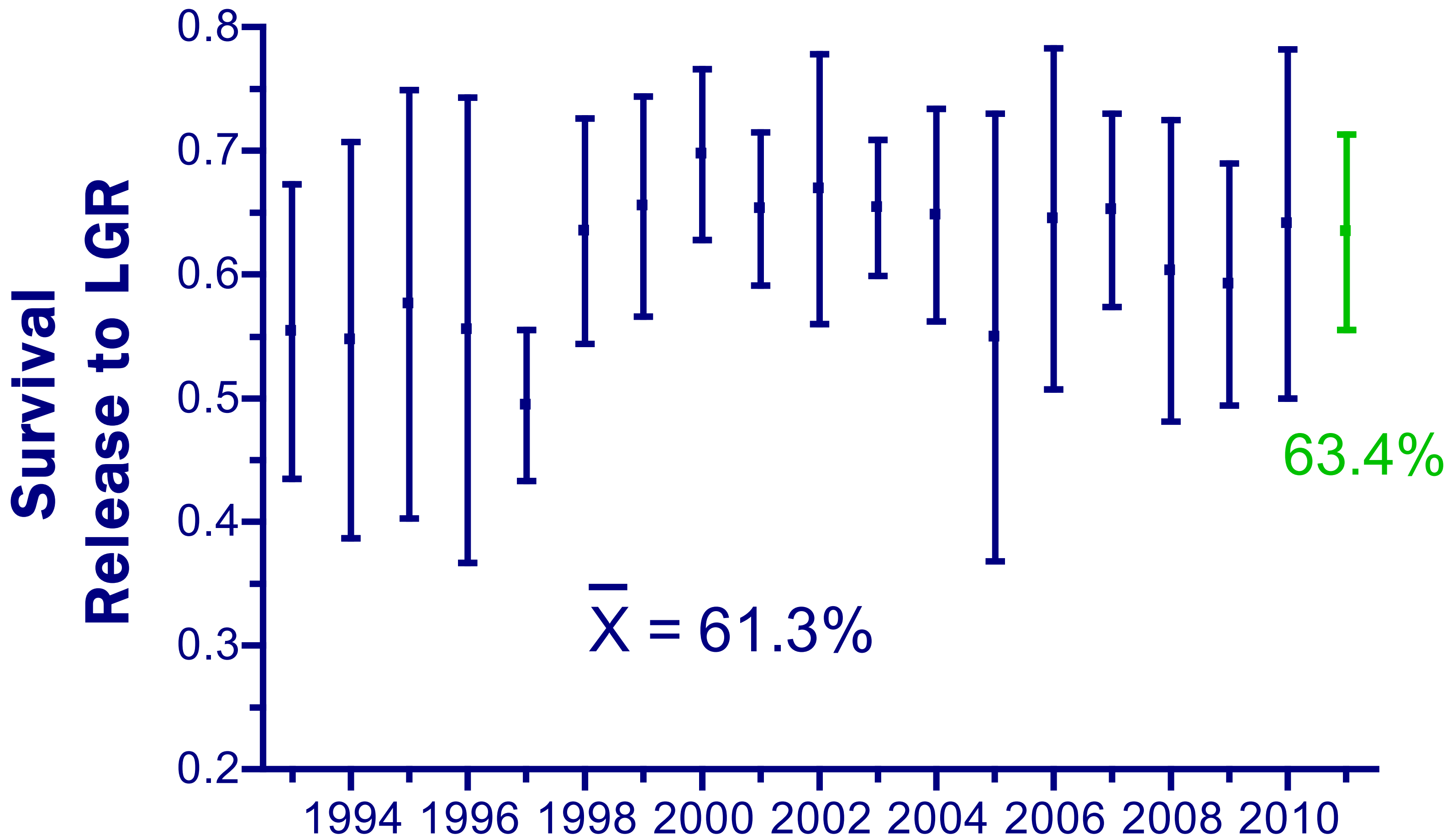
Bill Muir bill.muir@noaa.gov
Northwest Fisheries Science Center
NOAA Fisheries

Columbia Basin PIT Tag Releases

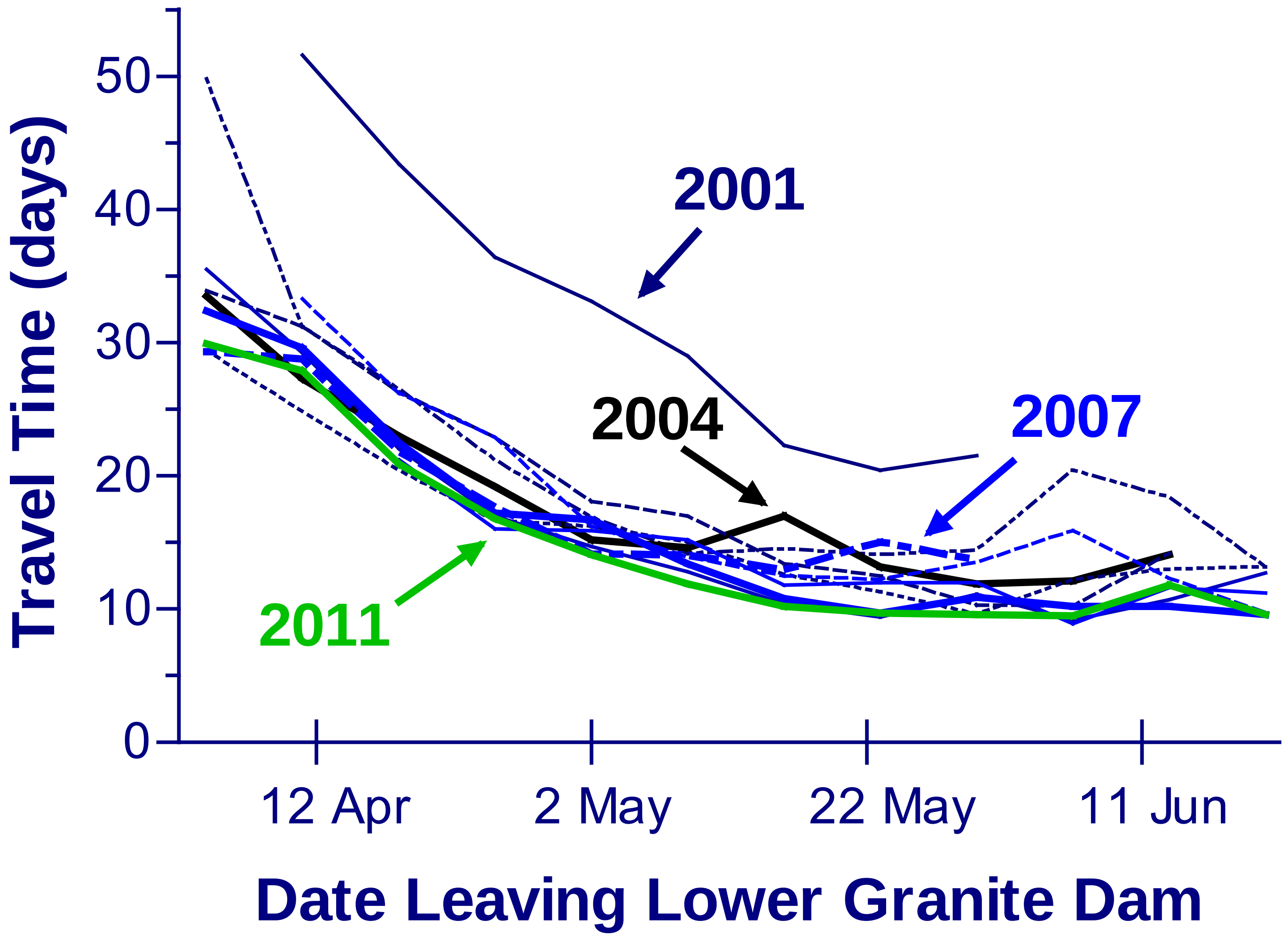
Detections at Bonneville Dam and Estuary Trawl (Rkm 75)



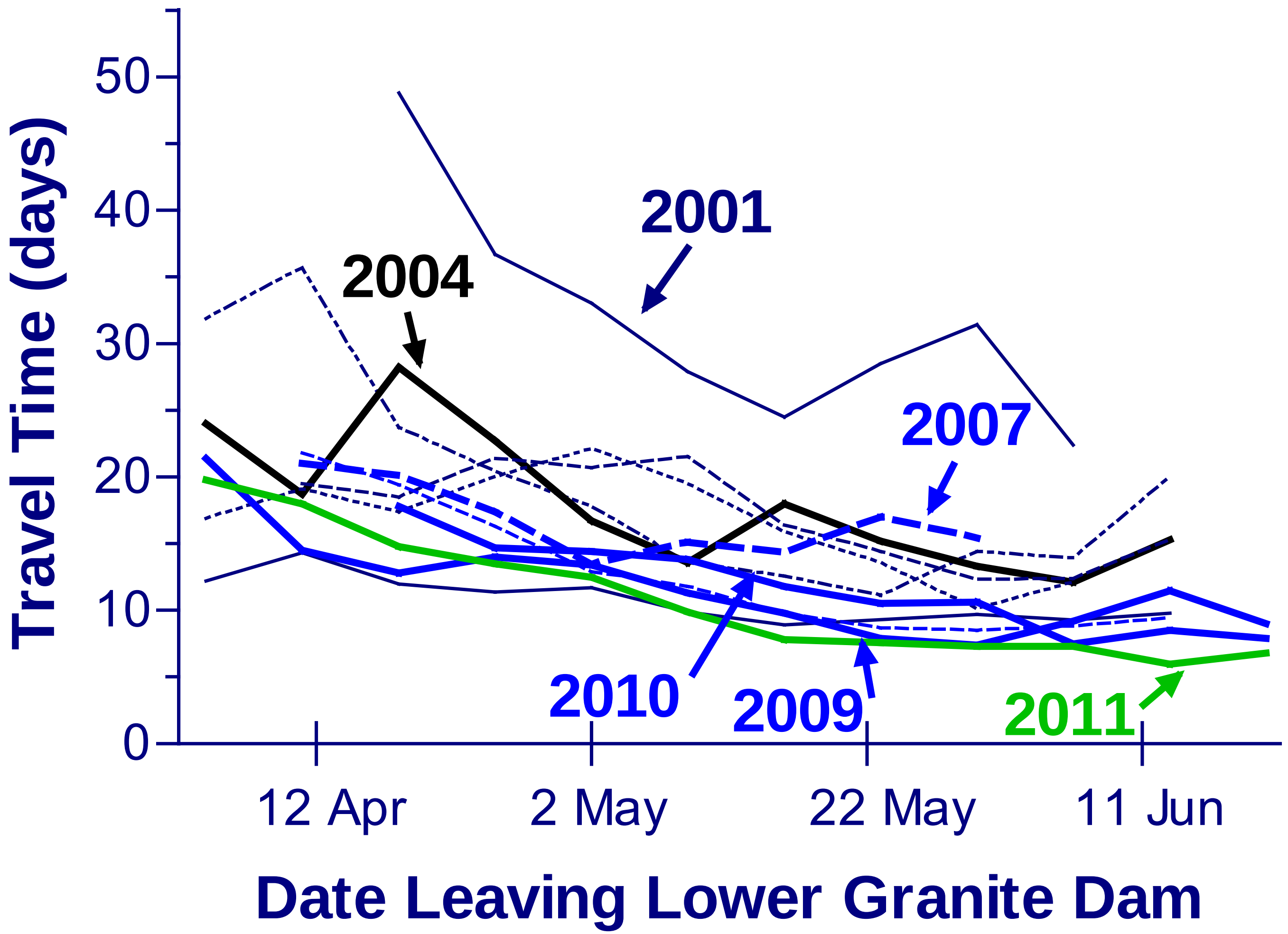
Yearling Chinook
Snake River Basin Hatcheries
Mean of Index Groups

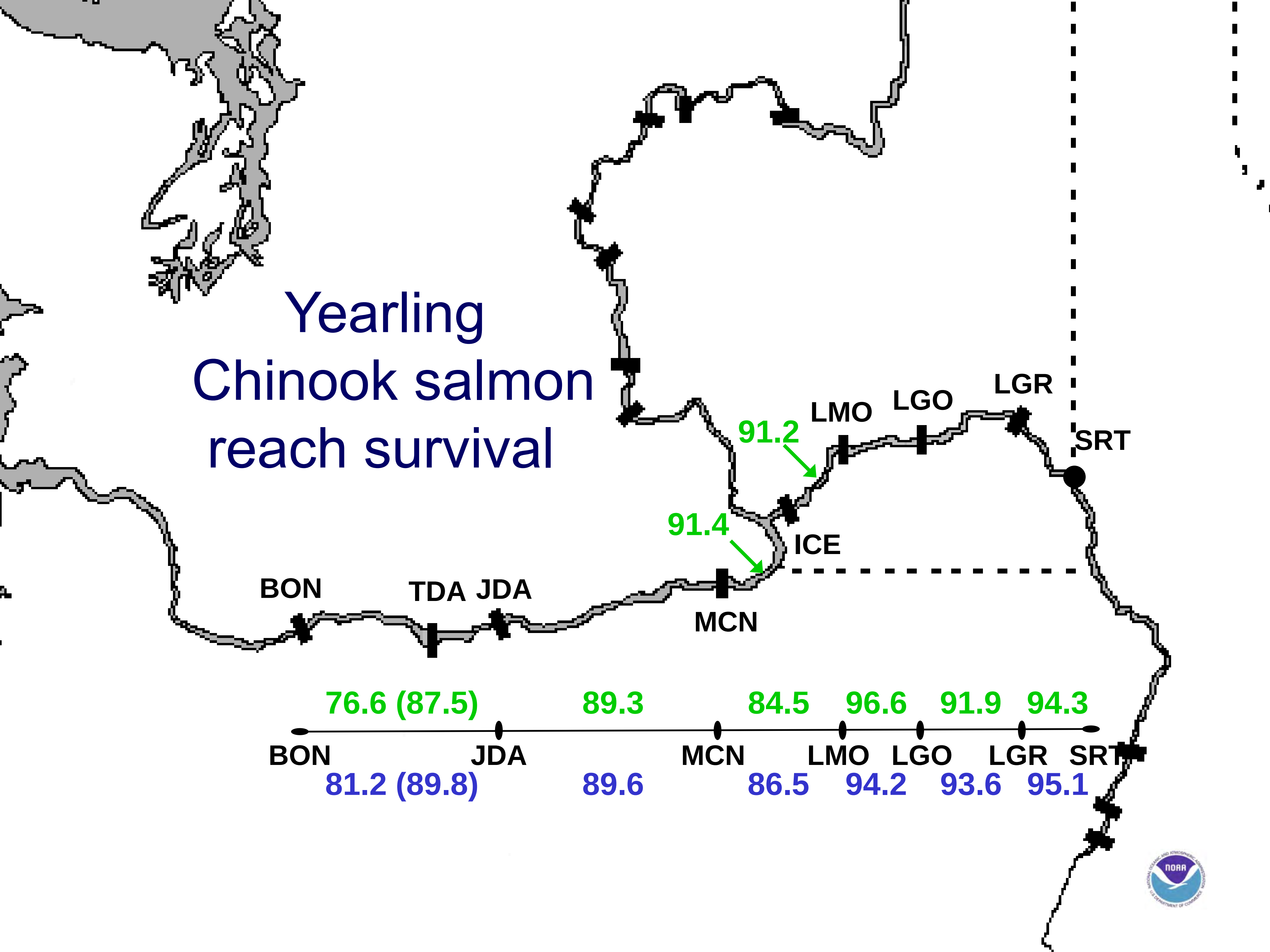


Yearling Chinook Median Travel Time Lower Granite to Bonneville (461 km)

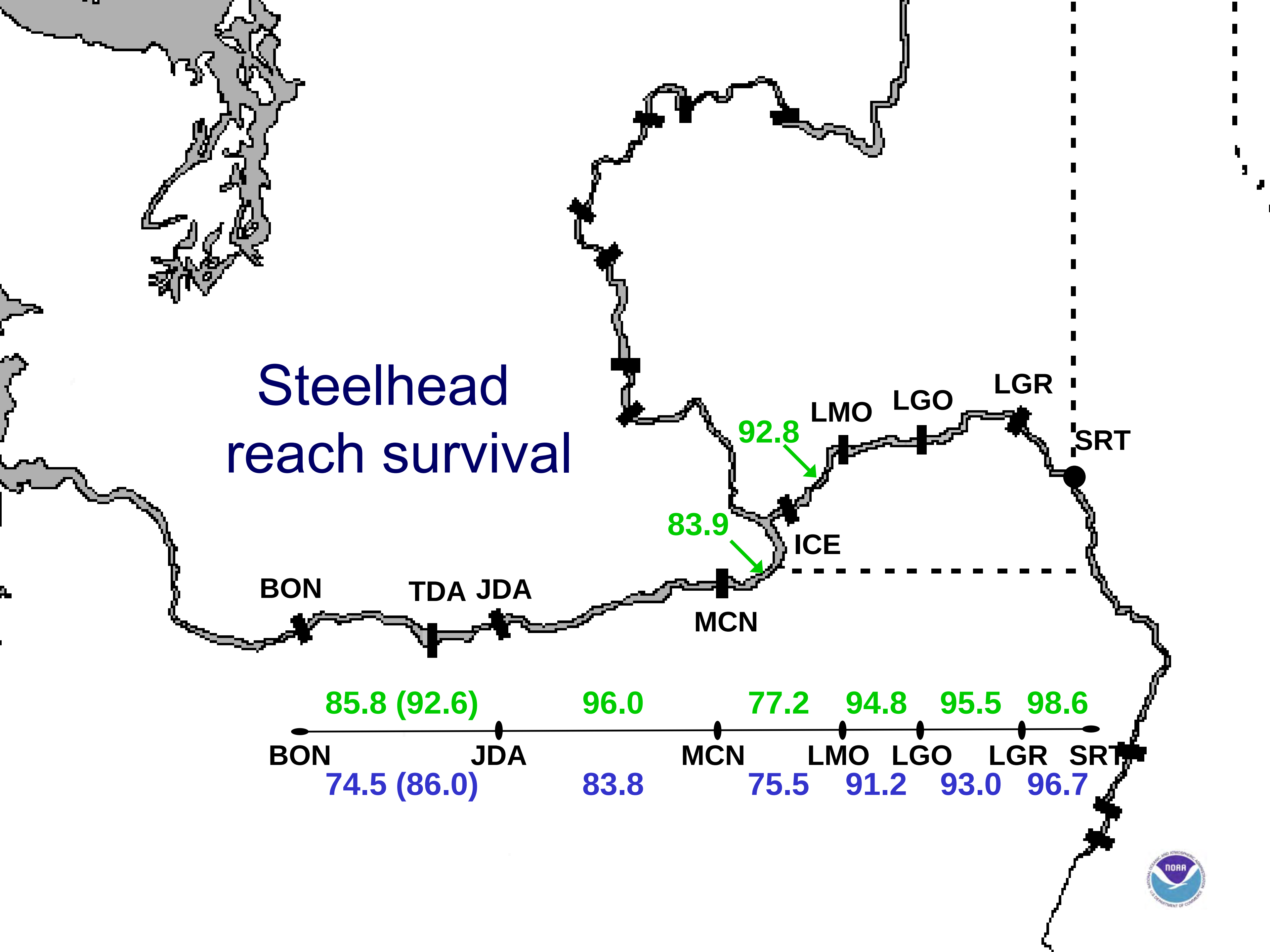


Steelhead Median Travel Time
Lower Granite to Bonneville (461 km)

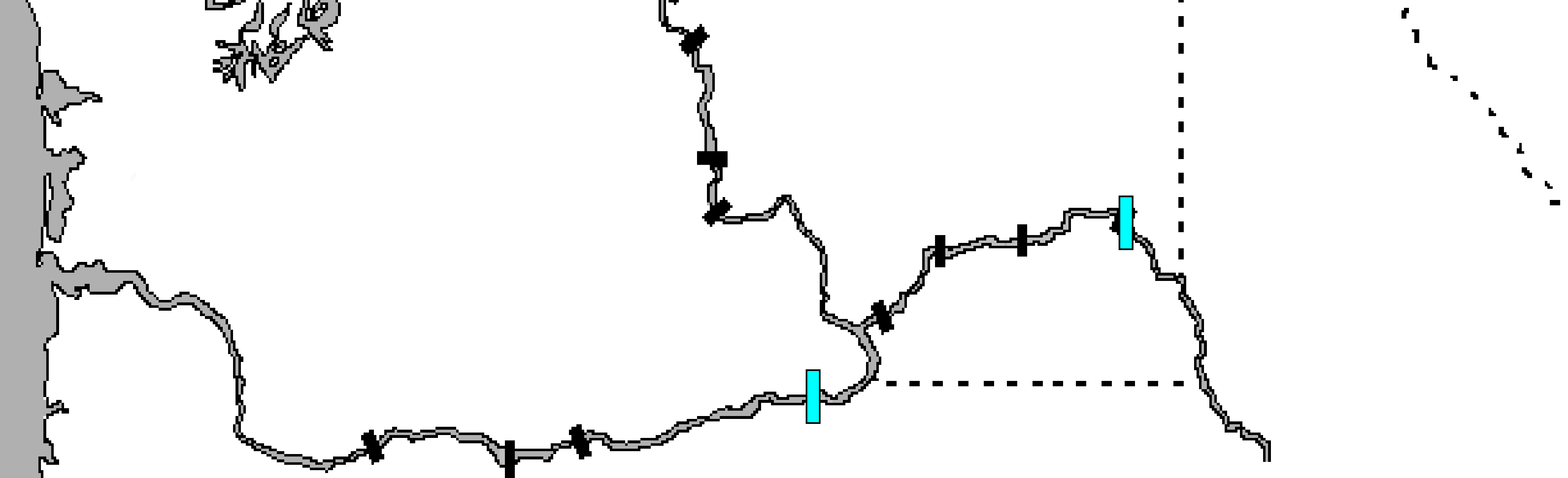




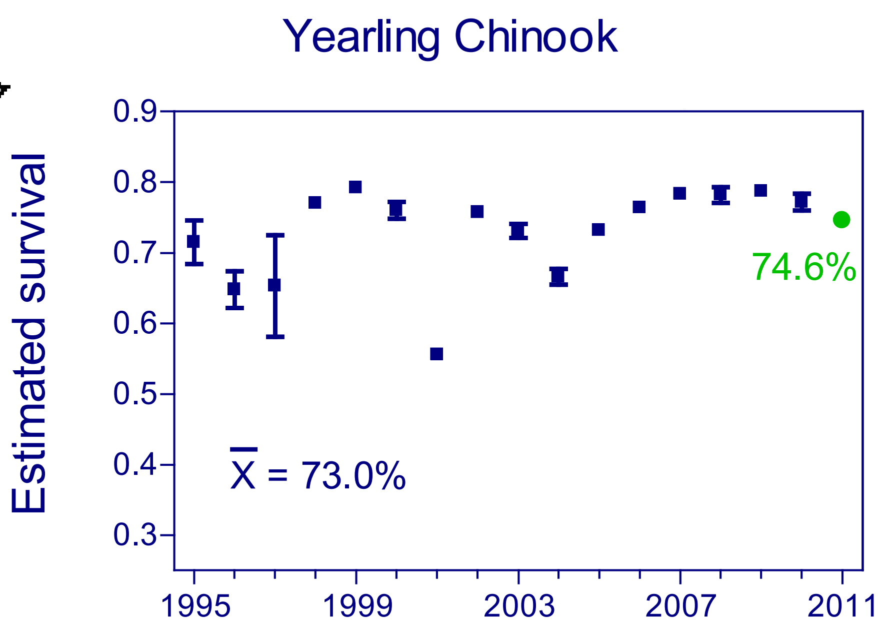
Yearling
Chinook salmon
reach survival
91.2
LMO
LGO
LGR
SRT
91.4
ICE
BON
TDA
JDA
MCN
76.6 (87.5)
89.3
84.5
96.6
91.9
94.3
BON
JDA
MCN
LMO
LGO
LGR
SRT
81.2 (89.8)
89.6
86.5
94.2
93.6
95.1

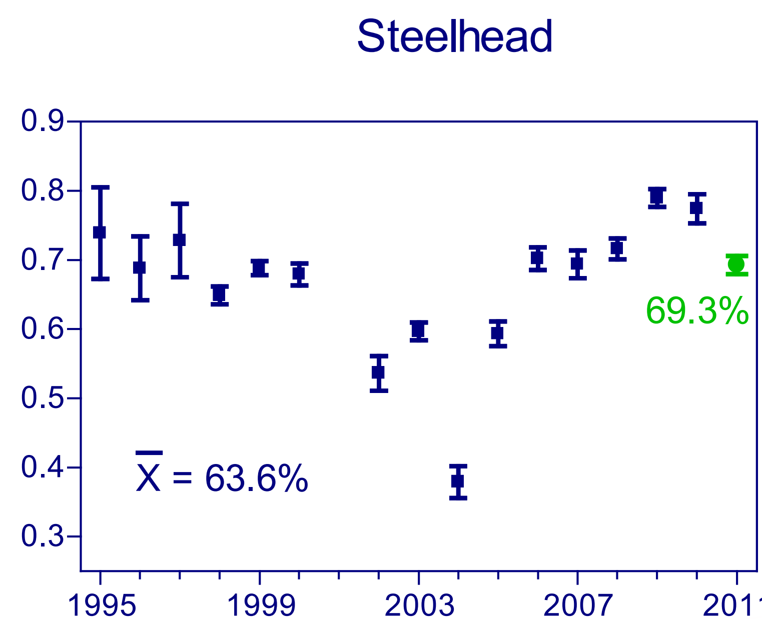


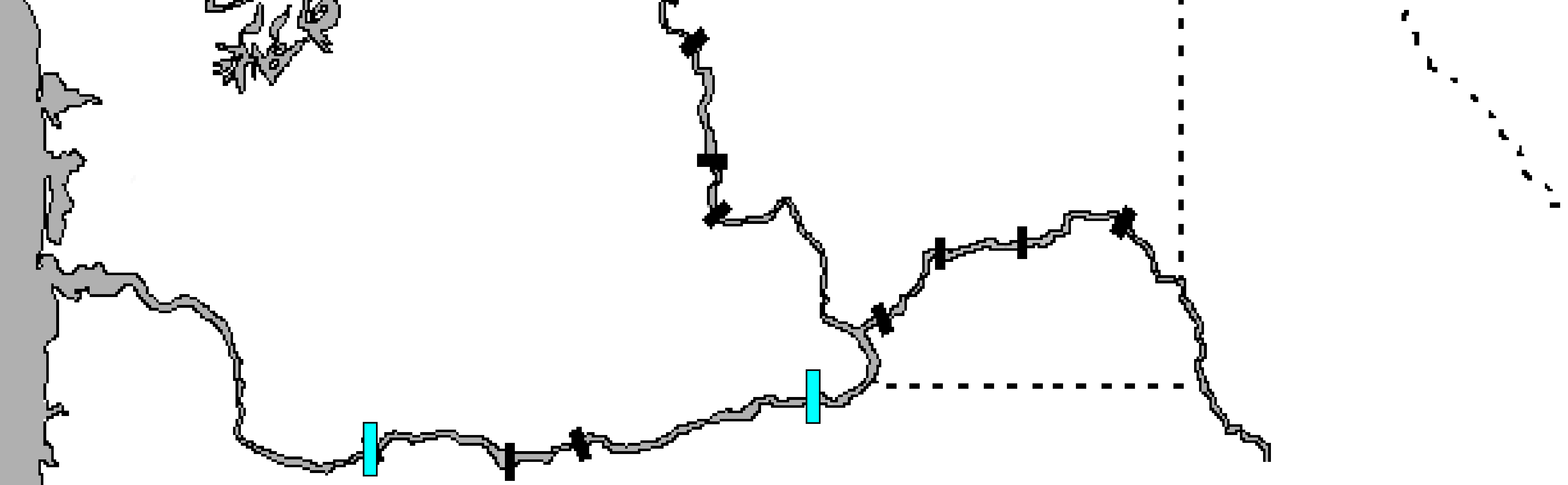
Steelhead
reach survival
92.8
LMO
LGO
LGR
SRT
83.9
ICE
BON
TDA
JDA
MCN
85.8 (92.6)
96.0
77.2
94.8
95.5
98.6
BON
JDA
MCN
LMO
LGO
LGR
SRT
74.5 (86.0)
83.8
75.5
91.2
93.0
96.7



Lower Granite to McNary

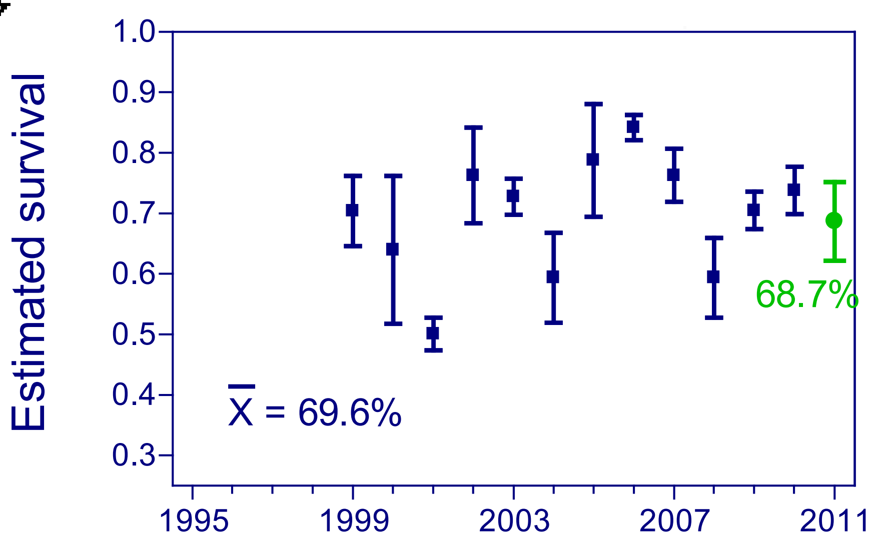




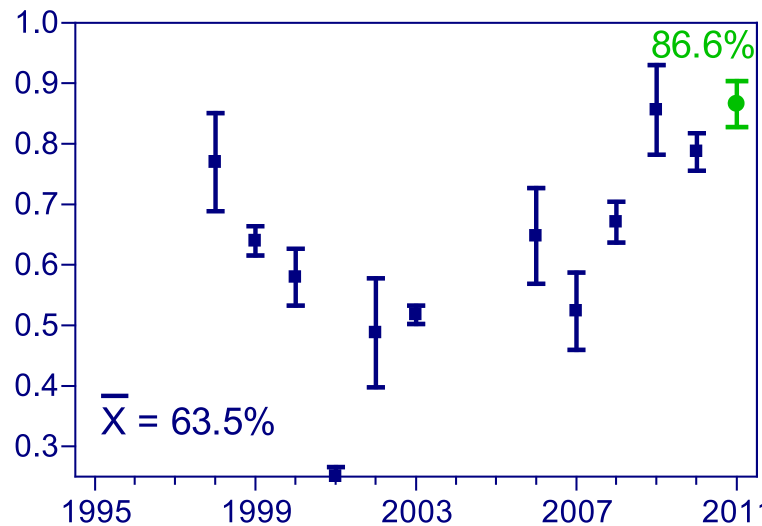


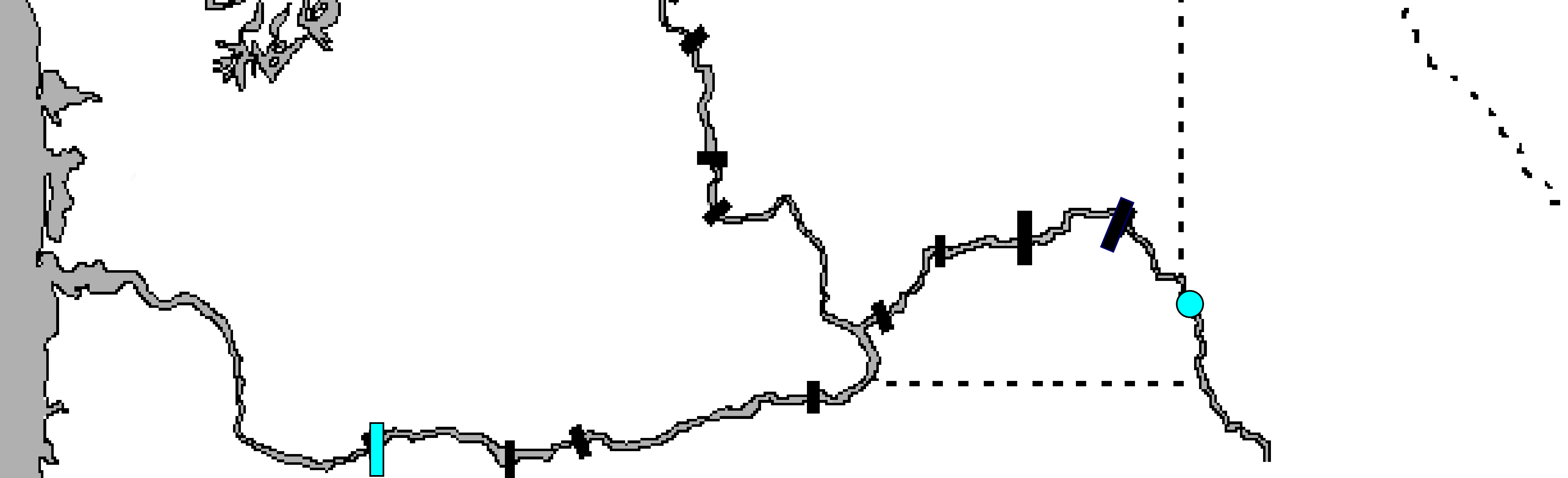
McNary to Bonneville
Fish From Snake River

Yearling Chinook



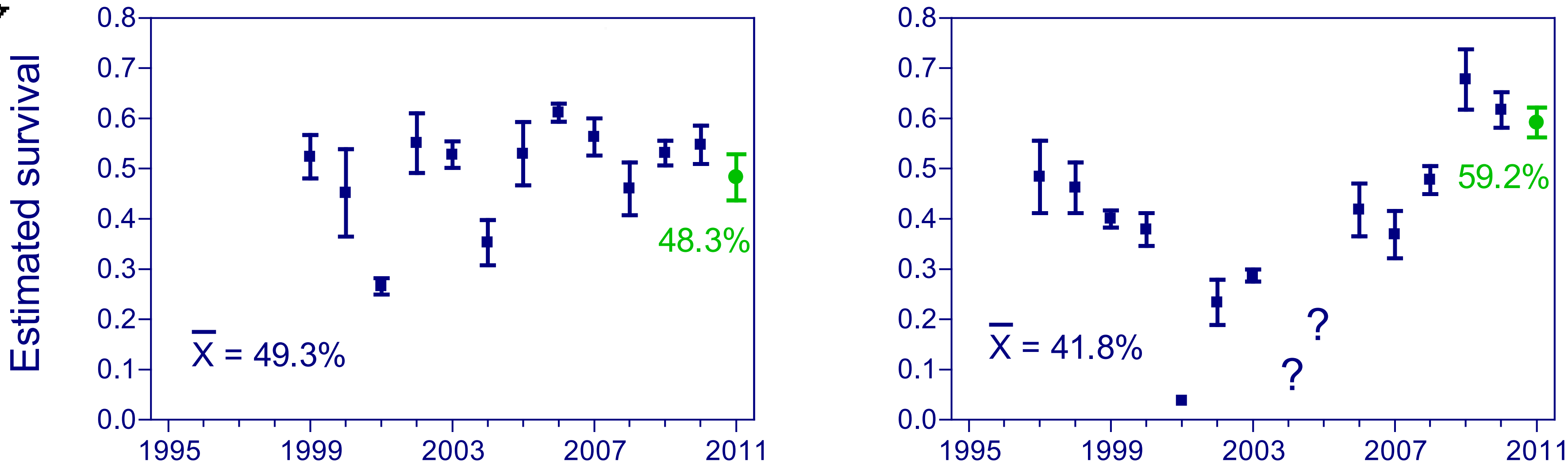
Steelhead



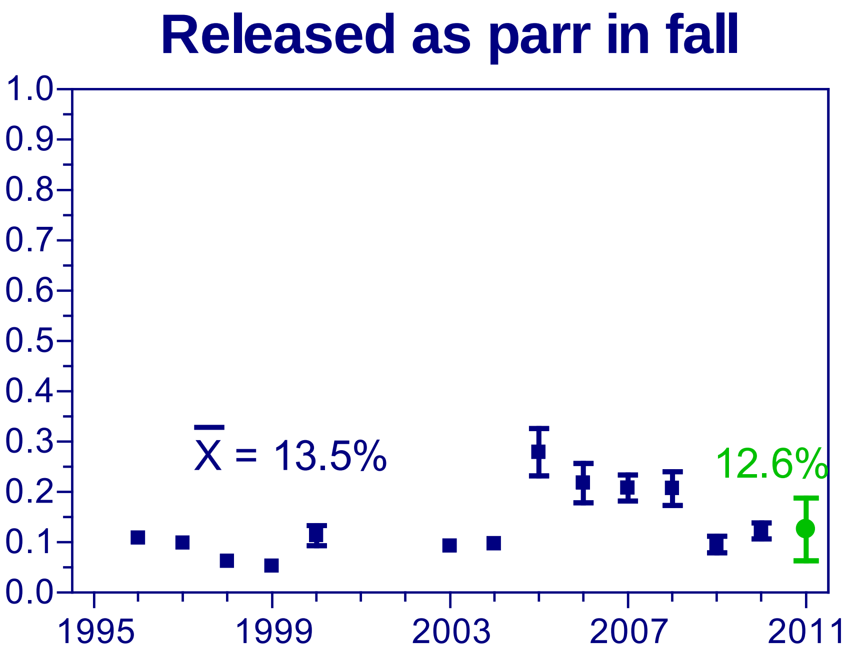


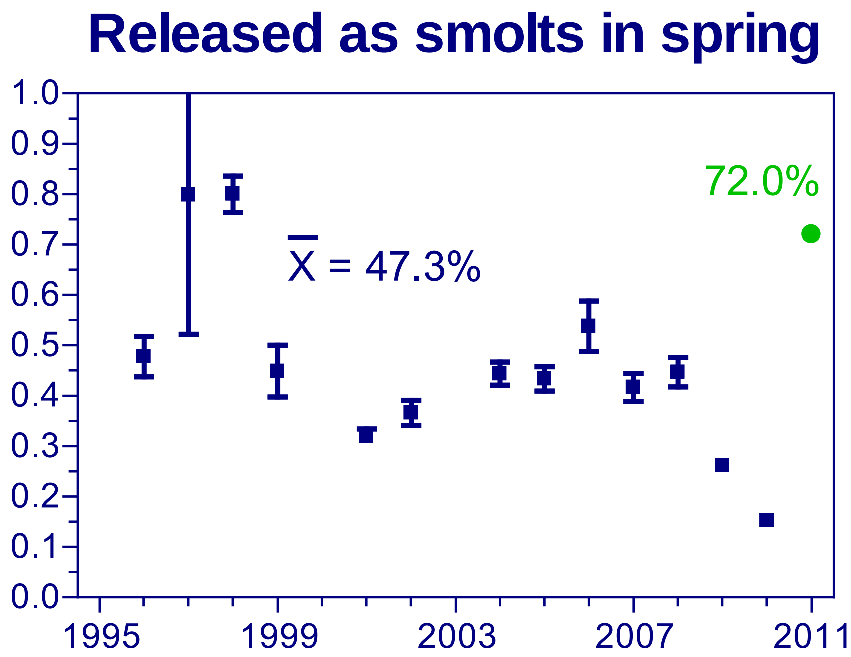
Snake River Trap to Bonneville

Yearling Chinook | Steelhead

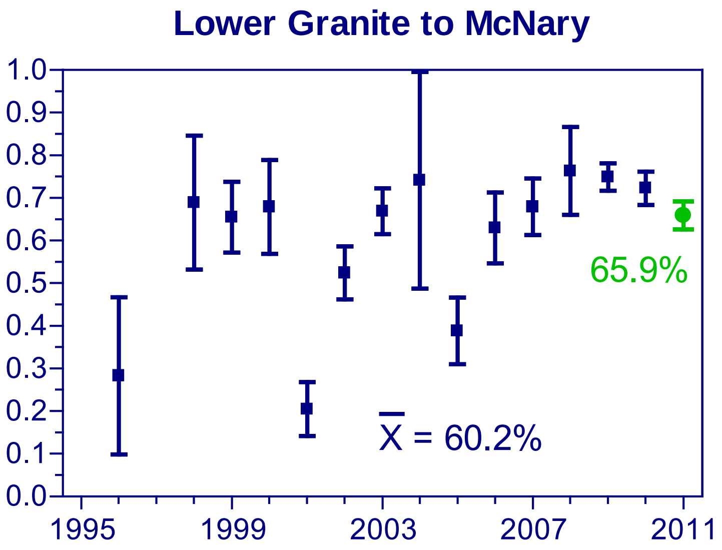


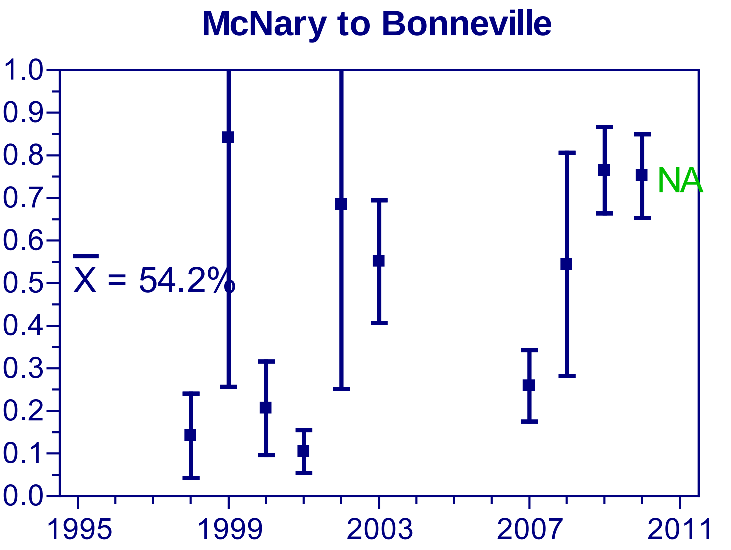
Snake River Sockeye
Redfish Lake to Lower Granite

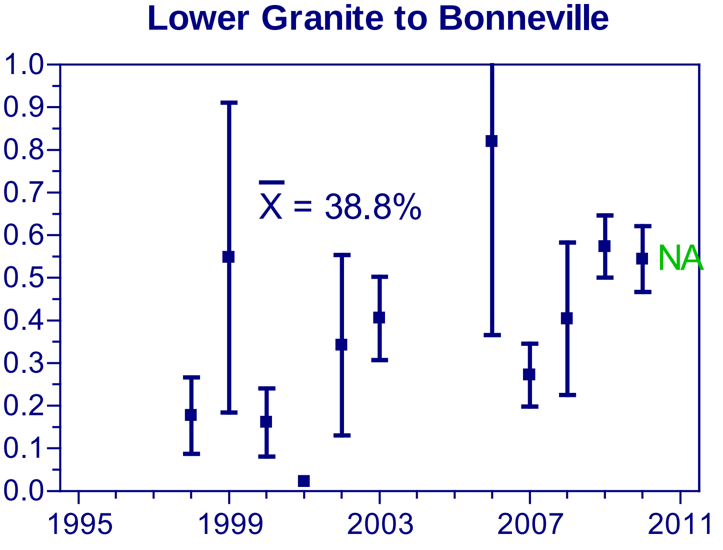




Snake River Sockeye
Smolts Migrating in Spring

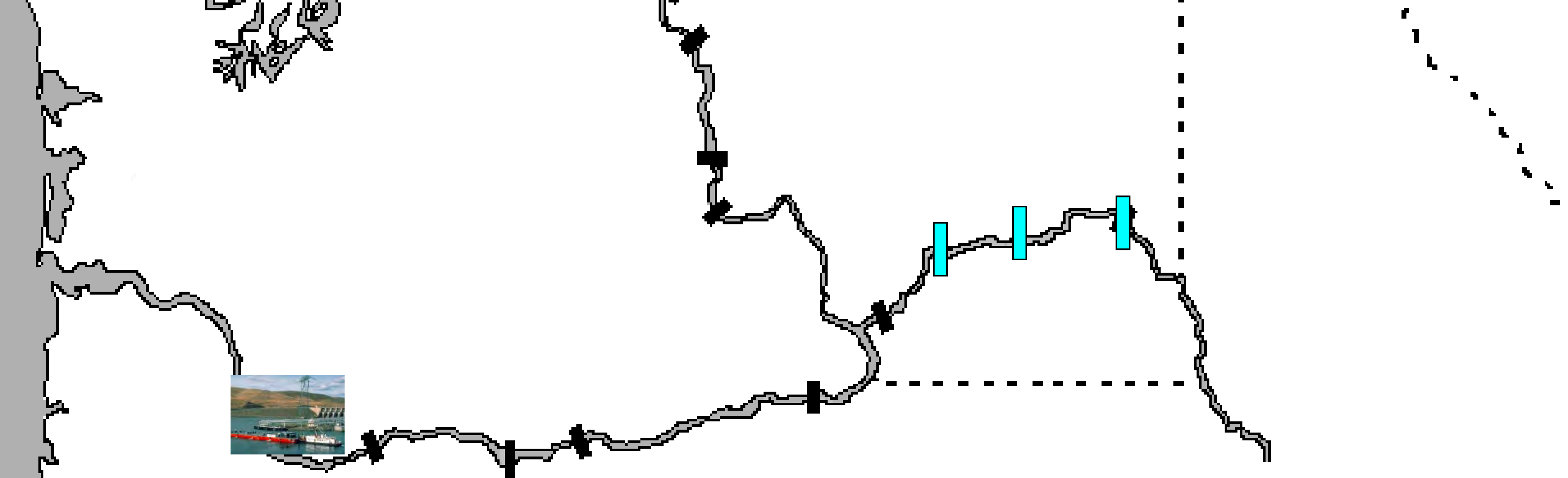




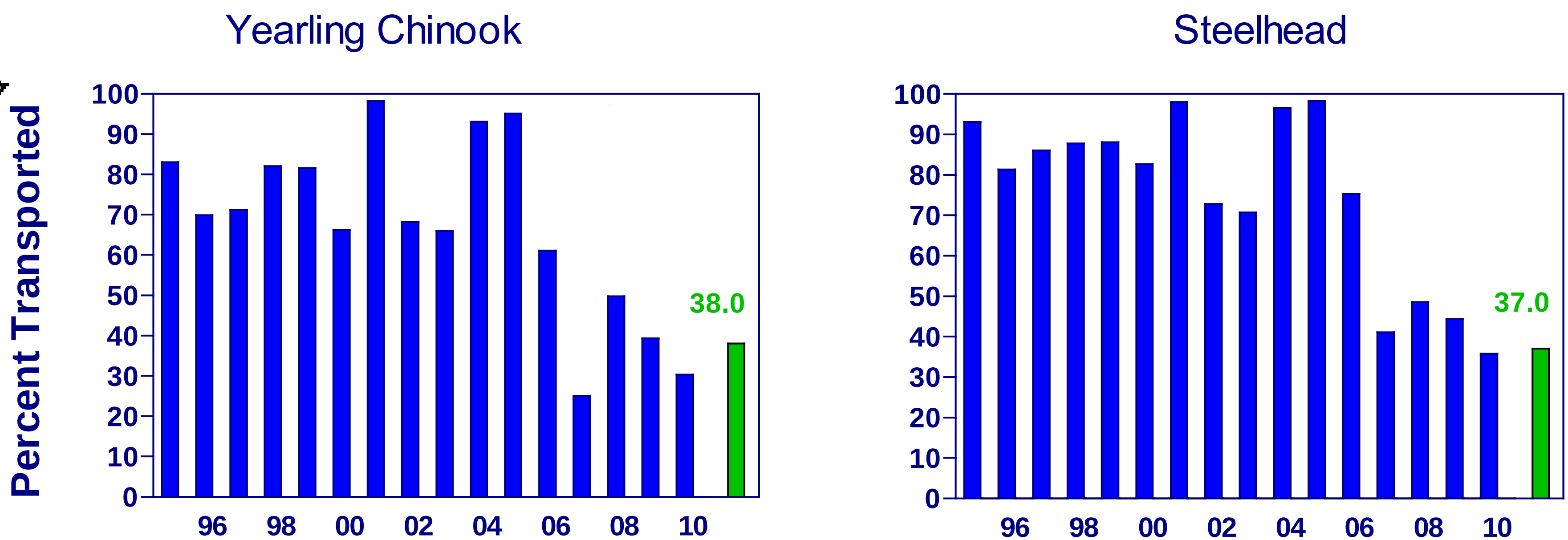


Preliminary estimates of transport % for 2011 based on PIT-tag data:

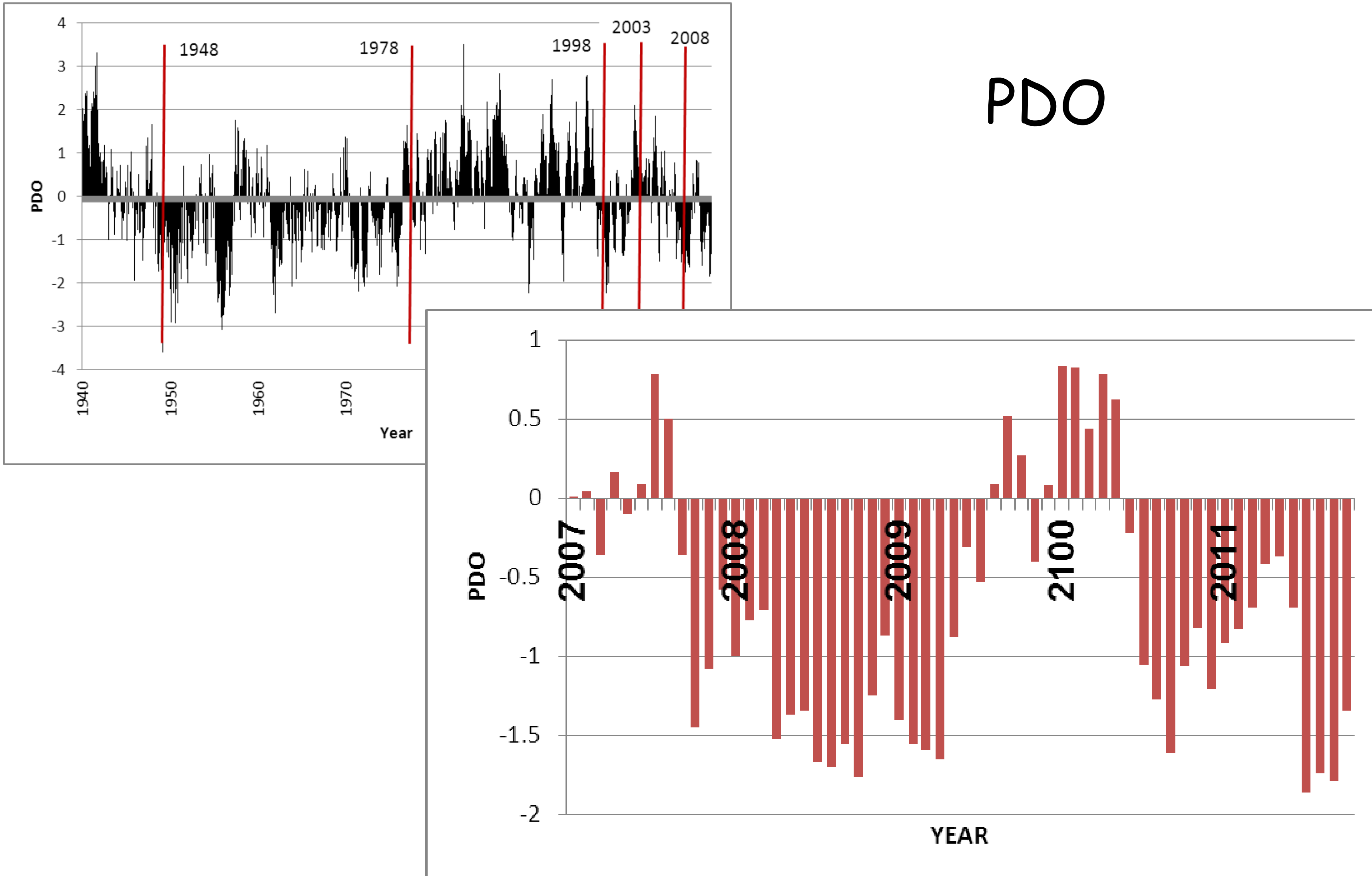
- **35% wild Chinook**
- **41% hatchery Chinook**
- **36% wild steelhead**
- **38% hatchery steelhead**



Percent Transported to Below Bonneville

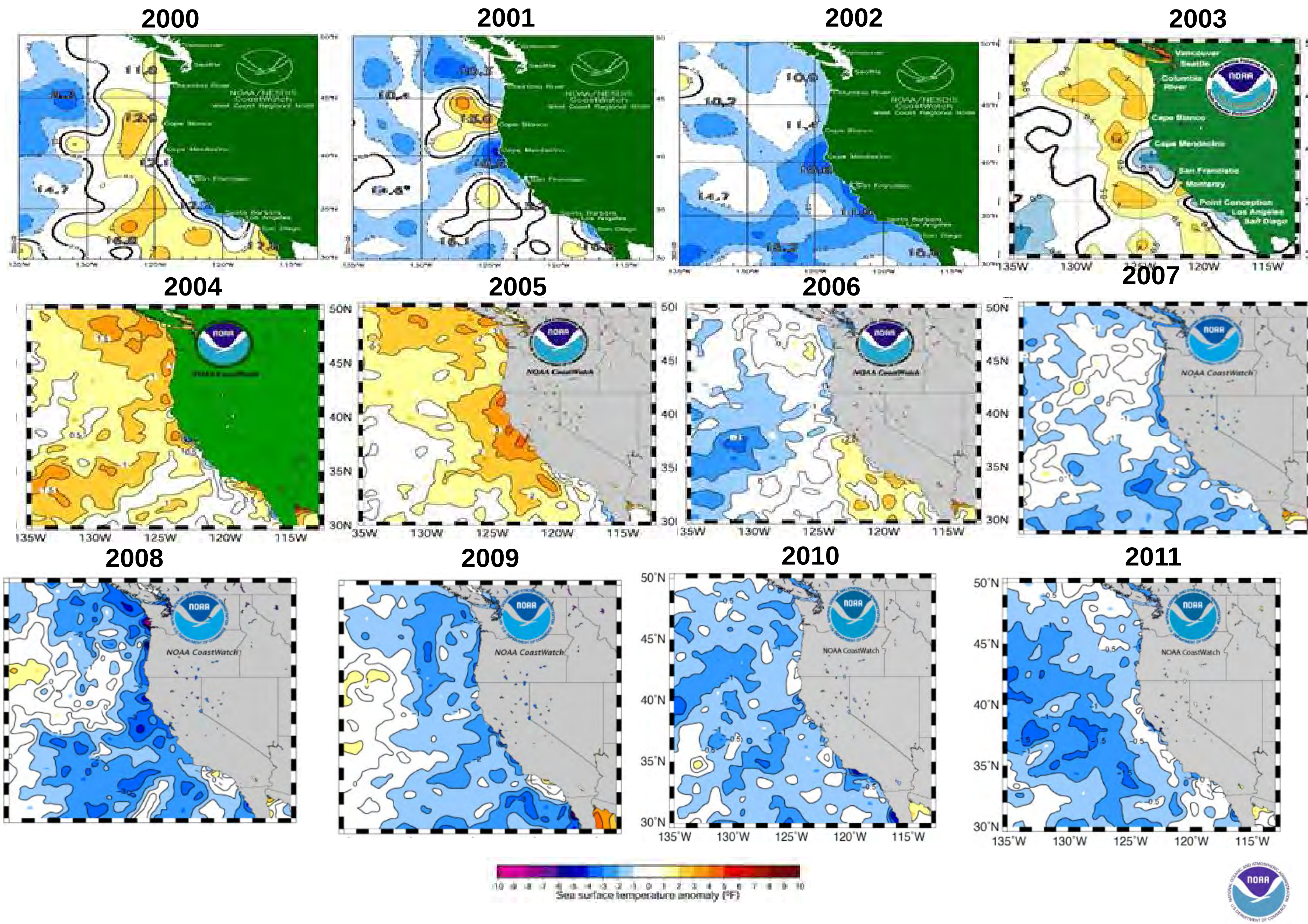


PDO


4
3
2
1
0
-1
-2
-3
-4
PDO
1948
1978
1998
2003
2008
1940
1950
1960
1970
Year
1
0.5
0
-0.5
-1
-1.5
-2
PDO
2007
2008
2009
2100
2011
YEAR

Ocean Conditions

Sea surface temperature anomalies May 1998-2010



Environmental Variables		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
PDO (December-March)		13	5	2	9	6	14	8	12	10	7	4	1	11	3
PDO (May-September)		8	3	5	4	9	13	12	14	10	11	1	7	6	2
ONI Jan-June		14	1	1	5	10	11	9	12	6	8	3	7	13	4
SST at 46050 (May-Sept)		12	8	3	4	1	7	14	11	5	13	2	9	6	10
SST at NH 05 (May-Sept)		8	4	1	6	2	5	14	11	7	13	3	12	10	9
SST winter before (Nov-Mar)		14	11	3	5	7	10	12	9	8	2	1	4	13	5
Physical Spring Trans (UI Based)		3	6	13	12	4	9	11	14	9	1	5	2	7	8
Upwelling Anomaly (Apr-May)		7	1	12	3	6	10	9	14	7	2	4	5	11	12
Length of upwelling season (UI Based)		6	2	13	9	1	10	8	14	5	3	7	3	11	12
Deep Temperature at NH 05		14	4	6	3	1	9	10	11	12	5	2	8	7	13
Deep Salinity at NH05		14	3	6	2	5	12	13	8	7	1	4	10	11	9
Copepod Richness Anomaly		14	2	1	6	4	10	9	13	11	7	5	8	12	3
N.Copepod Anomaly		13	9	5	6	3	12	11	14	10	8	2	7	4	1
Biological Transition		13	9	6	5	7	12	8	14	11	2	1	4	10	3
Copepod Community structure		14	4	3	6	1	10	11	13	12	8	2	5	9	7
Winter Ichthyoplankton		14	6	2	4	5	13	12	8	11	10	1	7	3	9
Catches of salmon in surveys															
June-Chinook Catches		13	2	3	11	7	9	12	14	8	6	1	4	5	10
Sept-Coho Catches		10	2	1	4	3	6	11	13	8	9	7	14	12	5
Mean of Ranks of Environmental Data		11.3	4.6	4.8	5.8	4.6	10.1	10.8	12.2	8.7	6.4	3.1	6.5	8.9	6.9
RANK of the mean rank		13	2	4	5	2	11	12	14	9	6	1	7	10	8


Questions

What do we expect in 2012

- Continued La Nina and negative PDO and cool ocean conditions – Good salmon marine survival
- Relatively high spring flows – also good for marine survival (larger plume)
- Fewer sardines – they like warm ocean
- More anchovy, smelt and herring – cool species
- More large copepods – food for things that Chinook and coho eat and food for sockeye and chum salmon.

TMT Annual Review

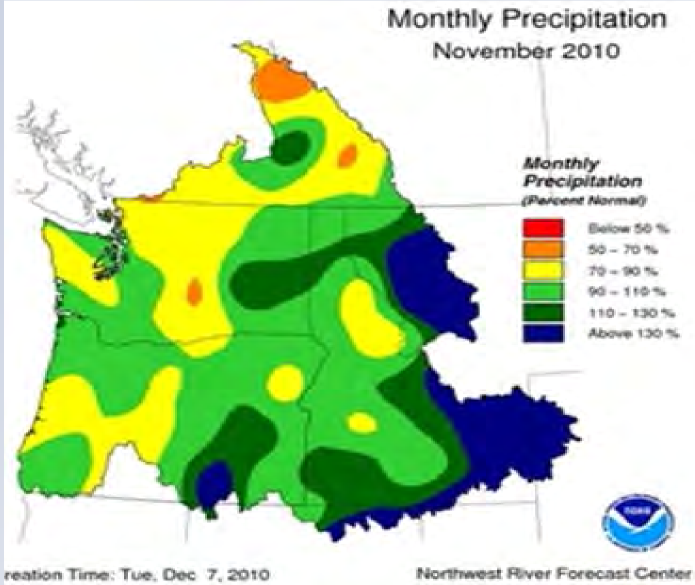
Weather and Water Summary

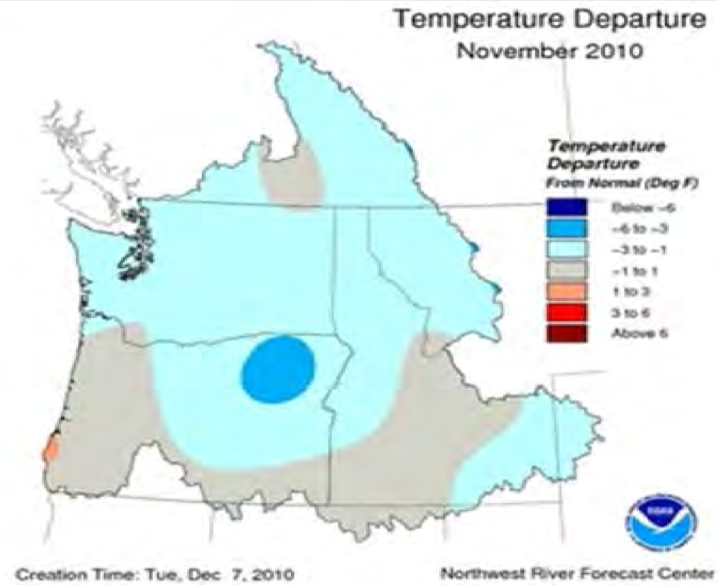
Presented by
Karl Kanbergs
USACE, Water Management Division

December 7, 2011

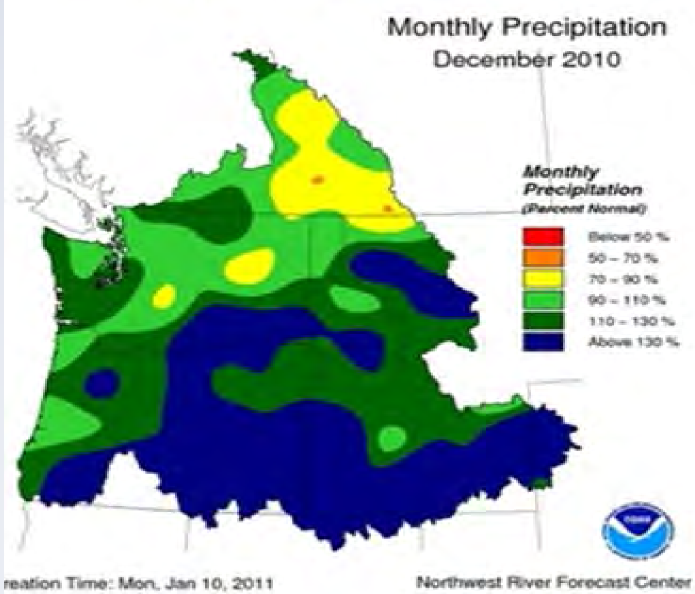
Season Highlights and Summary

- Fourth wettest year, 1929 – 2011, 127 MAF Apr – Aug volume at the Dalles. La Nina Conditions.
- Marked by a rising water supply forecast and a very wet, cool and protracted spring
- No system winter flooding but some record tributary flooding on west and east side, and a tornado!
- The Vancouver gage was up to 1.4 ft. above flood stage for more than three weeks but did not reach moderate or major flood stage. Portland gage below flood stage for the whole time
- No late season heavy rain events in the Cascades - - along with gradual Columbia Basin snow melt, avoided major system flooding

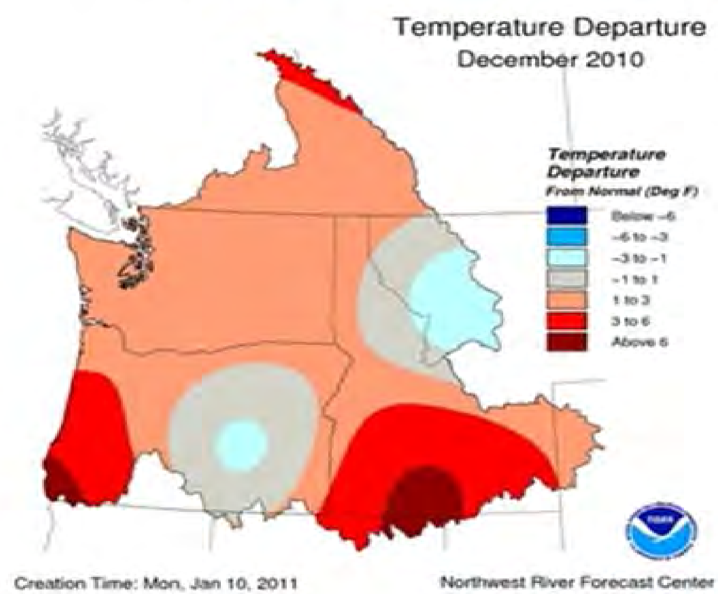


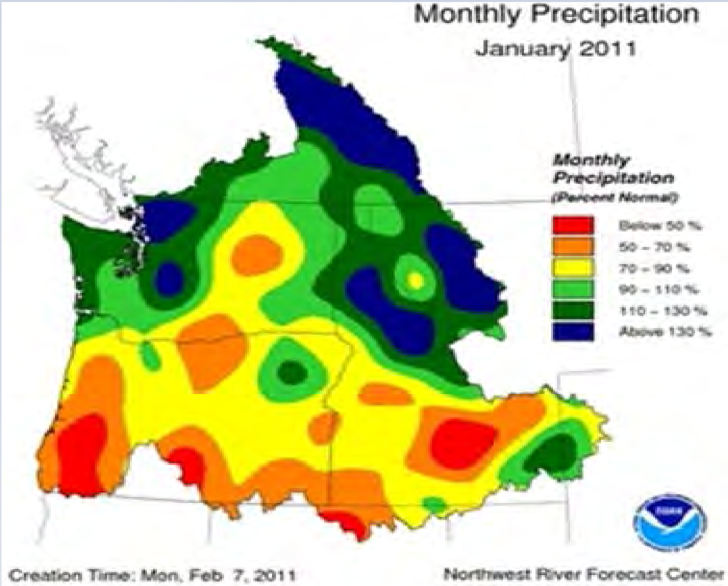


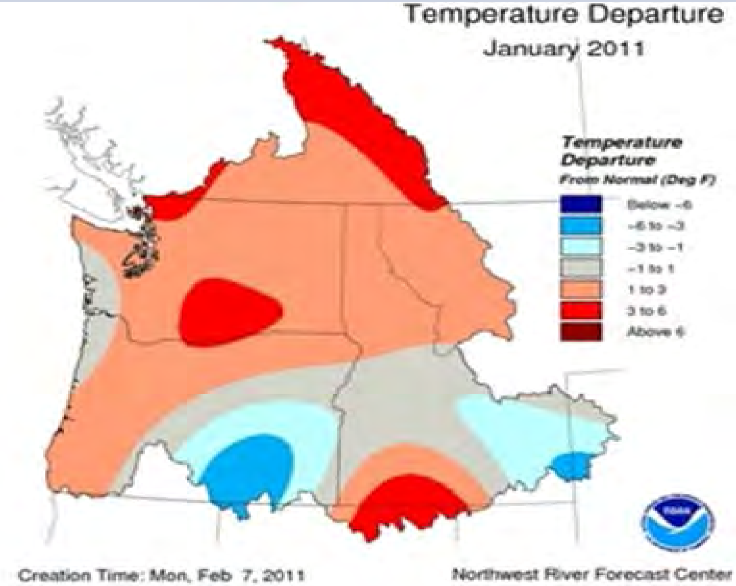
December Precipitation



December Temperature

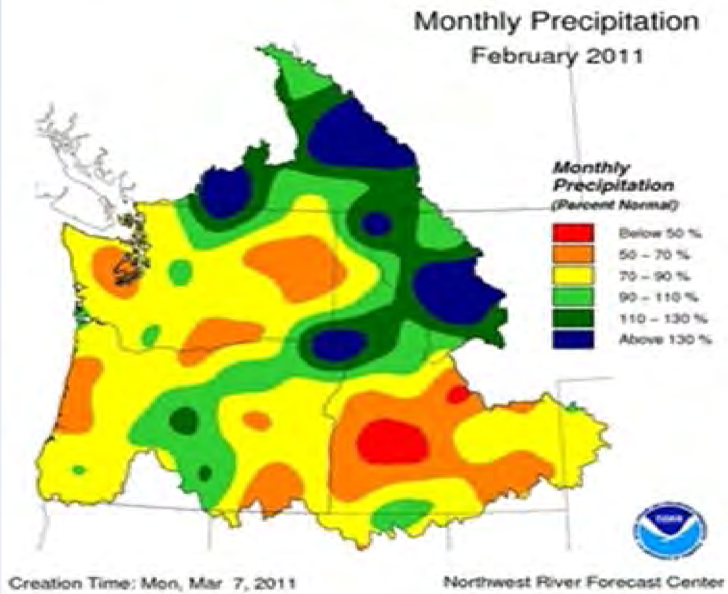


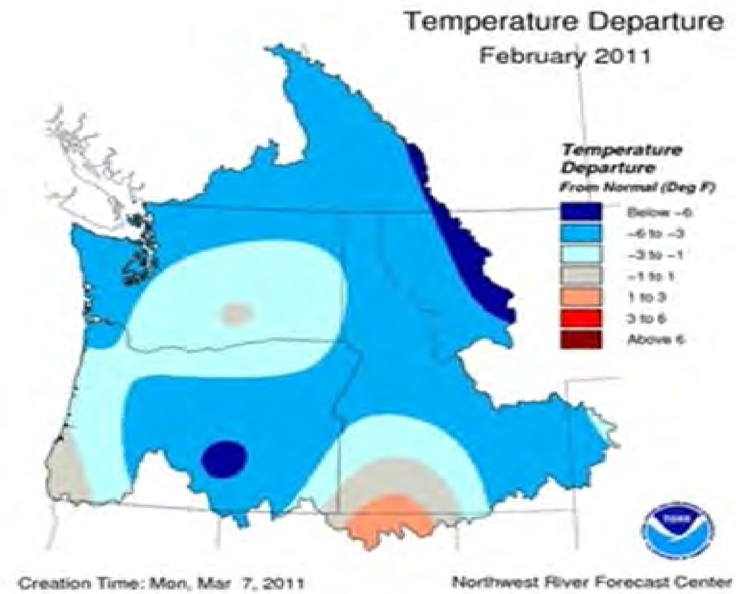


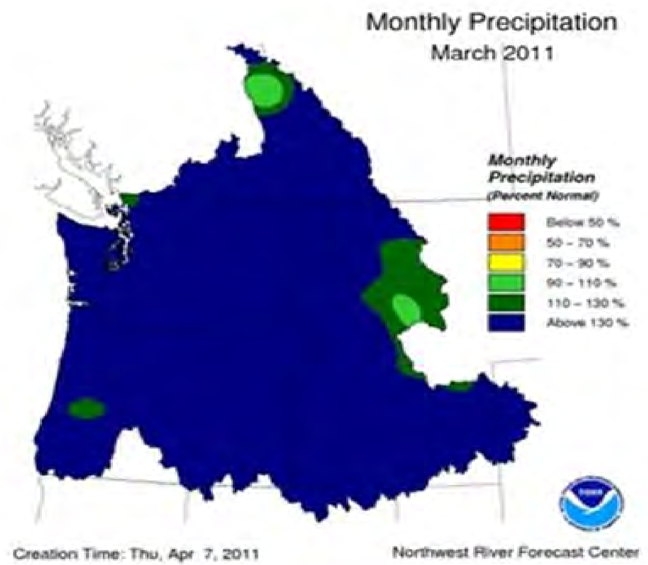


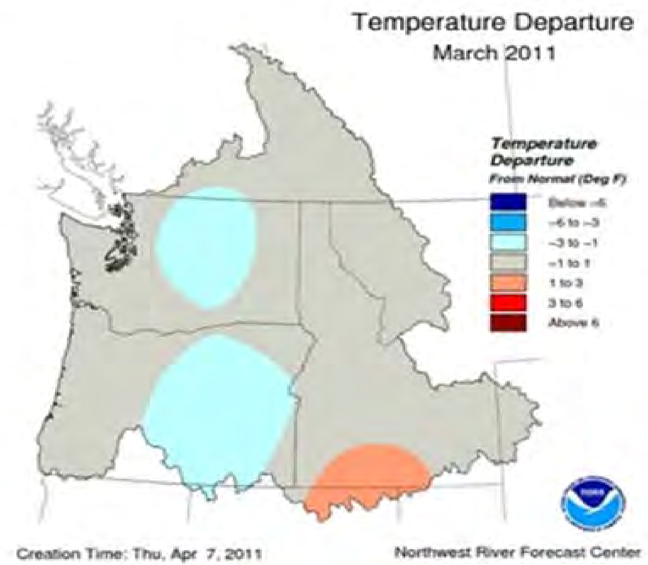
February Precipitation

February Temperature



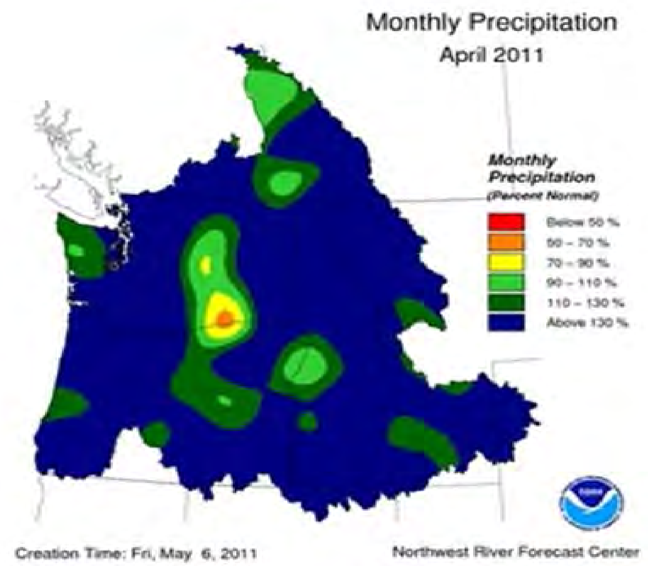


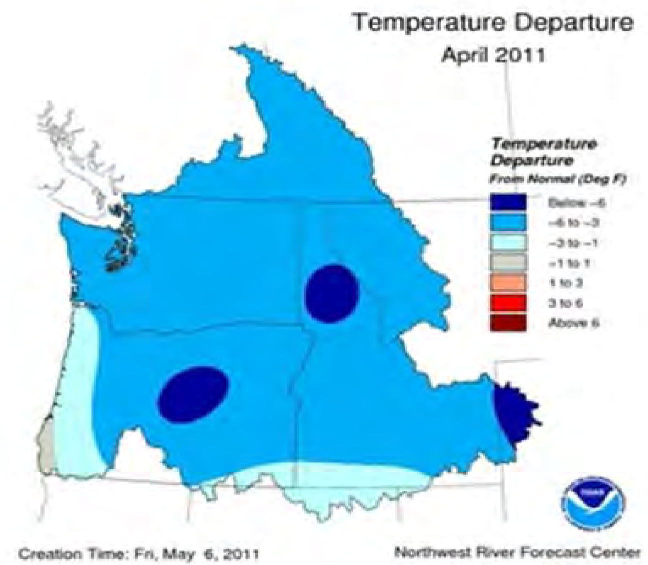


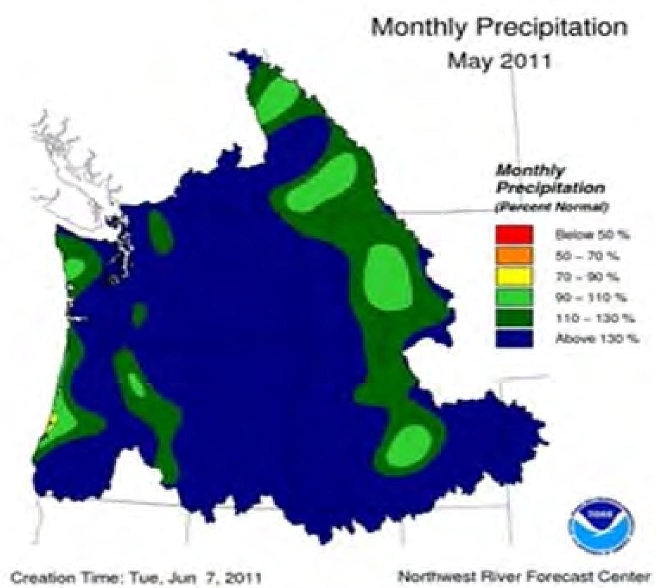


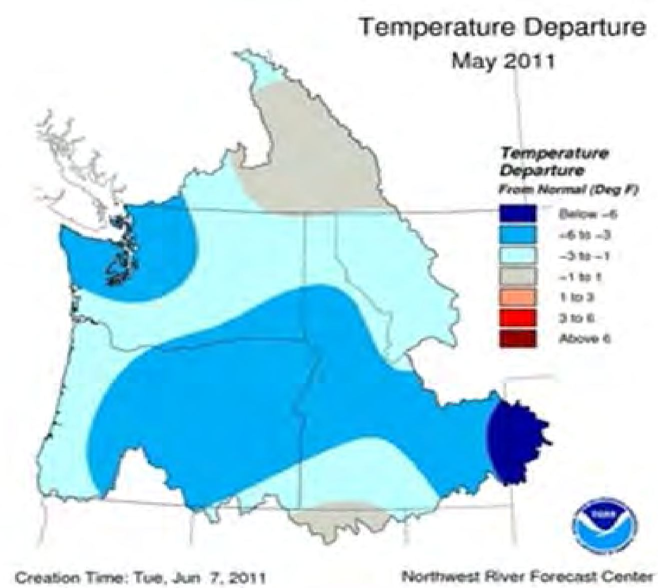
April Precipitation

April Temperature



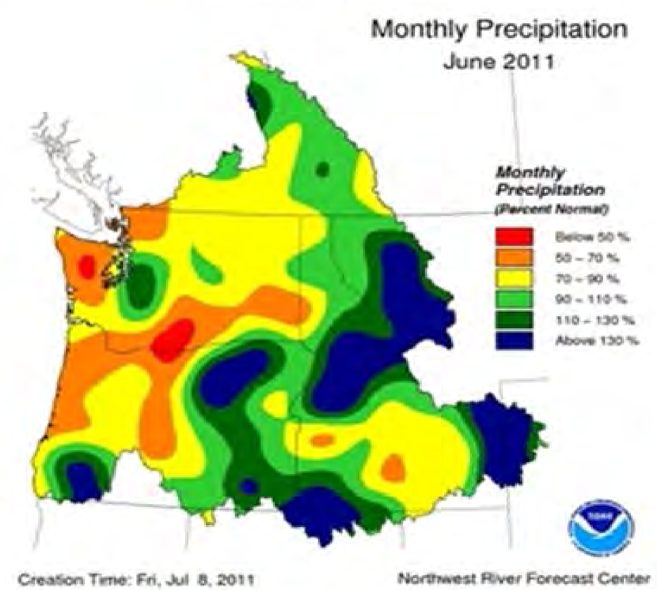


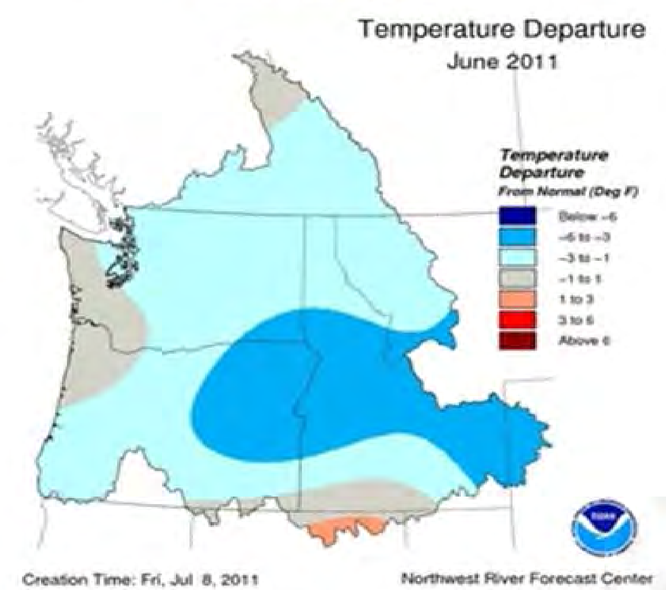


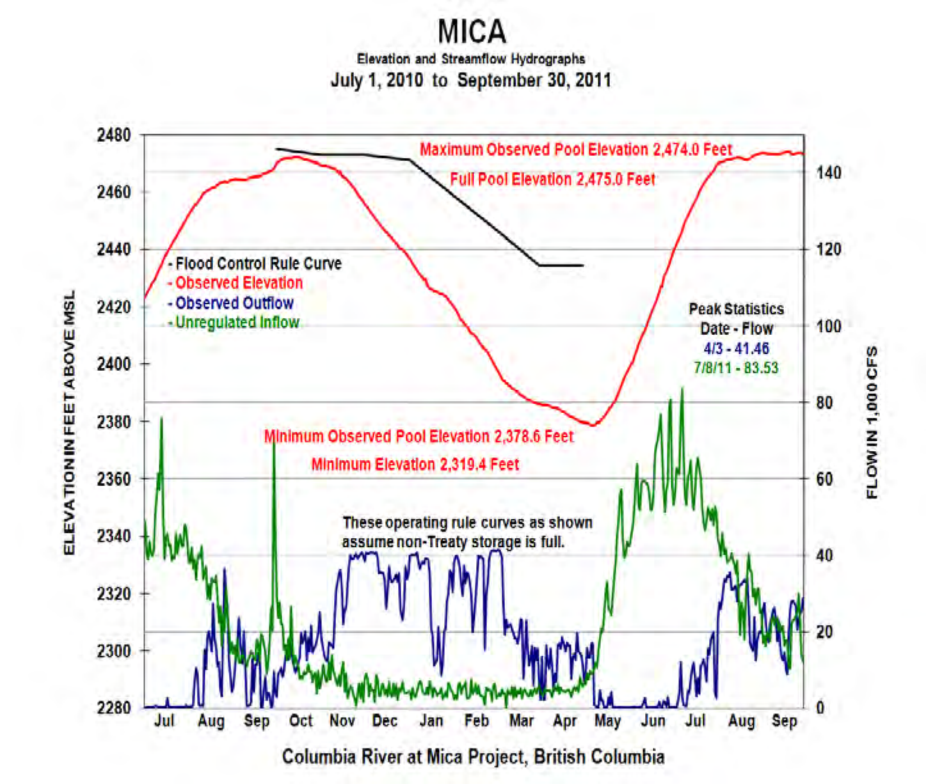


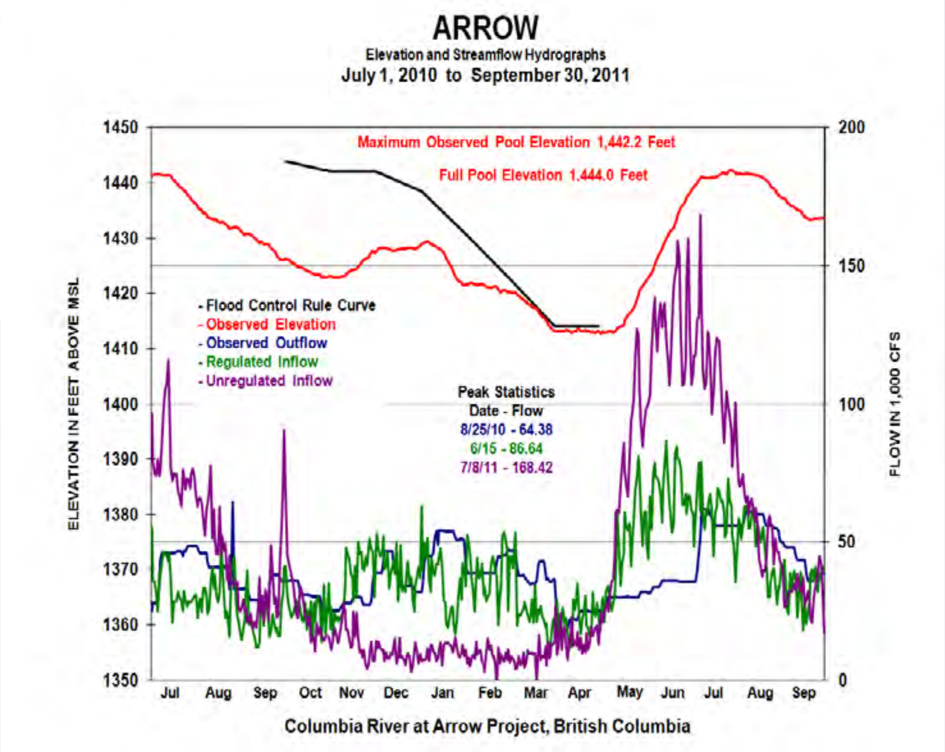
June Precipitation

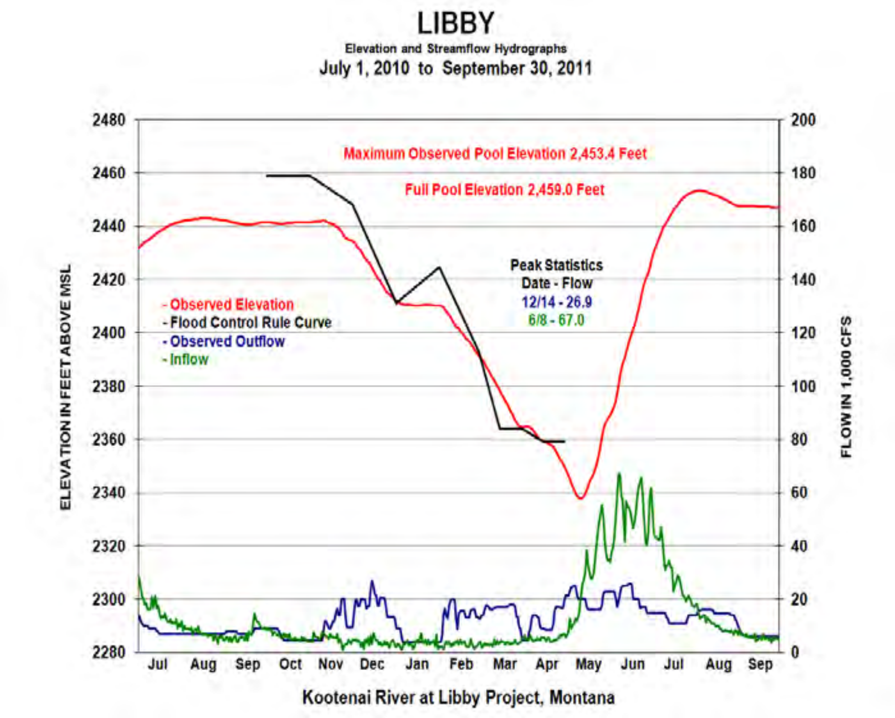
June Temperature

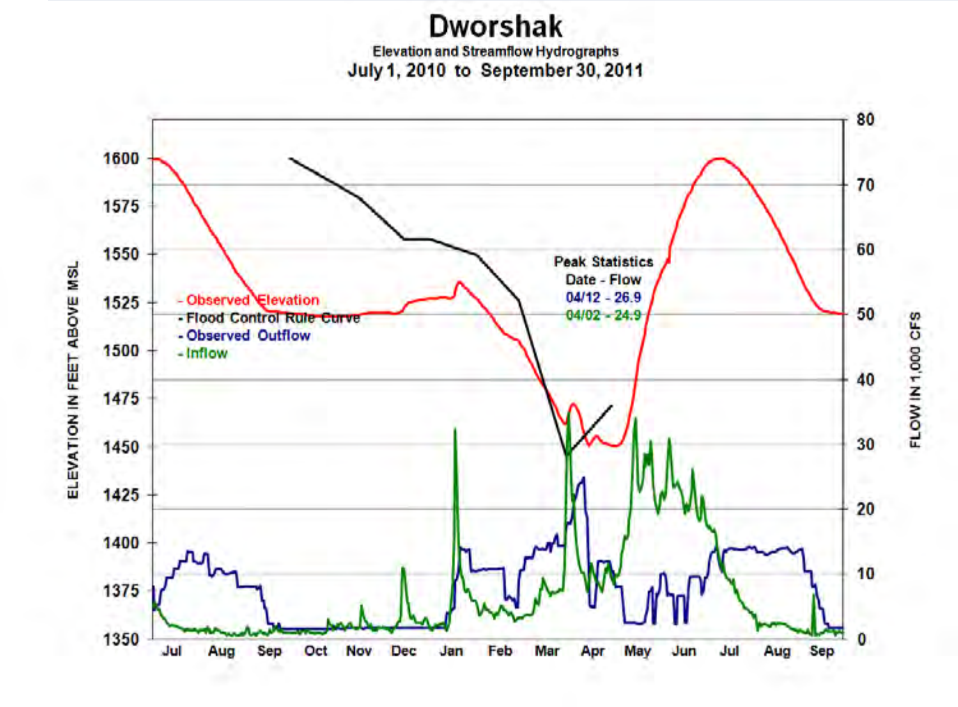


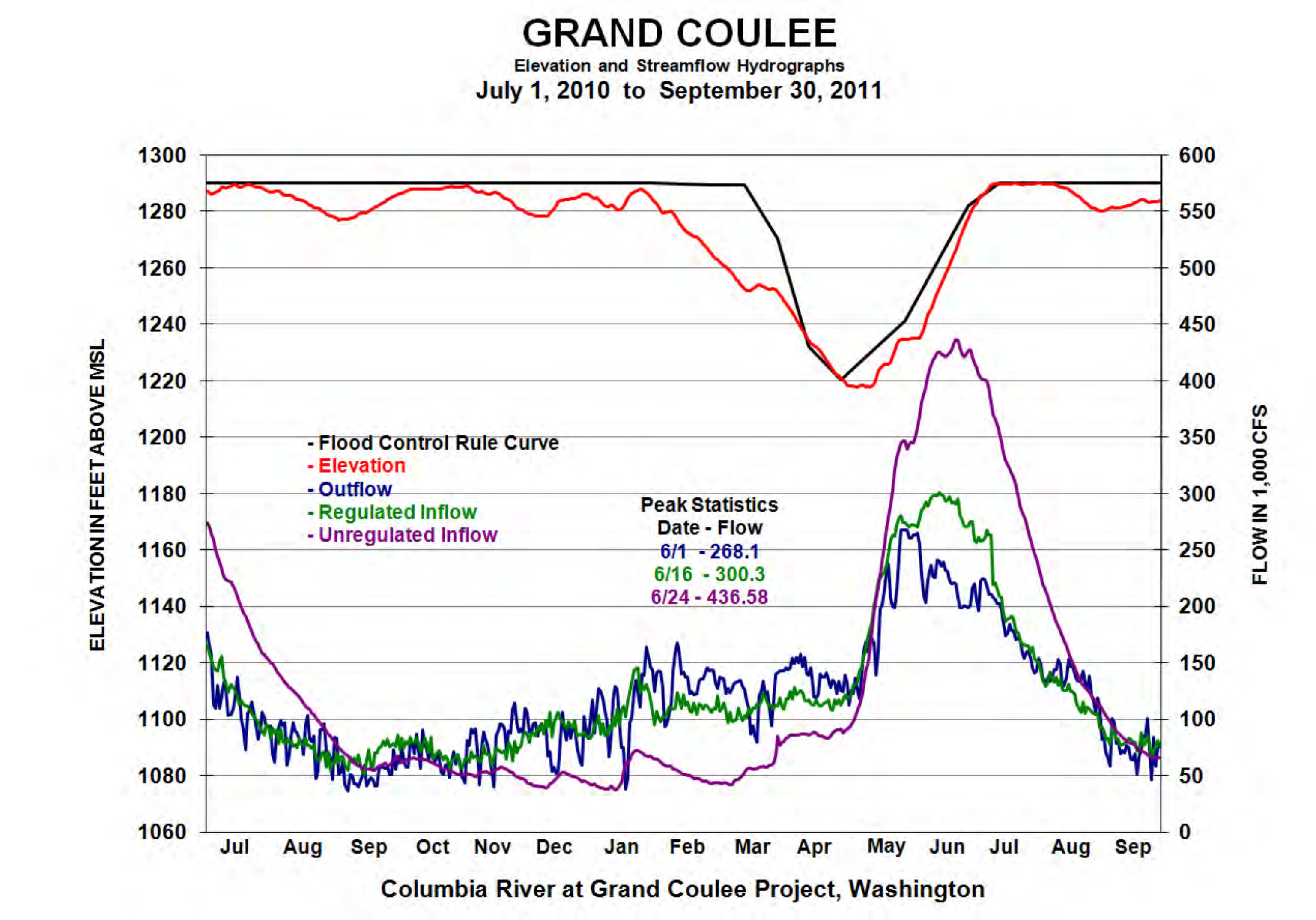


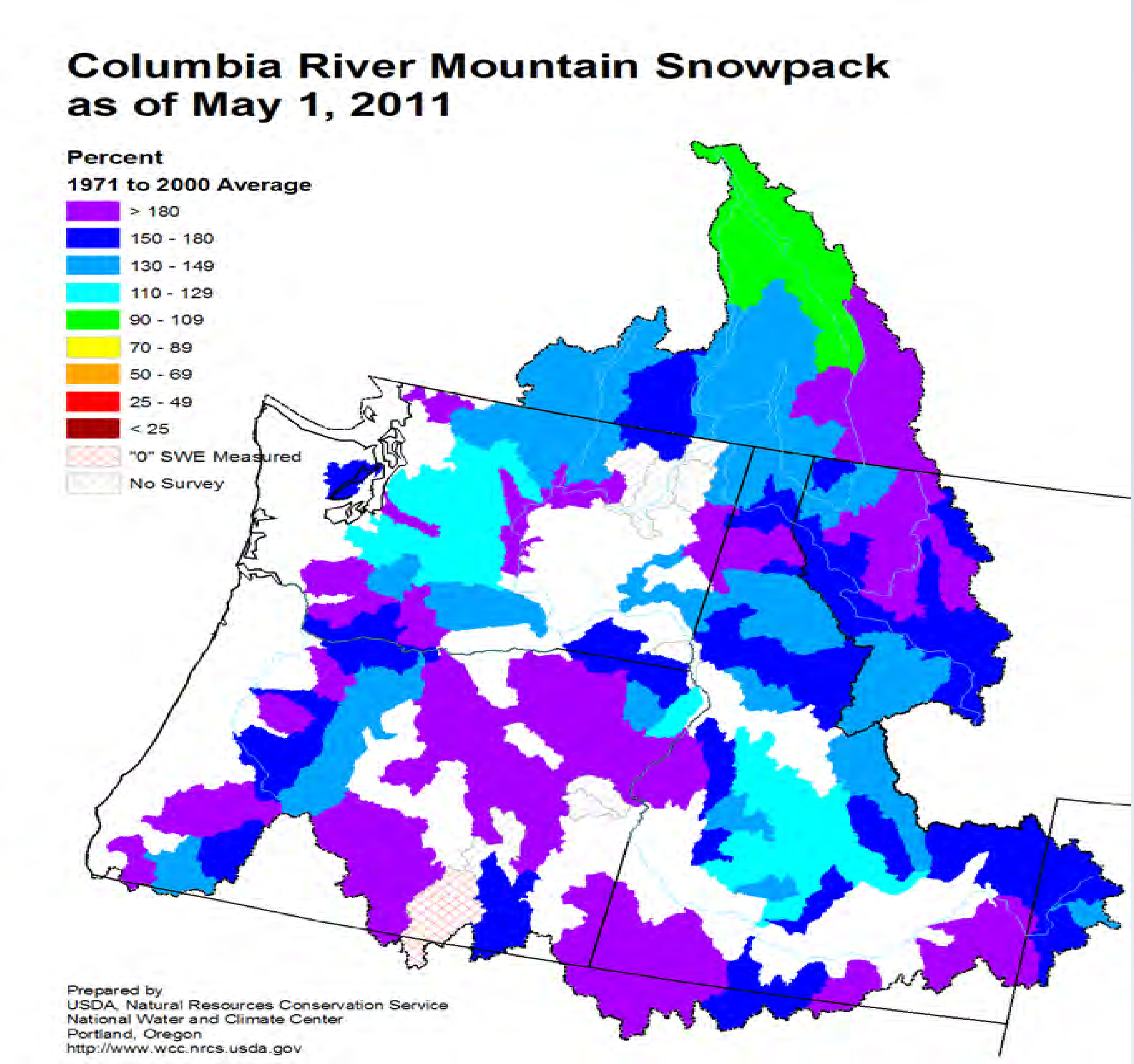

MICA
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Maximum Observed Pool Elevation 2,474.0 Feet
Full Pool Elevation 2,475.0 Feet
- Flood Control Rule Curve
- Observed Elevation
- Observed Outflow
- Unregulated Inflow
Peak Statistics
Date - Flow
4/3 - 41.46
7/8/11 - 83.53
Minimum Observed Pool Elevation 2,378.6 Feet
Minimum Elevation 2,319.4 Feet
These operating rule curves as shown assume non-Treaty storage is full.
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Columbia River at Mica Project, British Columbia


ARROW
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Maximum Observed Pool Elevation 1,442.2 Feet
Full Pool Elevation 1,444.0 Feet
- Flood Control Rule Curve
- Observed Elevation
- Observed Outflow
- Regulated Inflow
- Unregulated Inflow
Peak Statistics
Date - Flow
8/25/10 - 64.38
6/15 - 86.64
7/8/11 - 168.42
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Columbia River at Arrow Project, British Columbia


LIBBY
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Maximum Observed Pool Elevation 2,453.4 Feet
Full Pool Elevation 2,459.0 Feet
Peak Statistics
Date - Flow
12/14 - 26.9
6/8 - 67.0
- Observed Elevation
- Flood Control Rule Curve
- Observed Outflow
- Inflow
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
2480
2460
2440
2420
2400
2380
2360
2340
2320
2300
2280
200
180
160
140
120
100
80
60
40
20
0
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Kootenai River at Libby Project, Montana

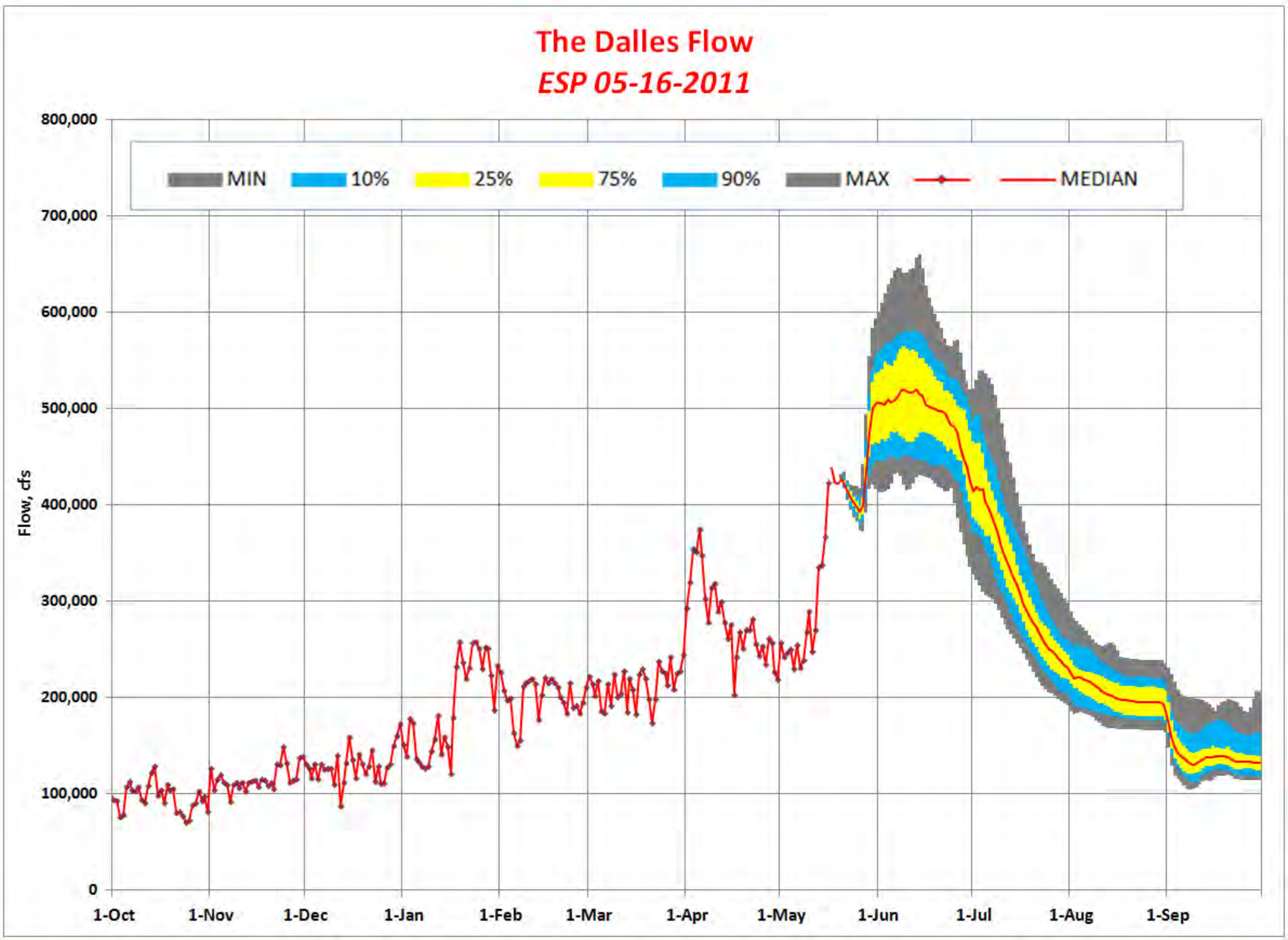

Dworshak
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
Peak Statistics
Date - Flow
04/12 - 26.9
04/02 - 24.9
- Observed Elevation
- Flood Control Rule Curve
- Observed Outflow
- Inflow
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
1600
1575
1550
1525
1500
1475
1450
1425
1400
1375
1350
80
70
60
50
40
30
20
10
0
Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

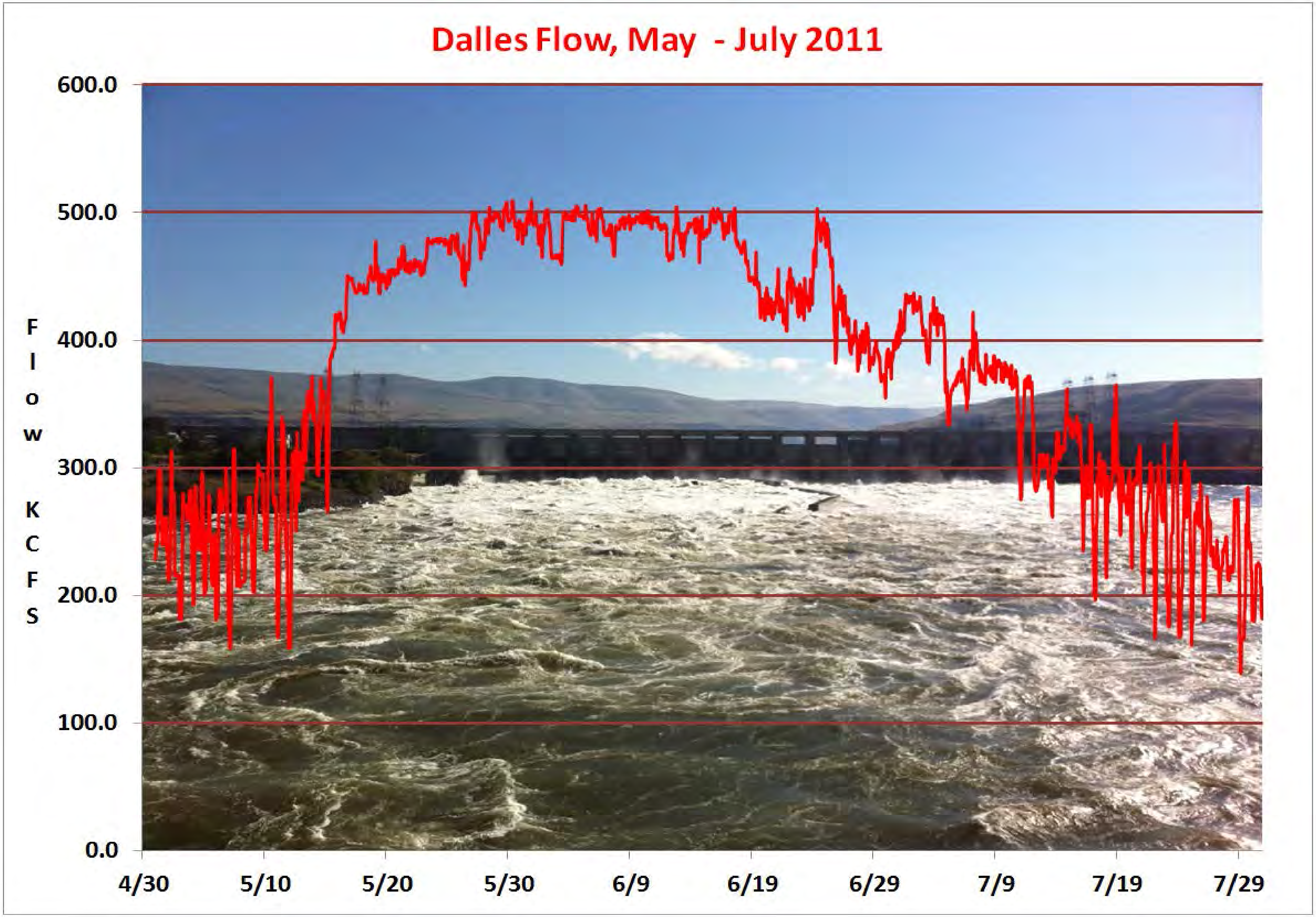

GRAND COULEE
Elevation and Streamflow Hydrographs
July 1, 2010 to September 30, 2011
1300
1280
1260
1240
1220
1200
1180
1160
1140
1120
1100
1080
1060
600
550
500
450
400
350
300
250
200
150
100
50
0
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
- Flood Control Rule Curve
- Elevation
- Outflow
- Regulated Inflow
- Unregulated Inflow
Peak Statistics
Date - Flow
6/1 - 268.1
6/16 - 300.3
6/24 - 436.58
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Columbia River at Grand Coulee Project, Washington

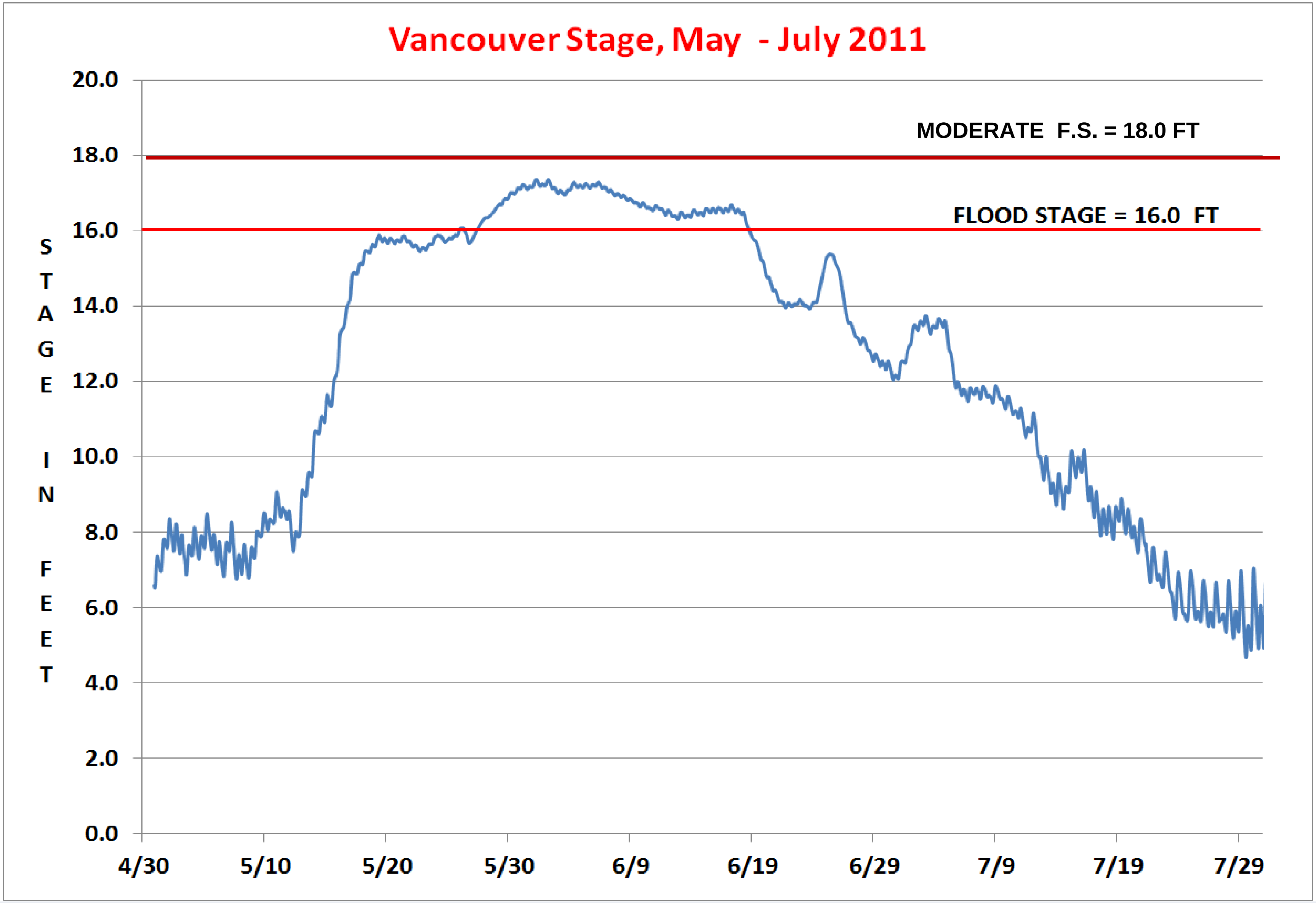

Columbia River Mountain Snowpack
as of May 1, 2011
Percent
1971 to 2000 Average
> 180
150 - 180
130 - 149
110 - 129
90 - 109
70 - 89
50 - 69
25 - 49
< 25
"0" SWE Measured
No Survey
Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

System Refill

- General goal to regulate The Dalles to non-damaging levels of about 450,000 cfs and major floods to 600,000 cfs.
- System refill accomplished by using all available forecasts, knowledge of available space and remaining snow and calculated Initial Control Flow (ICF) which is adjusted through time. May 01 ICF at 440 kcfs, adjusted to near 500 kcfs later in May.
- With the high but steady runoff a practical way to regulate was to adjust Coulee refill and regulate to flows at The Dalles and Bonneville so as to not exceed moderate flood stage at the Vancouver gage (band between 16.0 and 18.0 feet).
- Operation was set so as to avoid a fill and spill at Grand Coulee or other major storage projects if a sudden increase in runoff were to occur.


The Dalles Flow
ESP 05-16-2011
MIN
10%
25%
75%
90%
MAX
MEDIAN
Flow, cfs
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep


Dalles Flow, May - July 2011
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Flow KCFS
4/30
5/10
5/20
5/30
6/9
6/19
6/29
7/9
7/19
7/29


Vancouver Stage, May - July 2011
MODERATE F.S. = 18.0 FT
FLOOD STAGE = 16.0 FT
STAGE IN FEET
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
4/30
5/10
5/20
5/30
6/9
6/19
6/29
7/9
7/19
7/29

Spring and Summer Seasonal Flow Objectives

- Priest Rapids: 10 Apr – 30 June, objective was 135 kcfs, average was 232 kcfs
- Lower Granite Spring: 03 Apr – 20 June, objective was 100 kcfs, average was 138 kcfs
- Lower Granite Summer: 21 June – 31 August, objective was 54 kcfs, average was 81 kcfs
- McNary Spring: 10 Apr – 30 June, objective was 260 kcfs, average was 377 kcfs
- McNary Summer: 01 Jul – 31 August, objective was 200 kcfs, average was 262 kcfs

High Flow Impact Summary (Highlights)

- Localized flooding Areas around Sauvie Island, including some access roads, Deschutes State Park Campground. Waterfront Park at The Dalles, Eastside Esplanade, Portland, Waterfront Renaissance Trail, Vancouver, Marina at Lewis River near confluence with Columbia, camping losses and fishing losses
- Loss of Treaty Fishing
- Debris issues on fish screens
- Sheet pilings intended to isolate salvage area of the derelict barge "Davy Crocket" were overtopped
- Bank mitigation/stabilization projects flooded
- Docks within McNary pool threatened. Multiple occurrences.
- Operator of irrigation pumps at Port of Benton reported water had reached up to pumps
- Hatchery construction and intakes by Chief Joseph Dam threatened
- High flows from GCL (in combination with unit outages) create high TDG and cause problems at fish farm
- General wear and tear on spill gates and stilling basins and other structures (BON fish ladder, etc)
- Sediment build-up/gravel bar migration as high water recedes potentially affecting navigation channel and the house boat community near I-5 bridge
- Recreational fishing impacts due to deep drawdown of reservoirs

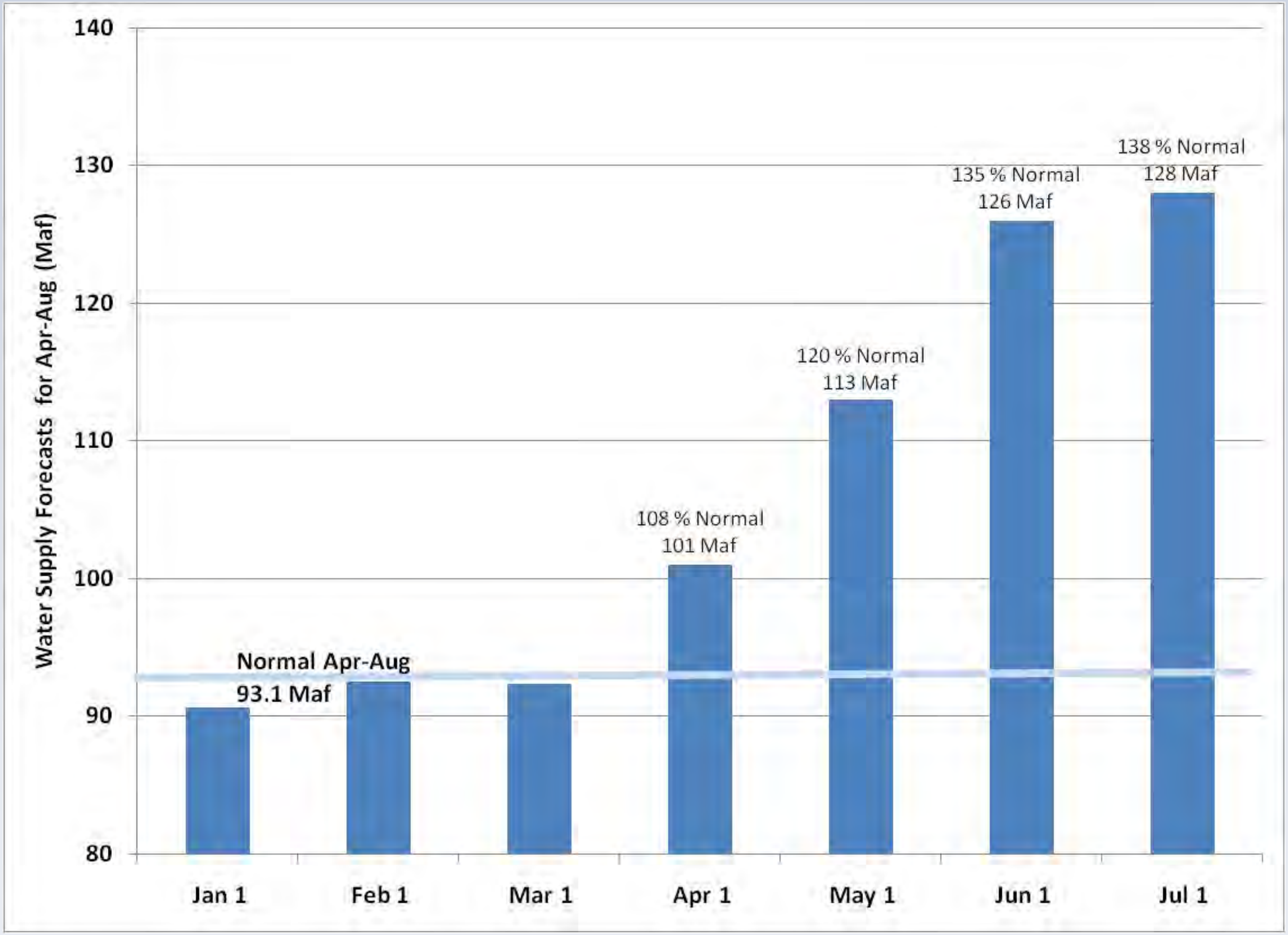
TMT Annual Review

2011 High Water Overview

Presented by
Kasi Rodgers
USACE, Water Management Division

December 7, 2011

2011 Water Supply Forecast at The Dalles (Apr – Aug)



Columbia River Basin

Apr 30th

Reservoir sizes depicted indicate relative proportion of usable space available

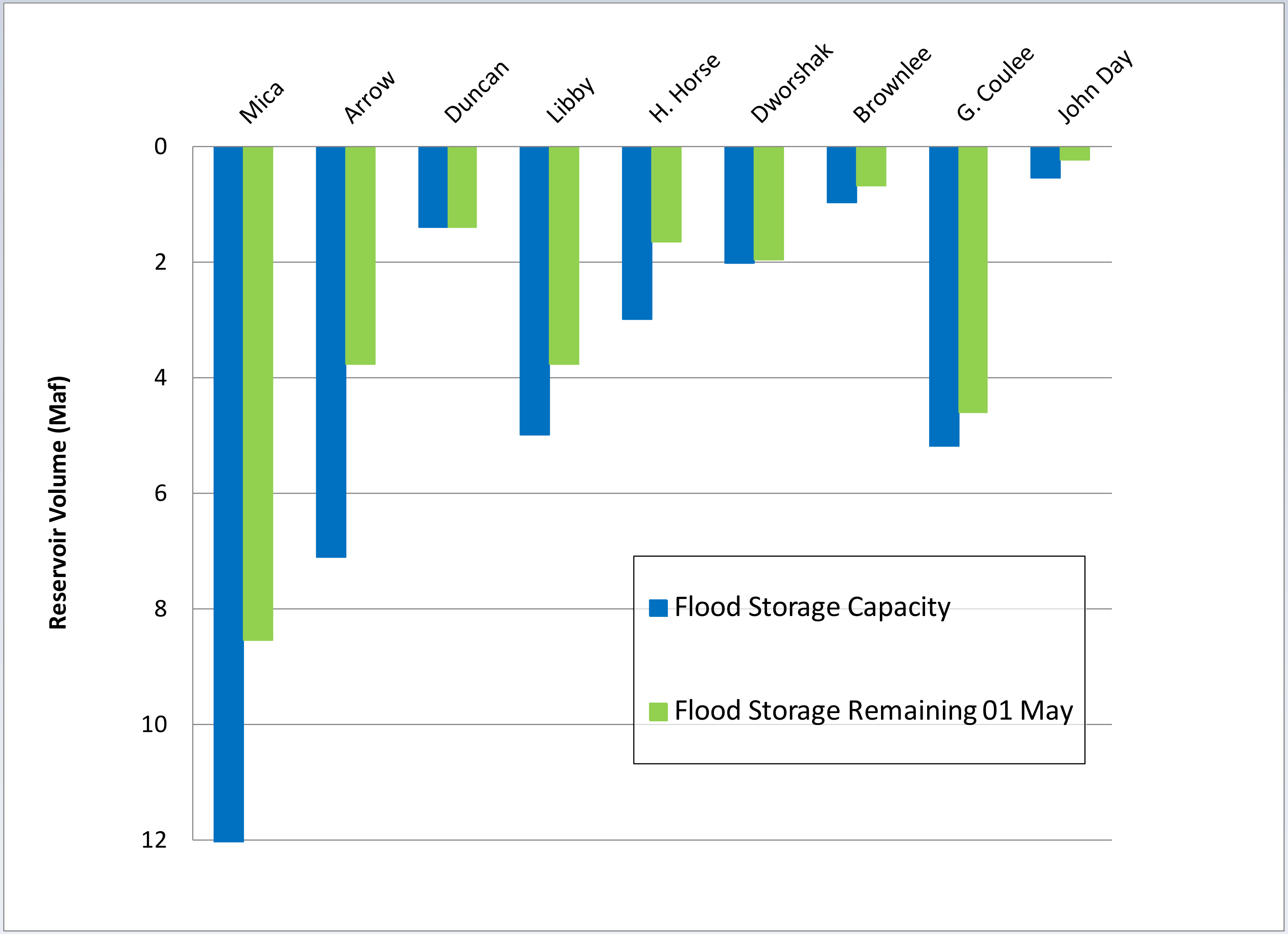
Active Storage Available

Active Storage Filled

% Percent Filled

Note: Not all U.S. reservoirs completely drafted as forecasts at the time of drafting did not warrant such.

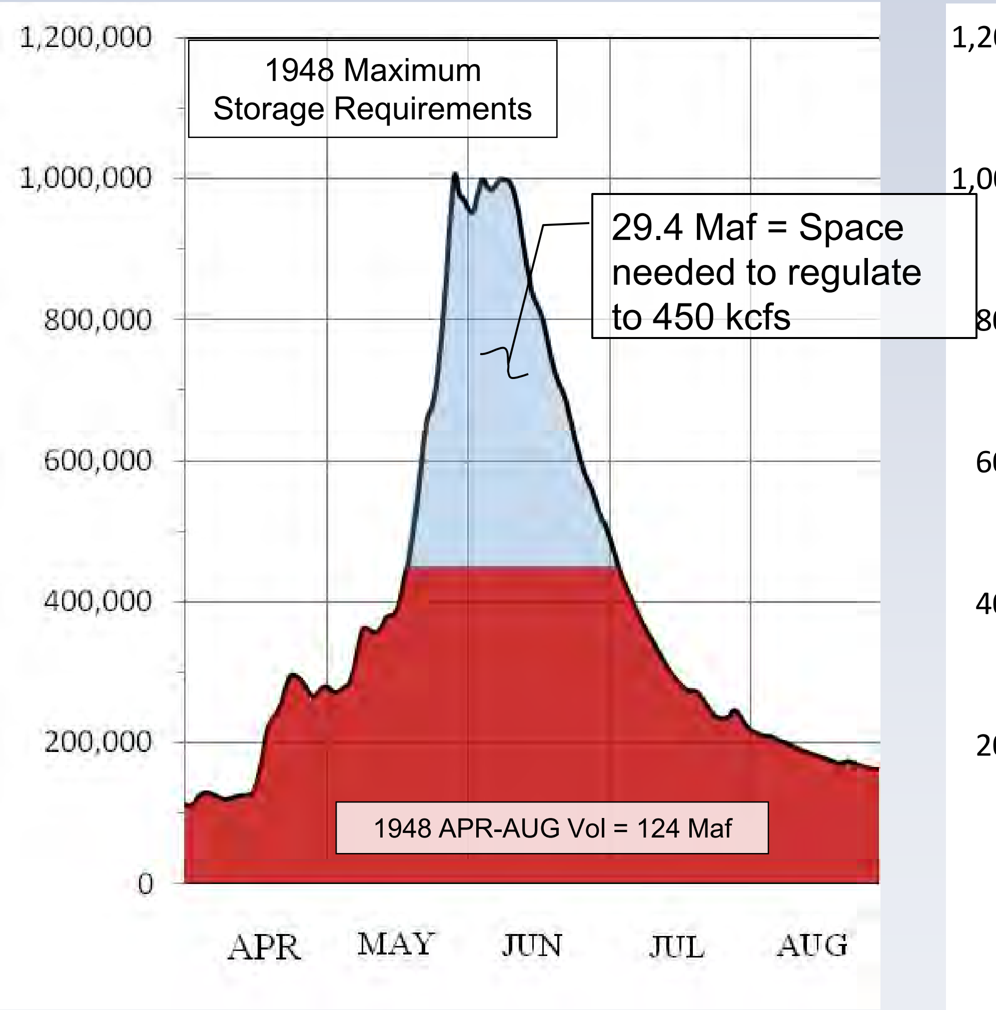
Reservoir Space Available for Flood Risk Mgmt

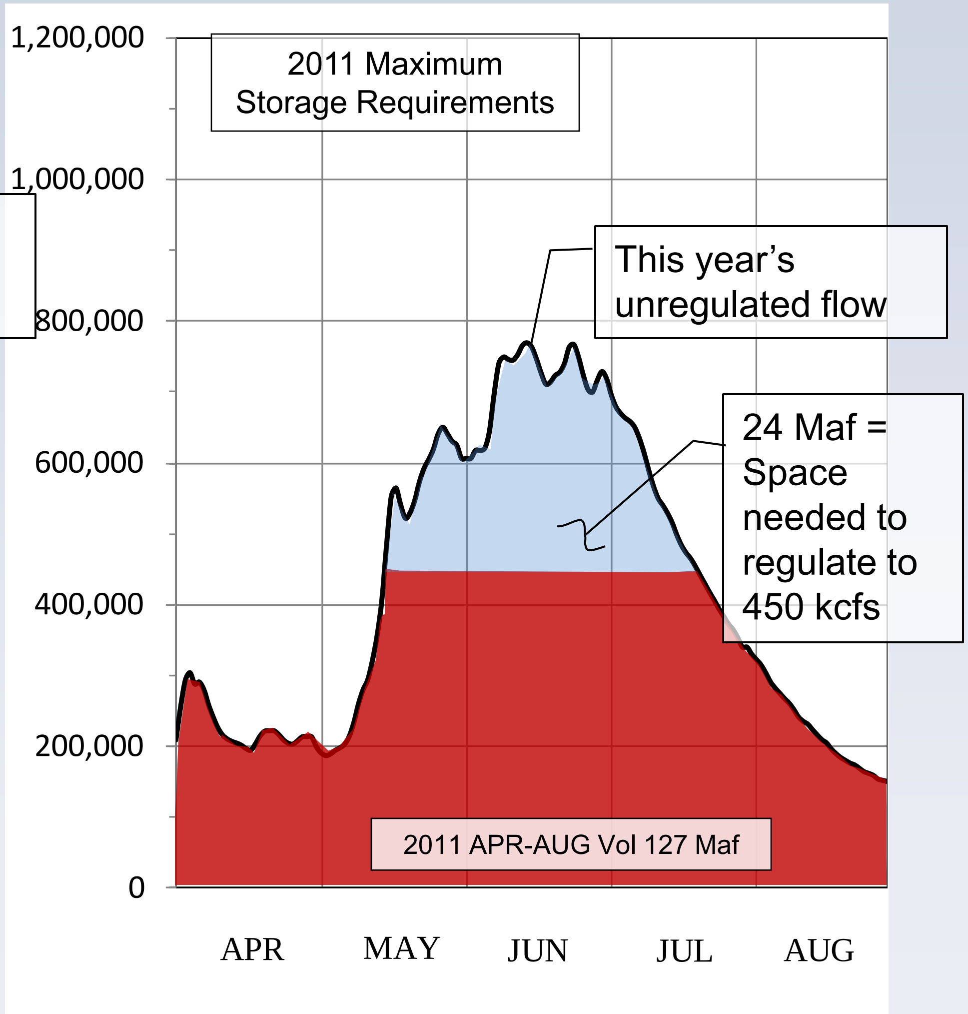


The year in comparison

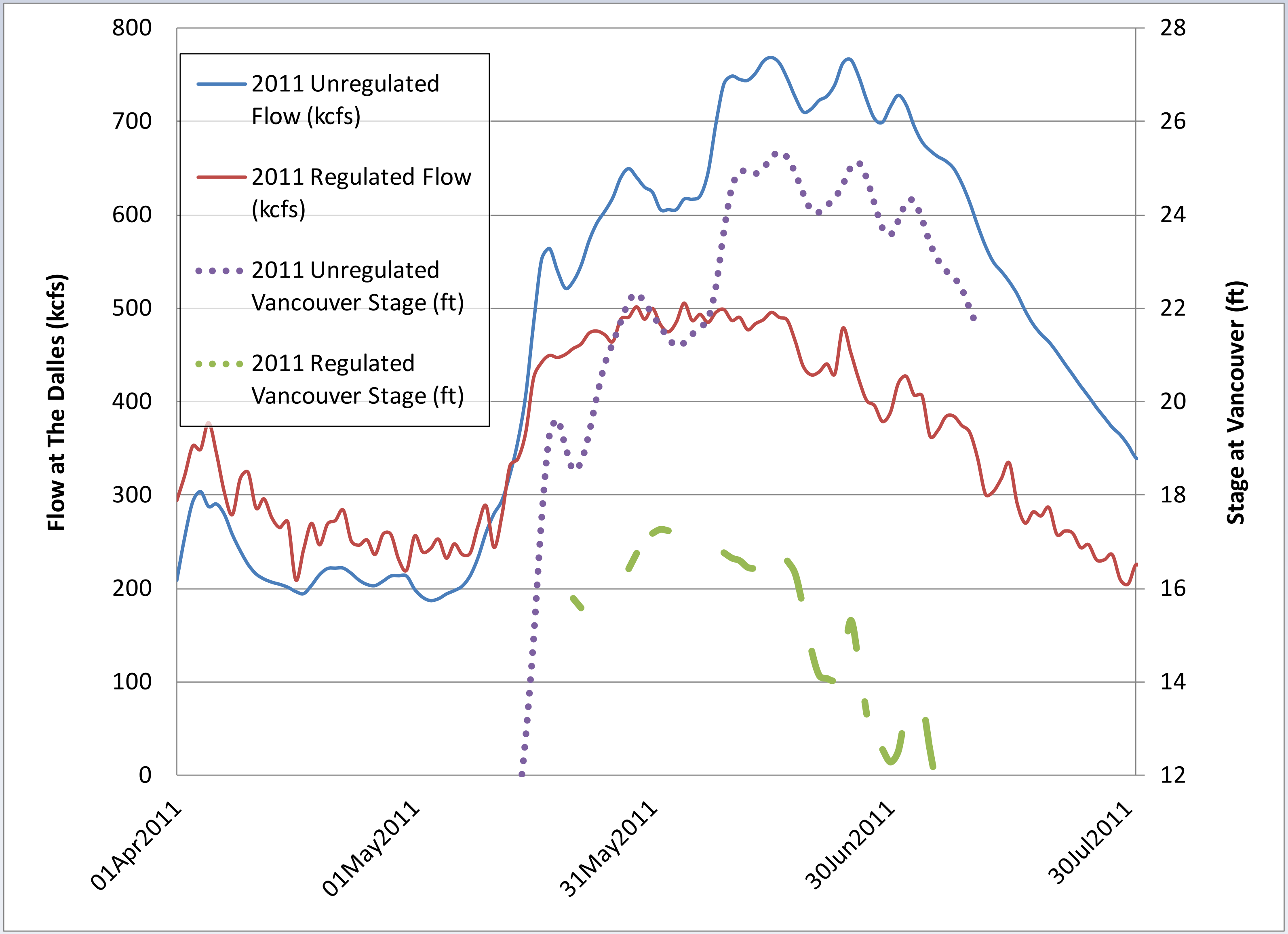
Rank	Year (1929 to 2011)	Apr-Aug TDA Runoff Volume (Maf)
1	1974	134
2	1997	133
3	1972	129
4	2011	127
5	1956	126
6	1948	124
7	1971	121
8	1982	115
9	1950	114
10	1976	114

Large year, but shape matters!

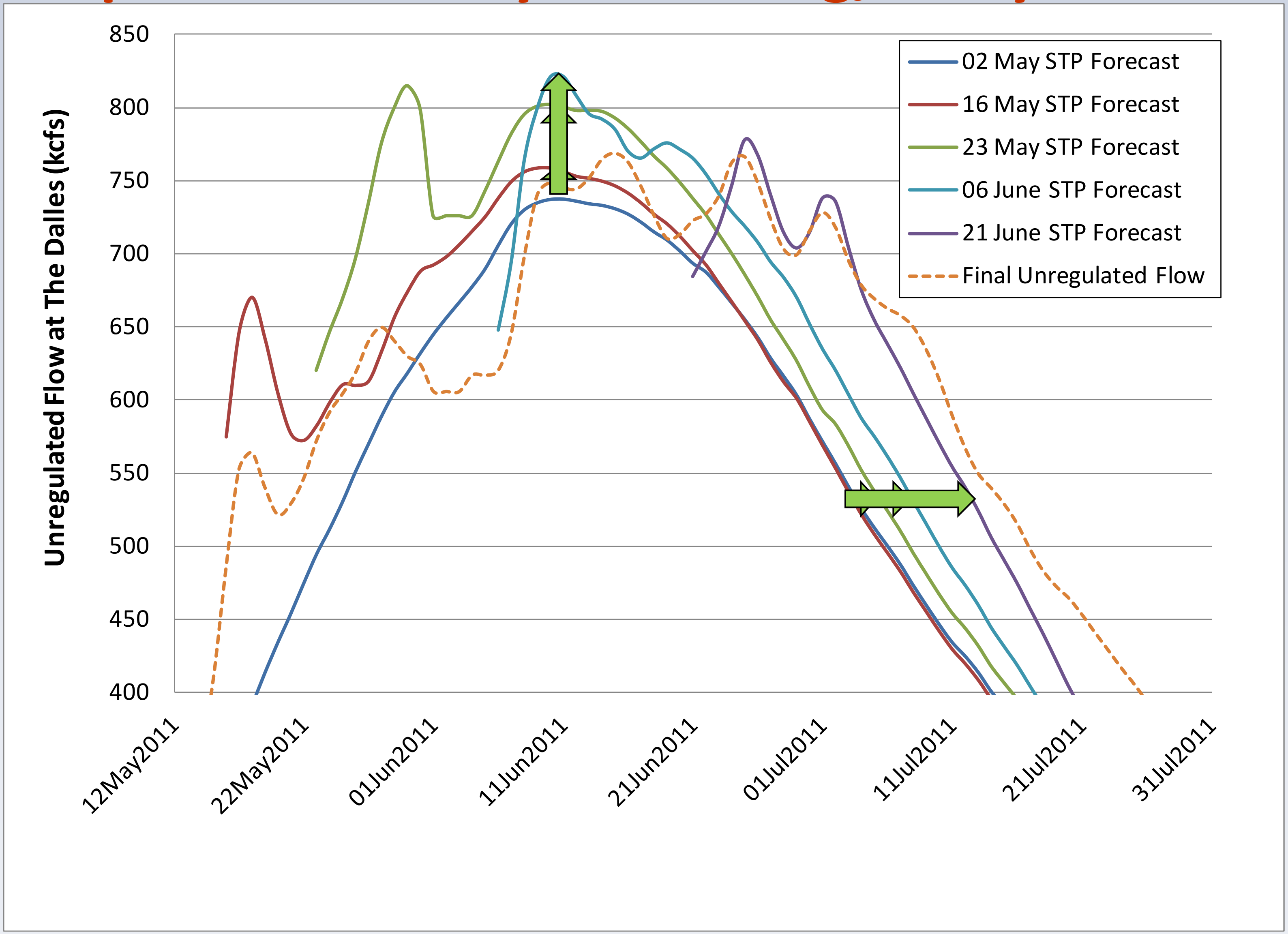




Flow at The Dalles and Stage at Vancouver 2011



A depiction of this year's rising/delayed forecasts



Flight Pictures, 03 June 2011

Bonneville

Flight Pictures, 03 June 2011

The Davy Crockett

Flight Pictures, 03 June 2011

Confluence with Willamette River

Flood Pictures, 24 May 2011
Vancouver, WA

Photo Source: AP News

Flight Pictures, 03 June 2011

Vancouver Lake

Flight Pictures, 03 June 2011

Lewis River

Flood Pictures, 30 May 2011

Riverfront Park at The Dalles

Photo Source: Sonya Dodge

RECLAMATION

Managing Water in the West

Grand Coulee Operations 2011

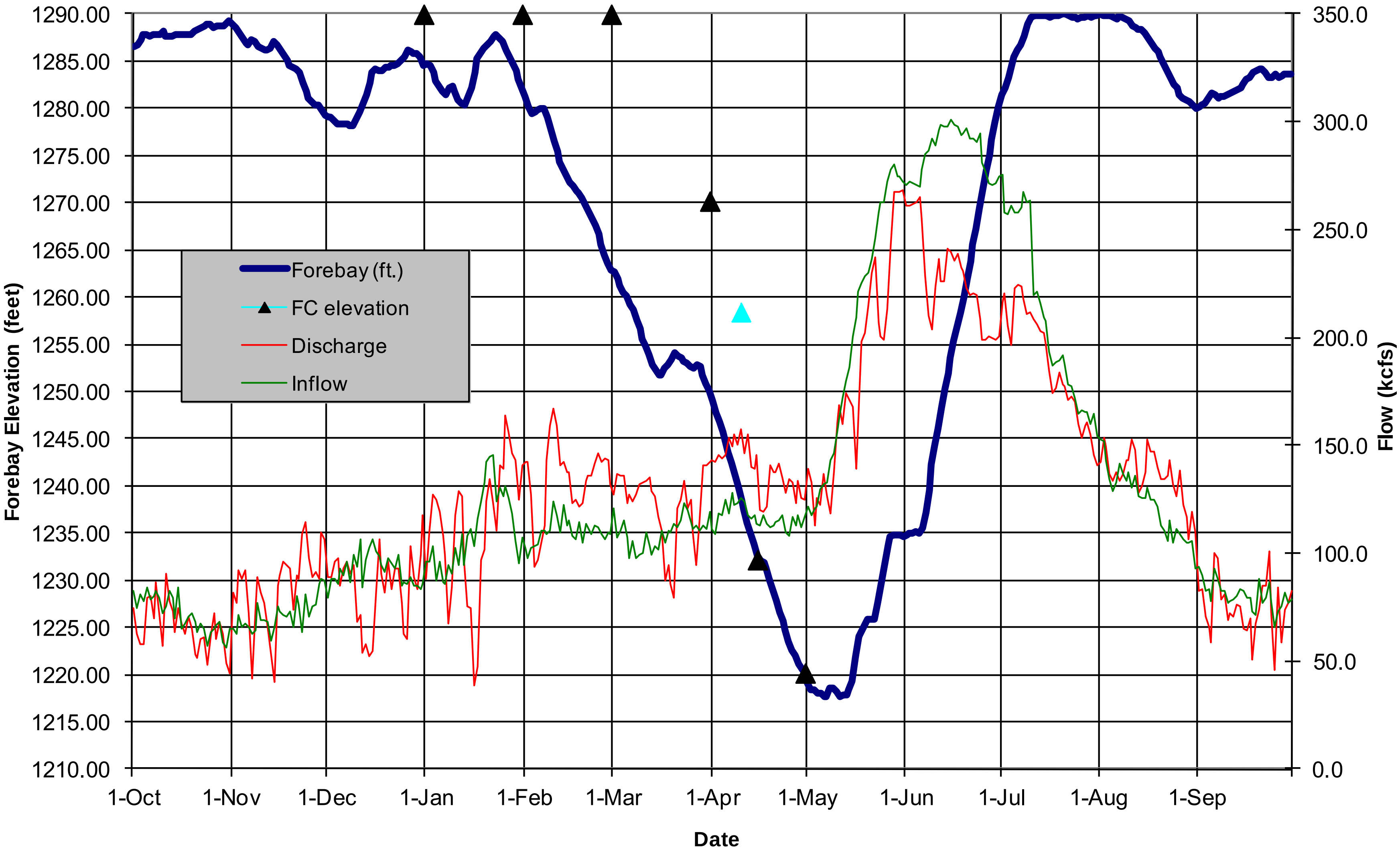
U.S. Department of the Interior
Bureau of Reclamation

Water Supply Forecasts and Flood Control Elevations

	Jan	Feb	Mar	Apr	May	Jun	Jul
The Dalles Apr-Aug forecast (% of average)	**97**	**99**	**99**	**109**	**121**	**135**	**138**
Grand Coulee Apr-Sep Forecast (% of average)	**94**	**102**	**103**	**107**	**117**	**126**	**128**
Grand Coulee Apr 30 flood control elevation (feet)	**1238.5**	**1235.1**	**1237.0**	**1220.2**			

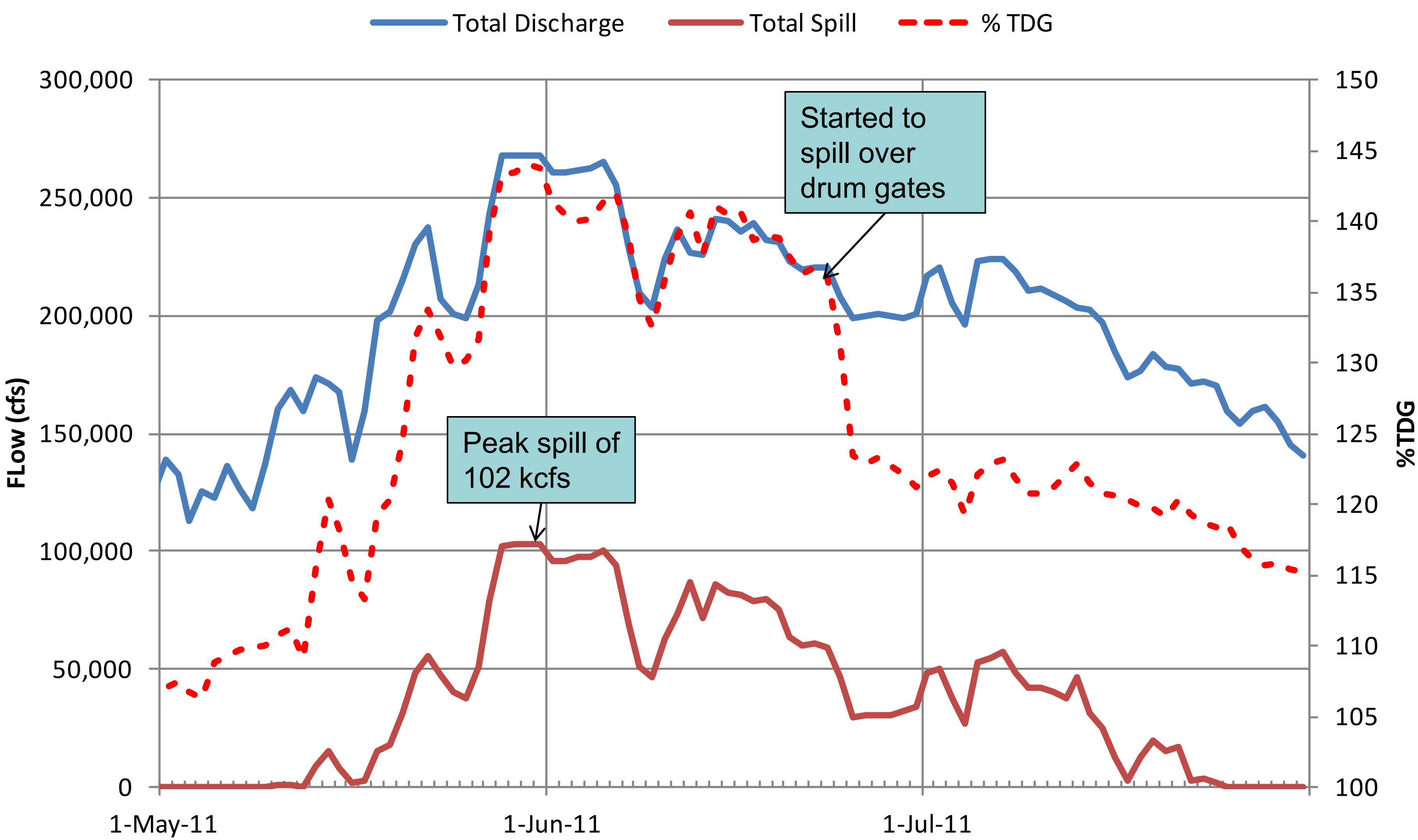
RECLAMATION

Grand Coulee Operations
(Oct 2010- Sep 2011)



RECLAMATION

Grand Coulee Daily Average Discharge, Spill, and Downstream %TDG



RECLAMATION

102 kcfs Outlet Tube Spill (May 29,2011)

RECLAMATION

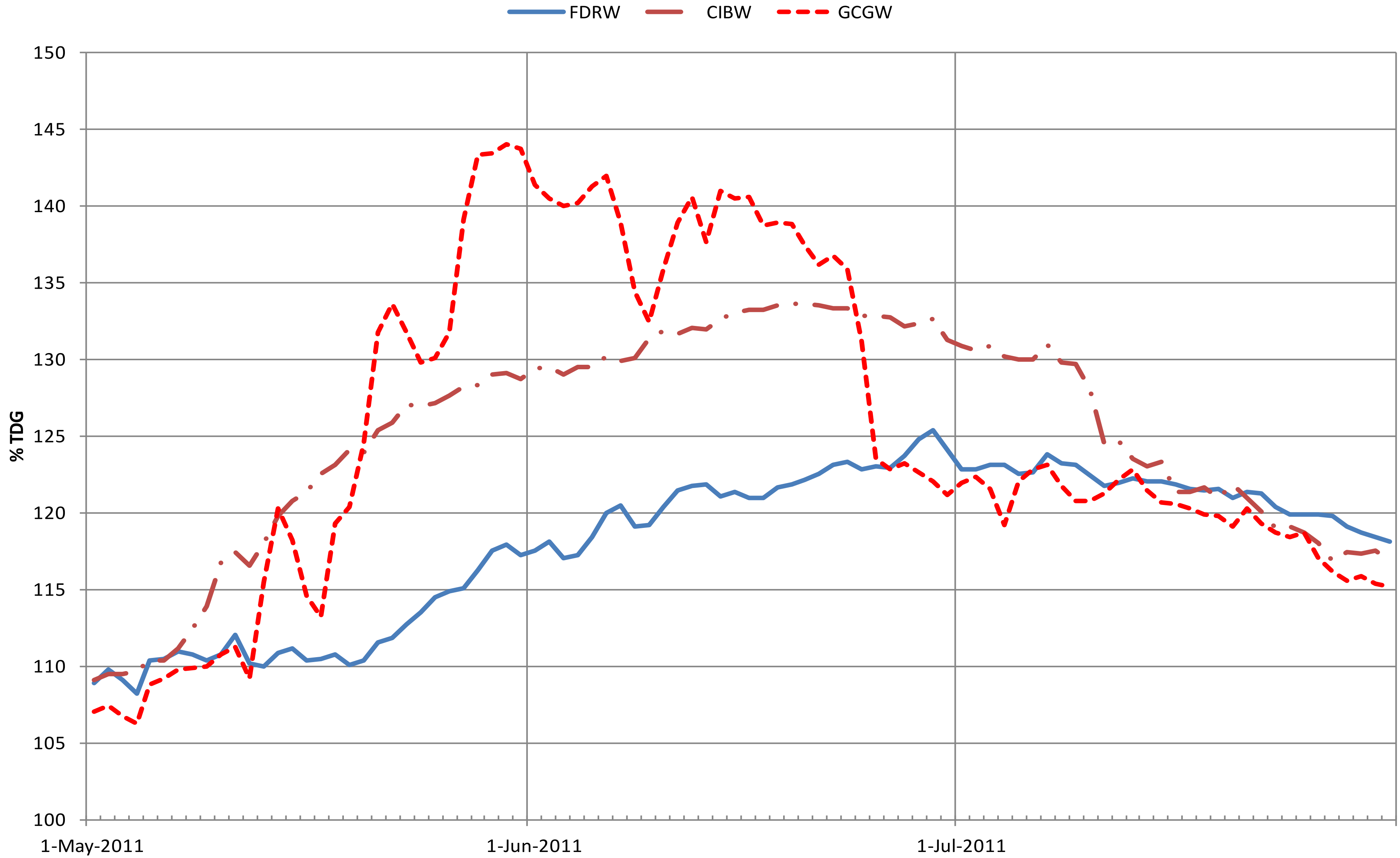
34 kcfs Drum Gate Spill (June 30,2011)

RECLAMATION

Lake Rufus Woods net pens are located about 20 miles downstream of Grand Coulee

RECLAMATION

Grand Coulee Daily Average %TDG: International Boundary, (CIBW) Forebay (FDRW), and Downstream (GCGW)



RECLAMATION

- Drum gate maintenance was completed in 2011
- Reached full pool (1290 ft) on July13, remained within 0.5 ft from full until August 10
- Draft to 1280 ft on August 31
- There was no water released in 2011 for the Lake Roosevelt Incremental Storage Release Project.

RECLAMATION

RECLAMATION

Managing Water in the West

Hungry Horse Operations 2011

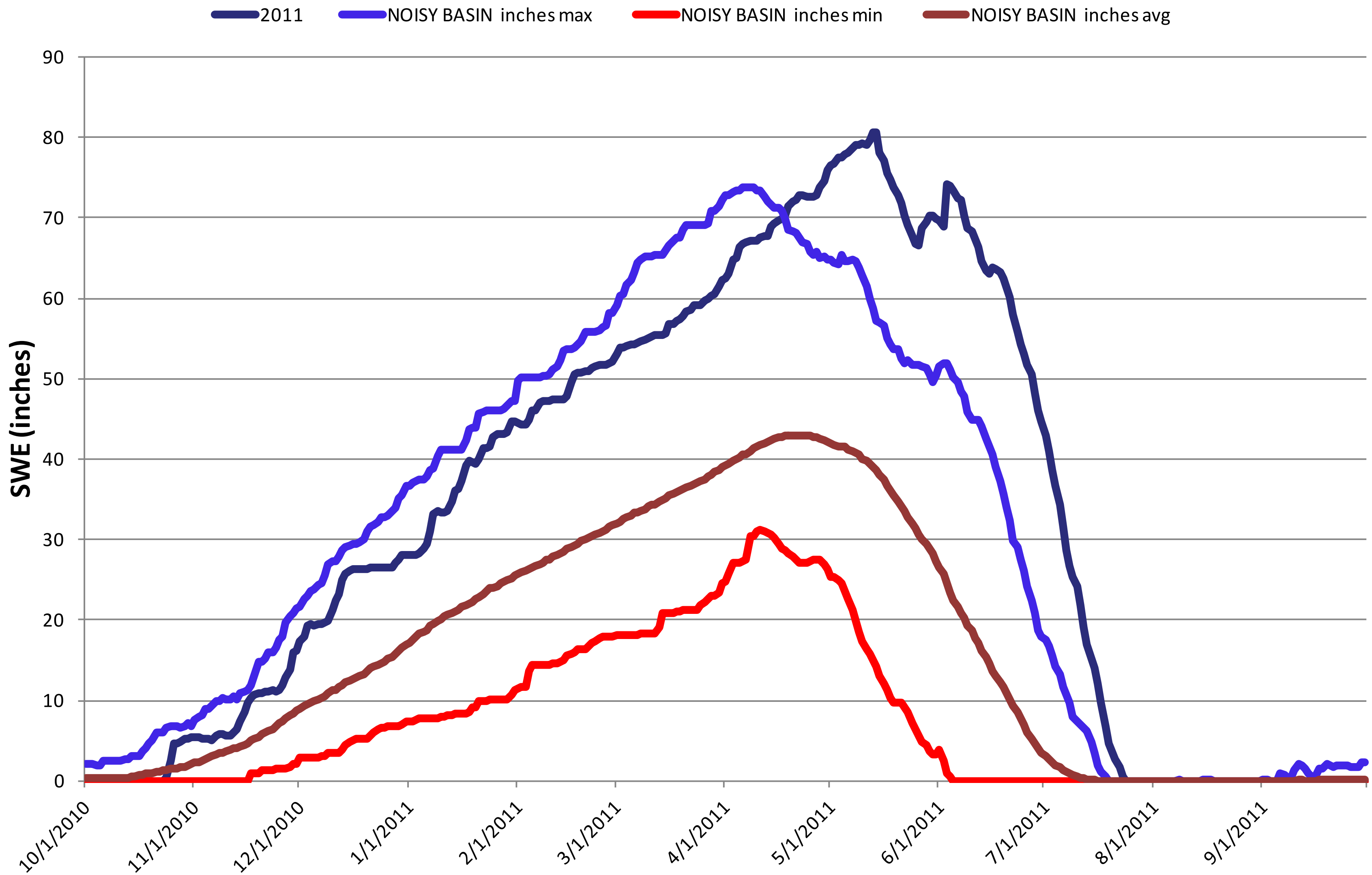
U.S. Department of the Interior
Bureau of Reclamation

Hungry Horse May-Sep Inflow

Forecast Month	**Forecast Volume (Kaf)**	**Forecast Volume (% of average)**
Jan	1944	106
Feb	2139	117
Mar	2222	121
Apr	2357	129
May	2798	153
June	3057	167
Actual May-Sep	**3213**	**175**

RECLAMATION

Noisy Basin (SF Flathead) Snow Water Equivalent (2011, max, min, average)



RECLAMATION

Logan Pass Visitor Center, June 4, 2011
(Elevation 6600 ft)

RECLAMATION

Going-to-the-Sun Road, July 6, 2011

RECLAMATION

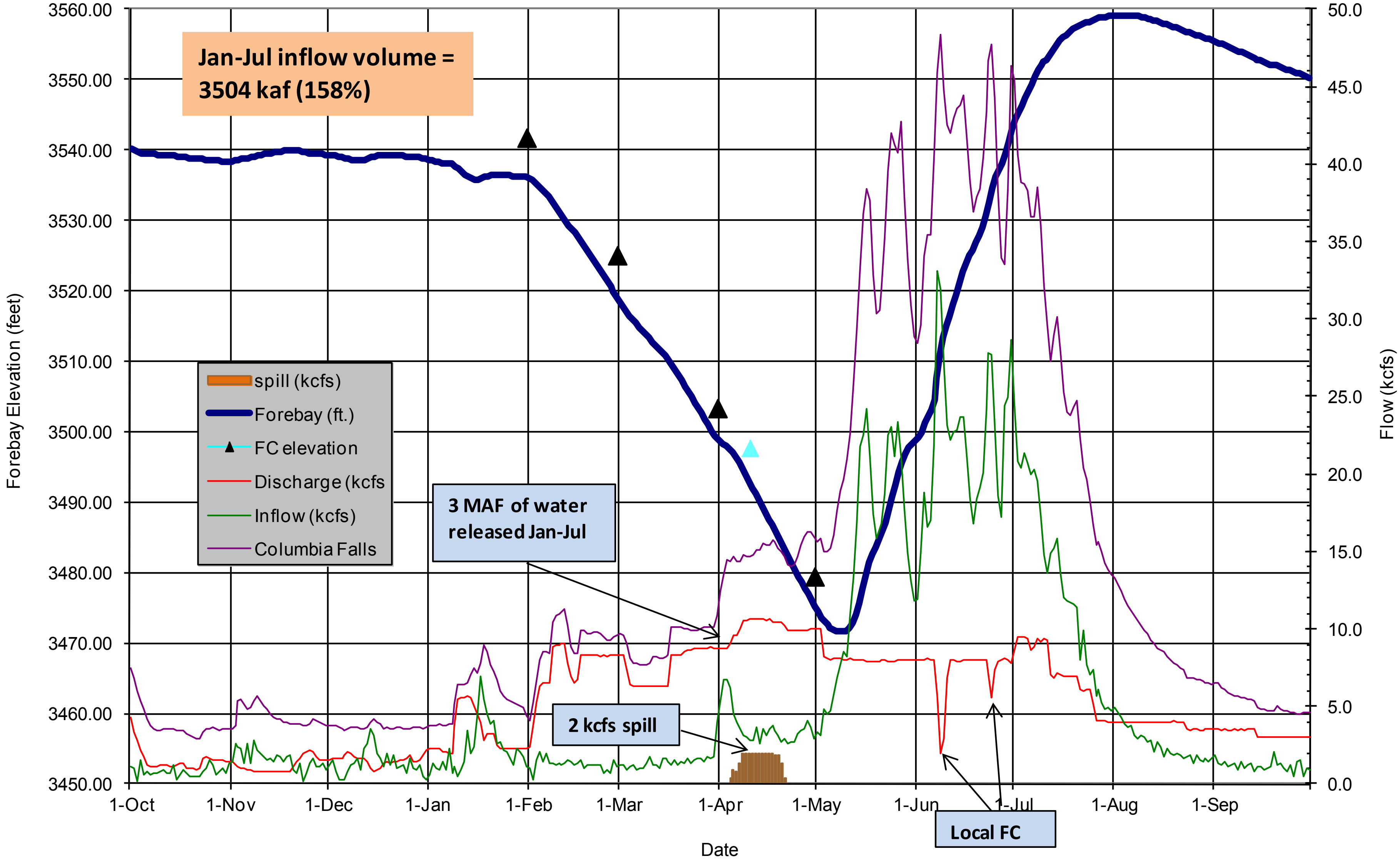
Visitor Center Parking Lot, July 6, 2011

RECLAMATION

Hidden Lake near Logan Pass, July 28, 2011

RECLAMATION

Hungry Horse Operations (Oct 2010 - Sep 2011)



~2.0 kcfs spill through hollow jet valves April 2011

RECLAMATION

RECLAMATION

Hamilton Springs Rehabilitation 2011

Hamilton Springs November 2011; note reference tree top photo

Late August 2011 Hamilton Springs at project start; note ground water which delayed excavation two weeks. The dense matt of reed canary grass suppresses groundwater upwelling which chum salmon prefer. Minimal spawning occurred in this sub-reach.

November 17th 2011; 58 chum salmon were observed spawning in this sub-reach after maintenance action

Chum salmon spawning in November 2010 (pre-project), note grass growing out of stream bed

9 of 200 chum spawning in Hamilton Springs on 11-17-2011

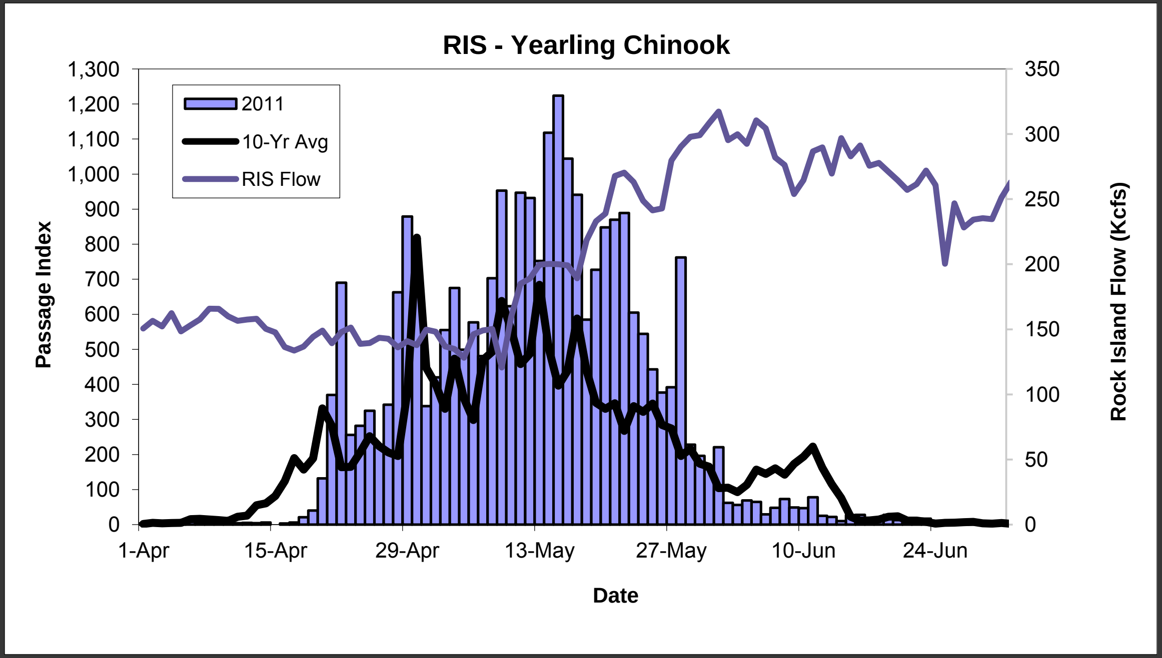
Pre and post project photos of lower Hamilton Springs chum spawning channel

Log toe bank armor prevents chum salmon from digging into stream banks which was thought to be the largest contributor of fine sediments into the channel. Water velocity in the channel is insufficient to move fine sediments which build up over time to provide a substrate for aquatic plants and reed canary grass which suppress ground water upwelling. The log toe armor is intended to decrease maintenance actions and to decrease habitat for predators of emergent chum fry.

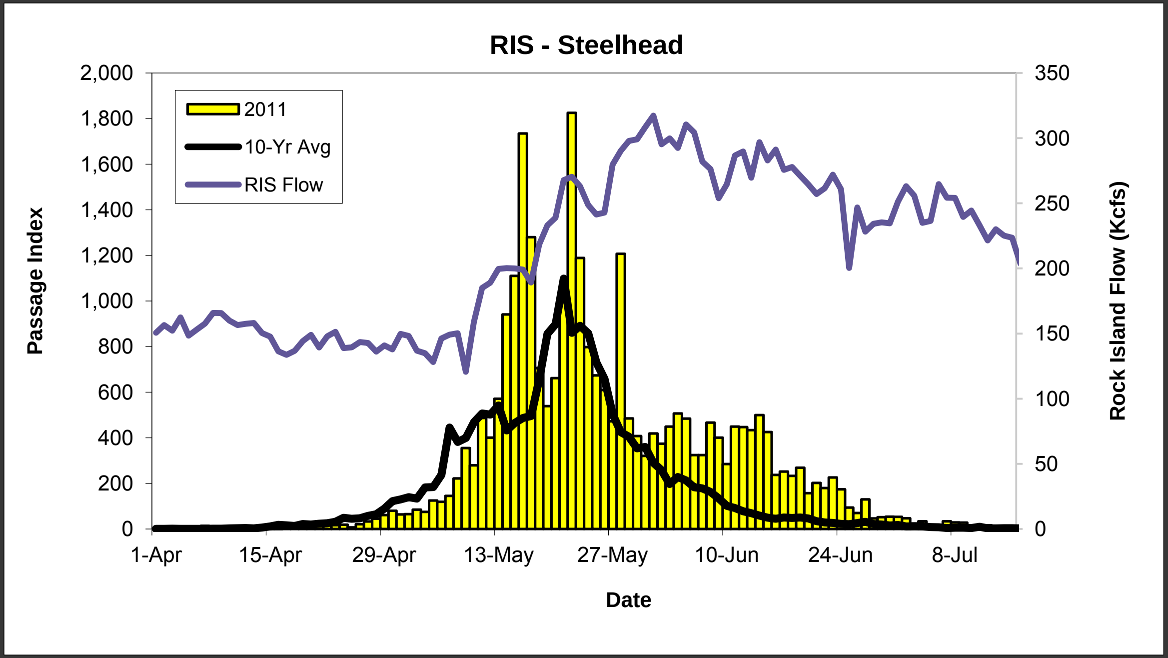
Photos show spawning activity on 11-17-2011
top photo is upper 220’ of Hamilton channel that was not finished; bottom photo shows finished channel

New 400’ long East Fork Hamilton Springs chum spawning channel

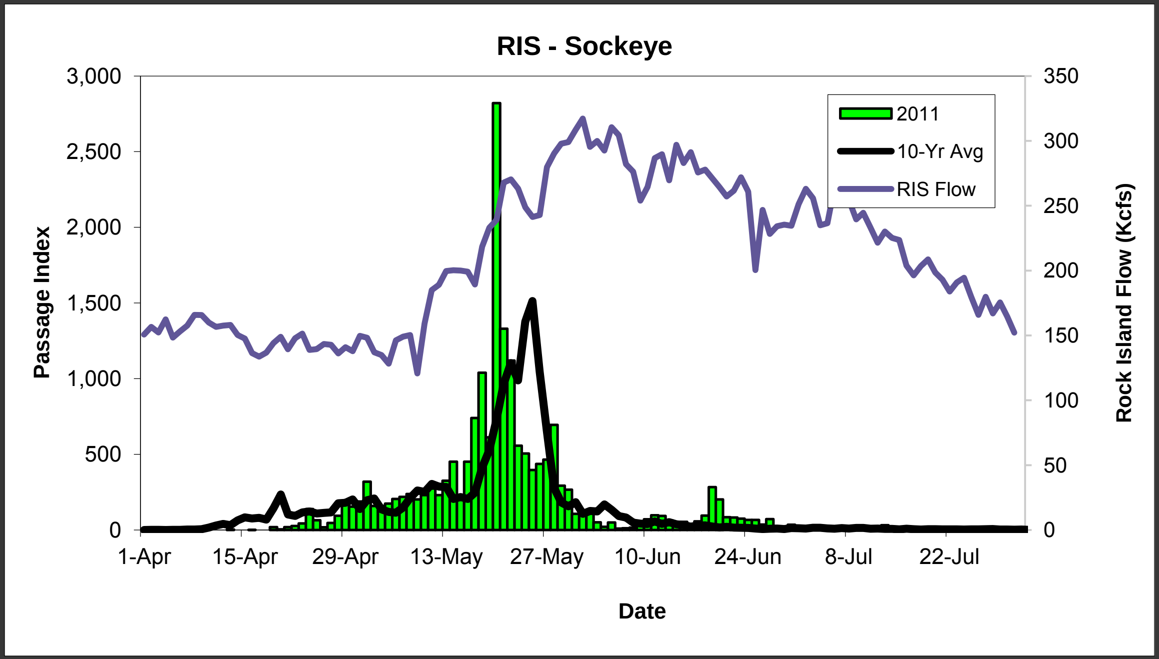
Rock Island Yearling Chinook



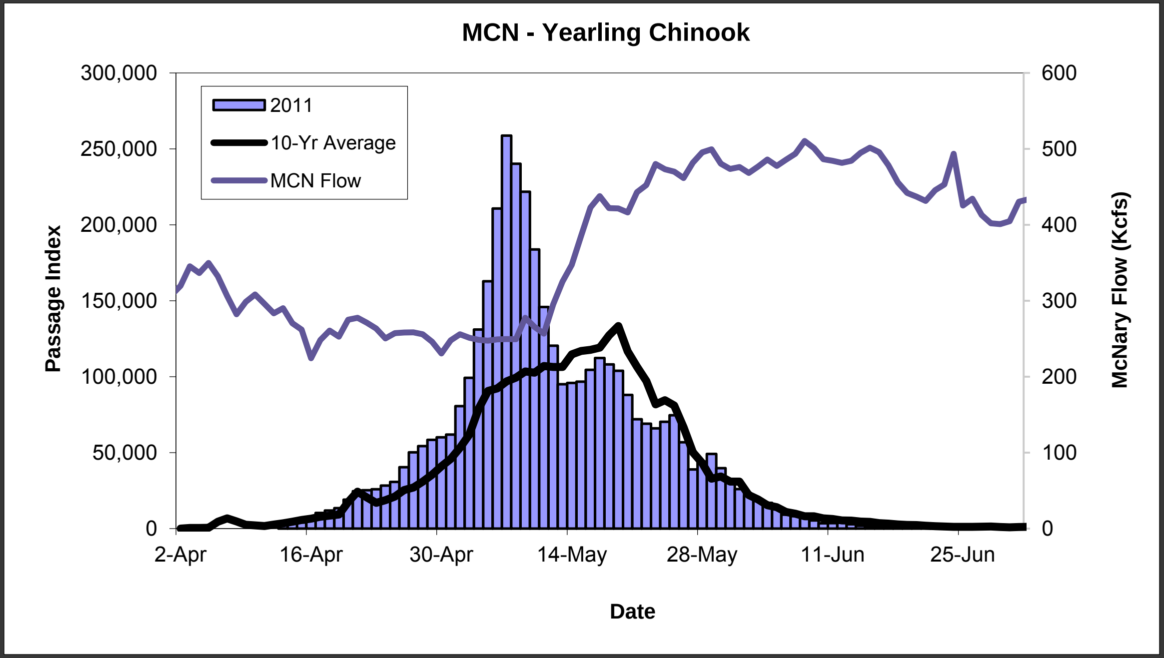
Rock Island Steehead



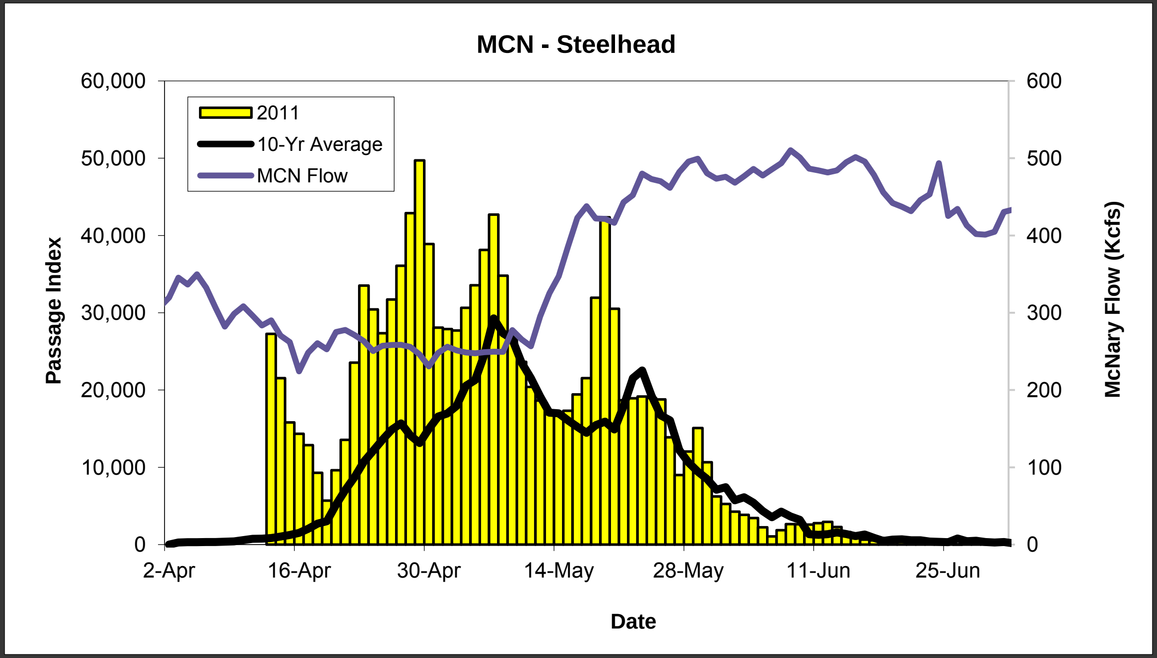
Rock Island Sockeye



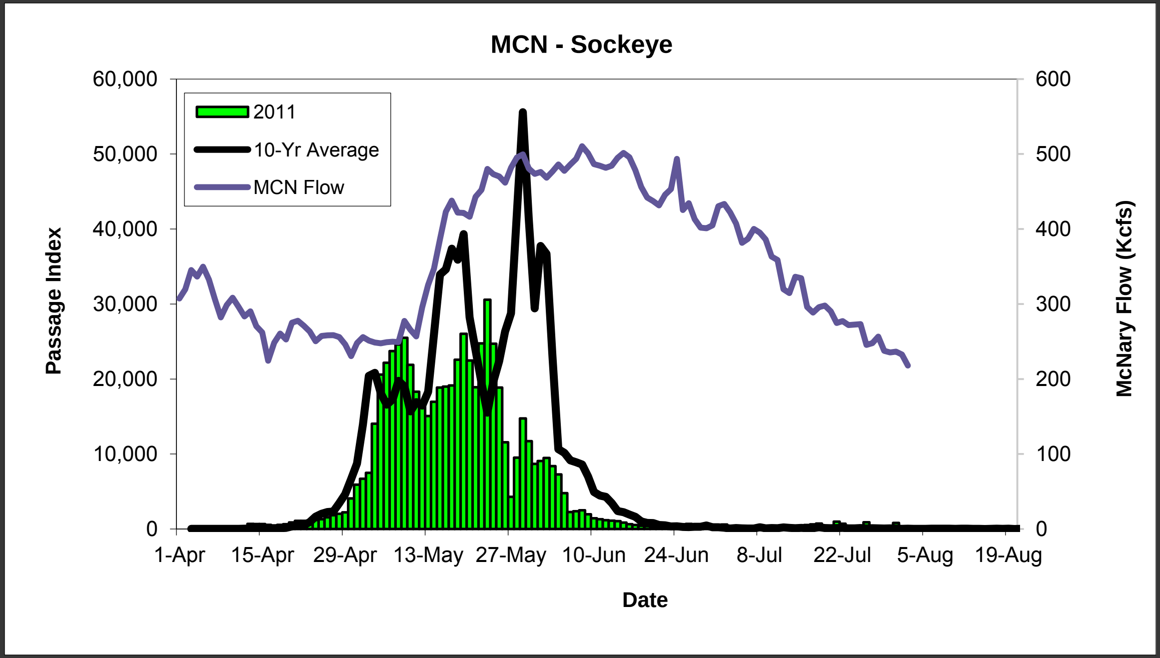
McNary Yearling Chinook



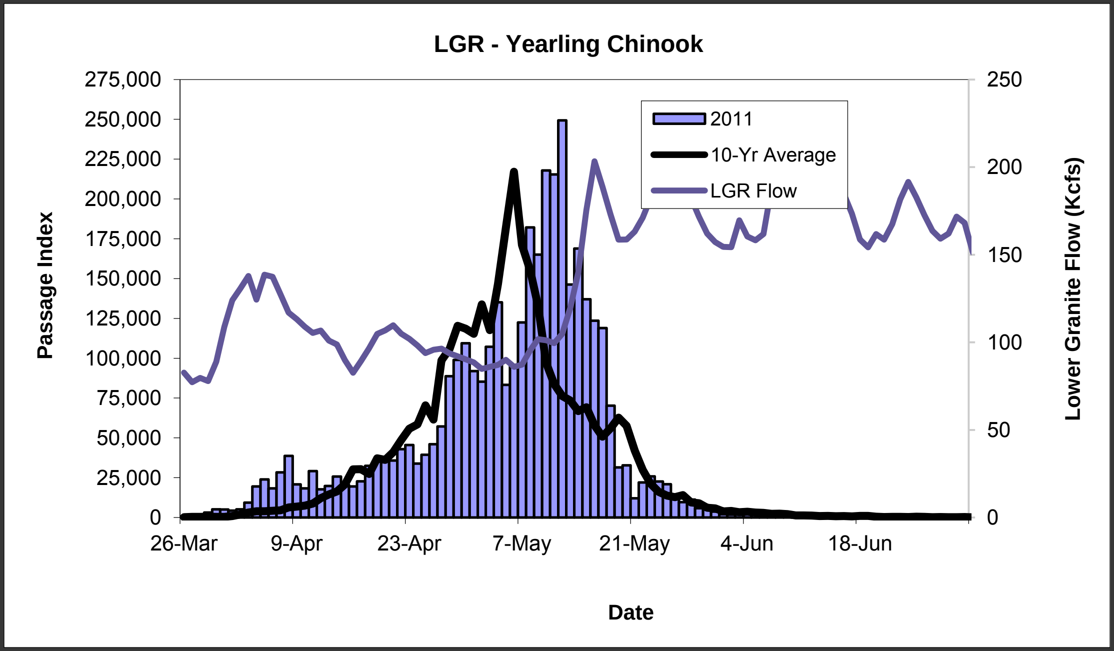
McNary Steelhead



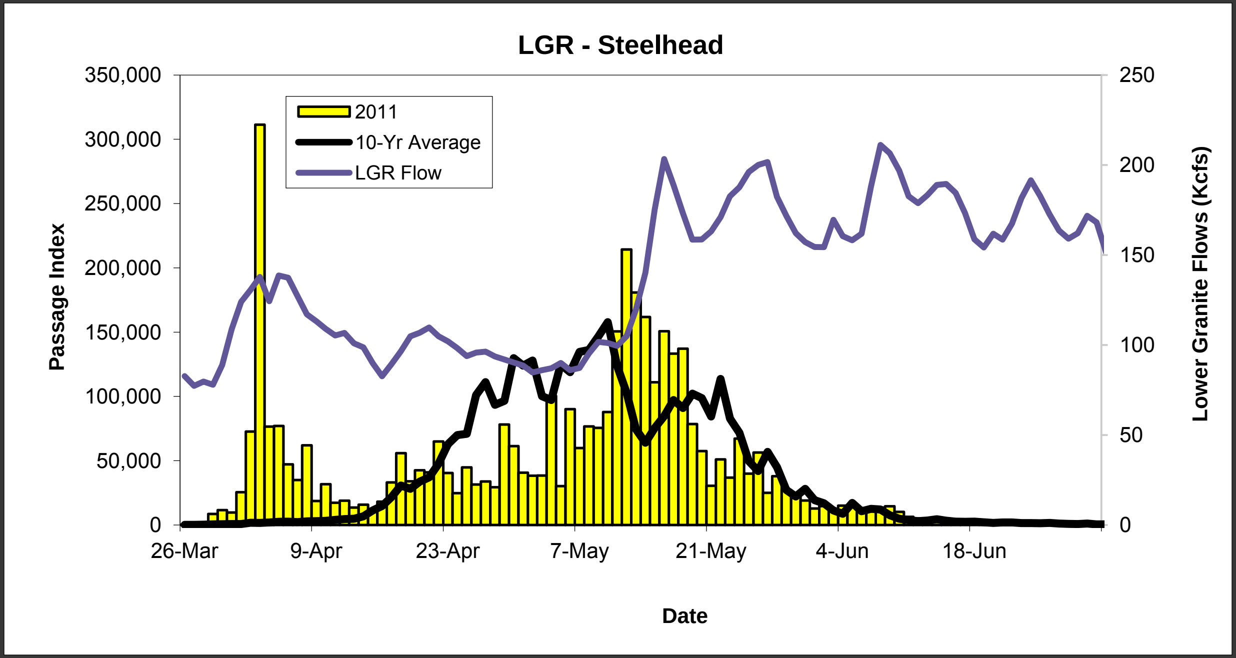
McNary Sockeye



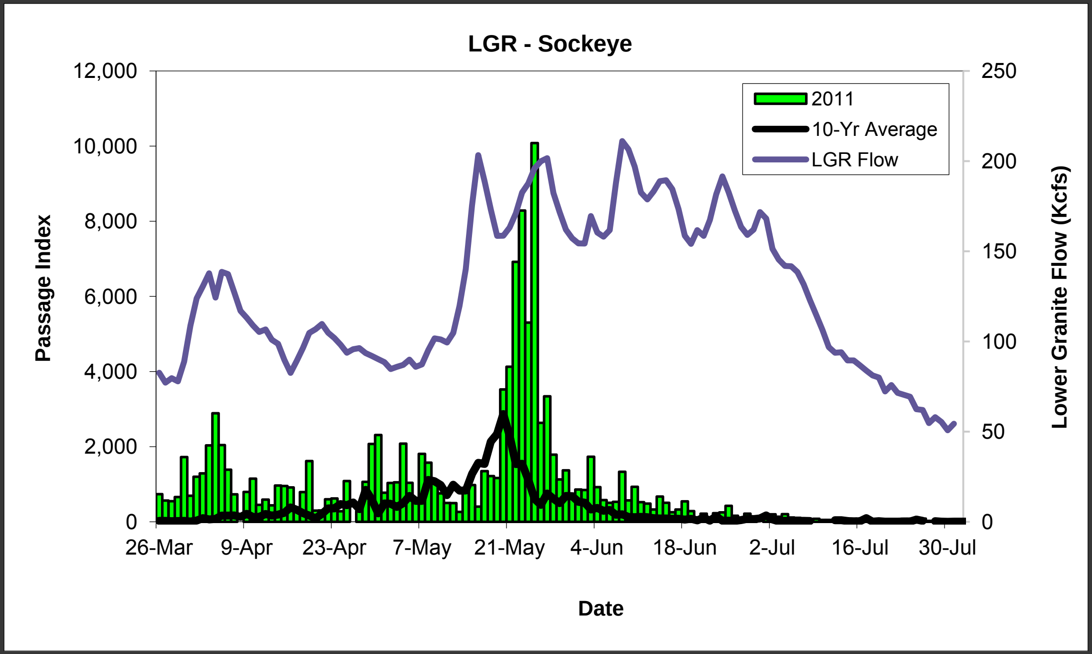
Lower Granite Yearling Chinook



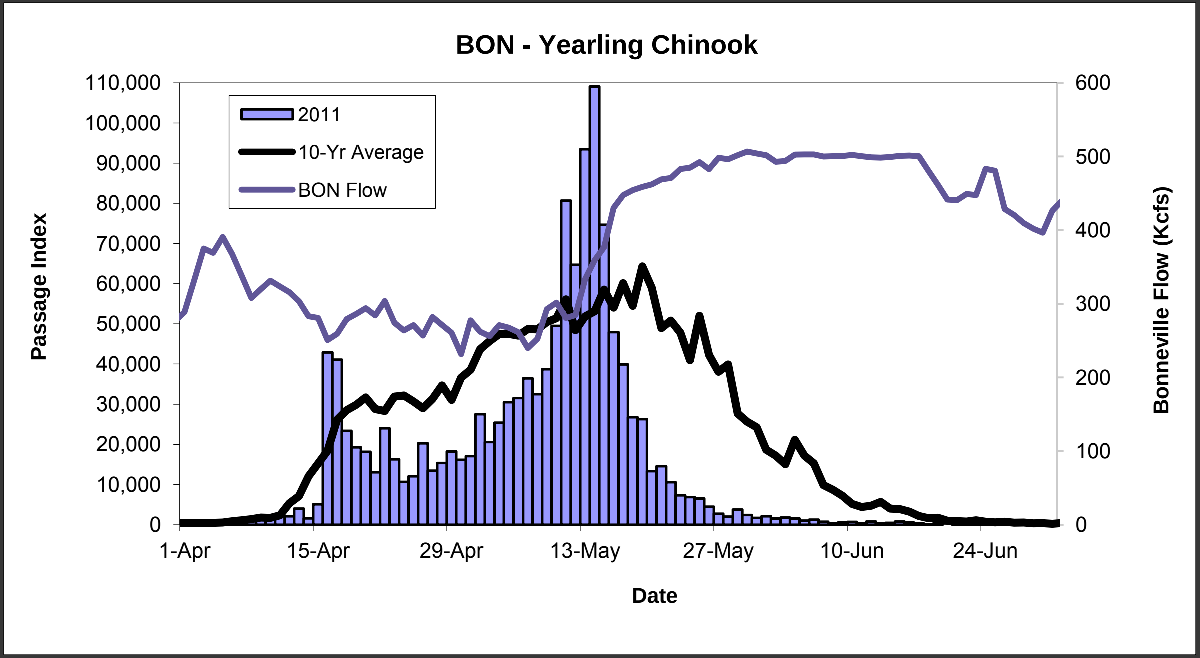
Lower Granite Steelhead



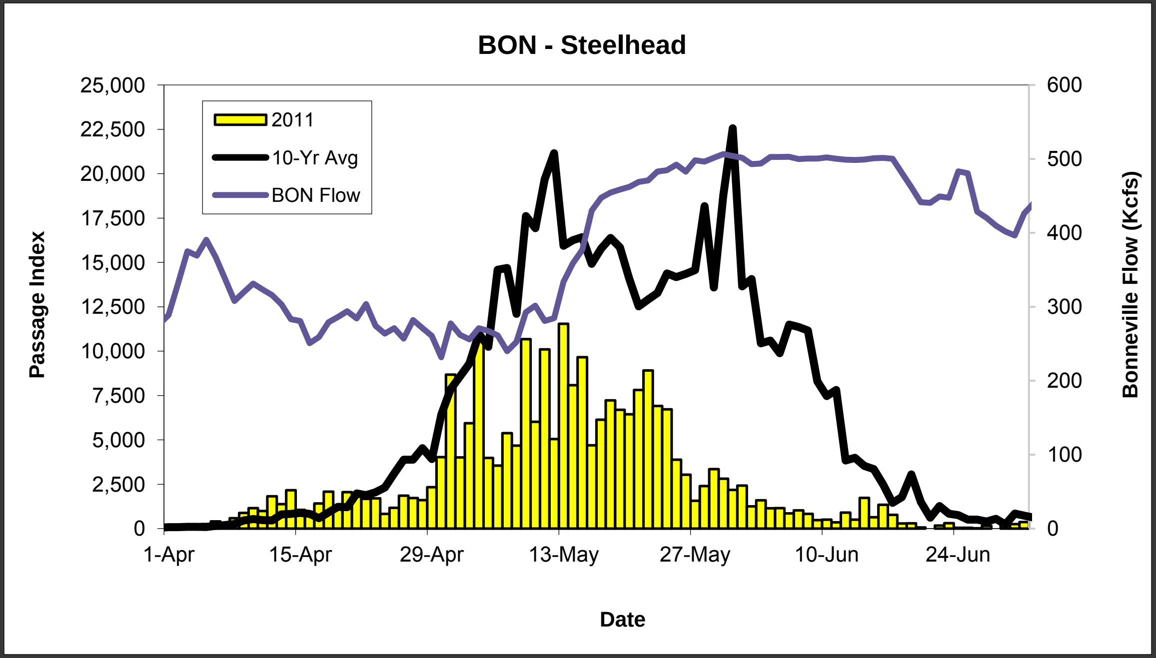
Lower Granite Sockeye



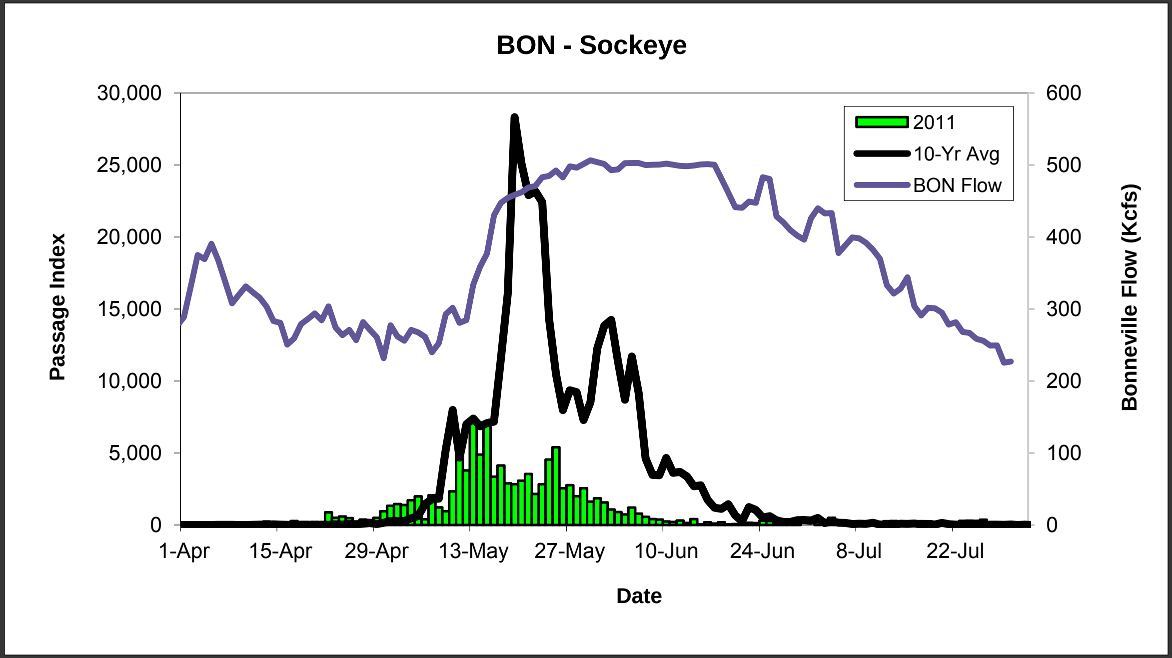
Bonneville Yearling Chinook



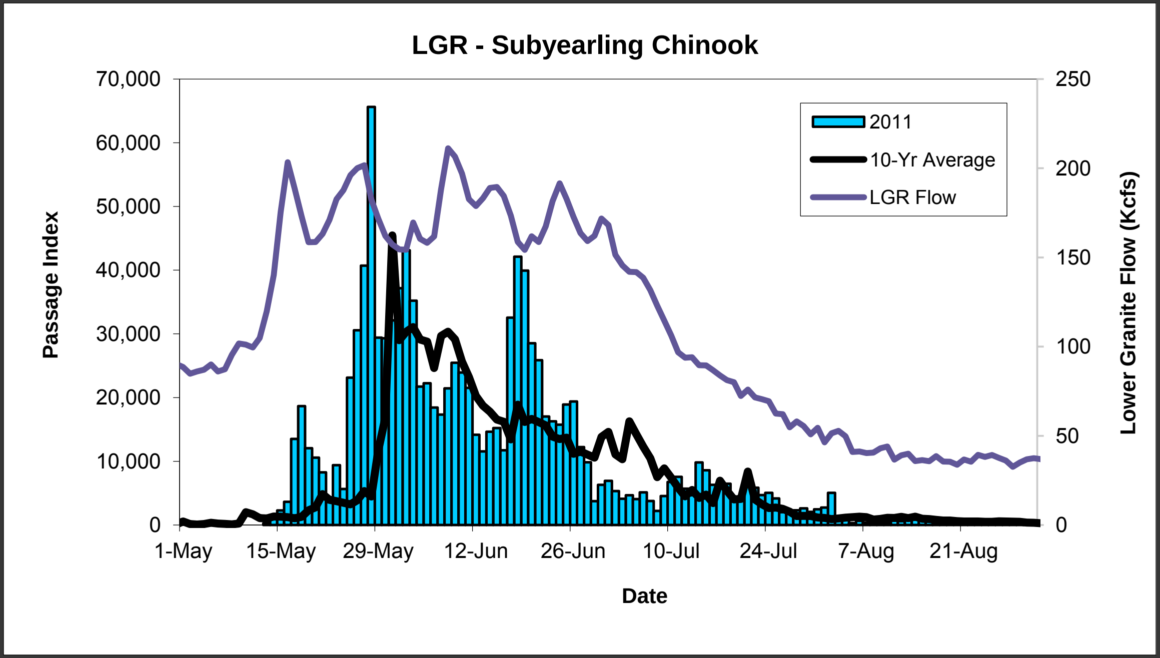
Bonneville Steelhead



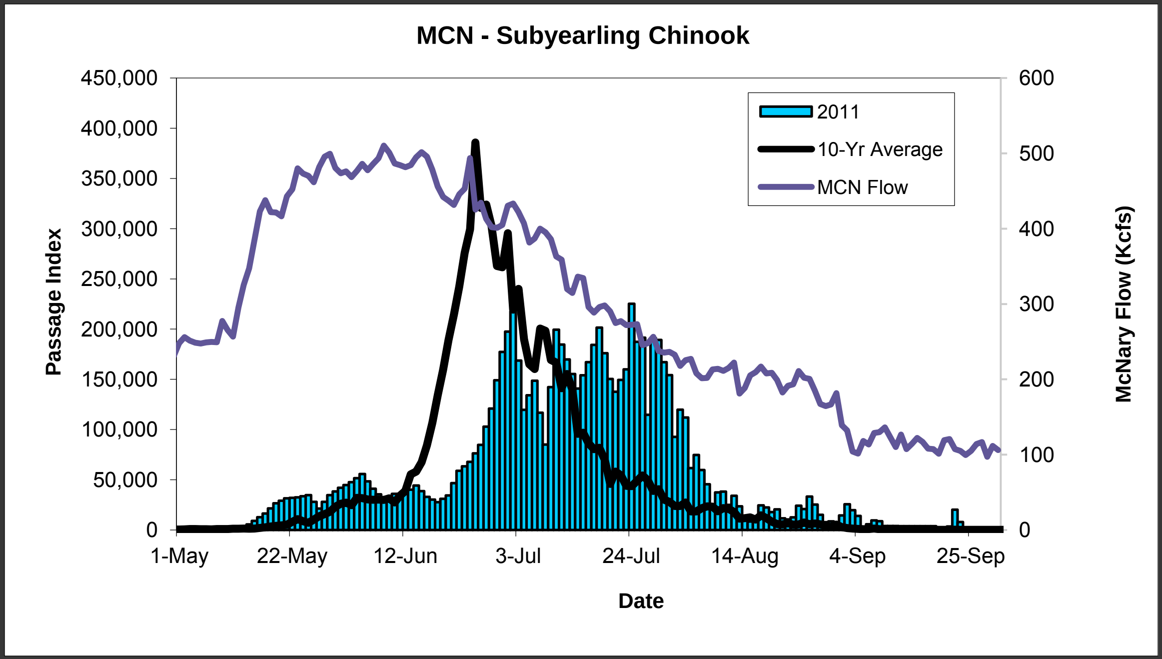
Bonneville Sockeye



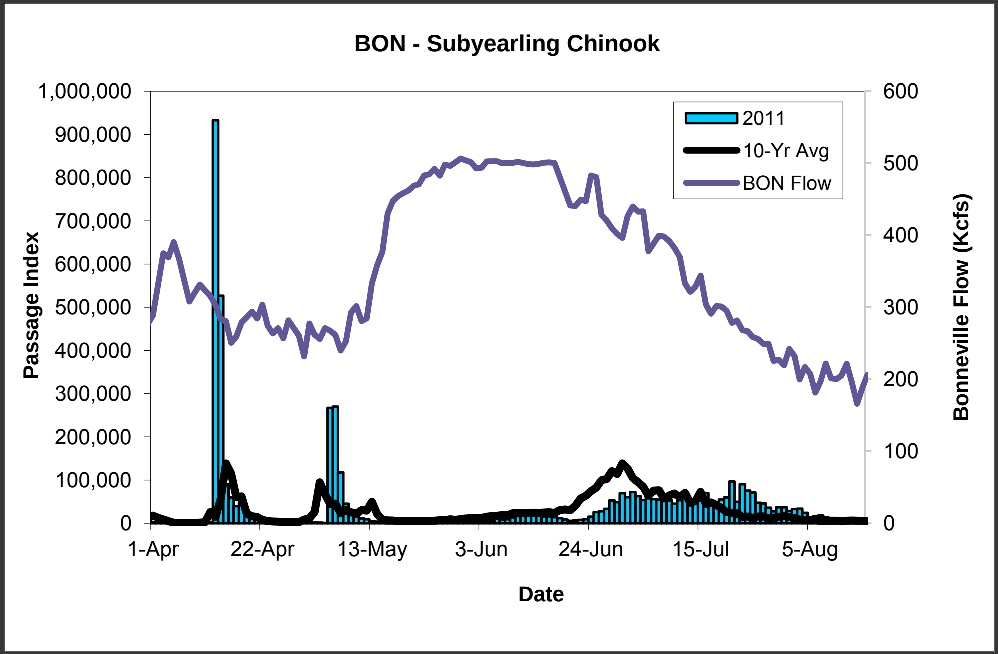
Lower Granite Subyearling Chinook



McNary Subyearling Chinook



Bonneville Subyearling Chinook



Bonneville Dam Special Operations Leading up to the Breach of Condit Dam

Sep-Oct 2011

Lisa Wright

Fishery Biologist

Reservoir Control Center

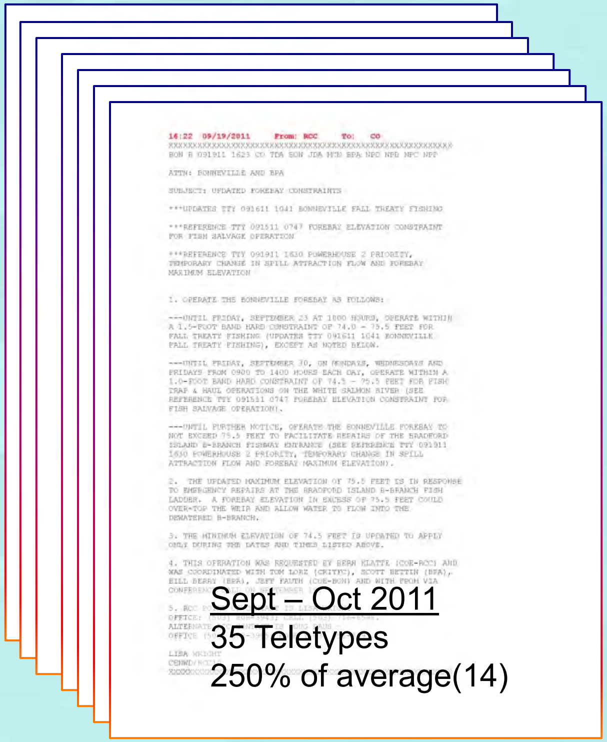
Corps Northwestern Division

7 December 2011

US Army Corps of Engineers
BUILDING STRONG®

Objective

Highlight the enormous level of coordination for BON operations in Sep-Oct 2011 (aka *"100-Year Flood of Teletypes"*)


16:22 09/19/2011 From: RCC To: CO
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
BON B 091911 1623 CO TDA BON JDA MTN BPA NPD NPB NPC NPP

ATTN: BONNEVILLE AND BPA

SUBJECT: UPDATED FOREBAY CONSTRAINTS

***UPDATES TTY 091611 1041 BONNEVILLE FALL TREATY FISHING

***REFERENCE TTY 091511 0747 FOREBAY ELEVATION CONSTRAINT FOR FISH SALVAGE OPERATION

***REFERENCE TTY 091911 1630 POWERHOUSE 2 PRIORITY, TEMPORARY CHANGE IN SPILL ATTRACTION FLOW AND FOREBAY MAXIMUM ELEVATION

1. OPERATE THE BONNEVILLE FOREBAY AS FOLLOWS:

---UNTIL FRIDAY, SEPTEMBER 23 AT 1800 HOURS, OPERATE WITHIN A 1.5-FOOT BAND HARD CONSTRAINT OF 74.0 - 75.5 FEET FOR FALL TREATY FISHING (UPDATES TTY 091611 1041 BONNEVILLE FALL TREATY FISHING), EXCEPT AS NOTED BELOW.

---UNTIL FRIDAY, SEPTEMBER 30, ON MONDAYS, WEDNESDAYS AND FRIDAYS FROM 0900 TO 1400 HOURS EACH DAY, OPERATE WITHIN A 1.0-FOOT BAND HARD CONSTRAINT OF 74.5 - 75.5 FEET FOR FISH TRAP & HAUL OPERATIONS ON THE WHITE SALMON RIVER (SEE REFERENCE TTY 091511 0747 FOREBAY ELEVATION CONSTRAINT FOR FISH SALVAGE OPERATION).

---UNTIL FURTHER NOTICE, OPERATE THE BONNEVILLE FOREBAY TO NOT EXCEED 75.5 FEET TO FACILITATE REPAIRS OF THE BRADFORD ISLAND B-BRANCH FISHWAY ENTRANCE (SEE REFERENCE TTY 091911 1630 POWERHOUSE 2 PRIORITY, TEMPORARY CHANGE IN SPILL ATTRACTION FLOW AND FOREBAY MAXIMUM ELEVATION).

2. THE UPDATED MAXIMUM ELEVATION OF 75.5 FEET IS IN RESPONSE TO EMERGENCY REPAIRS AT THE BRADFORD ISLAND B-BRANCH FISH LADDER. A FOREBAY ELEVATION IN EXCESS OF 75.5 FEET COULD OVER-TOP THE WEIR AND ALLOW WATER TO FLOW INTO THE DEWATERED B-BRANCH.

3. THE MINIMUM ELEVATION OF 74.5 FEET IS UPDATED TO APPLY ONLY DURING THE DATES AND TIMES LISTED ABOVE.

4. THIS OPERATION WAS REQUESTED BY BERN KLATTE (COE-RCC) AND WAS COORDINATED WITH TOM LORZ (CRITFC), SCOTT BETTIN (BPA), BILL BERRY (BPA), JEFF FAUTH (COE-BON) AND WITH FPOM VIA

LISA WRIGHT

- Operations in support of 4 events related to the breach of Condit Dam
- Concurrent operations related to several other project objectives (e.g., emergency fish ladder repair, Treaty fishing, etc.)

Partners/Stakeholders

- Condit Dam events - *White Salmon Working Group*

- Coordinators
  - TMT, FPOM, FFDRWG
  - Individuals (to name a few)

Dave Wills
Rod Engle

Jeanette
Burkhardt

Tom Lorz
Bob Heinith

Scott Bettin
Tony Norris
Bill Berry

Doug Baus
Greg Bowers
Karl Kanbergs

Tammy Mackey
Ben Hausmann
Bern Klatte
Operators!

Condit Dam - Location

22 River Miles
From BON to White Salmon River mouth

Condit Dam - Background

Sept 1999 – Settlement Agreement to remove Condit Dam signed by Pacificorp, State, Federal and Tribal Agencies and NGOs.

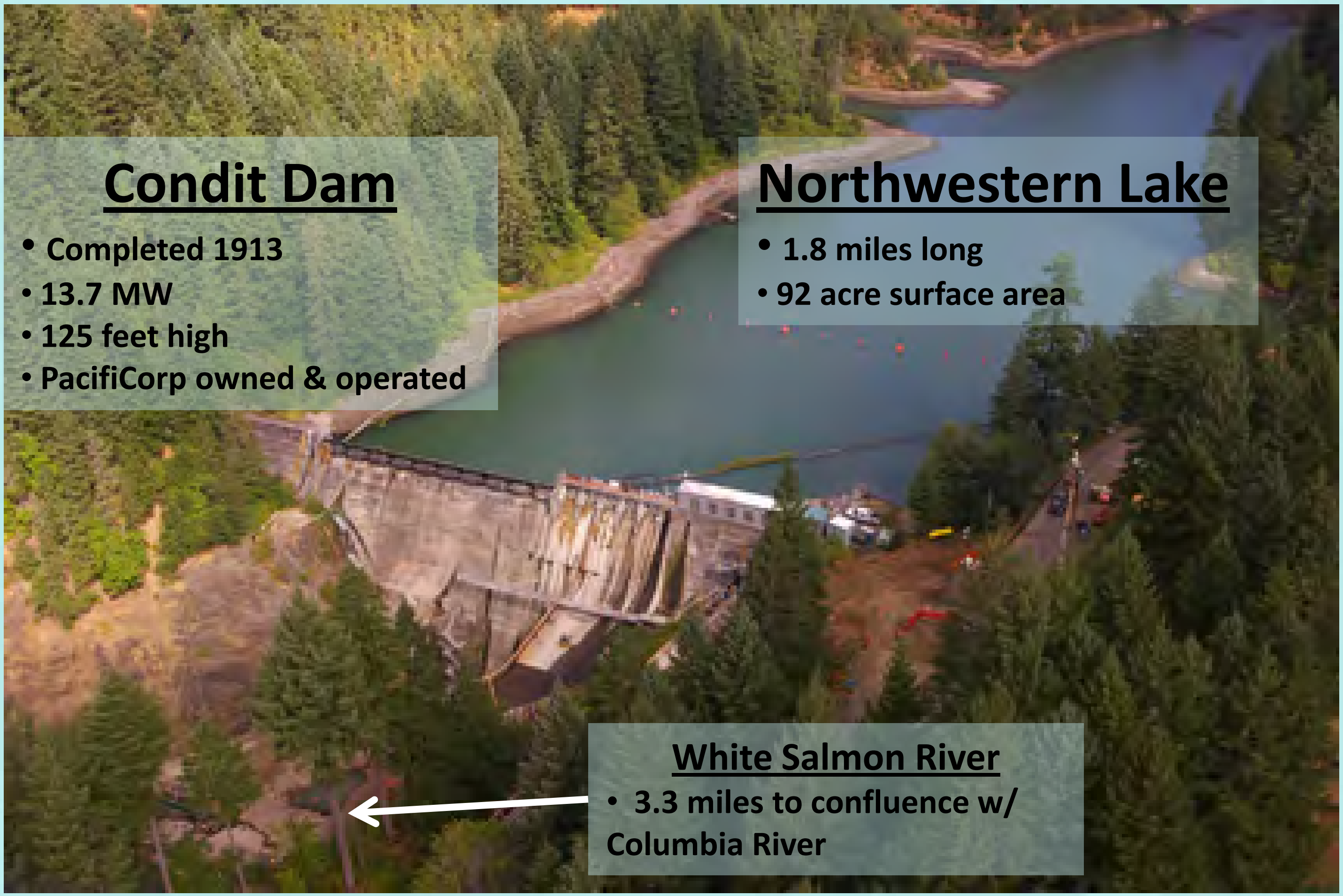


Photo Source: PacifiCorp

Condit Dam – Fish Relocation

WHO?

- USFWS lead (with White Salmon Working Group)

WHEN?

- Aug 30-Oct 5 (Mondays, Wednesdays & Fridays)

WHY?

- Capture & transport adult tule fall Chinook to spawning grounds upstream of Condit Dam

SPECIAL OPERATION

→ **BON pool target of 74.5 ft**

Condit Dam – Fish Relocation

USFWS coordinated through TMT to request BON Pool elevation target of 74.5 feet to provide boat access to seining areas in Lower White Salmon River.

Photo Source: Dave Wills, USFWS

Condit Dam – Fish Relocation

Photo Source: Dave Wills, USFWS

- **679** tule fall Chinook relocated
- **180** redds counted

Condit Dam – Trash Rodeo

WHO?

- White Salmon Working Group + others (~30 agencies & organizations)

WHEN?

- Saturday, Sept 17

WHY?

- Remove derelict boats, garbage from lower White Salmon River

SPECIAL OPERATION

→ **BON pool target of 74.0 ft**

Condit Dam – Trash Rodeo

Accomplishments

- 40 cubic yards of trash
- 12 broken, abandoned boats
- Large hazardous metal debris (aka, "The Can Opener")
- 6+ bags noxious weeds

Photo Source: Jeanette Burkhardt, Yakama Nation

Condit Dam – Underwood Tribal Fishing Site

WHO?

- CRITFC on behalf of Underwood Tribal Fishing Site

WHEN?

- Oct 26-28 (day of breach and 2 days after)

WHY?

- Minimize sediment deposition at in-lieu site

SPECIAL OPERATION

BON minimum pool of 71.5 ft during breach and for 3 days after. Operation cancelled after 1 day.

Condit Dam – Underwood Tribal Fishing Site

Photo Source: Gary Boggs, NW SkySports

Condit Dam – Bonneville

WHO?

- Corps Portland District, coordinated through FPOM

WHEN?

- Oct 26 for 4 weeks

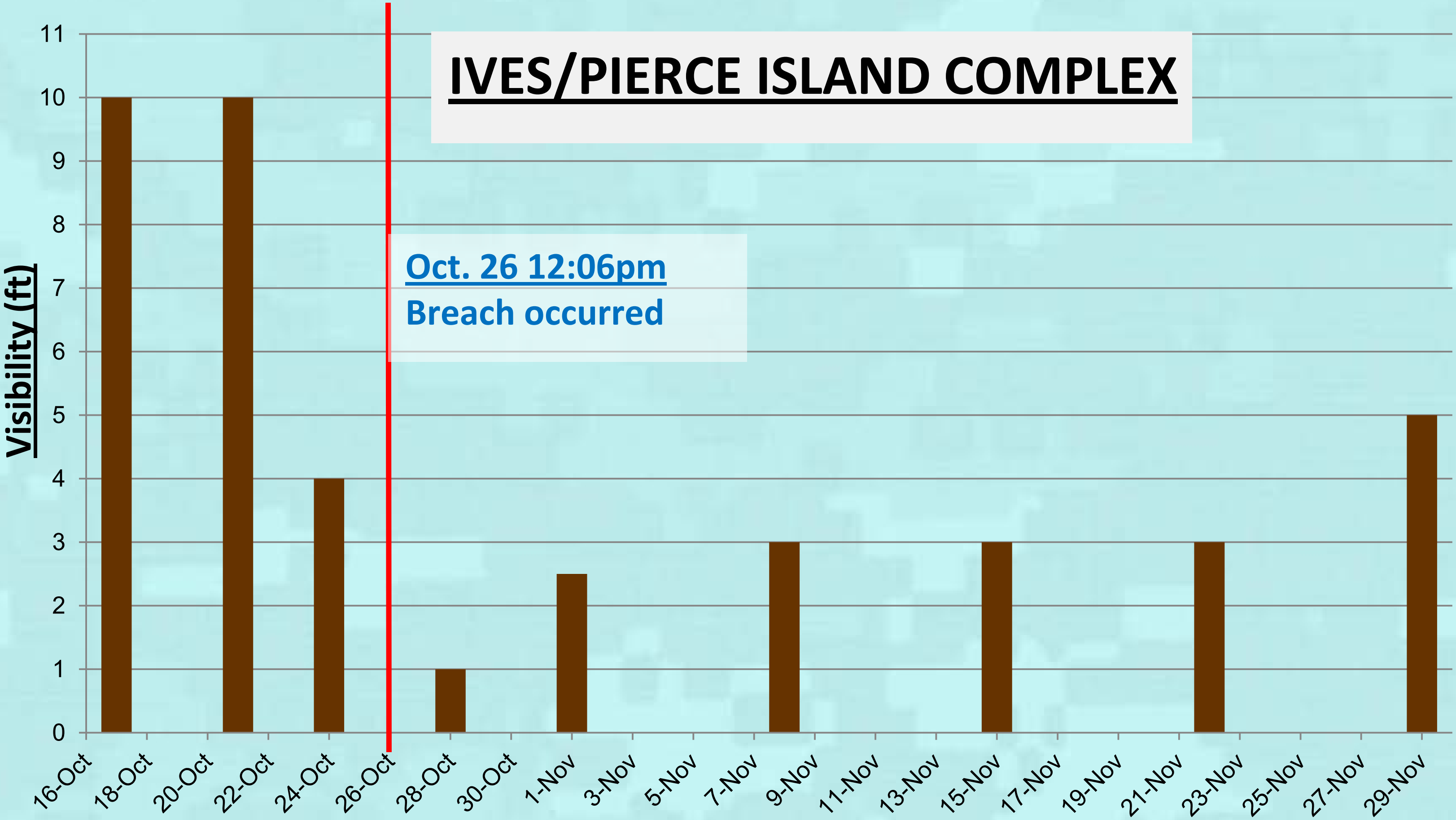
WHY?

- Minimize impact of sediment/debris at BON

SPECIAL OPERATION

→ **BON Powerhouse 1 priority**

Impacts to Visibility Below BON



Data Source: Ken Keller, WDFW

Concurrent Special Operations

- **Treaty Fishing**
  - 1.5 ft forebay operating range
- **Bradford Island Ladder Emergency Repair** –
  - changed spill attraction flow
  - forebay constraints
  - tailwater constraints
  - established spill pattern
- **Washington Shore Ladder Emergency Repair** –
  - PH1 priority, expanded range
  - restricted PH2 operations
  - implemented spill pattern

Photo Source: Scott Bettin, BPA

Summary

- Coordination works!
- 35 Teletypes for BON operations in Sept-Oct 2011. 250% of 3-yr avg (14).
- Achieved multiple simultaneous objectives – balanced needs of regional partners during an unprecedented, highly publicized event while implementing large-scale emergency repairs.

Questions?

- Breach (Alternate link)
- Reservoir Time Lapse

More footage and information at:

http://www.pacificorp.com/condit