BUREAU OF RECLAMATION

Sacramento River Temperature Task Group

Thursday, March 26, 2020 1:00 pm – 3:00 pm Conference Call Only:

Join from PC, Mac, Linux, iOS or Android: https://meetings.ringcentral.com/j/5306224350

Or iPhone one-tap :
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Meeting ID: 530 622 4350
International numbers available: https://meetings.ringcentral.com/teleconference

Agenda

1. Introductions
2. Purpose and Objective
3. 2020 Meeting Logistics
4. Long Term Operations Implementation - Update
5. Hydrology Update
6. Operations Update and Forecasts
    a. Storage/Release Management Conditions
    b. Temperature Management
7. River Fish Monitoring: carcass surveys, redd counts, stranding and dewatering surveys and sampling at rotary screw traps
8. Fish Distribution/Forecasts: Estimated percentage of the population upstream of Red Bluff Diversion Dam for steelhead, winter-run and spring-run Chinook salmon, steelhead update and Livingston Stone Hatchery.
9. Seasonal Topics
10. Discussion
11. Review Action Items
12. Next Meeting Scheduling

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF RECLAMATION-CENTRAL VALLEY PROJECT-CALIFORNIA

DAILY CVP WATER SUPPLY REPORT

MARCH 24, 2020

RUN DATE: March 25, 2020

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2019	WY 2020	15 YR MEDIAN
TRINITY	LEWISTON	318	303	303
SACRAMENTO	KESWICK	10,188	4,569	3,798
FEATHER	OROVILLE (SWP)	9,500	1,750	1,750
AMERICAN	NIMBUS	4,887	1,516	1,516
STANISLAUS	GOODWIN	4,504	206	428
SAN JOAQUIN	FRIANT	2,987	0	286

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15 YR AVG	WY 2019	WY 2020	% OF 15 YR AVG
TRINITY	2,448	1,715	1,881	2,000	117
SHASTA	4,552	3,491	3,827	3,567	102
FOLSOM	977	602	681	466	77
NEW MELONES	2,420	1,562	2,025	1,892	121
FED. SAN LUIS	966	724	965	513	71
TOTAL NORTH CVP	11,363	8,094	9,379	8,438	104
MILLERTON	520	306	389	0	0
OROVILLE (SWP)	3,538	2,378	2,724	2,274	96

ACCUMULATED INFLOW FOR WATER YEAR TO DATE IN THOUSANDS OF ACRE-FEET

RESERVOIR	CURRENT WY 2020	WY 1977	WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	218	73	1,155	540	40
SHASTA	1,801	1,341	6,512	2,968	61
FOLSOM	601	188	3,321	1,328	45
NEW MELONES	280	----	1,079	437	64
MILLERTON	331	107	1,514	446	74

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2020	WY 1977	WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	13.98	8.91	47.62	26.16 (58)	53	0.08
SACRAMENTO AT SHASTA DAM	26.14	10.28	96.11	50.93 (63)	51	0.00
AMERICAN AT BLUE CANYON	32.76	14.89	90.03	54.48 (45)	60	1.08
STANISLAUS AT NEW MELONES	17.38	----	40.06	22.60 (42)	77	0.05
SAN JOAQUIN AT HUNTINGTON LK	18.80	10.30	72.00	33.51 (45)	56	0.00

Upper Sacramento River Summary Conditions – March (On-going):

Storage/Release Management Conditions:

- Reservoir Inflow Uncertainty: Shorter term forecasts (8-14 day) suggest a below normal chance of precipitation
- Longer term forecasts (three-month outlook) suggest below normal chance of precipitation
- Dry pattern persisting and March inflows also falling below the 90% inflow exceedance probability estimates
- Current release from Keswick Dam: Current release at 4,500 cfs, Friday, March 27, 2020 increasing to 5,000 cfs for Delta salinity requirements.
- Long-term conservative (hydrology) projections suggest lower Shasta storage volumes

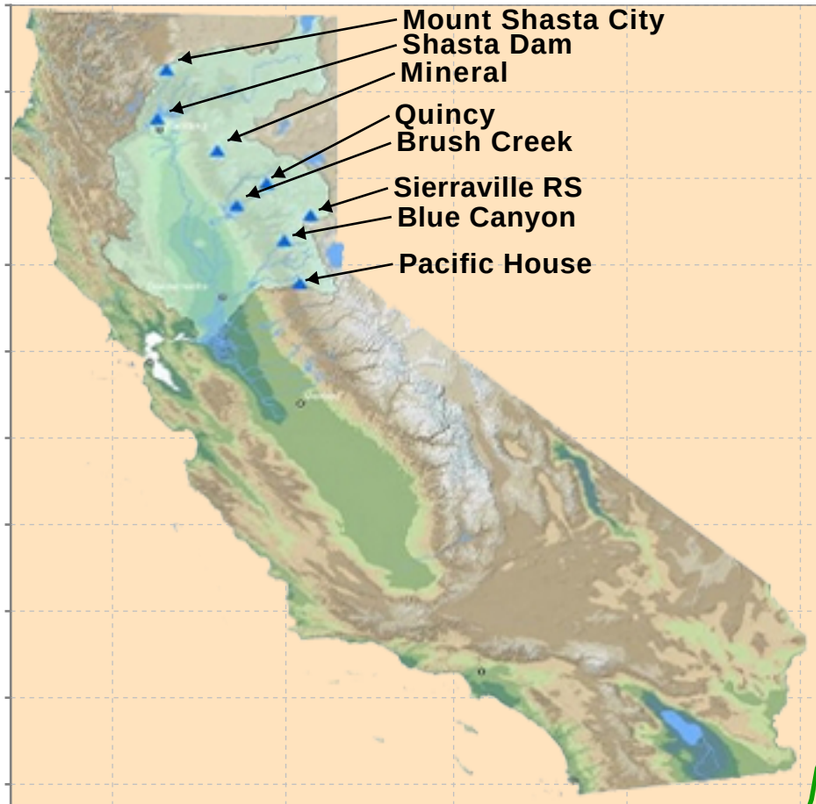
Temperature Management:

- Temperature management: inactive
- Selective withdrawal: Rebuilding cold-water-pool reserves. All Upper and Middle gates open due to storage elevation restrictions. Long term conservative (hydrology) projections suggest not reaching a TCD configuration with only the Top Gates.
- Meteorological Uncertainty: Shorter term forecasts (8-14 day) suggest normal to above normal temperatures
- Longer term forecasts (three-month outlook) suggest above normal chances of warmer temperatures

Resources:

- Reclamation Bay Delta website: https://www.usbr.gov/mp/bdo/lto/index.html
- LTO Proposed Action: https://www.usbr.gov/mp/bdo/docs/ba-chapter-4-proposed-action.pdf
- 2019 Biological Opinions: https://www.usbr.gov/mp/bdo/lto/biop.html
- Excellent link for short term precipitation forecasts, overlay with burn areas, debris flow potential, etc: https://www.cnrfc.noaa.gov/
- Comprehensive Upper Sacramento fishery information: https://www.calfish.org/ProgramsData/ConservationandManagement/CentralValleyMonitoring/CDFWUpperSacRiverBasinSalmonidMonitoring.aspx
- SacPAS: Central Valley Prediction & Assessment of Salmon: http://www.cbr.washington.edu/sacramento/
- Bulletin 120 Forecast Updates: http://cdec.water.ca.gov/b120up.html

Northern Sierra Precipitation: 8-Station Index, March 25, 2020



Percent of Average for this Date: 56%

2016-2017 Daily Precip (wettest) 94.7

1982-1983 (2nd wettest) 88.5

1997-1998 82.4

2018-2019 Daily Precip 70.7

Average (1966-2015) 51.8

2017-2018 Daily Precip 41.0

2014-2015 Daily Precip 37.2

Current: 23.6

1976-1977(2nd driest & driest thru Aug) 19.0

Cumulative Daily/Monthly Precipitation (inches)

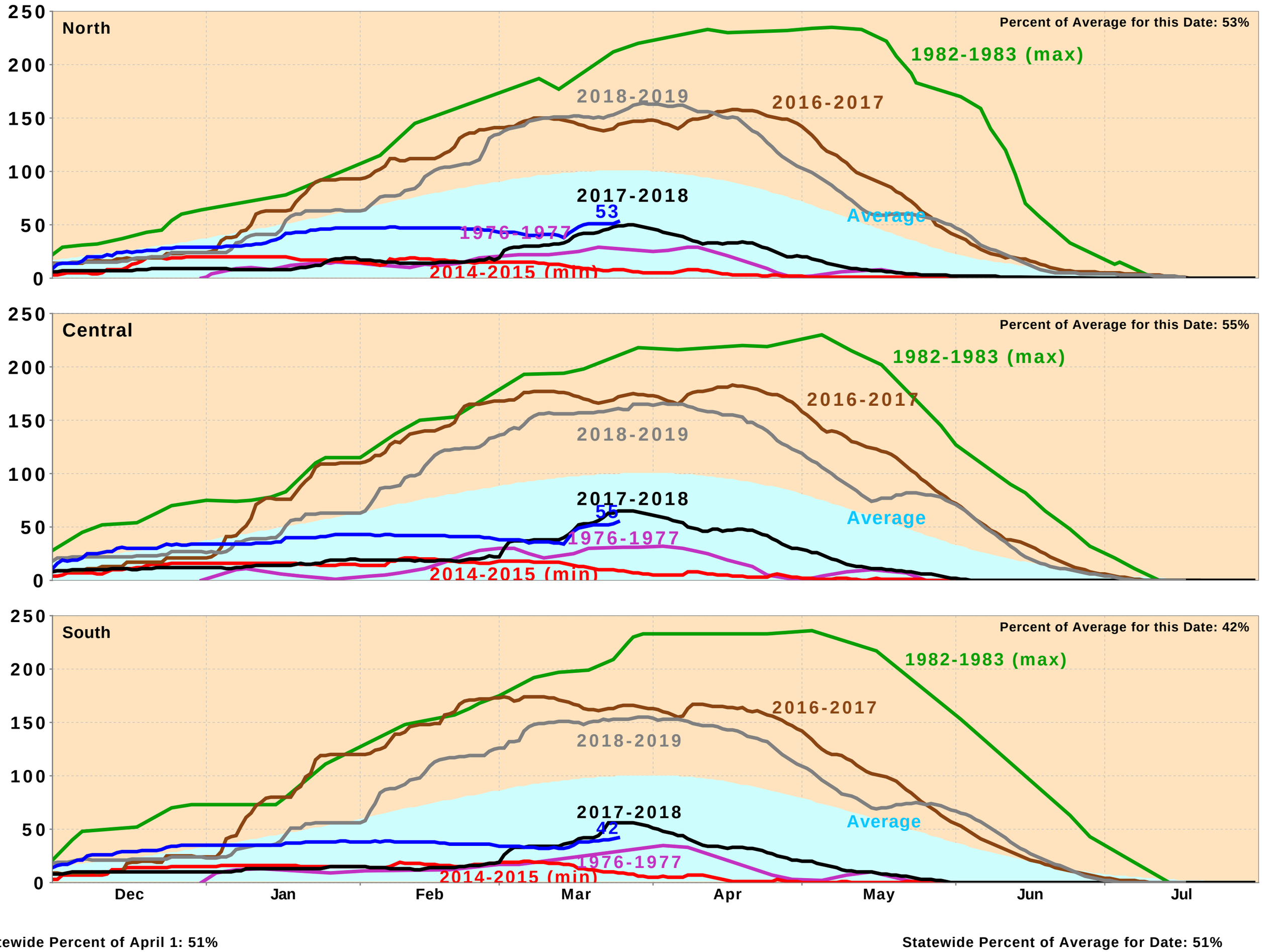
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Oct 1 Nov 1 Dec 1 Jan 1 Feb 1 Mar 1 Apr 1 May 1 Jun 1 Jul 1 Aug 1 Sep 1 Oct 1

Water Year (October 1 - September 30)

Total Water Year Precipitation

California Snow Water Content, March 25, 2020, Percent of April 1 Average



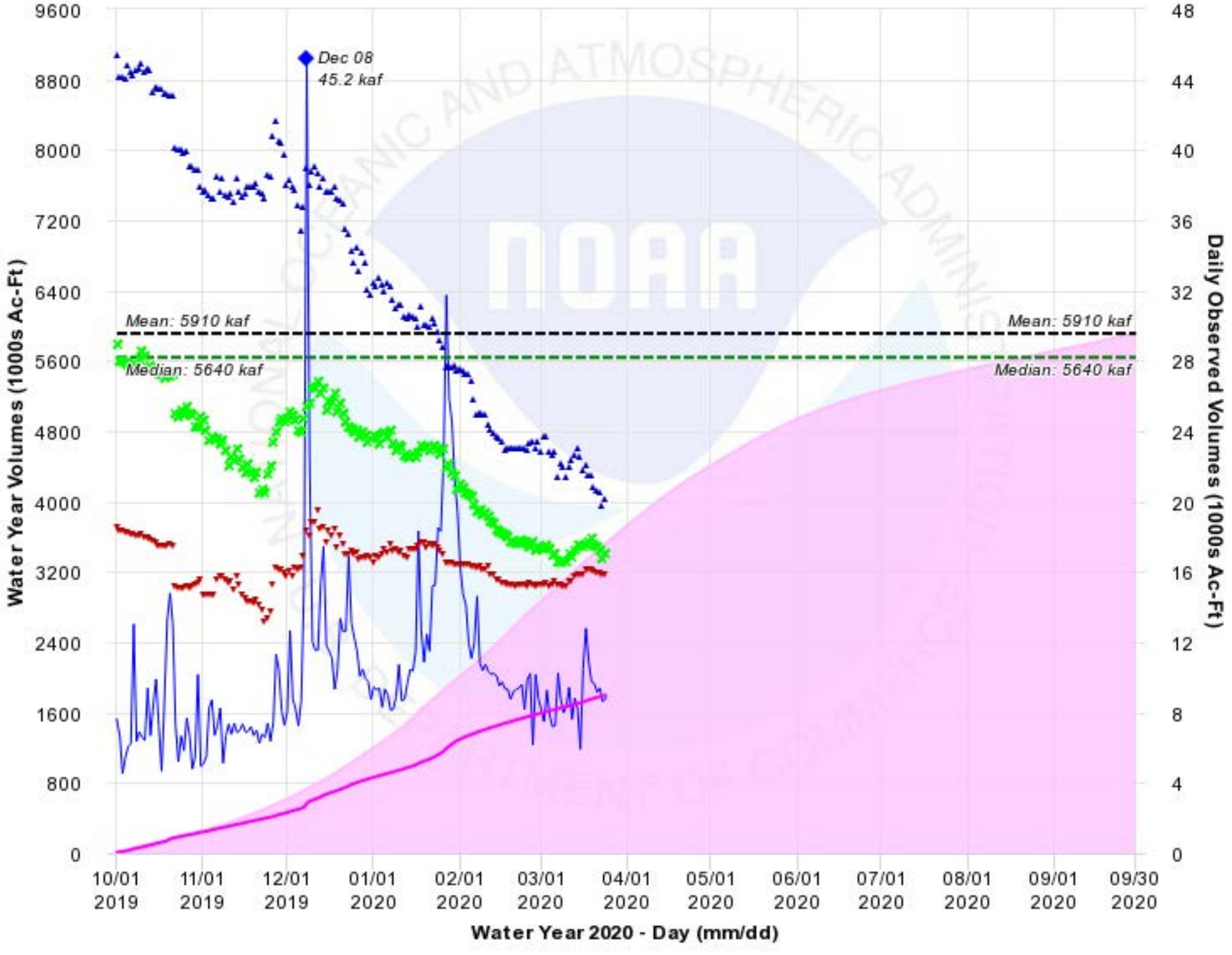
Statewide Percent of April 1: 51%

Statewide Percent of Average for Date: 51%

SACRAMENTO - SHASTA DAM (SHDC1) 03/24/2020

Most Probable: 3400 kaf | 58% of Average | 60% of Median

Created: 03/24/2020 at 09:01 AM PDT



Observed to Date Percent of Average: 51% (1800 kaf) **Water Year to Date Average: 3520 kaf**

Historical Water Year Vol Max: 10800 kaf in 1974 **Historical Water Year Vol Min: 2480 kaf in 1924**

WY Volume Average | WY Volume Median | WY to Date Obs | WY to Date Avg | Daily Obs

Obs Peak | ESP WY Vol Fcst 10% | ESP WY Vol Fcst 25% | ESP WY Vol Fcst 50% | ESP WY Vol Fcst 75%

ESP WY Vol Fcst 90%

CVP Northern System Operation Outlooks: Draft March 2020

90% Runoff Exceedance Outlook

End of Month Storage/Elevation	Mar	Apr	May	Jun	Jul	Aug
Shasta Volume (TAF)	3579	3565	3384	2932	2453	2075
Shasta Elevation (Feet)	1032	1031	1024	1005	982	962

Monthly Average River Release	Mar	Apr	May	Jun	Jul	Aug
Sacramento (CFS)	4800	7300	8500	11900	11500	9750
Clear Creek (CFS)	275	200	200	200	150	150

Trinity Diversions	Mar	Apr	May	Jun	Jul	Aug
Carr Power Plant (TAF)	58	119	96	100	100	101
Spring Creek PP (TAF)	60	90	90	90	90	90

50% Runoff Exceedance Outlook

End of Month Storage/Elevation	Mar	Apr	May	Jun	Jul	Aug
Shasta Volume (TAF)	3579	3717	3602	3169	2611	2190
Shasta Elevation (Feet)	1032	1037	1033	1015	990	968

Monthly Average River Release	Mar	Apr	May	Jun	Jul	Aug
Sacramento (CFS)	4800	6500	8000	12500	13500	11000
Clear Creek (CFS)	200	218	380	288	150	150

Trinity Diversions	Mar	Apr	May	Jun	Jul	Aug
Carr Power Plant (TAF)	36	111	49	101	99	100
Spring Creek PP (TAF)	60	90	40	90	90	90

Notes: Inflow is based on the DWR B120 90% or 50% inflow exceedance Outlook; Historical inflows are used in the month of October and future months.

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.

CVP operational forecasts or outlooks consider general system-wide dynamics and do not necessarily address specific watershed/tributary details.

CVP releases represent monthly averages.

CVP operations are updated monthly as new hydrology information is made available December through May.

Estimated CVP Operations 90% Exceedance
Assumes Shasta Non-Critical, 15% Ag, 65% M, 50% NoD

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Trinity	**2024**	**1991**	**1900**	**1756**	**1615**	**1485**	**1328**	**1173**	**1132**	**1097**	**1079**	**1077**	**1105**
	Elev.	2340	2334	2323	2312	2302	2288	2274	2269	2266	2264	2264	2267
Whiskeytown	**205**	**206**	**238**	**238**	**238**	**238**	**238**	**238**	**206**	**206**	**206**	**206**	**206**
	Elev.	1199	1209	1209	1209	1209	1209	1209	1199	1199	1199	1199	1199
Shasta	**3546**	**3579**	**3565**	**3384**	**2932**	**2453**	**2075**	**1879**	**1781**	**1806**	**1861**	**1973**	**2139**
	Elev.	1032	1031	1024	1005	982	962	950	944	946	949	956	965
Folsom	**447**	**449**	**495**	**492**	**433**	**341**	**271**	**250**	**251**	**255**	**271**	**295**	**345**
	Elev.	410	416	415	408	394	382	378	378	379	382	386	395
New Melones	**1930**	**1891**	**1835**	**1742**	**1650**	**1561**	**1488**	**1443**	**1406**	**1407**	**1411**	**1415**	**1415**
	Elev.	1042	1037	1028	1019	1010	1002	997	993	993	993	994	994
San Luis	**290**	**338**	**285**	**151**	**-26**	**-192**	**-230**	**-145**	**-81**	**-81**	**2**	**198**	**176**
	Elev.	473	463	442	415	382	367	376	391	408	438	466	453
Total		8454	8318	7762	6842	5887	5170	4838	4694	4690	4830	5165	5385

Monthly River Releases (TAF/cfs)

Trinity	TAF	18	36	92	47	28	53	52	23	18	18	18	17
	cfs	**300**	**600**	**1,498**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**	**300**
Clear Creek	TAF	17	12	12	12	9	9	9	12	12	12	12	11
	cfs	**275**	**200**	**200**	**200**	**150**	**150**	**150**	**200**	**200**	**200**	**200**	**200**
Sacramento	TAF	295	434	523	708	707	599	416	338	223	215	215	222
	cfs	**4800**	**7300**	**8500**	**11900**	**11500**	**9750**	**7000**	**5500**	**3750**	**3500**	**3500**	**4000**
American	TAF	92	84	86	107	136	111	60	40	39	40	40	56
	cfs	**1500**	**1413**	**1406**	**1800**	**2210**	**1808**	**1010**	**658**	**654**	**650**	**650**	**1000**
Stanislaus	TAF	37	29	25	9	9	9	9	35	12	12	13	12
	cfs	**600**	**480**	**410**	**150**	**150**	**150**	**150**	**577**	**200**	**200**	**213**	**214**

Trinity Diversions (TAF)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Carr PP	58	119	96	100	100	101	100	24	30	21	15	10
Spring Crk. PP	**60**	**90**	**90**	**90**	**90**	**90**	**90**	**45**	**20**	**12**	**10**	**10**

Delta Summary (TAF)

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Tracy		147	57	46	78	107	199	255	190	54	117	230	45
USBR Banks		0	0	0	0	7	7	7	0	0	0	0	0
Contra Costa		3.4	3.8	4.2	5.1	5.6	5.5	4.2	4.2	3.8	3.8	3.8	3.0
Total USBR		150	60	50	83	120	212	266	194	58	121	234	48
COA Balance		0	6	-56	0	0	0	16	0	0	-1	-1	-1
Vernalis	TAF	82	88	87	40	42	37	43	104	83	83	92	82
Vernalis	cfs	1332	1480	1410	671	687	605	722	1700	1393	1355	1498	1475
Old/Middle River Std.													
Old/Middle R. calc.		-3,114	-1,017	-817	-2,218	-2,305	-3,744	-4,488	-3,536	-2,757	-3,949	-4,849	-952
Computed DOI		7938	7682	7597	6152	4994	3497	3009	4002	4505	4506	6474	11599
Excess Outflow		0	0	0	0	0	0	0	0	0	0	1968	198
% Export/Inflow		34%	13%	10%	21%	22%	37%	49%	46%	41%	54%	53%	10%
% Export/Inflow std.		35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%	45%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	380		3,088		1,065		510	
Year to Date + Forecasted % of mean	31%		56%		39%		48%	

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3/25/2020

Estimated CVP Operations 50% Exceedance

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Trinity	**2024**	**2011**	**1981**	**1930**	**1800**	**1675**	**1521**	**1369**	**1334**	**1321**	**1351**	**1406**	**1516**
	Elev.	2342	2340	2336	2327	2317	2305	2292	2289	2288	2290	2295	2305
Whiskeytown	**205**	**206**	**238**	**238**	**238**	**238**	**238**	**238**	**206**	**206**	**206**	**206**	**206**
	Elev.	1199	1209	1209	1209	1209	1209	1209	1199	1199	1199	1199	1199
Shasta	**3546**	**3579**	**3717**	**3602**	**3169**	**2611**	**2190**	**2034**	**1945**	**2024**	**2169**	**2530**	**3070**
	Elev.	1032	1037	1033	1015	990	968	959	954	959	967	986	1011
Folsom	**447**	**429**	**495**	**535**	**510**	**373**	**333**	**296**	**279**	**280**	**318**	**377**	**556**
	Elev.	407	416	421	418	399	393	386	383	384	390	400	423
New Melones	**1930**	**1898**	**1860**	**1797**	**1713**	**1627**	**1557**	**1516**	**1488**	**1505**	**1529**	**1562**	**1617**
	Elev.	1043	1039	1033	1025	1016	1009	1005	1002	1004	1006	1010	1015
San Luis	**290**	**351**	**298**	**163**	**-46**	**-59**	**-36**	**55**	**194**	**390**	**611**	**812**	**965**
	Elev.	473	463	434	387	365	347	355	390	422	457	484	502
Total		8474	8589	8265	7384	6466	5804	5507	5445	5725	6184	6893	7929

Monthly River Releases (TAF/cfs)

Trinity	TAF	18	36	92	47	28	53	52	23	18	18	18	17
	cfs	**300**	**600**	**1,498**	**783**	**450**	**857**	**870**	**373**	**300**	**300**	**300**	**300**
Clear Creek	TAF	12	13	23	17	9	9	9	12	12	12	25	11
	cfs	**200**	**218**	**380**	**288**	**150**	**150**	**150**	**200**	**200**	**200**	**400**	**200**
Sacramento	TAF	295	387	492	744	830	676	416	369	238	246	246	222
	cfs	**4800**	**6500**	**8000**	**12500**	**13500**	**11000**	**7000**	**6000**	**4000**	**4000**	**4000**	**4000**
American	TAF	98	89	101	89	187	92	89	92	89	74	92	83
	cfs	**1600**	**1500**	**1644**	**1501**	**3042**	**1500**	**1500**	**1504**	**1500**	**1200**	**1500**	**1500**
Stanislaus	TAF	31	29	25	9	9	9	9	35	12	12	13	12
	cfs	**500**	**480**	**410**	**150**	**150**	**150**	**150**	**577**	**200**	**200**	**213**	**214**

Trinity Diversions (TAF)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Carr PP	36	111	49	101	99	100	99	23	25	9	10	2
Spring Crk. PP	**60**	**90**	**40**	**90**	**90**	**90**	**90**	**45**	**20**	**12**	**19.8**	**35**

Delta Summary (TAF)

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Tracy		160	56	46	45	260	260	260	265	250	255	235	220
USBR Banks		0	0	0	0	7	7	7	0	0	0	0	0
Contra Costa		12.7	12.7	12.7	9.8	11.1	12.7	14.0	16.8	18.4	18.3	14.0	14.0
Total USBR		173	69	59	55	278	280	281	282	268	273	249	234
COA Balance		0	-10	-74	4	56	56	56	90	19	19	19	19
Vernalis	TAF	76	118	124	56	48	46	51	104	83	83	92	111
Vernalis	cfs	1232	1980	2010	940	784	752	856	1700	1393	1355	1498	1997
Old/Middle River Std.													
Old/Middle R. calc.	cfs	-3,201	-1,203	-653	-1,135	-4,610	-4,582	-5,214	-6,311	-5,689	-6,097	-5,039	-5,016
Computed DOI		7938	8253	7597	7346	4994	3595	3110	4002	4505	8296	15259	19505
Excess Outflow		0	0	0	0	0	98	101	0	0	3790	10753	8105
% Export/Inflow		33%	15%	10%	9%	37%	42%	52%	59%	57%	48%	31%	26%
% Export/Inflow std.		35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%	45%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	499		3,453		1,227		577	
Year to Date + Forecasted % of mean	41%		62%		45%		55%	

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3/25/2020

Northern CVP Water Temperature Report

March - 2020

Page	Description
1	- Mean Daily Water Temperature, Release Flow Rates and Air Temperatures with Monthly Averages
2	- Redding 10-Day Forecasted Air Temperatures
3	- Sacramento River Mean Daily Water Temperature, Air Temperature and 10-Day Forecasted Air Temperature Plot - Water Temperature Measuring Station Details - Temperature Control Point Details
4	- Shasta Lake Isothermobaths Plot
5	- Trinity Lake Isothermobaths Plot
6	- Whiskeytown Lake Isothermobaths Plot
x	- TCD Configuration (External Link)

DATE	Mean Daily Water Temperatures (°F)													Mean Daily Release (CFS)			Mean Daily Air Temperatures (°F)			
	TCD[1]	SHD	SPP[1]	KWK	SAC	CCR	BSF[2]	JLF	BND	RDB	IGO	LWS	-----	Shasta Generation	Spring Creek P.P.	Keswick Total	RDD	BSF	RDB	LWS
Feb	49.9	49.0	48.1	49.2	49.5	49.7	49.8	50.1	50.3	50.2	47.4	44.2	-	4032	55	4372	53.8	50.8	53.4	-
03/01	50.4	? 49.0	# -	49.0	49.2	49.3	**49.7**	50.0	50.3	50.2	48.1	46.3	-	4691	1	5508	54.0	52.6	53.6	-
03/02	51.1	? 49.2	# -	48.9	49.2	49.5	**49.7**	50.0	50.2	50.0	48.4	46.3	-	5131	0	5507	60.0	57.4	59.2	-
03/03	49.9	? 49.2	# -	49.6	49.9	50.4	? **51.0**	51.7	52.0	51.7	49.2	47.1	-	5052	1	5498	68.0	63.4	65.5	-
03/04	49.8	? 48.9	# -	49.8	50.2	50.8	**51.6**	52.4	52.8	53.1	49.4	47.5	-	5587	0	5507	↑ 65.0	59.3	61.5	-
03/05	49.9	? 48.8	# -	49.7	50.1	50.6	**51.5**	52.4	52.8	53.4	49.2	47.4	-	5304	0	5479	57.5	55.0	57.4	-
03/06	# -	? 48.8	# -	49.5	49.9	50.3	**51.1**	52.1	52.6	53.2	48.9	47.9	-	5041	0	5315	53.0	52.5	54.0	-
03/07	# -	? 48.6	# -	49.3	49.5	49.7	**50.5**	51.3	51.7	52.1	48.7	48.2	-	4935	0	5147	50.5	49.4	49.9	-
03/08	# -	48.6	# -	49.1	49.5	49.8	**50.3**	51.0	51.3	51.5	? 48.7	47.7	-	4853	0	5027	51.0	50.0	50.7	-
03/09	# -	48.7	# -	49.0	49.5	50.0	**50.5**	51.3	51.6	52.0	48.9	48.5	-	4695	0	5009	52.5	51.0	53.2	-
03/10	# -	48.8	# -	49.3	49.7	50.3	**50.9**	51.8	52.1	52.6	49.2	48.3	-	4727	0	5009	59.5	54.6	58.5	-
03/11	# -	48.7	# -	49.4	49.9	50.6	**51.6**	52.6	53.0	53.4	49.4	48.6	-	4957	0	5005	58.5	56.3	58.8	-
03/12	# -	48.7	# -	49.8	50.3	50.8	**51.8**	52.8	53.3	53.9	49.5	49.0	-	3958	20	4827	62.5	60.2	63.0	-
03/13	# -	48.6	48.4	49.5	50.1	50.9	**52.0**	53.1	53.5	54.0	49.4	48.8	-	3943	391	4659	63.0	58.0	60.0	-
03/14	# -	48.5	48.8	49.5	49.7	49.9	**50.9**	51.8	52.4	53.1	? 48.8	48.5	-	3676	1000	4549	49.0	50.3	51.2	-
03/15	# -	48.4	48.5	49.1	49.3	49.3	**49.7**	50.2	50.3	50.5	47.7	47.5	-	2660	1887	4570	45.0	44.5	45.9	-
03/16	# -	48.6	48.6	48.7	49.0	49.1	**49.1**	49.5	49.7	49.9	48.4	47.1	-	3293	1670	4596	47.0	44.5	45.8	-
03/17	# -	48.7	48.6	48.5	48.6	48.4	**48.5**	49.2	49.5	49.5	? 47.8	45.5	-	2205	1676	4597	41.5	41.8	43.5	-
03/18	# -	48.4	48.4	48.5	48.7	48.6	**47.6**	47.9	48.0	48.2	48.2	46.5	-	3039	1124	4564	45.0	44.2	45.0	-
03/19	# -	48.6	48.8	48.8	49.2	49.5	**49.0**	49.3	49.3	49.0	48.7	47.1	-	2857	1332	4564	↓ 46.5	45.4	46.9	-
03/20	# -	48.7	48.7	49.0	49.4	50.0	**50.5**	51.2	51.5	51.5	49.0	46.9	-	2500	1643	4569	52.0	50.1	51.5	-
03/21	# -	48.7	48.6	49.3	49.8	50.4	**51.1**	52.0	52.3	52.7	49.3	47.2	-	2619	1370	4565	54.0	52.6	54.3	-
03/22	# -	? 48.8	48.6	49.4	50.0	50.7	**51.9**	52.9	53.2	53.7	49.6	48.0	-	2352	1927	4563	56.0	54.2	56.2	-
03/23	# -	? 48.4	48.5	49.4	49.8	50.2	**51.5**	52.8	53.5	54.0	49.3	48.1	-	2811	1901	4574	53.0	52.7	53.2	-
03/24	# -	48.5	48.8	49.3	49.6	49.8	**50.4**	51.0	51.5	52.2	49.2	47.7	-	3393	1963	4569	47.0	48.2	49.0	-
03/25																				
03/26																				
03/27																				
03/28																				
03/29																				
03/30																				
03/31																				
Mar	50.2	48.7	48.6	49.2	49.6	49.9	50.5	51.3	51.6	51.9	48.9	47.6	-	3928	746	4907	53.8	52.0	53.7	-
												Total CFS		94279	17906	117777				
												Total AF		186999	35516	233606				

Legend

? = 1-9 hours of data missing (Average includes estimations)
! = 10 or more hours of data missing (Average not calculated)
= Station out of service
↑ = Record high air temperature
↓ = Record low air temperature
= Monthly Averages

Notes

[1] Temperatures are weighted averages based on individual penstock flow and temperature
Highlighted cells in the TCD column indicate a TCD change was made on that day
[2] Current control point (see page 3 for more details)
[3] Column not used this month

DATE	Redding (RDD) Daily Air Temperatures (°F)																																						
	Actual			Forecasted																																					
	Previous Day			Current Day			1 Day			2 Days			3 Days			4 Days			5 Days			6 Days			7 Days			8 Days			9 Days			10 Days					
	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg	↓	↑	Avg			
03/01	36	64	50.0	48	61	54.5	38	71	54.5	45	78	61.5	42	75	58.5	43	75	59.0	42	67	54.5	41	62	51.5	39	65	52.0	38	70	54.0	42	71	56.5	43	69	56.0			
03/02	46	62	54.0	46	72	59.0	44	79	61.5	43	77	60.0	44	73	58.5	45	66	55.5	41	60	50.5	38	61	49.5	41	66	53.5	42	72	57.0	47	68	57.5	46	66	56.0			
03/03	46	74	60.0	56	80	68.0	45	78	61.5	44	74	59.0	43	65	54.0	43	58	50.5	37	60	48.5	39	63	51.0	40	70	55.0	46	74	60.0	45	68	56.5	46	63	54.5			
03/04	54	82	68.0	50	79	64.5	44	76	60.0	41	66	53.5	40	59	49.5	36	60	48.0	38	64	51.0	41	70	55.5	40	71	55.5	44	69	56.5	45	63	54.0	44	63	53.5			
03/05	49	**81**	65.0	41	75	58.0	44	65	54.5	40	57	48.5	36	59	47.5	39	64	51.5	38	71	54.5	43	73	58.0	45	69	57.0	40	59	49.5	40	60	50.0	39	66	52.5			
03/06	41	74	57.5	44	66	55.0	41	57	49.0	37	58	47.5	39	64	51.5	39	73	56.0	43	74	58.5	44	75	59.5	44	68	56.0	39	70	54.5	48	72	60.0	46	72	59.0			
03/07	43	63	53.0	46	57	51.5	38	57	47.5	40	60	50.0	39	74	56.5	43	74	58.5	43	78	60.5	44	73	58.5	47	72	59.5	45	75	60.0	48	74	61.0	48	72	60.0			
03/08	46	55	50.5	46	58	52.0	41	62	51.5	39	74	56.5	42	75	58.5	44	81	62.5	46	76	61.0	43	64	53.5	48	68	58.0	47	63	55.0	42	63	52.5	40	69	54.5			
03/09	45	57	51.0	41	64	52.5	39	75	57.0	43	75	59.0	42	79	60.5	41	75	58.0	43	62	52.5	38	61	49.5	47	72	59.5	46	75	60.5	43	71	57.0	45	73	59.0			
03/10	40	65	52.5	44	76	60.0	42	75	58.5	42	80	61.0	41	77	59.0	40	60	50.0	35	57	46.0	34	60	47.0	42	65	53.5	40	70	55.0	43	69	56.0	45	71	58.0			
03/11	42	77	59.5	47	74	60.5	43	79	61.0	42	71	56.5	41	56	48.5	41	55	48.0	34	60	47.0	33	59	46.0	42	65	53.5	39	68	53.5	44	71	57.5	45	70	57.5			
03/12	44	73	58.5	44	80	62.0	45	73	59.0	37	56	46.5	37	55	46.0	35	56	45.5	36	60	48.0	37	57	47.0	44	63	53.5	45	64	54.5	45	66	55.5	44	69	56.5			
03/13	44	81	62.5	59	73	66.0	38	56	47.0	35	54	44.5	37	55	46.0	38	57	47.5	39	57	48.0	38	60	49.0	40	66	53.0	42	69	55.5	47	69	58.0	46	72	59.0			
03/14	54	72	63.0	45	57	51.0	36	53	44.5	32	57	44.5	37	56	46.5	38	58	48.0	39	61	50.0	40	64	52.0	43	62	52.5	45	71	58.0	47	69	58.0	45	65	55.0			
03/15	41	57	49.0	43	52	47.5	33	55	44.0	37	50	43.5	38	57	47.5	37	60	48.5	39	62	50.5	41	63	52.0	44	62	53.0	45	59	52.0	41	64	52.5	42	68	55.0			
03/16	39	51	45.0	39	54	46.5	36	49	42.5	37	57	47.0	35	62	48.5	37	62	49.5	39	64	51.5	40	62	51.0	41	60	50.5	42	63	52.5	43	67	55.0	43	67	55.0			
03/17	39	55	47.0	39	48	43.5	38	56	47.0	33	62	47.5	35	62	48.5	38	65	51.5	40	66	53.0	43	62	52.5	42	60	51.0	44	61	52.5	43	65	54.0	44	65	54.5			
03/18	39	44	41.5	40	55	47.5	31	62	46.5	36	65	50.5	37	70	53.5	40	69	54.5	43	62	52.5	43	60	51.5	41	62	51.5	43	64	53.5	44	63	53.5	44	64	54.0			
03/19	37	53	45.0	32	63	47.5	34	66	50.0	37	71	54.0	40	72	56.0	44	62	53.0	42	57	49.5	39	61	50.0	43	64	53.5	42	62	52.0	47	67	57.0	45	74	59.5			
03/20	**31**	62	46.5	38	66	52.0	36	71	53.5	39	72	55.5	44	63	53.5	40	56	48.0	38	57	47.5	35	62	48.5	43	60	51.5	45	61	53.0	49	67	58.0	46	65	55.5			
03/21	37	67	52.0	38	70	54.0	39	70	54.5	43	64	53.5	39	56	47.5	36	57	46.5	34	63	48.5	38	61	49.5	42	65	53.5	49	71	60.0	46	71	58.5	45	68	56.5			
03/22	37	71	54.0	38	72	55.0	41	64	52.5	39	55	47.0	36	57	46.5	34	63	48.5	36	62	49.0	40	66	53.0	43	70	56.5	48	73	60.5	47	73	60.0	47	76	61.5			
03/23	40	72	56.0	43	65	54.0	39	56	47.5	35	57	46.0	32	63	47.5	35	62	48.5	41	64	52.5	41	70	55.5	46	73	59.5	51	75	63.0	51	75	63.0	48	77	62.5			
03/24	42	64	53.0	45	55	50.0	34	56	45.0	33	63	48.0	35	62	48.5	41	61	51.0	42	67	54.5	43	72	57.5	46	72	59.0	49	67	58.0	47	66	56.5	44	67	55.5			
03/25	40	54	47.0	37	55	46.0	31	61	46.0	34	62	48.0	41	53	47.0	43	63	53.0	43	68	55.5	44	74	59.0	48	76	62.0	53	72	62.5	52	76	64.0	50	75	62.5			
03/26																																							
03/27																																							
03/28																																							
03/29																																							
03/30																																							
03/31																																							

Web Links

[10-Day Min/Max Forecast]

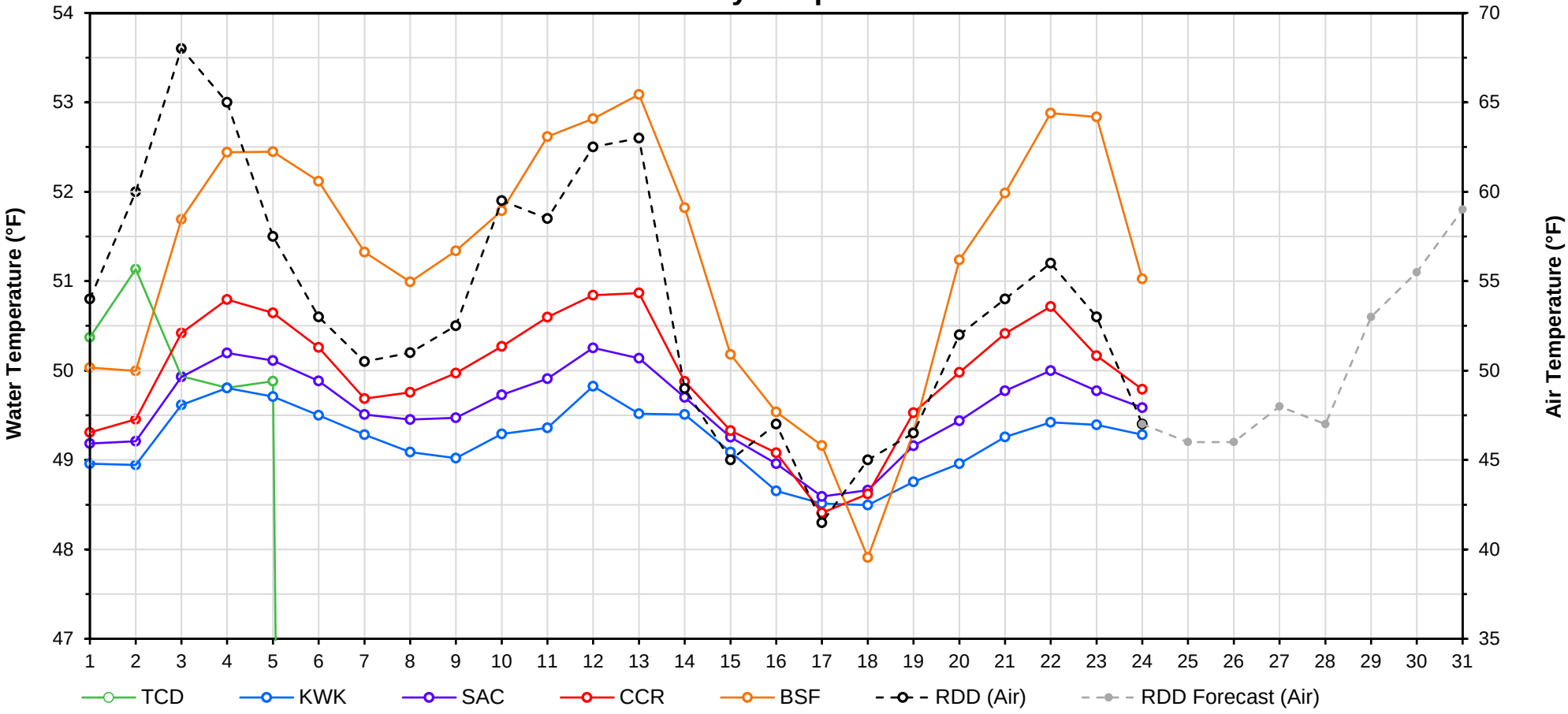
[Previous Days Min/Max Actuals]

Legend

NR = Forecasted temperatures not recorded

100 = Previous day actual temperatures in red and bolded indicate a record temperature for that date

Mean Daily Temperatures



Station Details			
Code	Body of Water	Location[1]	CDEC Link
TCD	N/A	Shasta Power Plant	N/A
SHD	Sacramento River	0.3 miles downstream of Shasta Power Plant	Click Here
SPP	N/A	Spring Creek Power Plant	N/A
KWK	Sacramento River	0.8 miles downstream of Keswick Dam	Click Here
SAC	Sacramento River	4.8 miles downstream of Keswick Dam	Click Here
CCR	Sacramento River	9.7 miles downstream of Keswick Dam	Click Here
BSF	Sacramento River	25 miles downstream of Keswick Dam	Click Here
JLF	Sacramento River	34 miles downstream of Keswick Dam	Click Here
BND	Sacramento River	41 miles downstream of Keswick Dam	Click Here
RDB	Sacramento River	58 miles downstream of Keswick Dam	Click Here
IGO	Clear Creek	7.3 miles downstream of Whiskeytown Dam	Click Here
LWS	Trinity River	1.1 miles downstream of Lewiston Dam	Click Here
DGC[2]	Trinity River	19 miles downstream of Lewiston Dam	Click Here
NFH[3]	Trinity River	38 miles downstream of Lewiston Dam	Click Here

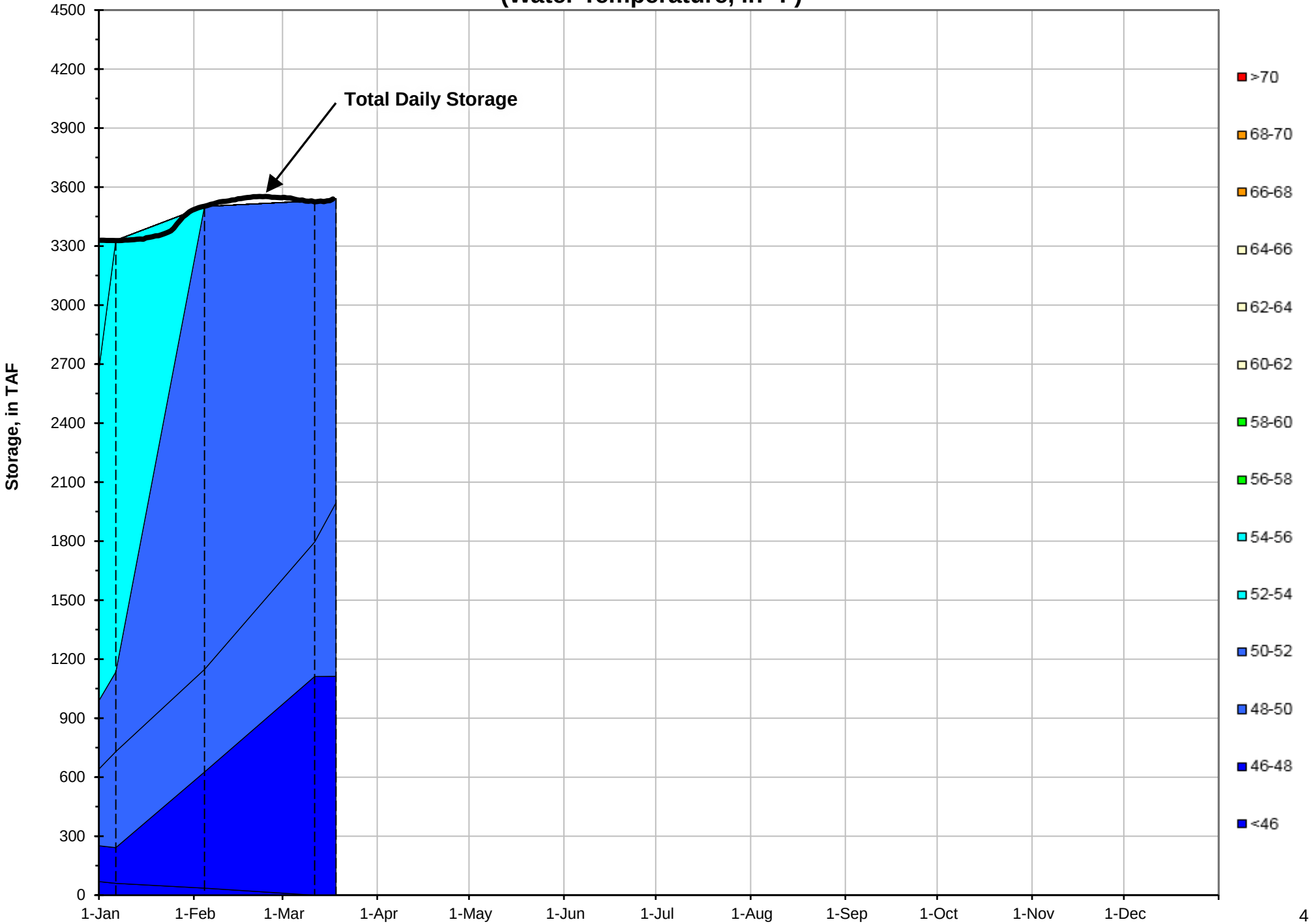
Temperature Control Point		
Point	Temp. (°F)	Begin Date
BSF	**56.0**	**5/25/2018**

Notes

[1] Distances are approximate
[2] DGC is only reported in September
[3] NFH is only reported in October, November and December

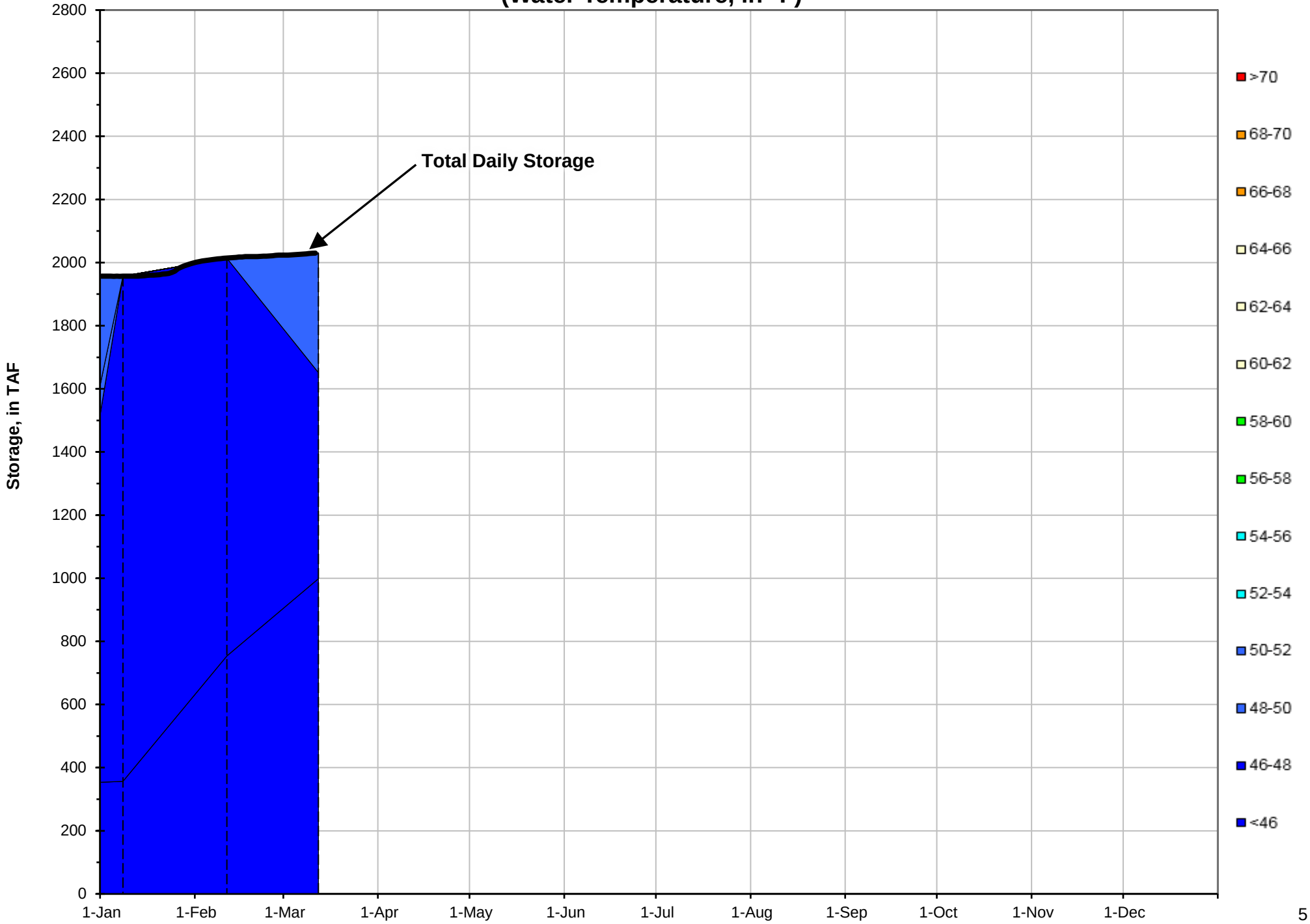
Latest Profile Date: 03/18/2020

Shasta Lake Isothermobaths - 2020
(Water Temperature, in °F)



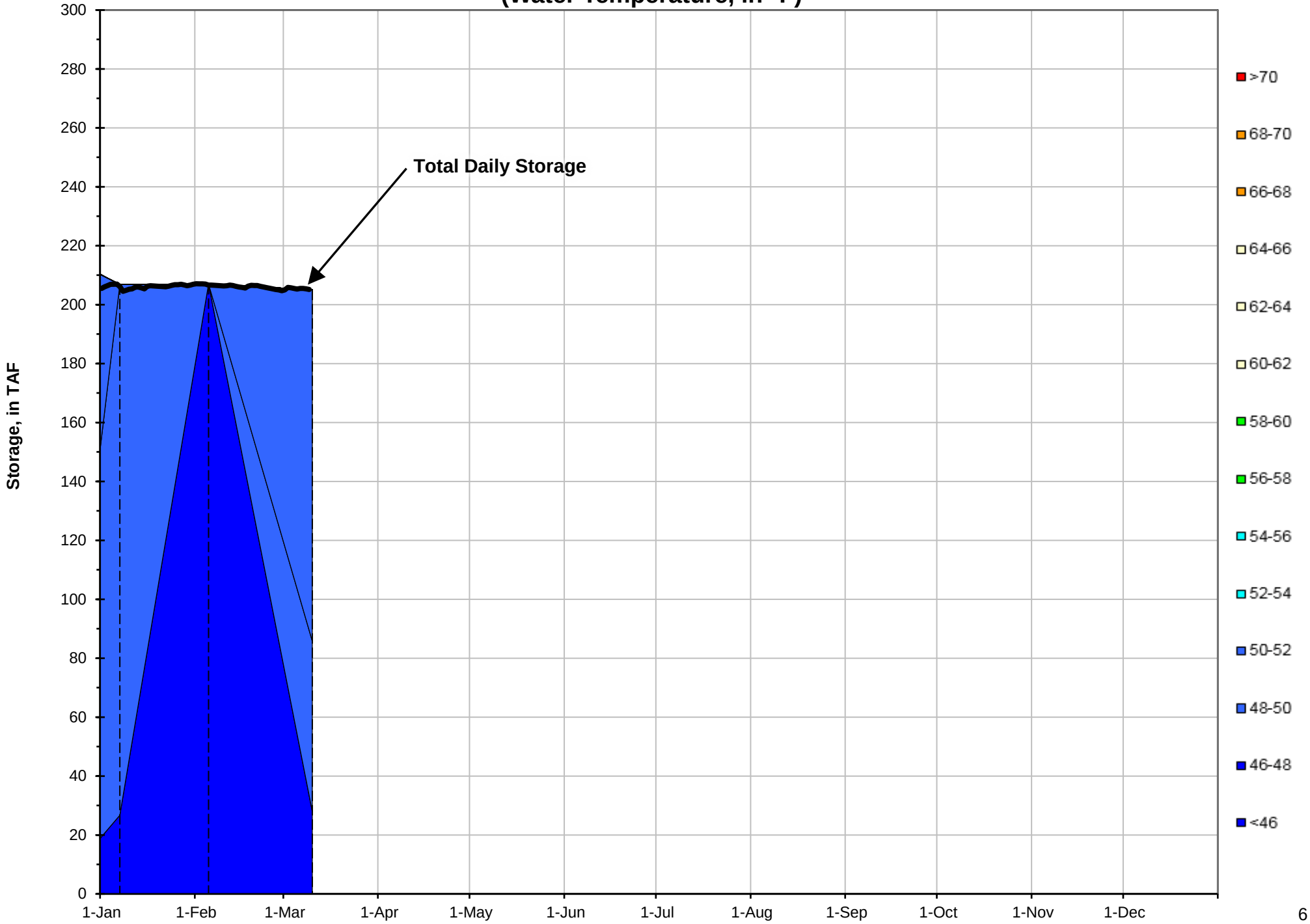
Latest Profile Date: 03/12/2020

Trinity Lake Isothermobaths - 2020
(Water Temperature, in °F)



Latest Profile Date: 03/10/2020

Whiskeytown Lake Isothermobaths - 2020
(Water Temperature, in °F)

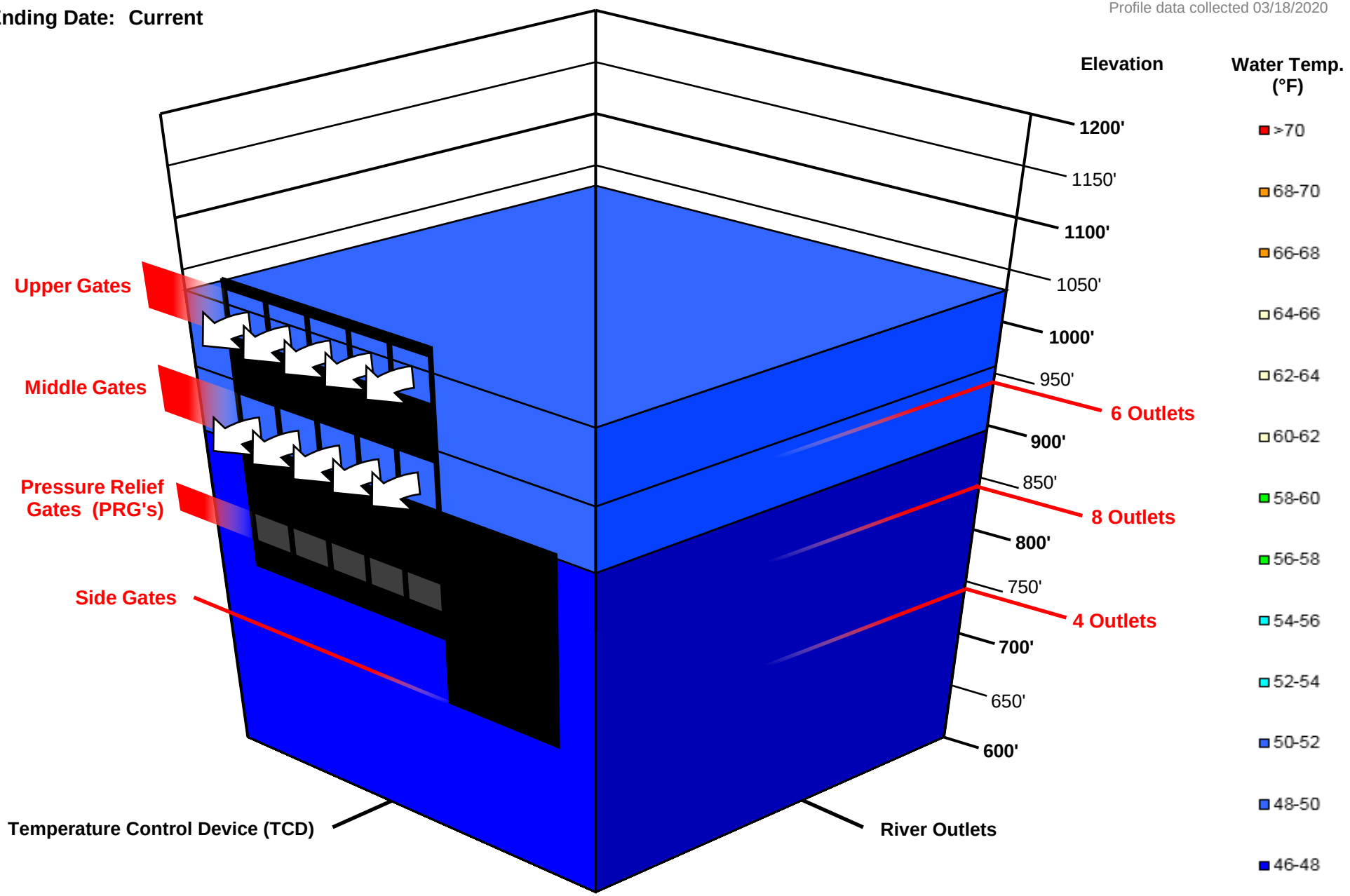


Shasta TCD Configuration

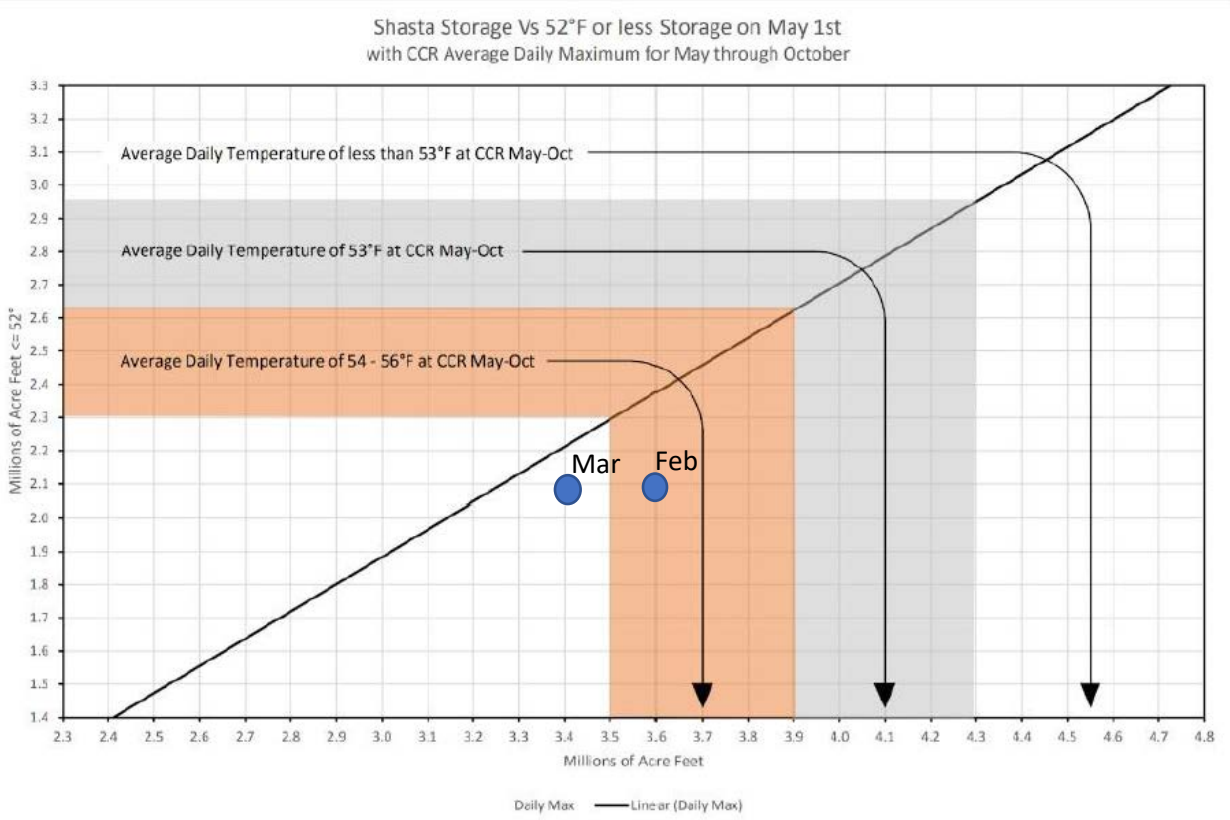
Starting Date: 12/19/2019

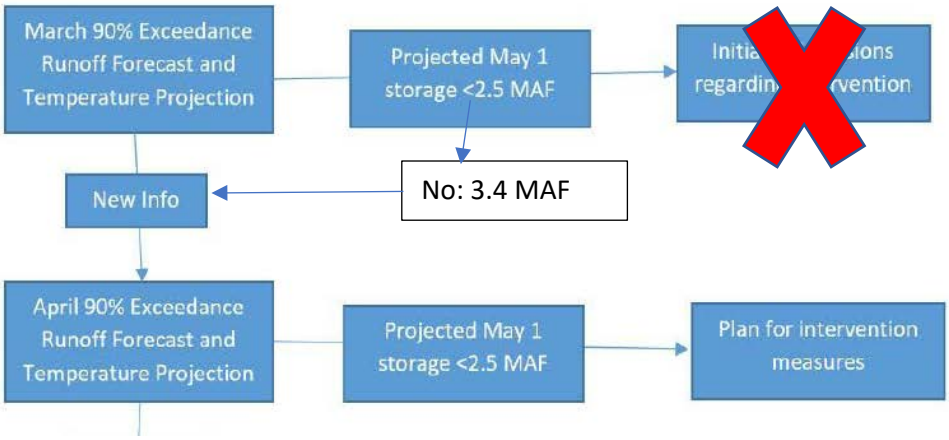
Ending Date: Current

Profile data collected 03/18/2020



Arrows indicate open Gate or Outlet (i.e. Water flowing from this location)


Shasta Storage Vs 52°F or less Storage on May 1st
with CCR Average Daily Maximum for May through October
Average Daily Temperature of less than 53°F at CCR May-Oct
Average Daily Temperature of 53°F at CCR May-Oct
Average Daily Temperature of 54 - 56°F at CCR May-Oct
Mar
Feb
Millions of Acre Feet <= 52°
Millions of Acre Feet
Daily Max
Linear (Daily Max)


March 90% Exceedance Runoff Forecast and Temperature Projection
Projected May 1 storage <2.5 MAF
No: 3.4 MAF
New Info
April 90% Exceedance Runoff Forecast and Temperature Projection
Projected May 1 storage <2.5 MAF
Plan for intervention measures

March 20, 2020

Upper Sacramento River – March 2020 Preliminary Temperature Analysis

Summary of Temperature Results by Month (Monthly Average Temperature °F)

Model Run	Location	Apr	May	Jun	Jul	Aug	Sep*	Oct*
90% Hydrology 25% Historical Meteorology Targeting CCR at 53.5°F	Keswick Dam KWK	51.0	52.4	53.0	52.9	53.5	See Fig. 3	See Fig. 3
	Sac. R. abv Clear Creek CCR	51.3	52.9	53.4	53.4	53.9	See Fig. 4	See Fig. 4
	Airport Road	51.8	53.5	54.0	54.0	54.5	n/a	n/a
	Balls Ferry BSF	53.2	55.0	55.1	55.1	55.5	See Fig. 5	See Fig. 5
90% Hydrology 25% Historical Meteorology Targeting CCR at 56°F	Keswick Dam KWK	51.0	52.6	54.7	55.6	55.4	See Fig. 3	See Fig. 3
	Sac. R. abv Clear Creek CCR	51.3	53.1	55.0	56.0	55.7	See Fig. 4	See Fig. 4
	Airport Road	51.8	53.7	55.5	56.5	56.3	n/a	n/a
	Balls Ferry BSF	53.2	55.2	56.5	57.5	57.3	See Fig. 5	See Fig. 5

Summary of Shasta Lake Cold Water Pool and TCD Operation

Model Run	End of September Cold Water Pool <56°F (TAF)	First Side Gate Use (Date)	Full Side Gate Use (Date)
90%Hydro. - 25%Hist. Met. CCR at 53.5°F	141	7/20	8/12
90%Hydro. - 25%Hist. Met. CCR at 56°F	414	9/8	10/30

Model Run Date March 19, 2020

* The HEC5Q model output is displayed for the months April through August. Based on past analysis, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates.

For the months of September and October, ranges in possible outcomes are illustrated with the Fall Temperature Index (graphics above Figures 6-8). This relationship is an end of September Lake Shasta Volume less than 56°F and likely downstream temperature performance for the early fall months. Estimated temperatures for September and October may fall into a range indicated within the Fall Temperature Index (graphical chart), illustrating historical performance. However, this range should be viewed as an element of uncertainty based on past performance, not a simulation or projection of temperature management operations or results.

Temperature Analysis Results:

Modeling runs explore Sacramento River compliance performance above Clear Creek confluence and Balls Ferry locations by varying hydrology and meteorology. The temperature results for the Sacramento River between Keswick Dam and Balls Ferry are shown in Figures 1 through 2. The relationship between end-of-September lake volume below 56°F and a downstream Sacramento River compliance location through fall is based on the Figures 3-5. Runs targeting temperature above Clear Creek confluence and at Balls Ferry target locations attempt to meet the April 15 – May 15 temperature target of 56°F at Balls Ferry. The end of September cold-water-pool volumes were insufficient to confidently sustain the temperature targets into the late fall period for the sustained Clear Creek target at 53.5°F.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on March 18, March 12, and March 10, respectively. Model results are sensitive to initial reservoir temperature conditions and the model performs best under highly stratified conditions. The temperature profiles prior to May do not yet exhibit conditions for ideal model computations (still nearly isothermal conditions). The model performs well after the reservoir stratifies, typically in late spring (i.e. end of April). The concern this year is assuming over or under estimations with variable hydrologic and meteorological conditions and not capturing the stratification with sufficient detail to project into the future with confidence.
2. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge are not available beyond 5 days. Creek flows developed from the historical record that most closely reflects current conditions were used for all model runs. The resulting creek flows can cause significant additional warming in the upper Sacramento River during spring.
3. Operation is based on the March 2020 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90%- and 50%-exceedances (when available), with minor modifications to accommodate for within month real-time operations

(e.g. flood operations, underestimated system demands/requirements, etc.). After September historical information is used for inflow. Trinity Lake inflows are updated with the CNRFC 90% runoff exceedance for the 90% and DWR Bulletin 120 for the 50% runoff exceedance studies. The Operation Outlook assumes a representation of the State and Federal regulatory environment under NMFS and FWS 2019 Biological Opinions.

4. Although mean daily flows and releases are temperature model inputs, they are based on the mean monthly values from the operation outlooks. Mean daily flow patterns are user defined and are generalized representations. It is important to note that these outlooks do not suggest a certain actual future outcome, but rather the statistical likelihood of an event occurring, including, but not limited to, projected storage and releases. Thus, the outlooks do not provide exact end of month storages or flow rates but general projections that will likely fall within the range of uncertainty based on the different hydrologic runoff conditions between the 90% and 50% runoff exceedance hydrology.
5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and ACID diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period. Side-flows were adjusted to a 95% historical exceedance for both the 90% and 50% runoff exceedance studies.
6. Meteorological inputs represent historical (1985 – 2017) monthly mean equilibrium temperature exceedance at 25% and 50% patterned after like months on a 6-hour time-step (for months prior to April). Assumed inflows temperature remain static inputs and do not vary with the assumed meteorology. Tools to use local three-month-temperature outlooks, driven by the NOAA NWS Climate Prediction Center (CPC) are used beginning in April.
7. Meteorology, as well as the flow volume and pattern, significantly influences reservoir inflow temperatures and downstream tributary temperatures; and consequently, the development of the cold-water pool during winter and early spring, which is still uncertain prior to the end of April.
8. Modified model coefficients more closely represent actual Keswick Dam temperatures. As a result, temperature predictions downstream of Keswick Dam are likely to be warmer than actual.
9. The model is specifically being applied to generate the most accurate results at the Sacramento River above Clear Creek confluence location (CCR).

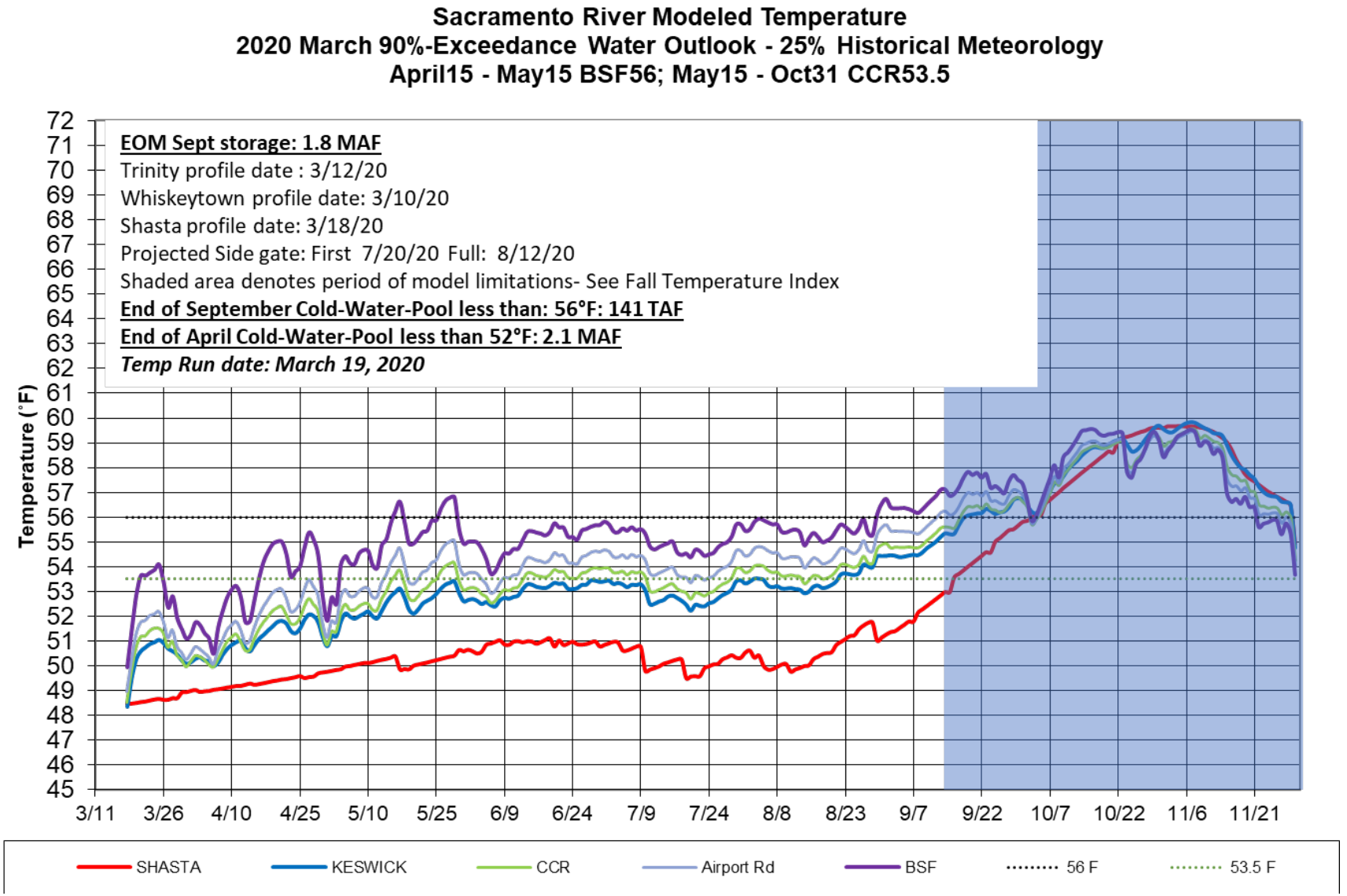


Figure 1. March 2020 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 25% historical meteorology targeting CCR at 53.5°F.

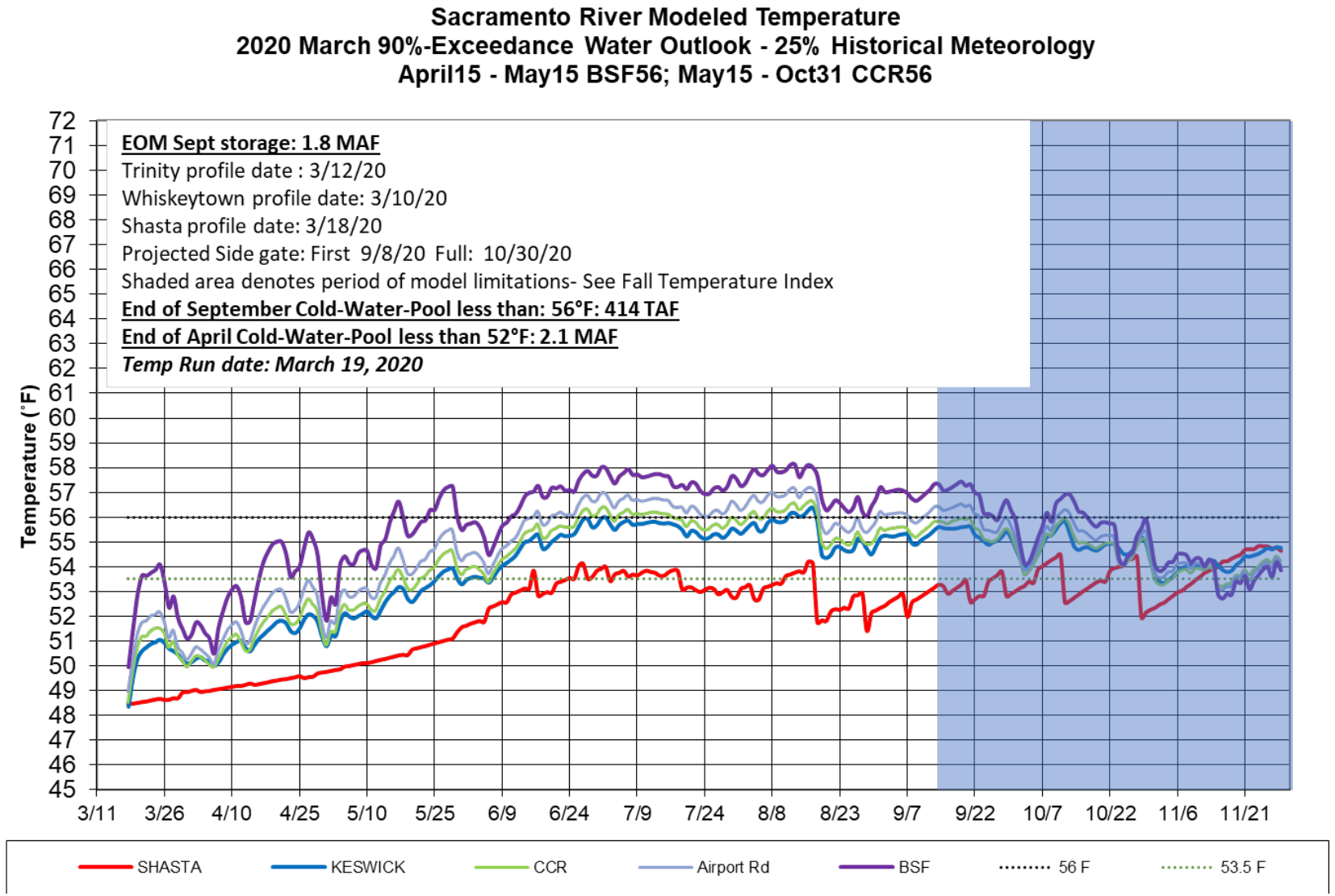


Figure 2. March 2020 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 25% historical meteorology targeting CCR at 56°F.

Figures 3-5 Model Performance and Fall Temperature Index:

1. Based on past analyses, the temperature model does not perform well in late September and October. One factor is that the modeled release temperatures are cooler than has historically been achieved when all release is through the side gates (lowest gates), especially when there's a large temperature gradient between the pressure relief gates (PRG) and the side gates.
2. Based on historical records, the end-of-September Lake Shasta volume below 56˚F is a good indicator of fall water temperature in the river reaches.
3. Based on these records and estimates, the charts below illustrate a range of uncertainty in the expected river temperatures based on the end-of-September lake volume less than 56˚F.

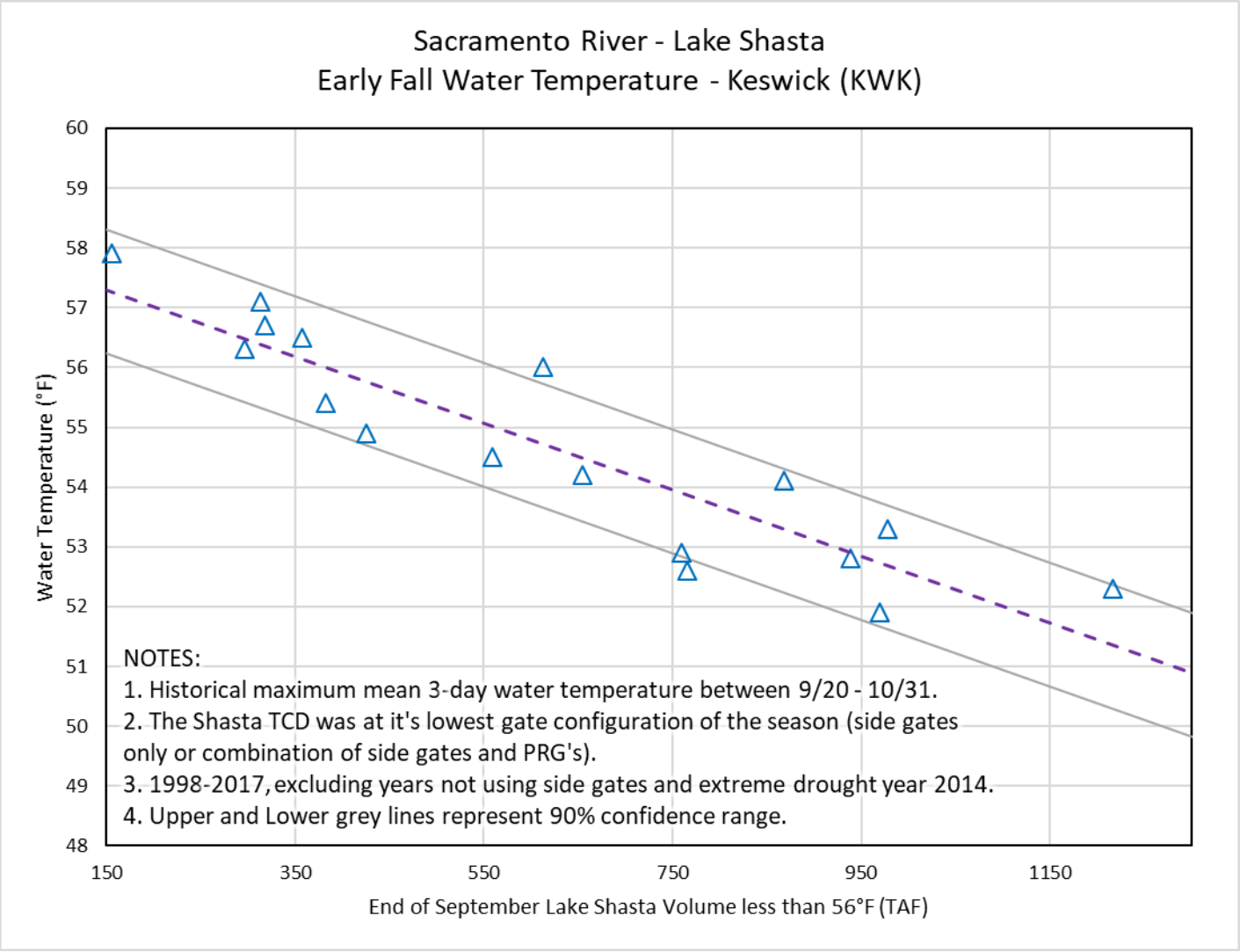


Figure 3. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Keswick water temperature.

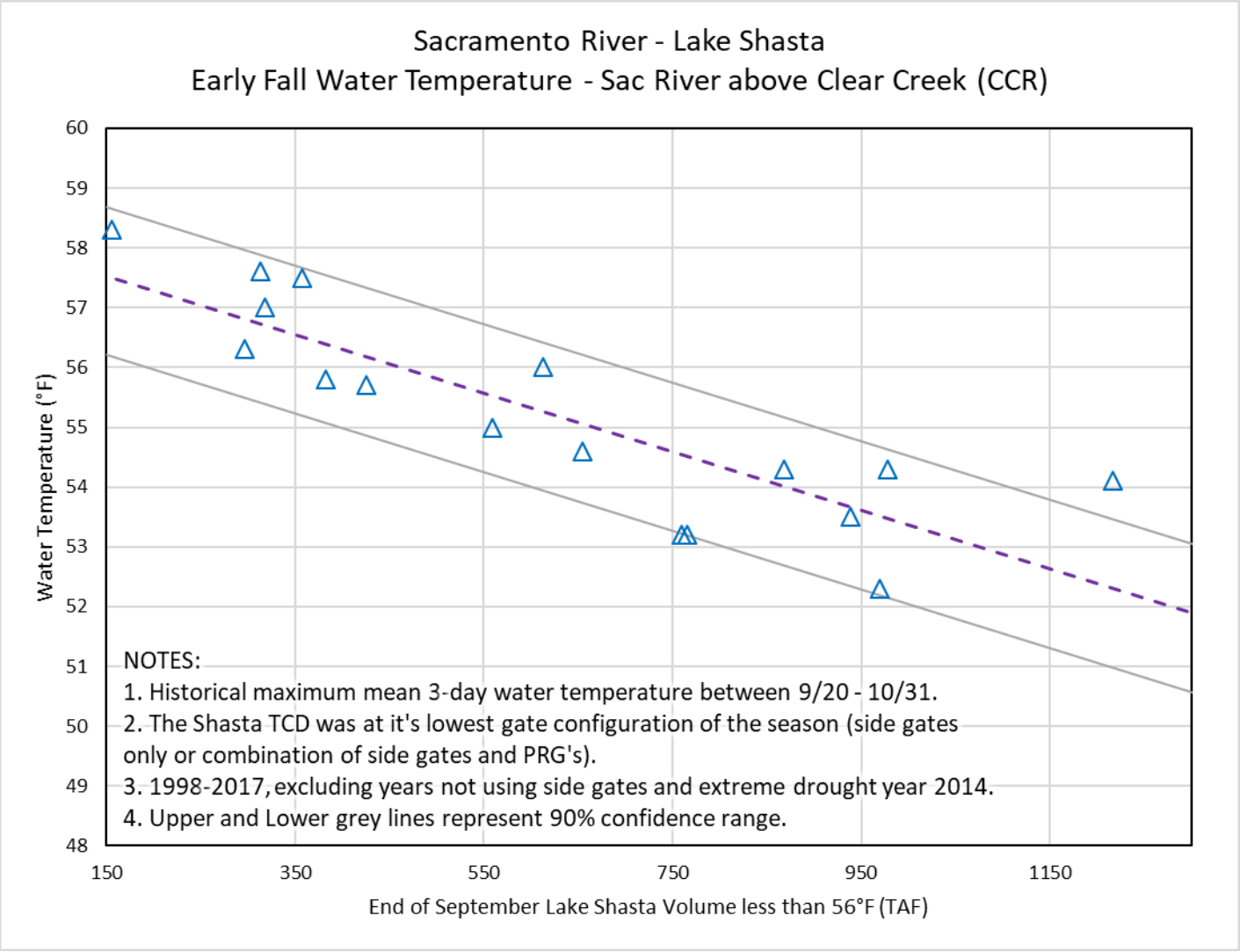


Figure 4. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Sacramento River above Clear Creek confluence water temperature.

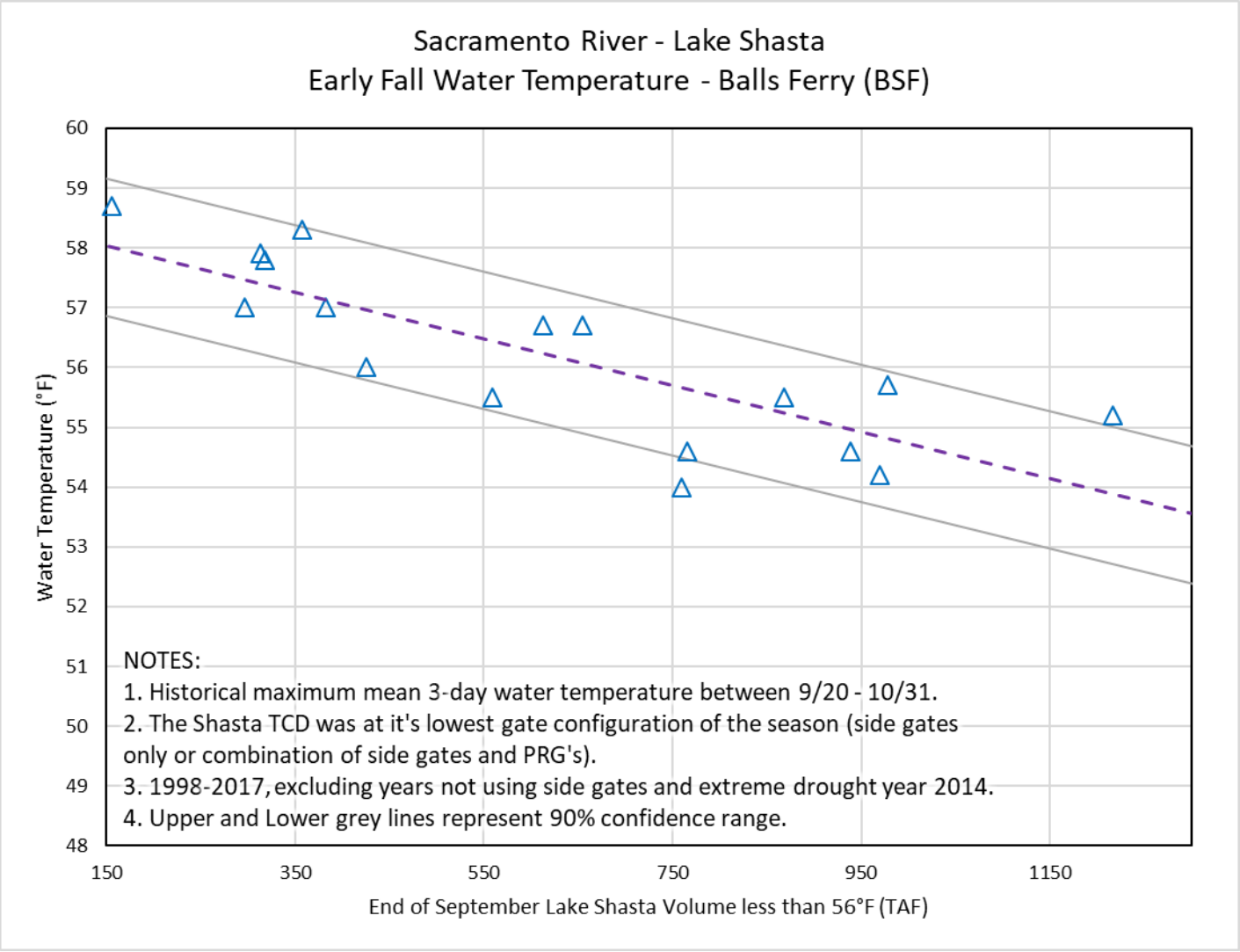
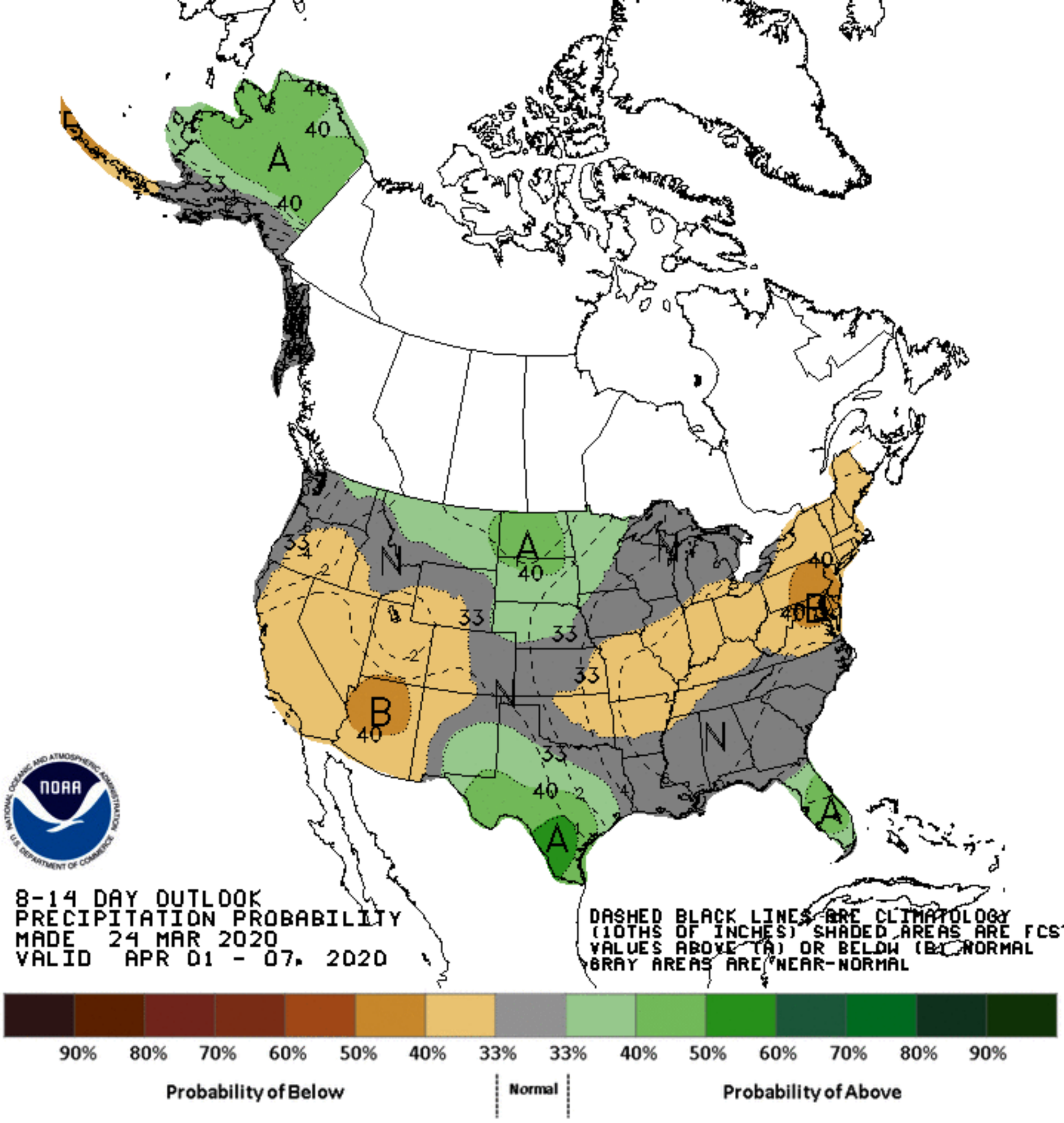
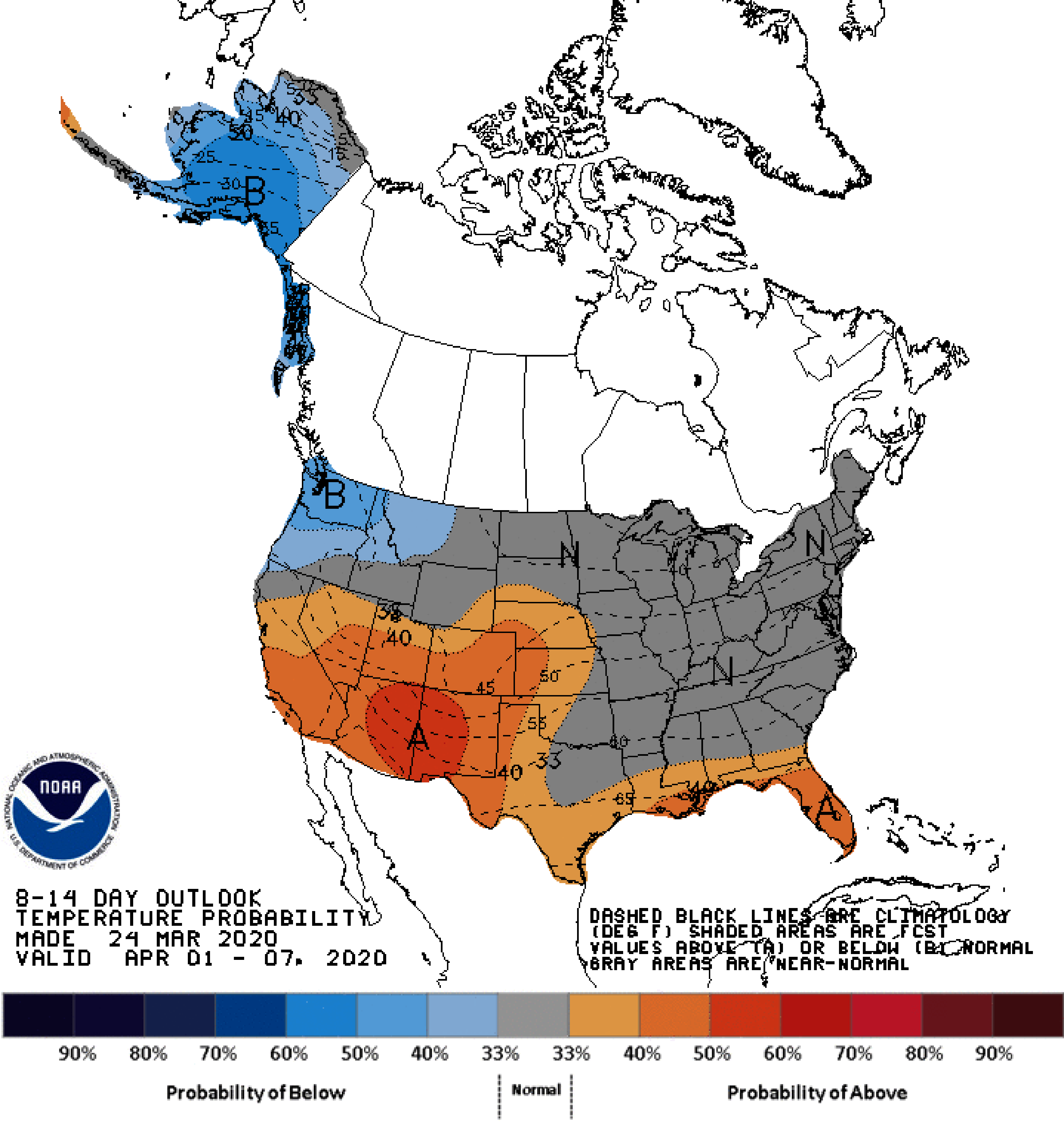


Figure 5. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Balls Ferry water temperature.


8-14 DAY OUTLOOK
PRECIPITATION PROBABILITY
MADE 24 MAR 2020
VALID APR 01 - 07, 2020
DASHED BLACK LINES ARE CLIMATOLOGY
(10THS OF INCHES) SHADED AREAS ARE FCS
VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
NOAA
90% 80% 70% 60% 50% 40% 33% 33% 40% 50% 60% 70% 80% 90%
Probability of Below
Normal
Probability of Above


8-14 DAY OUTLOOK
TEMPERATURE PROBABILITY
MADE 24 MAR 2020
VALID APR 01 - 07, 2020
DASHED BLACK LINES ARE CLIMATOLOGY
(DEG F) SHADED AREAS ARE FCST
VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
B
B
A
A
N
N
N
90%
80%
70%
60%
50%
40%
33%
33%
40%
50%
60%
70%
80%
90%
Probability of Below
Normal
Probability of Above

Summary Document for temperature-dependent egg mortality
Prepared by the Southwest Fisheries Science Center on Mar 23rd, 2020

Below are results comparing two USBR scenarios ran Mar 23rd 2020. Inputs from scenarios are used to generate daily average Sacramento River water temperatures using the RAFT model and associated temperature-dependent egg mortality and survival estimates using the NMFS temperature mortality model (Martin et al. 2017) for the 2020 temperature management season.

Further details of modeling methods are at: http://oceanview.pfeg.noaa.gov/CVTEMP/

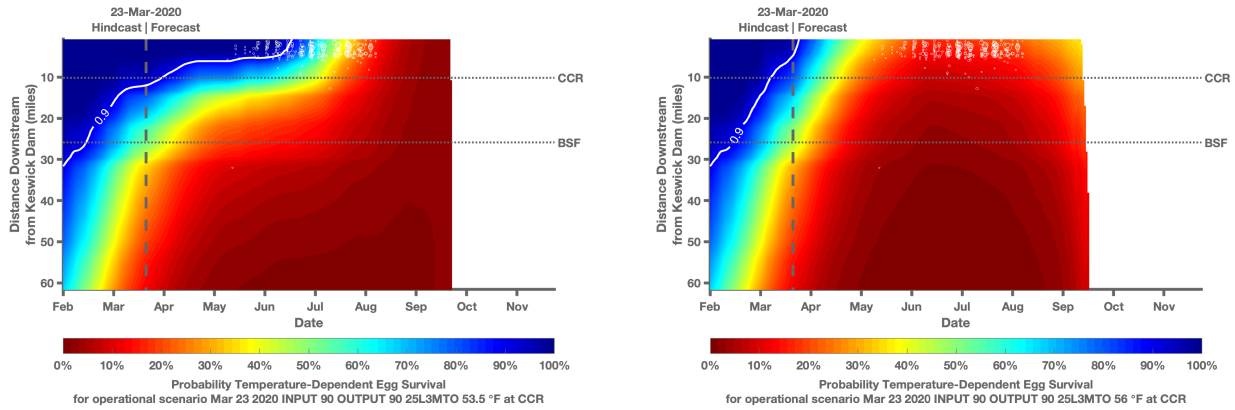


Figure1: Estimated temperature-dependent egg survival produced by the NMFS temperature mortality model under the two Mar 23rd 2020 scenarios. Note that plots are using 2012-2018 redd distributions.

Table 1: Estimated temperature-dependent egg mortality under different scenarios assuming a 2012-2018 spatial and temporal redd distribution using RAFT water temperature predictions.

Scenario	Mean (%)	Median (%)	Lower (%)	Upper (%)
MAR_23_2020_INPUT_90_OUTPUT_90_25L3MTO 53.5 °F CCR (Drier/ Warmer)	47.34	46.47	20.36	73.22
MAR_23_2020_INPUT_90_OUTPUT_90_25L3MTO 56 °F CCR (Drier / Warmer)	74.95	82.92	1.31	90.66

Reference:

Martin, B. T., Pike, A., John, S. N., Hamda, N., Roberts, J., Lindley, S. T. and Danner, E. M. (2017), Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters 20: 50–59. doi:10.1111/ele.12705

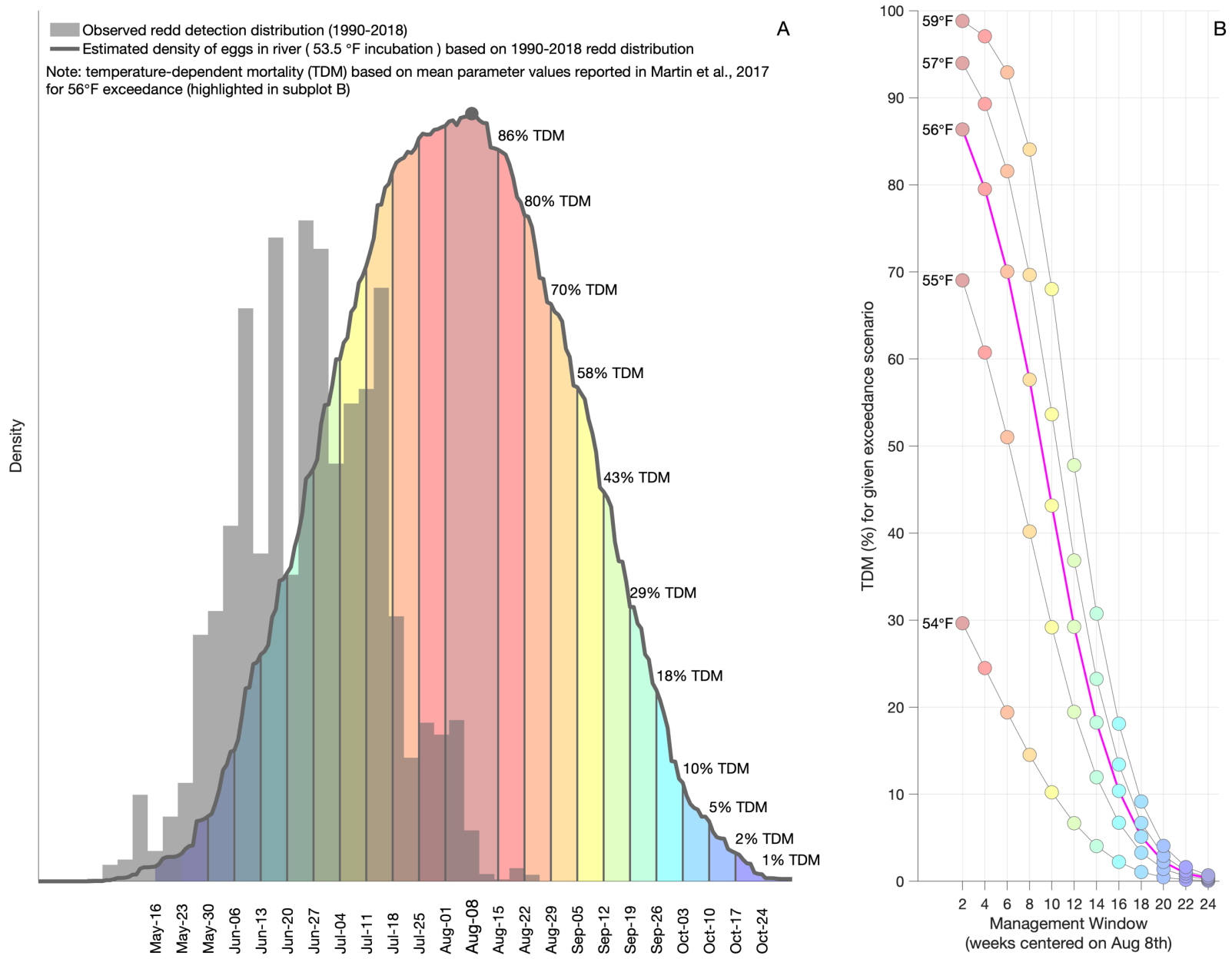


Figure: Temporal distribution of redds detection from 1990-2018, with the maximum density of eggs incubating in river estimated from the 1990-2018 dataset, with various temperature management windows (shaded colors) and associated values of temperature-dependent egg mortality (TDM) displayed assuming temperature compliance of 53.5 °F and exceedance of 56 °F (subplot A). Subplot B shows the relationship between TDM, temperature compliance, and various exceedance temperatures under the same temperature management windows as subplot A.