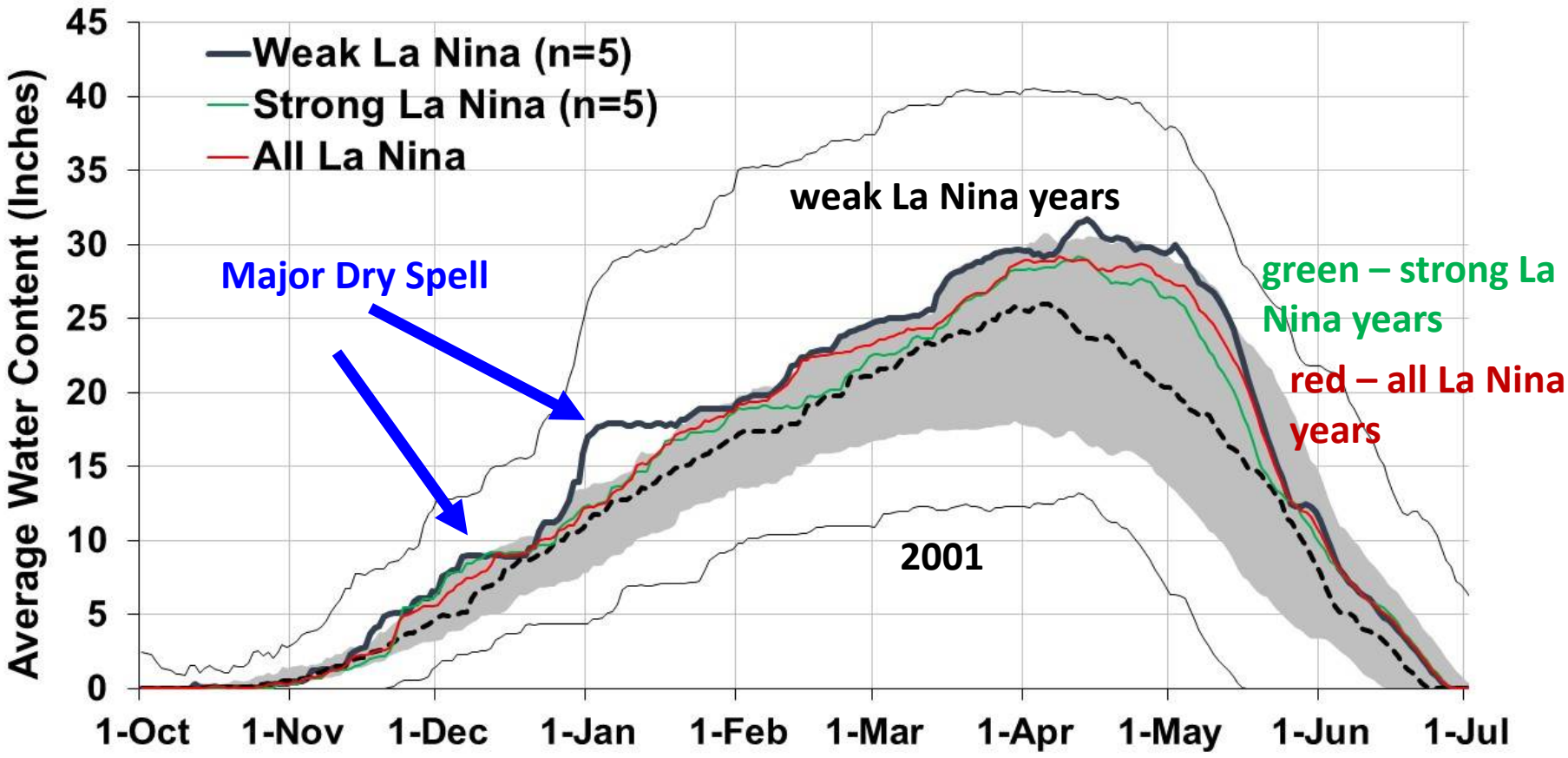
Boise Basin Snowpack and Historic Range, 1982-2017



The black dashed line is a "normal snowpack", while **darker line represents weak La Nina years**, green – strong La Nina years, and **red – all La Nina years**.

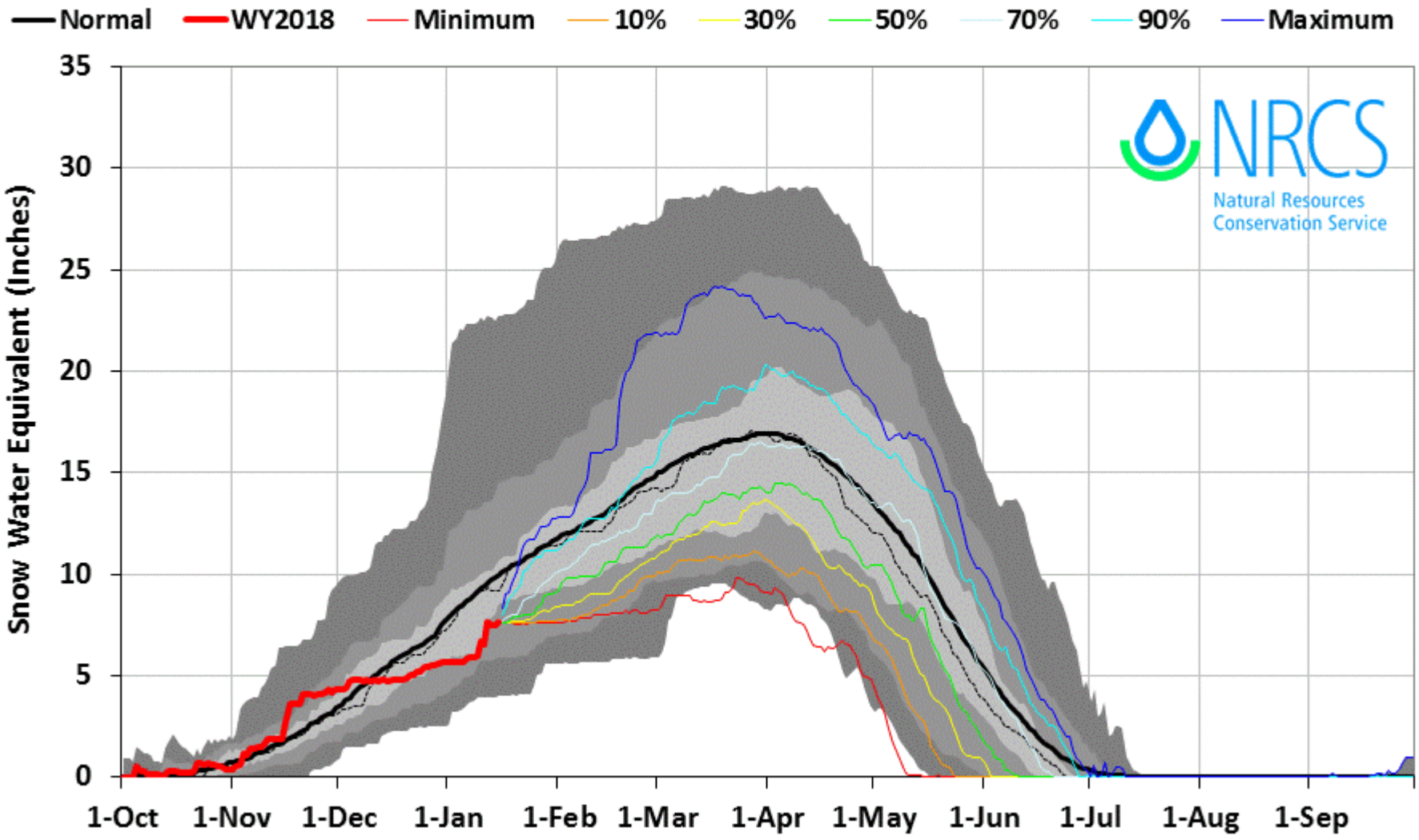
13 total La Nina events since 1982 - snowpack was above normal 12 of those 13 years in the Boise River basin.

Weak La Nina's appear to produce the most snow, with the median snowpack during 5 La Nina events hovering around or above the 75th percentile.

Danny Tappa

Big Wood Basin 2018 Snow Water with Non-Exceedence Projections (9 sites)

Based on Provisional SNOTEL data as of Jan 15, 2018



Reservoir Storage Projection for Spring 2018

As of October 30, 2017 -- Updated January 9, 2018 with end of month storage levels
Projected change in reservoir storage from Fall 2017 to start of runoff season in Spring 2018.

	Sep 30 storage KAF	Observed Oct 31 storage KAF	Observed Nov 30 storage KAF	Observed Dec 31 storage KAF	Projected Jan 31 Storage KAF	Projected Feb 28 storage KAF	Projected Mar 31 storage KAF	Estimated change in storage KAF
Boise Reservoir	603.3	584.9	663.5	719.5			800	197
Magic Reservoir	107.8	123.8	138.9	150.4			160	52
Little Wood Reservoir	12.7	12.4	17.5	21.4		22		9
Mackay Reservoir	38.1	38.1	37.6	33.6			20	-18
Jackson & Palisades Reservoir System	1909.8	1929.9	2016.0	2009.9			1900	-10
Oakley Reservoir	28.5	29.7	31.7	33.4		38		10
Salmon Falls Reservoir	92.8	92.1	92.7	93.1		97		4
Lake Owyhee	432.2	422.0	441.5	461.4	480			48
Bear Lake	1114.5	1090.7	1058.6	1035.5			1000	-115

Other basins, Spokane, Clearwater, Salmon, Weiser, Payette and Bruneau basins, the surface agricultural irrigation demand is not known or relevant. For the Henrys Fork basin, recent diversion data has not been loaded in our AWDB streamflow database.

Amount of Runoff Needed in 2018 for Adequate Irrigation Supply

Summary Table: Amount of streamflow needed in 2018 for adequate surface irrigation supplies.

For complete summary see: Surface Water Supply Index (SWSI)
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/id/snow/waterproducts/?cid=stelprdb1240689

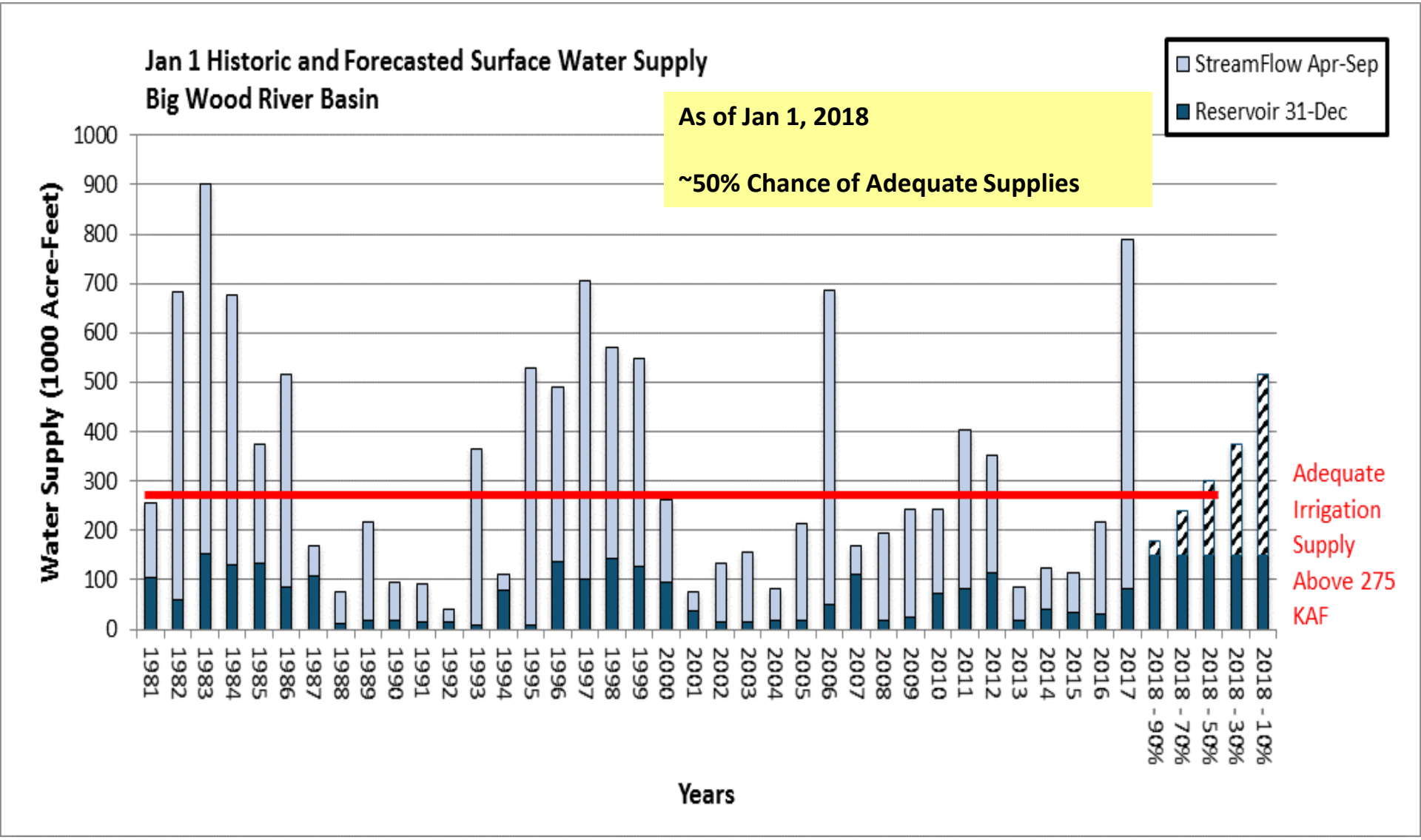
Created: October 30, 2017
Updated: December 1, 2017

Fall reservoir carryover storage is used to project spring reservoir storage levels based on current conditions and recent trends. Then, by knowing the adequate irrigation water supply needed in your basin, the projected spring reservoir volumes are subtracted from the adequate irrigation supply to determine the volume of streamflow to marginally meet adequate surface irrigation supplies in 2018.

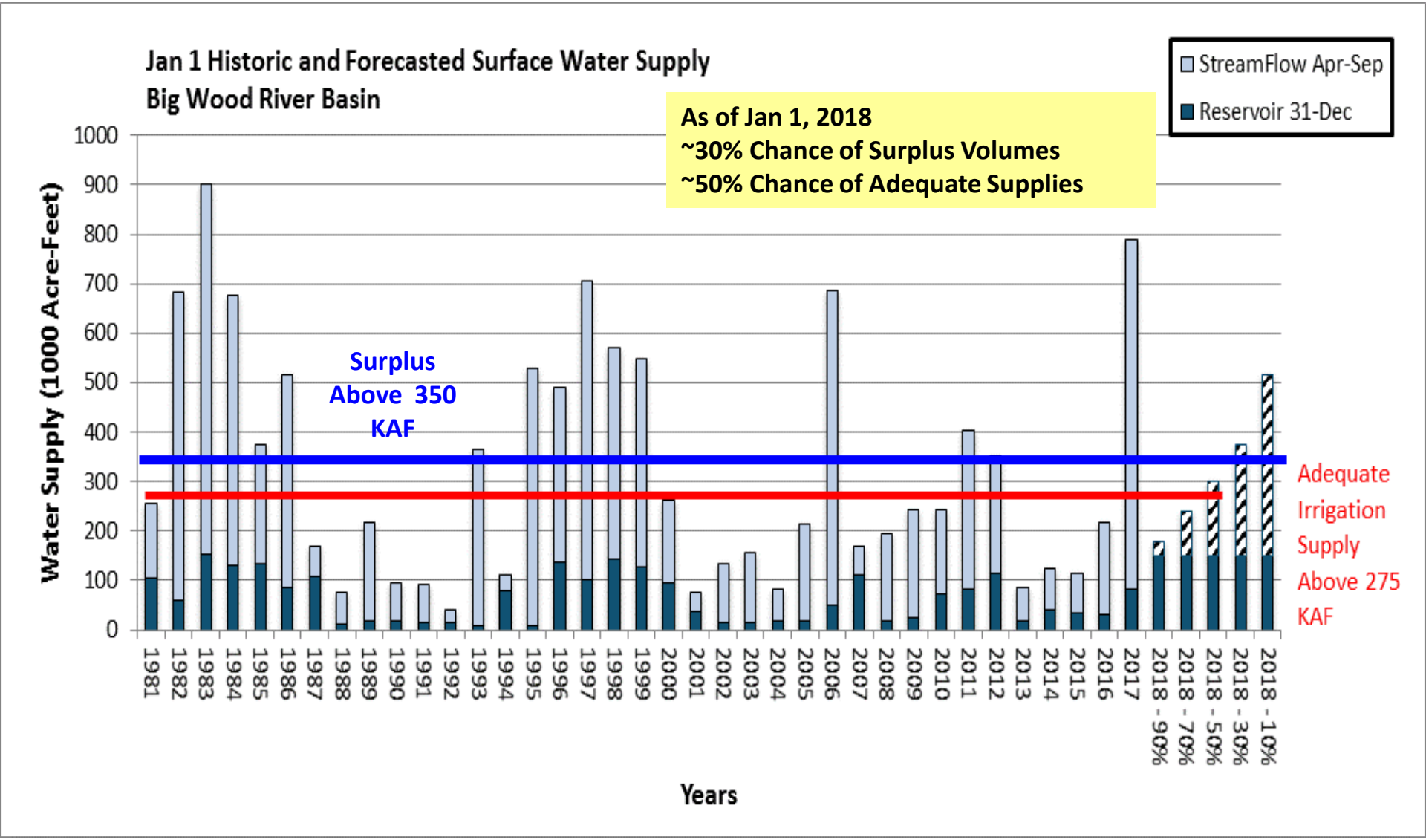
	Column 2 -	Column 3 =	Column 4	Col4/Col6 X 100= Col 5				
Column 1	2	3	4	5	6	7	9	
	Amount needed for adequate irrigation water supply	Projected end of month reservoir storage (Jan, Feb or Mar)	**2018 streamflow volume needed for adequate water supply**	**% of average streamflow to meet adequate irrigation supply in 2018**	1981-2010 average streamflow	Streamflow runoff period used in the analysis	2017 Streamflow Runoff	
Basin	KAF	KAF	**KAF**	**KAF**	KAF		KAF	% of average
Boise	1500	800	**700**	**51%**	1360	Apr-Sep	2460	181%
Big Wood	275	160	**115**	**43%**	265	Apr-Sep	707	267%
Little Wood	60	22	**38**	**41%**	92	**Mar-Sep**	**250**	**272%**
Big Lost	180	20	**160**	**107%**	150	Apr-Sep	310	207%
Little Lost	40	---	**40**	**118%**	34	Apr-Sep	48.5	143%
Teton	85	---	**85**	**44%**	193	Apr-Sep	285	148%
Snake (Heise)	4,400	1900	**2500**	**66%**	3,780	Apr-Sep	6116	162%
Oakley	50	38	**12**	**39%**	31	**Mar-Sep**	**48.6**	**157%**
Salmon Falls	110	97	**13**	**15%**	85	**Mar-Sep**	**157**	**185%**
Owyhee	575	480	**95**	**14%**	665	**Feb-Sep**	**1030**	**155%**
* **Bear River**	280	1000	**35**	**17%**	205	Apr-Sep	540	263%

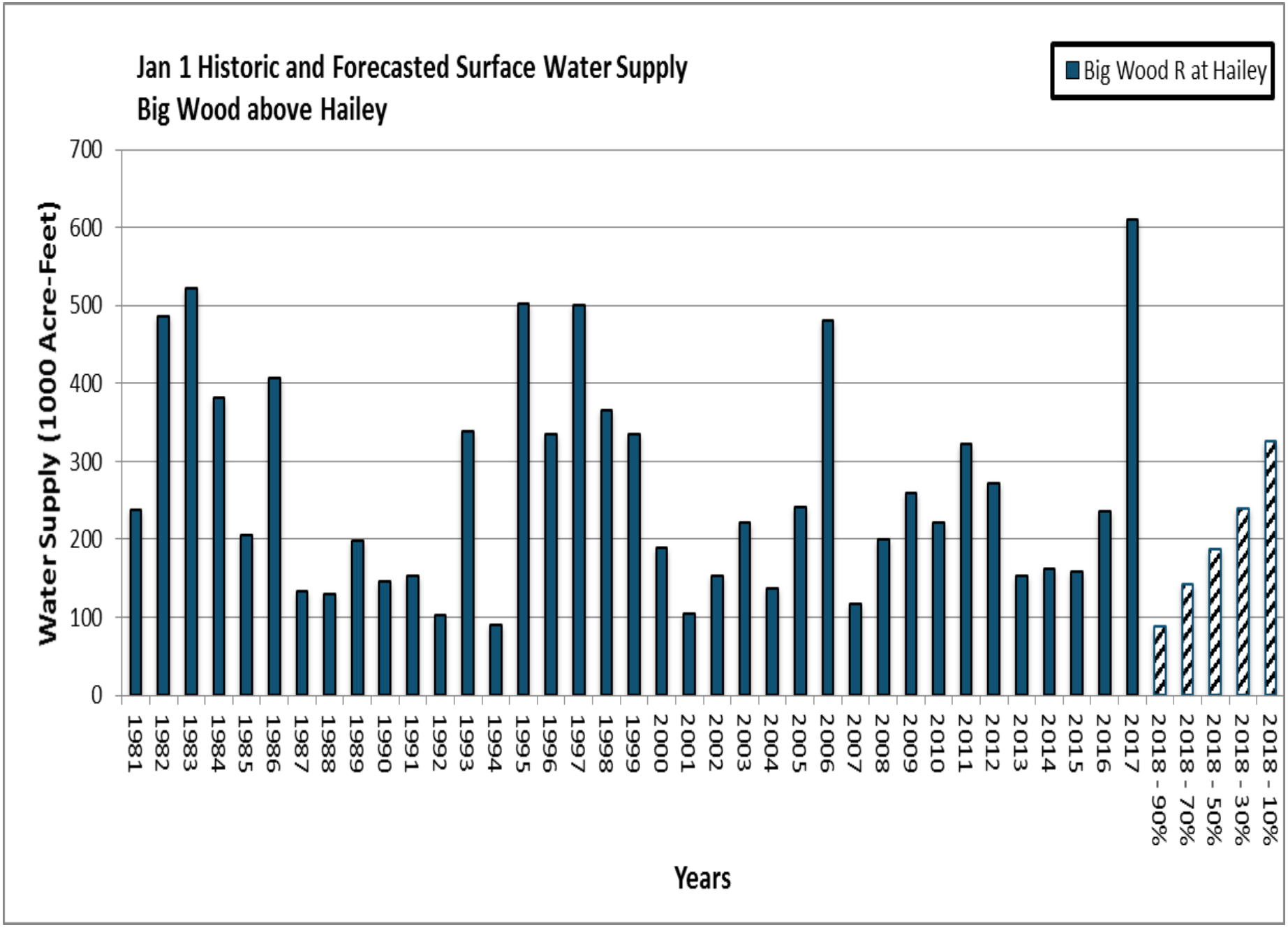
* Based on **Bear River** reservoir allocation: only 245 KAF in storage can be used in 2018 and remaining 35 KAF to meet adequate irrigation supply is from runoff.

2018 Big Wood Jan 1 Surface Water Supply Index SWSI with Adequate Irrigation Supply



2018 Big Wood Basin Jan 1 Surface Water Supply Index SWSI with Adequate Irrigation Supply & Surplus Threshold




Jan 1 Historic and Forecasted Surface Water Supply
Big Wood above Hailey
Big Wood R at Hailey
Water Supply (1000 Acre-Feet)
700
600
500
400
300
200
100
0
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018 - 90%
2018 - 70%
2018 - 50%
2018 - 30%
2018 - 10%
Years

Big Wood above Hailey SWSI

Adequate Water Supply Not Available or Known

Station ID	Station Name	Period	Data Type	Years	# of Years	
13139510	Big Wood R at Hailey	Apr-Sep	strm	1981-2017	37	Units KAF

ENSO Classification
SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina

Rank	Year	Enso	Stream Flow Apr-Sep	Reservoir 31-Dec	Streamflow + Reservoir Sum	Non-Exceedance Probability	SWSI
1	2017	LN	611	0	611	97%	3.9
2	1983	SE	521	0	521	95%	3.7
3	1995	SE	501	0	501	92%	3.5
4	1997	N	500	0	500	89%	3.3
5	1982	N	485	0	485	87%	3.1
6	2006	N	480	0	480	84%	2.9
7	1986	N	406	0	406	82%	2.6
8	1984	N	381	0	381	79%	2.4
9	1998	SE	366	0	366	76%	2.2
10	1993	EN	338	0	338	74%	2.0
11	1999	SL	335	0	335	71%	1.8
12	1996	N	334	0	334	68%	1.5
	2018 10% Chance Exceedance Forcast	LN	325	0	325	67%	1.4
13	2011	SL	321	0	321	66%	1.3
14	2012	LN	272	0	272	63%	1.1
15	2009	N	259	0	259	61%	0.9
16	2005	EN	242	0	242	58%	0.7
	2018 30% Chance Exceedance Forcast	LN	240	0	240	57%	0.5
17	1981	N	237	0	237	55%	0.4
18	2016	SE	236	0	236	53%	0.2
19	2010	EN	221	0	221	50%	0.0
20	2003	EN	221	0	221	47%	-0.2
21	1985	N	205	0	205	45%	-0.4
22	2008	N	199	0	199	42%	-0.7
23	1989	SL	198	0	198	39%	-0.9
24	2000	N	190	0	190	37%	-1.1
	2018 50% Chance Exceedance Forcast	LN	188	0	188	36%	-1.2
25	2014	N	162	0	162	34%	-1.3
26	2015	EN	159	0	159	32%	-1.5
27	2013	N	154	0	154	29%	-1.8
28	1991	N	153	0	153	26%	-2.0
29	2002	N	153	0	153	24%	-2.2
30	1990	N	147	0	147	21%	-2.4
	2018 70% Chance Exceedance Forcast	LN	143	0	143	20%	-2.5
31	2004	N	136	0	136	18%	-2.6
32	1987	N	134	0	134	16%	-2.9
33	1988	SE	130	0	130	13%	-3.1
34	2007	EN	117	0	117	11%	-3.3
35	2001	LN	104	0	104	8%	-3.5
36	1992	EN	103	0	103	5%	-3.7
37	1994	SE	91	0	91	3%	-3.9
	2018 90% Chance Exceedance Forcast	LN	88	0	88	1%	-4.1

Big Wood Water Supply Threshold Documentation USDA NRCS October 2016

A volume greater than 350 KAF with a maximum flow greater 1,500 cfs passing through Magic Dam gage meets the surplus threshold. The agricultural shortage threshold is 275 KAF.

The surplus threshold of 325 KAF for the Big Wood basin was determined based the following analysis for years 1917-2015.

The Surface Water Supply Index (SWSI), which is the summation of the March 31 Magic Reservoir storage plus the April-September runoff volume, was sorted high to low.

Peak outflows from Magic Dam gage were reviewed and information gathered from the NRCS Magic Reservoir Operating Guide. Natural inflow peaks were used as a guide but the amount released from the reservoir is primarily a function of the storage in the reservoir. Releases are generally limited to about 1,300 cfs to optimize hydropower production. Outflows greater than 3,200 cfs can only occur when the reservoir is full and water is flowing over the spillway. Downstream channel capacity (maximum non-damaging flow) is approximately 7,000 cfs.

Big Wood Water Supply Threshold Documentation USDA NRCS October 2016

The total volume and if the reservoir filled was then compared to the maximum outflow at the gage below Magic Dam. Borderline years were 1966, 1945, 1944, 1947 and 1962 with a total volume of 322 to 346 KAF as noted in table below. Peak outflows below the dam for these years ranged from 1,240 to 4,920 cfs.

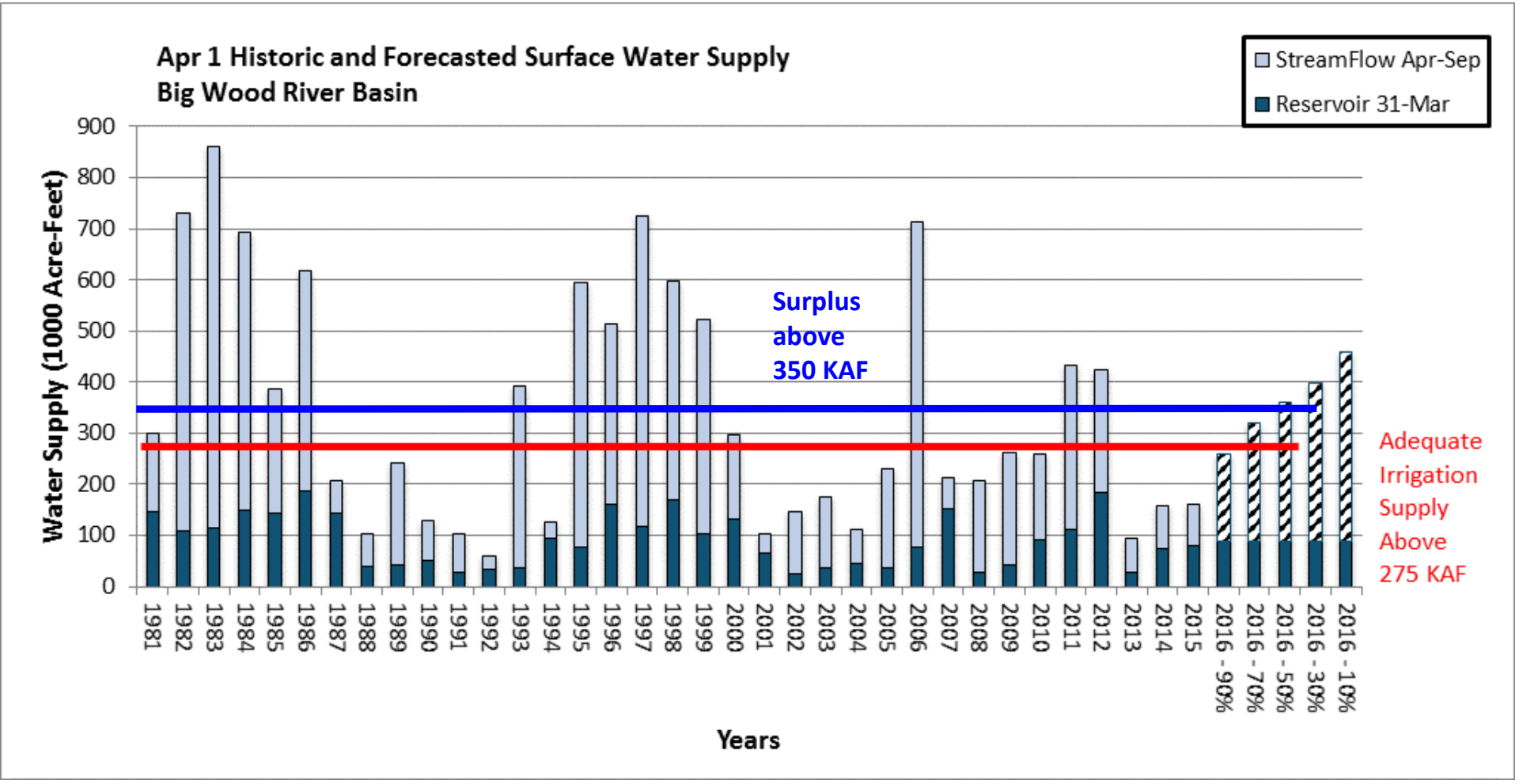
The Surplus volume was rounded to 350 KAF when a reservoir outflow release of about 1,500 cfs or more occurred.

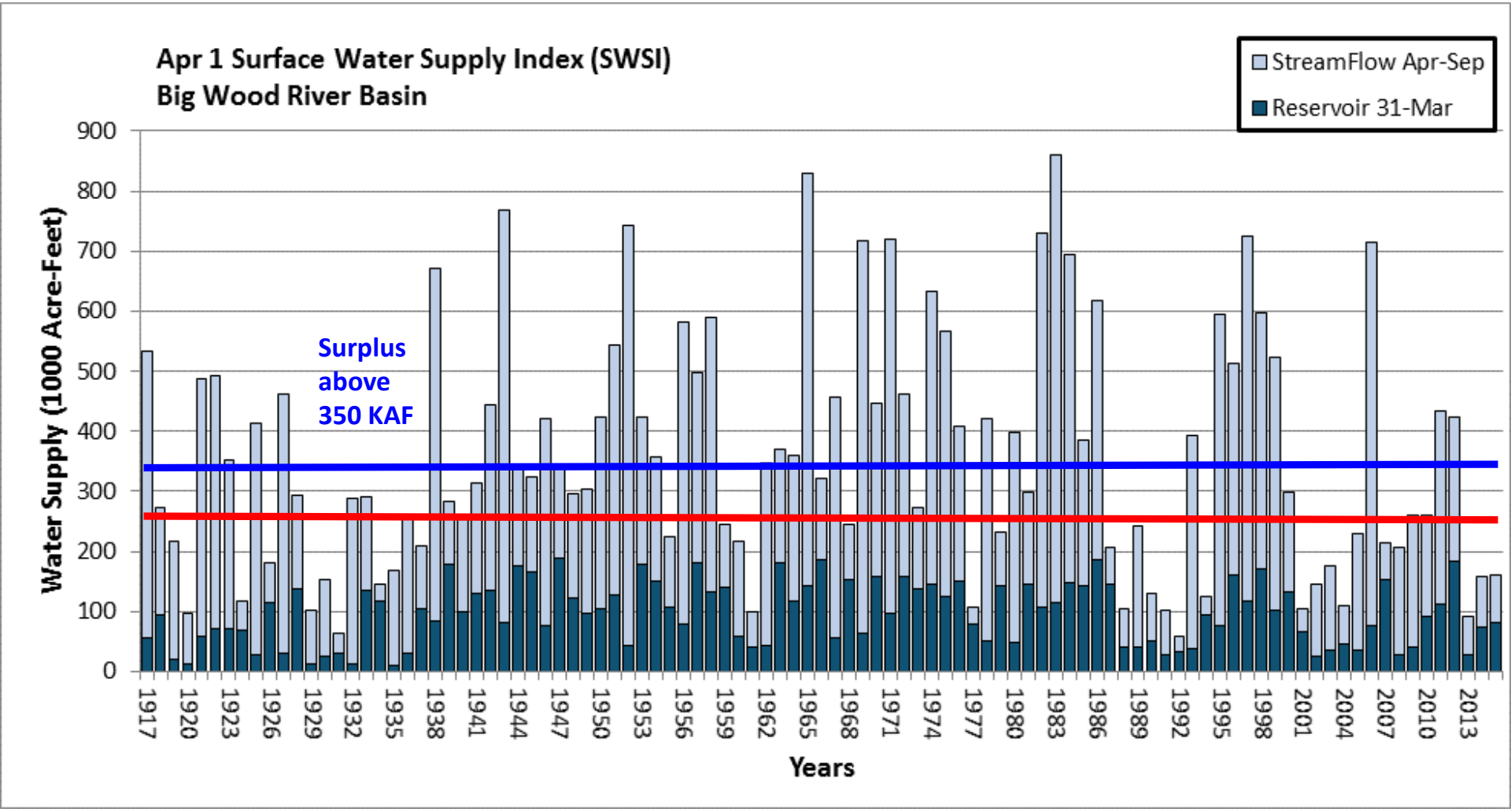
The agricultural shortage threshold is 275 KAF. This shortage threshold was determined in the mid-1990s and verified again in 2011/2012.

Magic Reservoir storage:

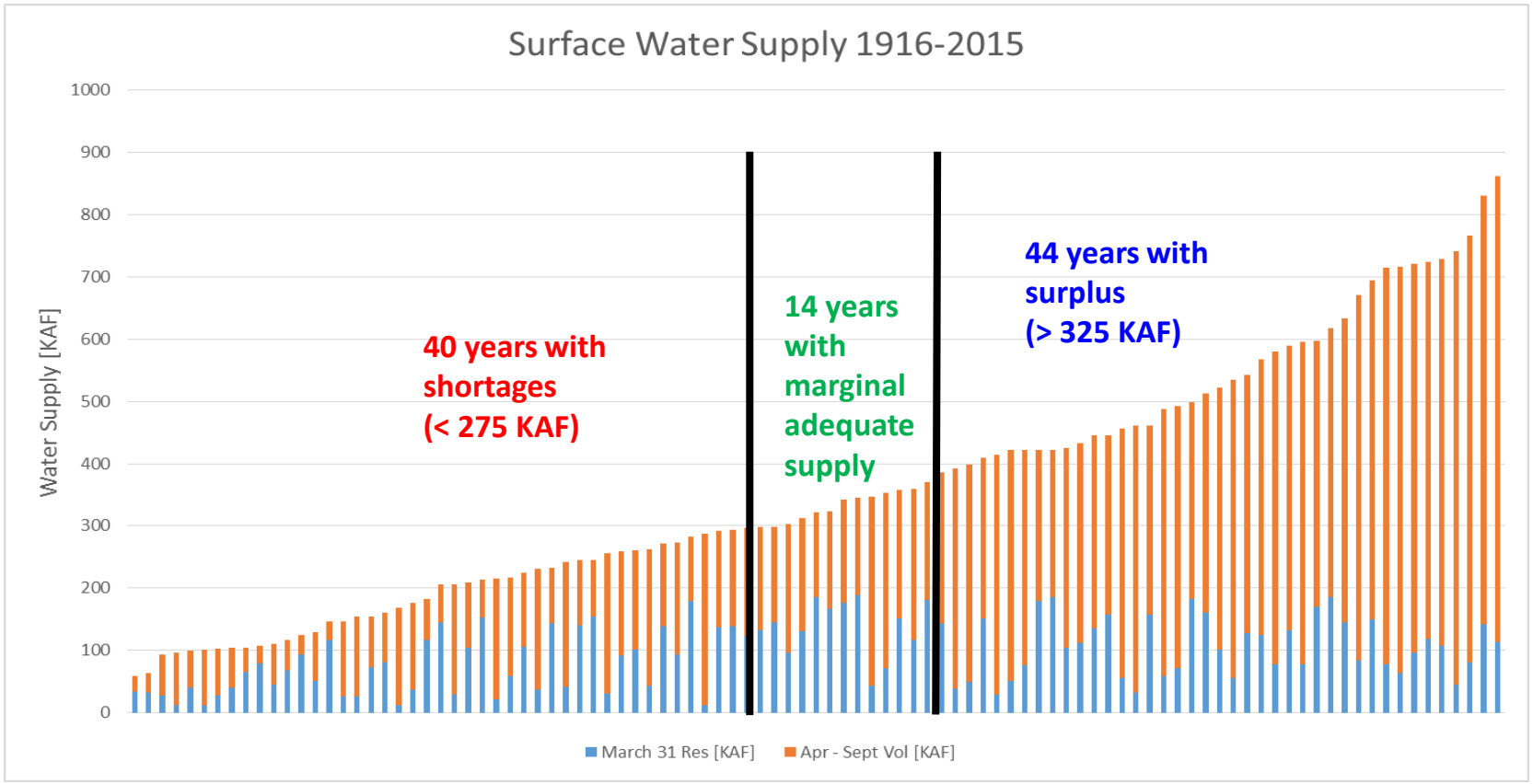
Storage type	KAF
Active	191,500 total active storage with the flashboards in place
	172,000 storage without flashboards

All reservoir storage is usable and can be released.


Apr 1 Historic and Forecasted Surface Water Supply
Big Wood River Basin
StreamFlow Apr-Sep
Reservoir 31-Mar
Water Supply (1000 Acre-Feet)
900
800
700
600
500
400
300
200
100
0
Surplus above 350 KAF
Adequate Irrigation Supply Above 275 KAF
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016 - 90%
2016 - 70%
2016 - 50%
2016 - 30%
2016 - 10%
Years

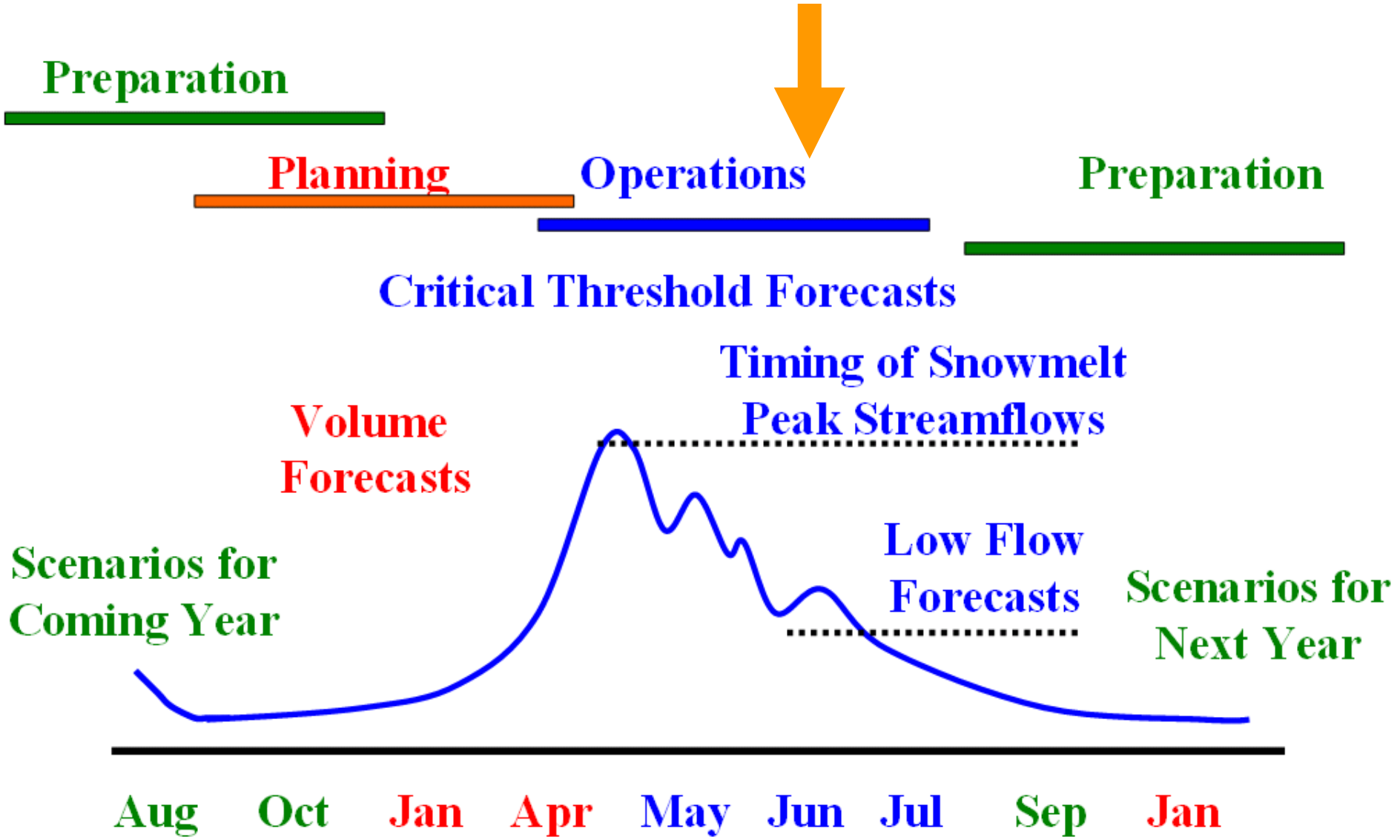

Apr 1 Surface Water Supply Index (SWSI)
Big Wood River Basin
StreamFlow Apr-Sep
Reservoir 31-Mar
Surplus
above
350 KAF
Water Supply (1000 Acre-Feet)
0
100
200
300
400
500
600
700
800
900
1917
1920
1923
1926
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
2013
Years

Big Wood Basin Water Supply Threshold



Big Wood Basin					
Year	March 31 Res [KAF]	Apr - Sept Vol [KAF]	Res + Flow [KAF]	Max Q below Magic Dam	
1992	34	24	58	997	
1931	32	32	64	1120	
2013	27	66	93		
1920	12	85	97	1780	
1961	40	59	99	1000	
1929	12	89	101	1220	
1991	27	76	103	1180	
1988	40	64	104	963	
2001	65	38	104	909	
1977	80	28	108	889	
2004	45	66	110	974	
1924	68	48	116	1600	
1994	94	31	125	1040	
1990	51	79	130	1100	
1934	117	29	146	673	
2002	26	120	146	997	
1930	26	129	154	1380	
2014	73	82	155	1040	
2015	81	80	161	911	
1935	11	157	169	780	
2003	36	140	176	1020	
1926	116	66	182	1420	
1987	145	61	206	889	
2008	28	178	206	943	
1937	104	104	208	772	
2007	153	60	213	1040	
1919	21	195	216	1570	
1960	59	158	217	1020	
1955	107	119	225	1370	
2005	36	194	230	1010	
1979	144	89	233	1030	
1989	42	200	242	1140	
1959	141	104	244	913	
1968	154	91	245	953	
1936	31	225	256	750	
2010	92	167	259	863	
1940	101	160	261	914	
2009	43	219	262	954	
1973	138	134	272	1140	
1918	93	180	274	1610	**irrigation shortage**
1939	180	104	283	2250	**adequate irrigation supply**
1932	12	276	288	1950	
1933	137	156	292	1380	
1928	138	156	294	1530	
1948	123	175	297	1040	
2000	132	165	298	1010	
1981	146	153	299	1760	
1949	97	207	303	1580	
1941	130	183	313	1140	
1966	**186**	**136**	**322**	**4920**	**Borderline years**
1945	**166**	**157**	**324**	**1240**	**Borderline years**
1944	**176**	**167**	**342**	**1490**	**Borderline years**
1947	**189**	**156**	**345**	**1790**	**Borderline years**
1962	**42**	**304**	**346**	**1820**	**Borderline years**
1923	**71**	**283**	**353**	**1800**	**Above Surplus**
1954	151	207	358	1730	
1964	117	243	360	1600	
1963	180	190	370	2210	
1985	144	242	386	2300	
1993	38	355	393	3170	
1980	49	349	398	3130	
1976	151	259	410	2140	
1925	29	385	414	2510	
1978	51	370	421	2840	
1946	77	345	422	4050	
1953	180	243	423	2400	
2012	185	238	423	3240	
1950	105	320	425	2360	
2011	111	322	433		
1942	135	309	445	2680	
1970	158	288	446	2210	
1967	56	401	456	3760	
1927	32	429	461	3390	
1972	157	304	462	3580	
1921	58	429	487	4240	
1922	71	421	492	3330	
1957	182	316	498	3680	
1996	161	351	512	3920	
1999	102	420	522	3910	
1917	56	479	535	3840	
1951	128	414	542	4230	
1975	124	443	567	3920	
1956	78	503	581	4500	
1958	133	456	589	4490	
1995	77	518	595	3900	
1998	170	427	597	3000	
1986	186	432	618	5060	
1974	146	488	634	3990	
1938	84	586	670	5610	
1984	149	545	694	5870	
2006	78	636	714	6170	
1969	63	654	716	5090	
1971	97	624	721	4960	
1997	118	605	724	4610	
1982	108	622	729	4110	
1952	45	697	742	10000	
1943	81	686	767	7160	
1965	142	688	830	4360	
1983	114	747	861	6760	

Water User Needs Timeline



Partnerships to Accomplish More

Completed CESU Agreements

BOISE STATE UNIVERSITY

Snow to Flow Relationships

1. **Estimating timing of peak streamflow using SNOTEL data**

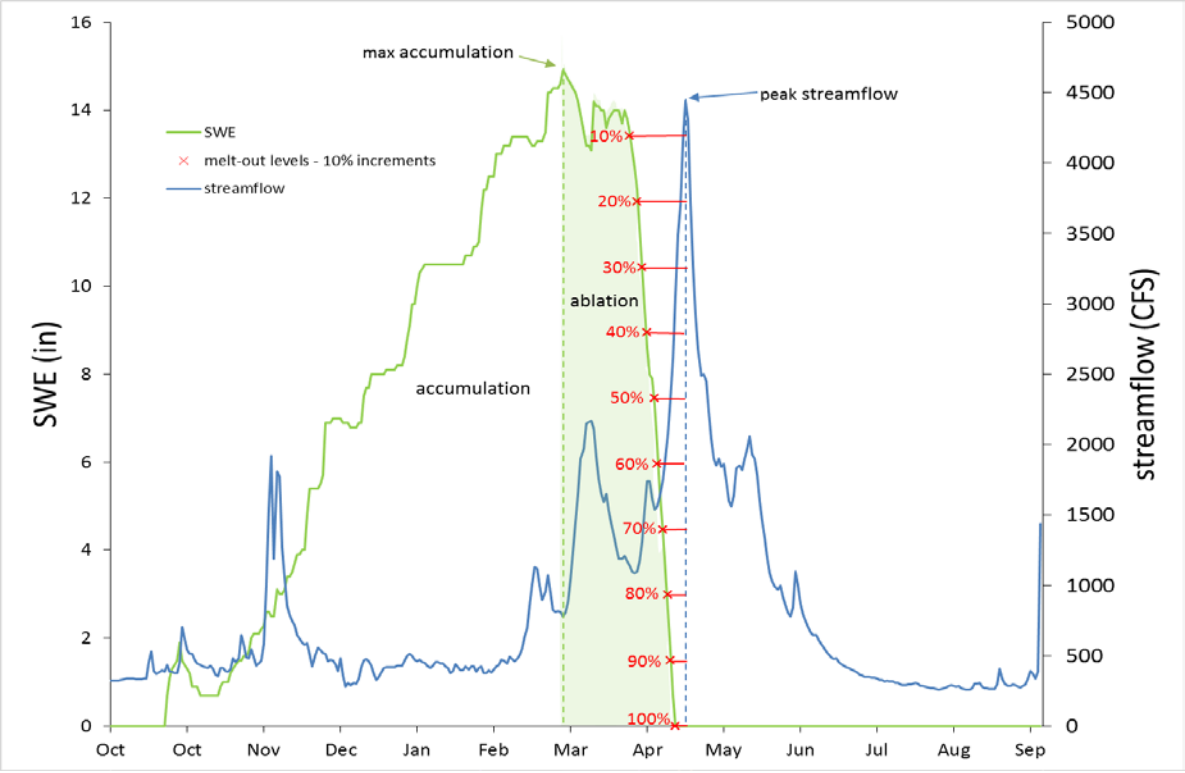
   (Kara Ferguson & Dr. Jim McNamara)

2. **Estimating critical flow levels using SNOTEL data**

   (Becca Garst & Dr. Jim McNamara)

1. Snowmelt streamflow relationships to estimate timing of peak flows:

- **Statistical evaluation of historical melt and peak streamflow**
- **Statistical summaries of snowmelt-streamflow relationship completed for 14 basins**



List of Basins for Operational Use in 2017

Moyie River at Eastport ID
Lochsa River nr Lowell ID
Selway River nr Lowell ID
SF Salmon River nr Krassel
MF Salmon River at MF Lodge ID

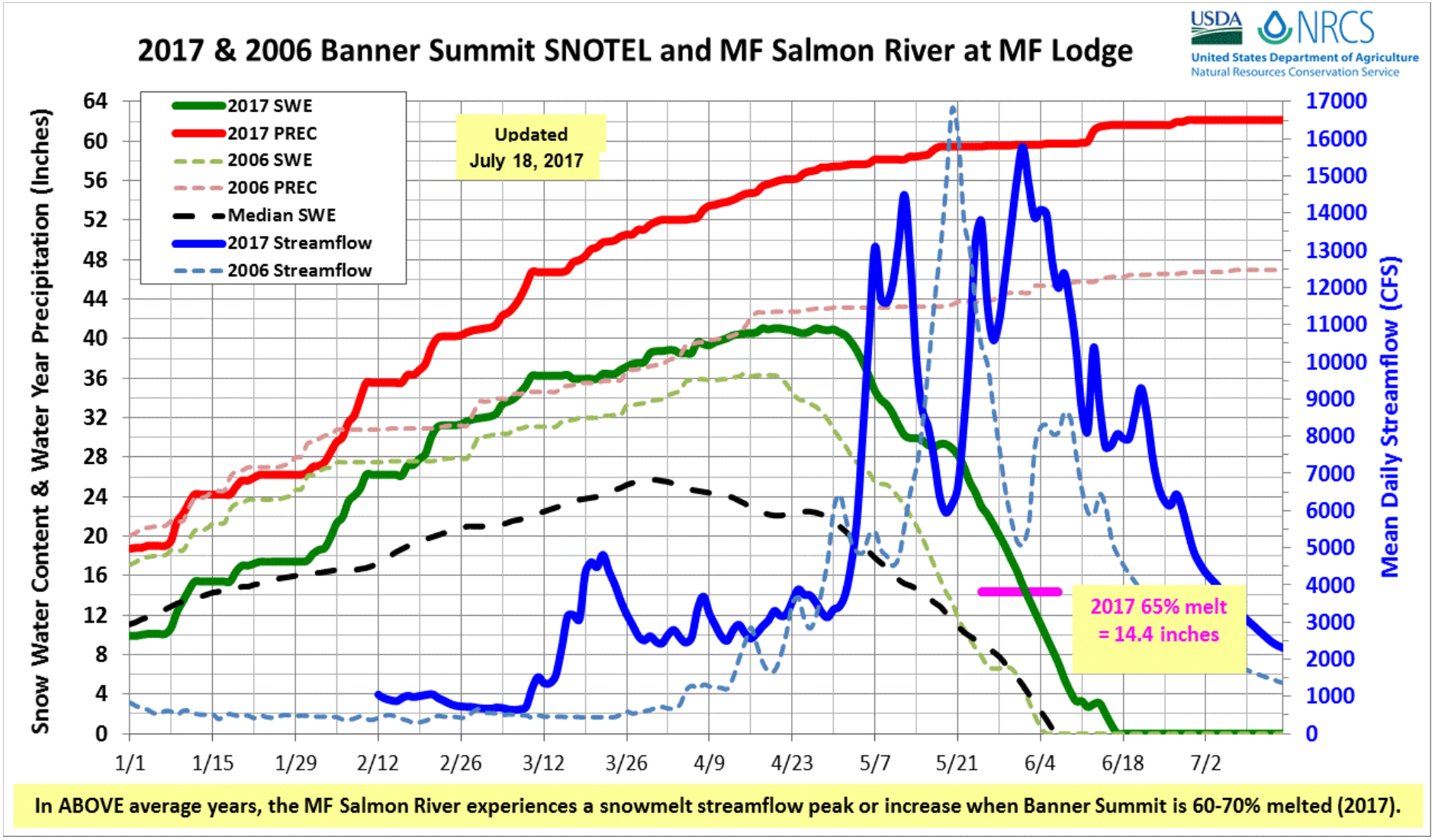
Boise River nr Twin Springs ID
SF Boise River nr Featherville ID
Big Wood River at Hailey
Big Lost River at Howell Ranch ID

Bruneau River nr Hot Springs ID
Owyhee River nr Rome ID
Salmon Falls Creek nr San Jacinto NV

Teton River nr Driggs ID
Snake River at Flagg Ranch WY

1. Snow 2 Flow Relationships

- **Mountain snowpack melt consistently from year to year**



2. Predicting critical flow levels using SNOTEL data:

DOA predictions developed and used in three basins – Boise, Payette and Upper Snake

Early May 2017 -- DOA Projections

2017 Day of Allocation Predictions

- Boise River
  - July 18 +/- 12 days (50% confidence)
  - July 18 +/- 29 days (90% confidence)

Average DOA = June 20

Actual DOA July 11

- Payette River
  - July 18 +/- 9 days (50% confidence)
  - July 18 +/- 24 days (90% confidence)

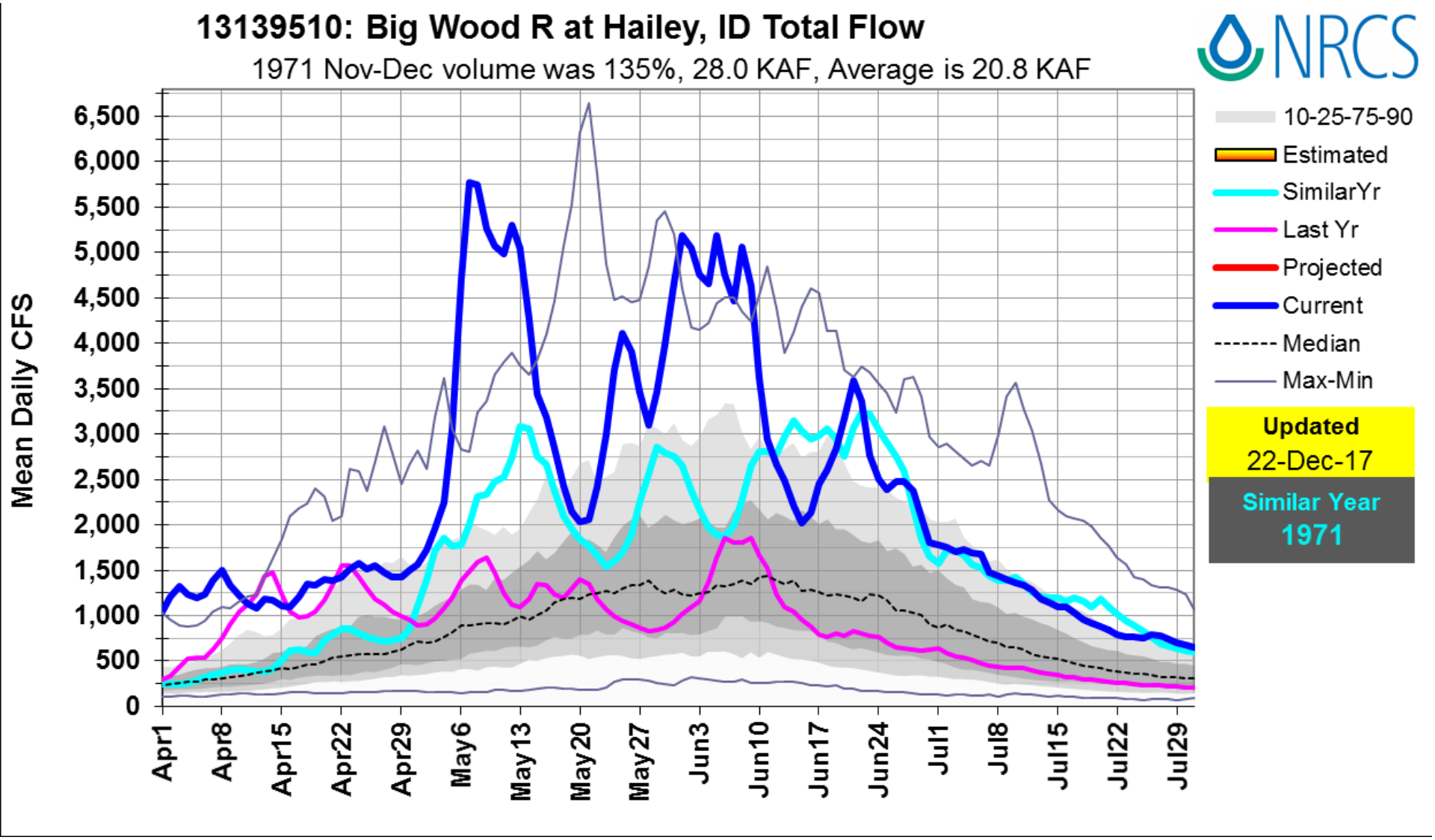
Average DOA = July 10

Actual DOA July 22

- Upper Snake River
  - July 3 +/- 11 days (50% confidence)
  - July 3 +/- 26 days (90% confidence)

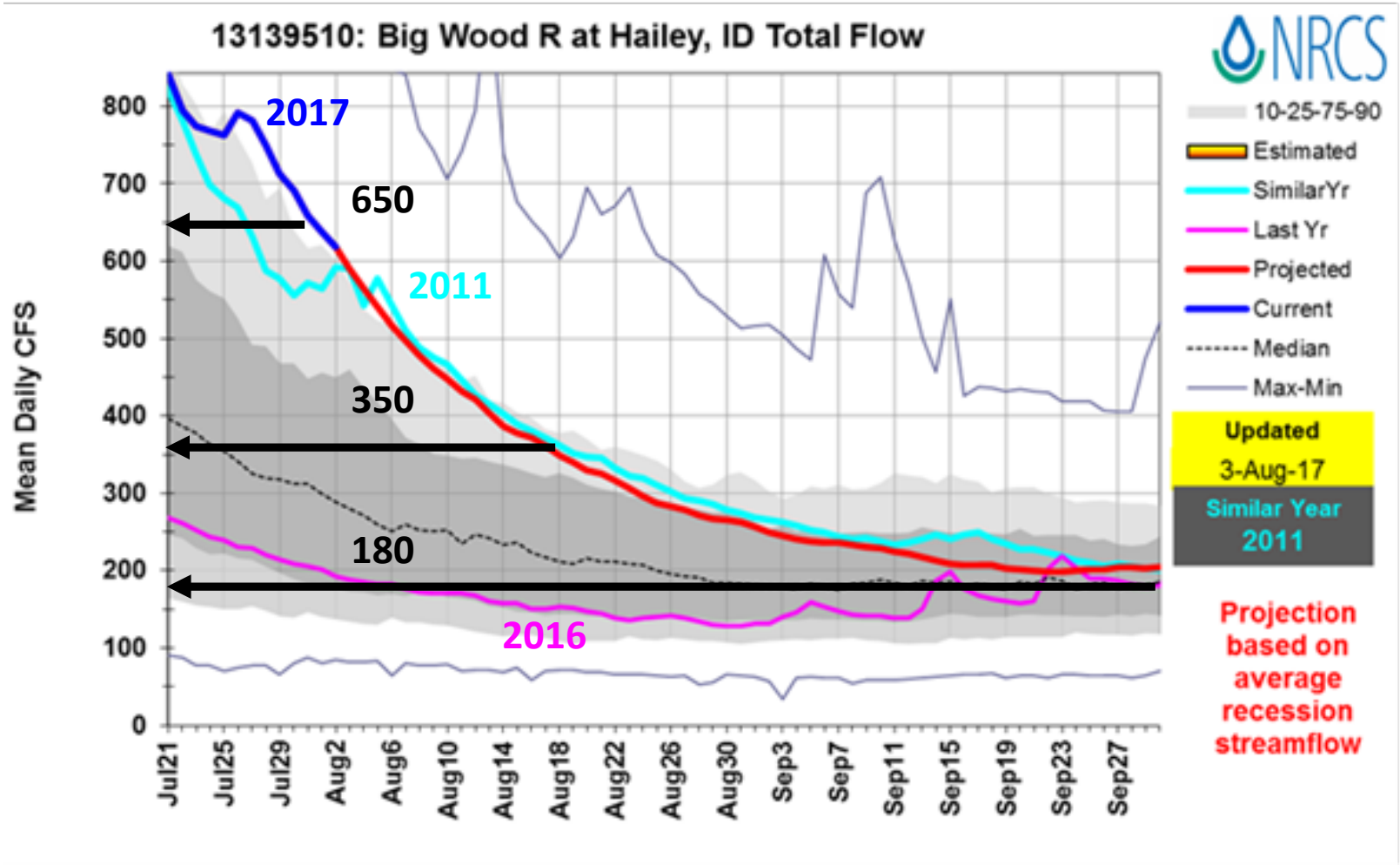
Average DOA = June 26

Actual DOA July 10

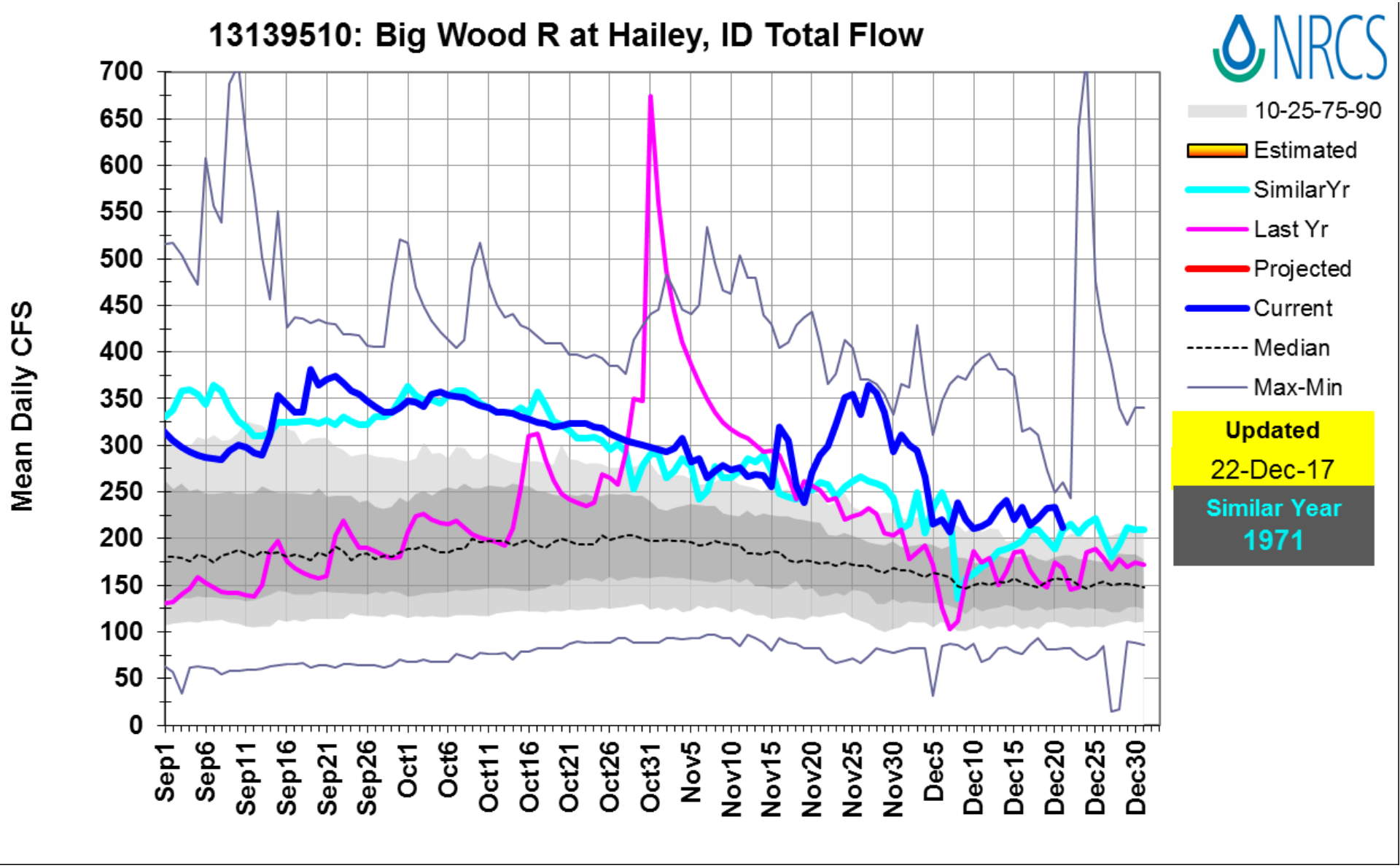

13139510: Big Wood R at Hailey, ID Total Flow
1971 Nov-Dec volume was 135%, 28.0 KAF, Average is 20.8 KAF
NRCS
Mean Daily CFS
6,500
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Apr1
Apr8
Apr15
Apr22
Apr29
May6
May13
May20
May27
Jun3
Jun10
Jun17
Jun24
Jul1
Jul8
Jul15
Jul22
Jul29
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
22-Dec-17
Similar Year
1971

Flow Projections for Water Right Cutoff Dates OR for River Runners

Useful information when Hailey gage reaches 650, 350, and 180 cfs.



Key is how early to start looking at these type of projections – when the snow peaks or based on Apr-Jul volumes forecasts.


13139510: Big Wood R at Hailey, ID Total Flow
Mean Daily CFS
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Sep1
Sep6
Sep11
Sep16
Sep21
Sep26
Oct1
Oct6
Oct11
Oct16
Oct21
Oct26
Oct31
Nov5
Nov10
Nov15
Nov20
Nov25
Nov30
Dec5
Dec10
Dec15
Dec20
Dec25
Dec30
NRCS
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
22-Dec-17
Similar Year
1971

SNOTEL Status

North Idaho

- Mica Creek & Pierce RS – back online this week
- Elk Butte & Cool Creek – helicopter flight end of January

Central Idaho

- Smiley Mountain precipitation problem fixed

Southside & Upper Snake

- No issues

Staff Directory

Program Manager and Staff Supervisor

Name	Position	Phone	Email
Shawn Nield	State Soil Scientist	208-378-5728	Shawn Nield

Office Staff

Office Staff

Name	Position	Phone
Ron Abramovich	Water Supply Specialist	208-378-5741
Earl Adsley	Pathways Student Trainee (Hydrologist)	208-378-6921
Tina Andry	Pathways Student Trainee (Hydrologist)	208-378-6983
Danny Tappa	Hydrologist/Acting Data Collection Officer	208-378-5740
Vacant	Data Collection Officer/Senior Hydrologist	
Vacant	Hydrologist	

Field Staff

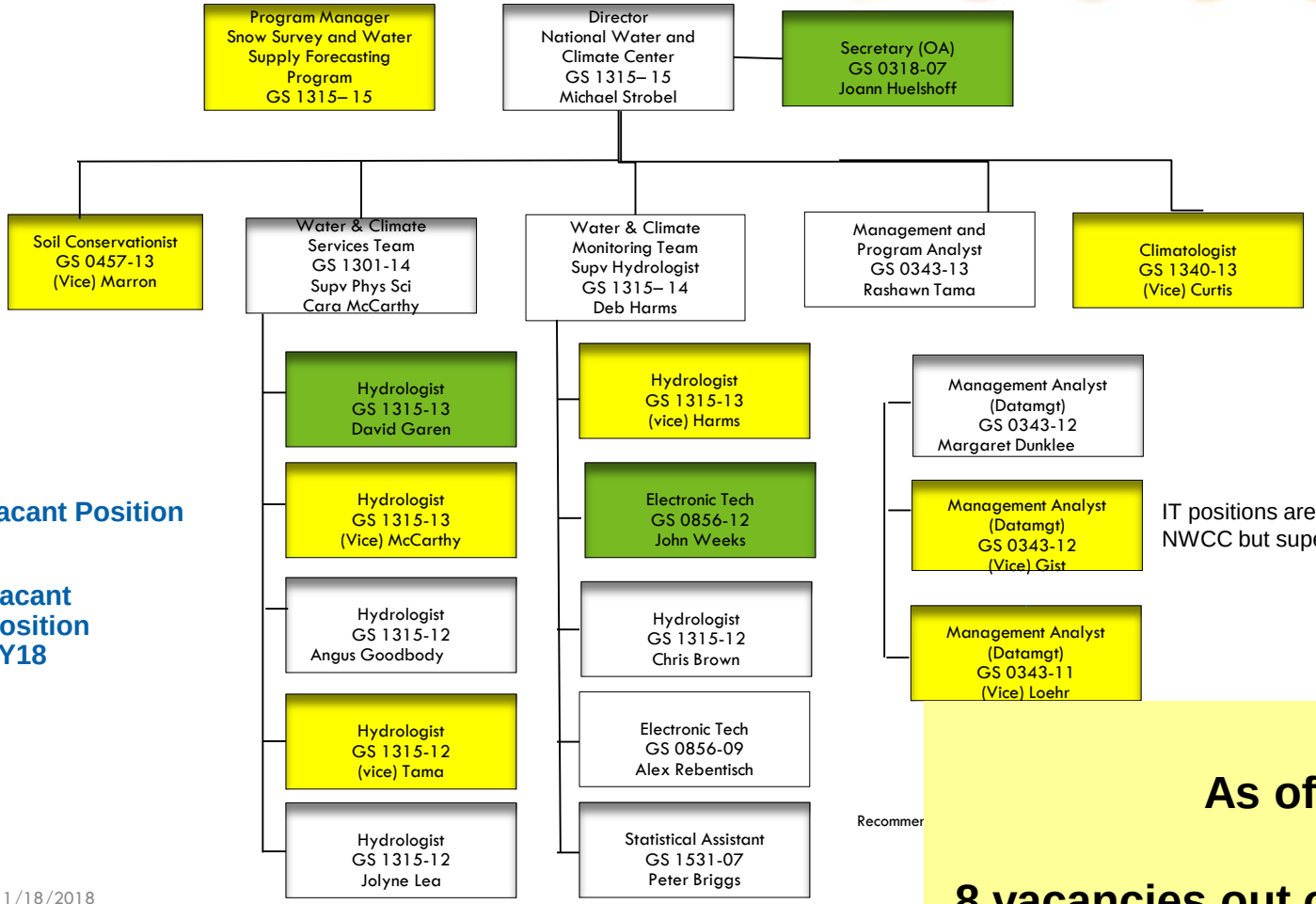
Name	Position	Phone	Email
John Wilford	Electronics Technician	208-685-6943	John Wilford
Tom Beers	Field Hydrologist	208-685-6942	Tom Beers
Vacant	Hydrologic Technician		

Idaho Snow Survey Office
As of Jan. 2018

3 vacancies out of 7 FTEs

2 newer Pathways Trainee Hydrologists

Resources Inventory Division (National Water and Climate Center) – Working Org Chart



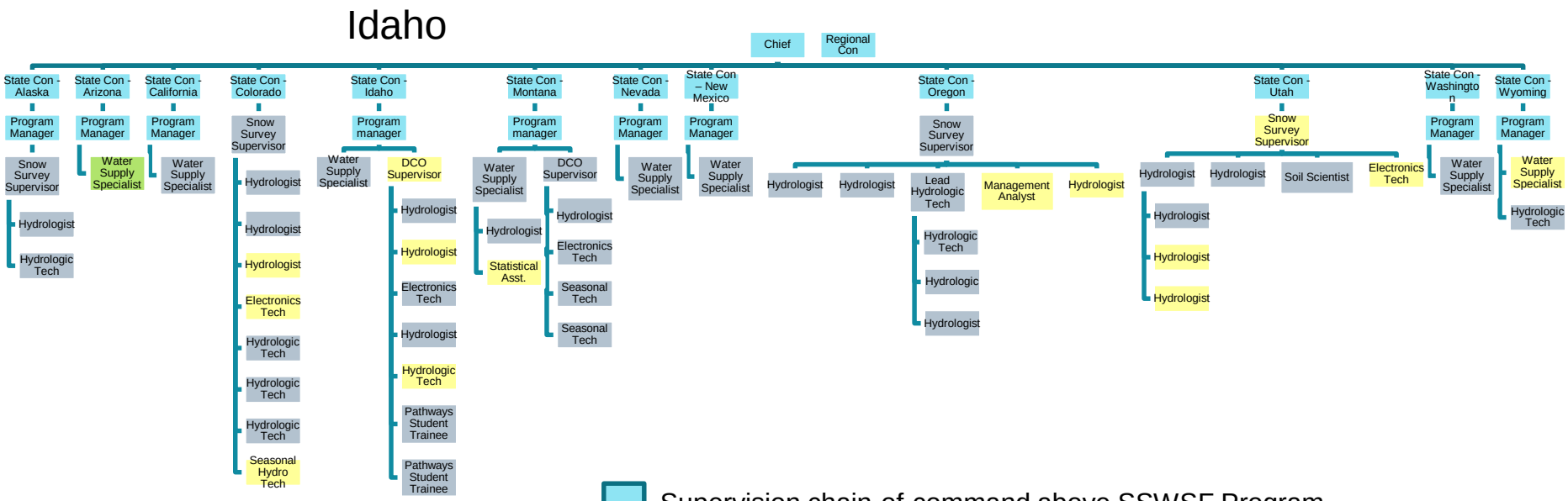
1/18/2018

NWCC
As of Jan. 2018

8 vacancies out of 21 FTEs

Summer 2018
11 vacancies out 21 FTEs

Snow Survey Program State Structure



Supervision chain-of-command above SSWSF Program

Permanent SSWSF Program positions

Permanent SSWSF Program positions presently vacant

Permanent SSWSF Program positions vacant in FY18

West-wide Snow Survey Program
As of Jan. 2018

About 1/3 vacancies of the 71 FTEs

Natural Resources Conservation Service