BUREAU OF RECLAMATION

Sacramento River Temperature Task Group

Thursday, September 24, 2020 1:00 pm – 3:00 pm

Conference Call:

NEW CALL-IN INFORMATION
Join from PC, Mac, Linux, iOS or Android: https://meetings.ringcentral.com/j/1480091225
+1(623)4049000,,1480091225# (US West)
Meeting ID: 148 009 1225

Agenda

1:00 pm	Introductions
1:10 pm	Purpose and Objective
1:12 pm	Prior Action Items
1:17 pm	Communications
1:20 pm	Long Term Operations Implementation - Update
1:25 pm	River Fish Monitoring: carcass surveys, redd counts, stranding and dewatering surveys and sampling at rotary screw traps
1:35 pm	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.
1:45 pm	Recommendations: Agencies provide feedback and information to Reclamation regarding fish monitoring/operations
1:50 pm	Hydrology Update
1:55 pm	Operations Update and Forecasts
2:00 pm	Storage/Release Management Conditions
2:05 pm	Temperature Management
2:15 pm	Temperature Dependent Mortality

2:25 pm Trinity and Whiskeytown Updates

2:30 pm Recommendations: Agencies provide feedback and information to Reclamation regarding temperature management operations

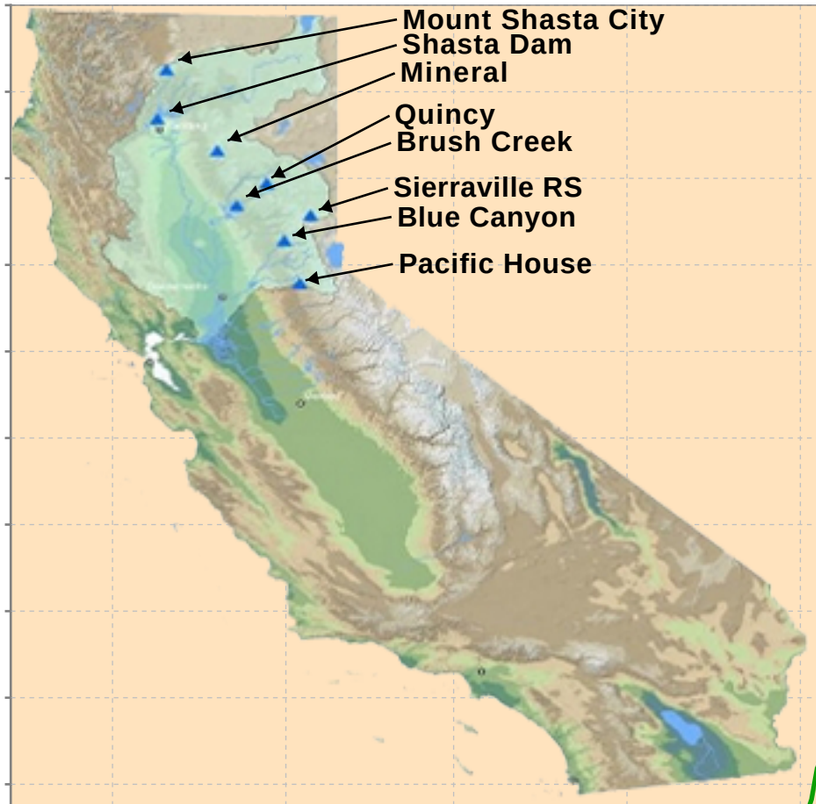
2:45 pm Seasonal Topics

2:50 pm Discussion

2:55 pm Review Action Items

2:59 pm Next Meeting Scheduling

Northern Sierra Precipitation: 8-Station Index, September 23, 2020



Percent of Average for this Date: 62%

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: 31.9

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

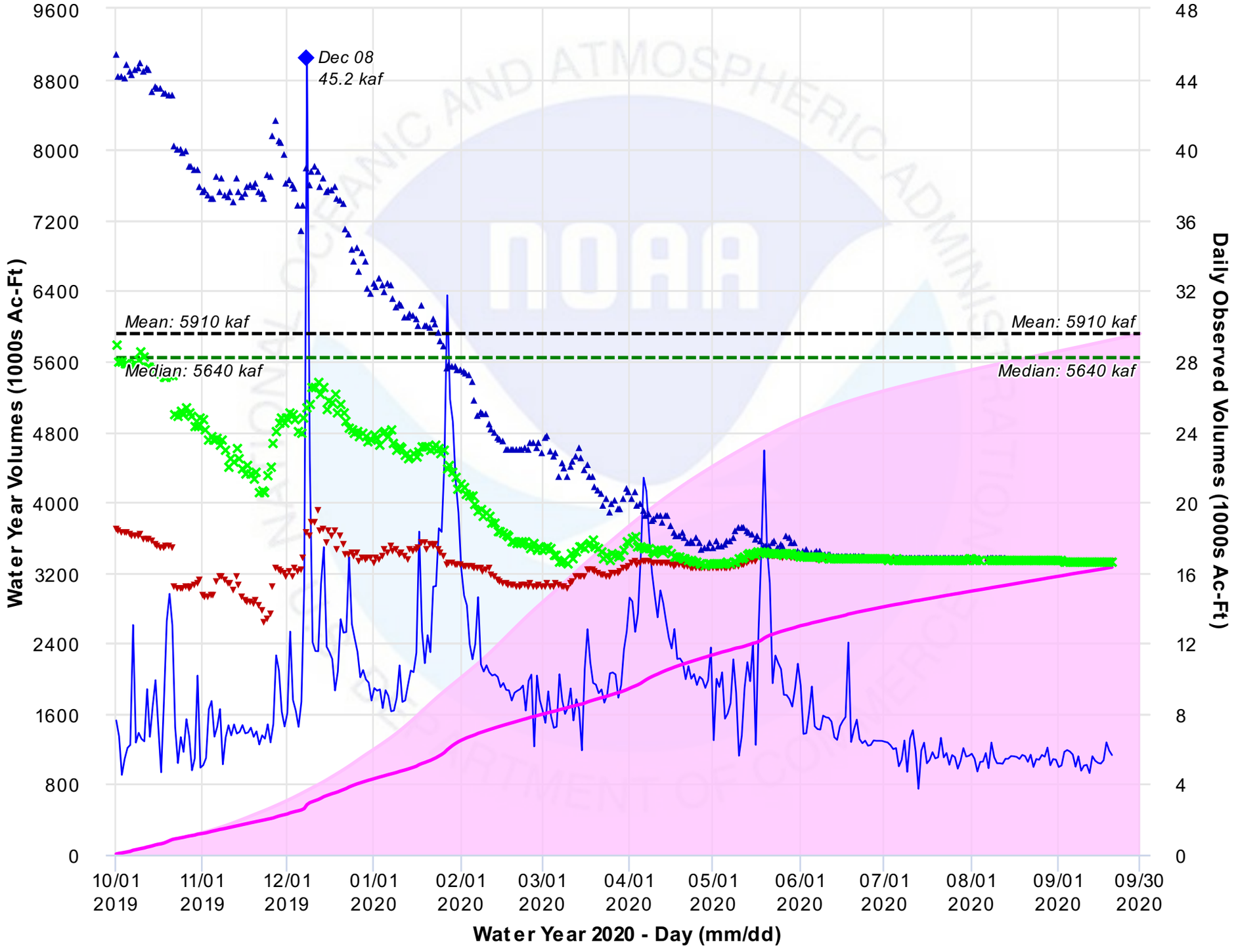
Water Year (October 1 - September 30)

Total Water Year Precipitation

SACRAMENTO - SHASTA DAM (SHDC1) 09/20/2020

Most Probable: 3330 kaf | 56% of Average | 59% of Median

Created: 09/20/2020 at 08:09 AM PDT



Observed to Date Percent of Average: 56% (3260 kaf) **Water Year to Date Average: 5840 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%

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

DAILY CVP WATER SUPPLY REPORT

SEPTEMBER 22, 2020

RUN DATE: September 23, 2020

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2019	WY 2020	15 YR MEDIAN
TRINITY	LEWISTON	468	438	468
SACRAMENTO	KESWICK	7,853	6,821	7,506
FEATHER	OROVILLE (SWP)	8,000	2,100	4,000
AMERICAN	NIMBUS	2,068	1,768	1,737
STANISLAUS	GOODWIN	401	204	205
SAN JOAQUIN	FRIANT	387	423	347

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	1,423	2,068	1,393	98
SHASTA	4,552	2,469	3,466	2,236	91
FOLSOM	977	475	720	439	93
NEW MELONES	2,420	1,360	2,034	1,532	113
FED. SAN LUIS	966	301	470	337	112
TOTAL NORTH CVP	11,363	6,027	8,758	5,937	98
MILLERTON	520	271	376	172	63
OROVILLE (SWP)	3,538	1,744	2,330	1,663	95

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	454	217	2,880	1,158	39
SHASTA	3,225	2,553	10,718	5,124	63
FOLSOM	1,518	351	6,499	2,692	56
NEW MELONES	637	----	2,734	1,069	60
MILLERTON	915	366	4,647	1,647	56

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	20.54	15.43	56.67	31.98 (58)	64	0.00
SACRAMENTO AT SHASTA DAM	34.51	24.23	114.50	62.20 (63)	55	0.00
AMERICAN AT BLUE CANYON	39.50	17.57	104.10	66.67 (45)	59	0.00
STANISLAUS AT NEW MELONES	22.38	----	46.48	27.54 (42)	81	0.00
SAN JOAQUIN AT HUNTINGTON LK	28.25	17.60	83.40	41.98 (45)	67	0.00

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

Storage/Release Management Conditions:

- Reservoir Inflow Uncertainty: Shorter term forecasts (8-14 day) suggest slightly below normal chance of precipitation
- Longer term forecasts (one-month outlook) suggest equal chance of above/below normal precipitation
- Observed Shasta inflow for September is tracking about equal to the 90% inflow exceedance probability estimate for the month (148 TAF)
- Releases from Keswick Dam: Current releases are holding at 6,800 cfs for winter run redd protection
- End of September Shasta storage volume is estimated to be approximately 2.190 MAF

Temperature Management:

- Temperature management: Active draw on cold water pool for temperature management
- Selective withdrawal: Using cold-water-pool reserves. Two PRGs are open and two Side Gates are open
- Reclamation continues to actively look for opportunities to conserve cold water pool using operational refinements
- Meteorological Uncertainty: Shorter term forecasts (8-14 day) suggest above normal temperatures
- Longer term forecasts (one-month outlook) suggest 40%-50%o probability of above normal temperatures

Resources:

- Sac Temp Report: https://www.usbr.gov/mp/cvo/vungvari/sactemprpt.pdf
- Reclamation Bay Delta website: https://www.usbr.gov/mp/bdo/lto/index.html
- Reclamation SRTTG website: https://www.usbr.gov/mp/bdo/sacramento-river-temperature-task-group.html
- Sacramento River Forum- Habitat Restoration: https://www.sacramentoriver.org/forum/index.php?id=channels
- 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
- California Nevada River Forecast Center: short term precipitation forecasts, overlay with burn areas, debris flow potential, etc: https://www.cnrfc.noaa.gov/
- CDFW 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/

- DWR Bulletin 120 Forecast Updates: http://cdec.water.ca.gov/b120up.html

CVP Northern System Operation Outlooks: Draft September 2020

90% Runoff Exceedance Outlook

End of Month Storage/Elevation	Sep	Oct	Nov	Dec	Jan	Feb
Shasta Volume (TAF)	2191	2092	2109	2180	2307	2486
Shasta Elevation (Feet)	968	963	964	967	974	984

Monthly Average River Release	Sep	Oct	Nov	Dec	Jan	Feb
Sacramento (CFS)	6500	5500	3873	3250	3250	3750
Clear Creek (CFS)	150	200	200	200	200	200

Trinity Diversions	Sep	Oct	Nov	Dec	Jan	Feb
Carr Power Plant (TAF)	101	24	30	21	15	10
Spring Creek PP (TAF)	90	45	20	12	10	10

50% Runoff Exceedance Outlook

End of Month Storage/Elevation	Sep	Oct	Nov	Dec	Jan	Feb
Shasta Volume (TAF)	2208	2149	2224	2414	2811	3393
Shasta Elevation (Feet)	969	966	970	980	999	1024

Monthly Average River Release	Sep	Oct	Nov	Dec	Jan	Feb
Sacramento (CFS)	6500	5500	4000	3250	3250	3250
Clear Creek (CFS)	150	200	200	200	400	200

Trinity Diversions	Sep	Oct	Nov	Dec	Jan	Feb
Carr Power Plant (TAF)	100	23	20	9	0	2
Spring Creek PP (TAF)	90	45	15	12	10	35

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.

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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

Storages

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

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Trinity	**1497**	**1341**	**1300**	**1264**	**1246**	**1244**	**1272**	**1332**	**1388**	**1415**	**1321**	**1204**	**1051**
	Elev.	2289	2286	2282	2281	2280	2283	2289	2294	2296	2288	2277	2261
Whiskeytown	**237**	**238**	**206**	**206**	**206**	**206**	**206**	**206**	**238**	**238**	**238**	**238**	**238**
	Elev.	1209	1199	1199	1199	1199	1199	1199	1209	1209	1209	1209	1209
Shasta	**2351**	**2191**	**2092**	**2109**	**2180**	**2307**	**2486**	**2782**	**2822**	**2644**	**2283**	**1791**	**1450**
	Elev.	968	963	964	967	974	984	998	1000	991	973	945	922
Folsom	**477**	**437**	**384**	**351**	**327**	**313**	**350**	**445**	**545**	**616**	**598**	**435**	**321**
	Elev.	408	401	396	392	389	396	409	422	430	428	408	391
New Melones	**1574**	**1530**	**1489**	**1490**	**1494**	**1497**	**1497**	**1495**	**1458**	**1369**	**1279**	**1186**	**1109**
	Elev.	1006	1002	1002	1002	1003	1003	1003	999	989	978	967	957
San Luis	**249**	**346**	**394**	**498**	**559**	**753**	**727**	**677**	**595**	**451**	**260**	**211**	**218**
	Elev.	456	455	467	485	509	497	488	476	457	422	398	384
Total		6082	5864	5918	6013	6321	6537	6937	7045	6734	5979	5064	4386

Monthly River Releases (TAF/cfs)

Trinity	TAF	52	23	18	18	18	17	18	36	92	47	28	53
	cfs	**870**	**373**	**300**	**300**	**300**	**300**	**300**	**600**	**1,498**	**783**	**450**	**857**
Clear Creek	TAF	9	12	12	12	12	11	17	12	16	11	9	9
	cfs	**150**	**200**	**200**	**200**	**200**	**200**	**275**	**200**	**265**	**190**	**150**	**150**
Sacramento	TAF	387	338	230	200	200	208	231	416	523	678	768	599
	cfs	**6500**	**5500**	**3873**	**3250**	**3250**	**3750**	**3750**	**7000**	**8500**	**11400**	**12500**	**9750**
American	TAF	104	92	75	77	77	66	77	107	103	90	203	154
	cfs	**1752**	**1500**	**1258**	**1250**	**1250**	**1189**	**1255**	**1802**	**1669**	**1520**	**3305**	**2503**
Stanislaus	TAF	12	39	12	12	13	12	12	27	55	12	12	12
	cfs	**200**	**635**	**200**	**200**	**219**	**221**	**200**	**460**	**887**	**200**	**200**	**200**

Trinity Diversions (TAF)

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Carr PP	101	24	30	21	15	10	7	44	25	99	100	101
Spring Crk. PP	**90**	**45**	**20**	**12**	**10**	**10**	**10**	**15**	**15**	**90**	**90**	**90**

Delta Summary (TAF)

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Tracy		252	178	161	98	232	44	46	45	46	77	262	265
USBR Banks		29	0	0	0	0	0	0	0	0	0	0	0
Contra Costa		9.5	10.5	12.6	13.8	13.7	10.5	10.5	9.5	9.5	9.5	7.4	8.3
Total USBR		291	189	174	112	246	55	57	54	56	87	269	273
COA Balance		120	89	0	-19	-19	-43	-91	-68	-31	-19	-19	-9
Vernalis	TAF	46	108	83	83	92	82	82	105	135	43	45	40
Vernalis	cfs	772	1758	1393	1355	1504	1482	1339	1767	2194	721	737	655
Old/Middle River Std.													
Old/Middle R. calc.		-5,013	-2,598	-3,142	-3,285	-4,995	-1,053	-1,397	-1,073	-877	-1,864	-4,296	-4,746
Computed DOI		3362	4994	5009	6003	6637	11400	11403	9497	6865	7800	4994	3741
Excess Outflow		0	0	0	0	2131	0	0	0	0	0	0	0
% Export/Inflow		50%	34%	40%	40%	52%	10%	13%	12%	15%	15%	36%	43%
% Export/Inflow std.		65%	65%	65%	65%	65%	45%	35%	35%	35%	35%	65%	65%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	460		3,253		1,534		652	
Year to Date + Forecasted % of mean	38%		59%		56%		62%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.
CVP releases or export values represent monthly averages.
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Estimated CVP Operations 50% Exceedance

Storages

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

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Trinity	**1497**	**1343**	**1308**	**1300**	**1330**	**1395**	**1505**	**1634**	**1748**	**1612**	**1487**	**1340**	**1191**
	Elev.	2290	2286	2286	2288	2294	2304	2314	2323	2312	2302	2289	2275
Whiskeytown	**237**	**238**	**206**	**206**	**206**	**206**	**206**	**206**	**238**	**238**	**238**	**238**	**238**
	Elev.	1209	1199	1199	1199	1199	1199	1199	1209	1209	1209	1209	1209
Shasta	**2351**	**2208**	**2149**	**2224**	**2414**	**2811**	**3393**	**3947**	**4253**	**4316**	**4012**	**3542**	**3228**
	Elev.	969	966	970	980	999	1024	1046	1057	1059	1048	1030	1018
Folsom	**477**	**432**	**415**	**415**	**435**	**509**	**566**	**753**	**901**	**961**	**965**	**843**	**779**
	Elev.	408	405	405	408	418	424	445	459	465	465	454	447
New Melones	**1574**	**1527**	**1496**	**1512**	**1536**	**1569**	**1623**	**1681**	**1665**	**1724**	**1733**	**1650**	**1582**
	Elev.	1006	1003	1004	1007	1010	1016	1022	1020	1026	1027	1019	1012
San Luis	**249**	**339**	**471**	**667**	**878**	**966**	**966**	**966**	**887**	**735**	**708**	**643**	**625**
	Elev.	457	473	500	537	543	543	543	532	514	509	502	494
Total		6086	6044	6324	6799	7456	8258	9187	9691	9587	9143	8256	7643

Monthly River Releases (TAF/cfs)

Trinity	TAF	52	23	18	18	18	17	18	36	258	126	68	53
	cfs	**870**	**373**	**300**	**300**	**300**	**300**	**300**	**600**	**4,189**	**2,120**	**1,102**	**857**
Clear Creek	TAF	9	12	12	12	25	11	12	12	16	11	9	9
	cfs	**150**	**200**	**200**	**200**	**400**	**200**	**200**	**200**	**265**	**190**	**150**	**150**
Sacramento	TAF	387	338	238	200	200	180	277	339	492	678	768	596
	cfs	**6500**	**5500**	**4000**	**3250**	**3250**	**3250**	**4500**	**5700**	**8000**	**11400**	**12500**	**9700**
American	TAF	107	92	89	92	77	205	123	274	400	211	234	154
	cfs	**1800**	**1500**	**1502**	**1500**	**1250**	**3700**	**2000**	**4600**	**6500**	**3550**	**3805**	**2500**
Stanislaus	TAF	12	39	12	12	14	13	12	91	76	22	15	12
	cfs	**200**	**635**	**200**	**200**	**226**	**229**	**200**	**1537**	**1242**	**363**	**250**	**200**

Trinity Diversions (TAF)

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Carr PP	100	23	20	9	0	2	1	55	92	95	99	100
Spring Crk. PP	**90**	**45**	**15**	**12**	**10**	**35**	**26**	**35**	**90**	**90**	**90**	**90**

Delta Summary (TAF)

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Tracy		260	265	255	250	130	76	100	54	57	256	265	265
USBR Banks		30	0	0	0	0	0	0	0	0	0	0	0
Contra Costa		14.0	16.8	18.4	18.3	14.0	14.0	12.7	12.7	12.7	9.8	11.1	12.7
Total USBR		304	282	273	268	144	90	113	66	70	266	276	278
COA Balance		123	102	16	16	16	16	16	16	16	64	155	196
Vernalis	TAF	54	108	83	83	93	112	57	169	134	69	54	49
Vernalis	cfs	906	1758	1393	1355	1511	2012	932	2844	2188	1153	884	802
Old/Middle River Std.													
Old/Middle R. calc.	cfs	-5,321	-5,170	-5,301	-6,410	-2,628	-2,888	-2,960	-630	-944	-5,466	-5,867	-5,286
Computed DOI		3362	4994	5009	7418	16902	23233	21619	17398	11891	7447	4994	3741
Excess Outflow		0	0	0	1415	10899	11833	10216	7900	4083	0	0	0
% Export/Inflow		51%	50%	53%	52%	17%	15%	14%	7%	10%	39%	44%	45%
% Export/Inflow std.		65%	65%	65%	65%	65%	45%	35%	35%	35%	35%	65%	65%

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	461		3,270		1,534		649	
Year to Date + Forecasted % of mean	38%		59%		56%		61%	

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

BUREAU OF RECLAMATION

CVP Sep 2020 90% Exceedance Operations Outlook Information

General Information:

Central Valley Project (CVP) reservoir operations are re-assessed monthly for a one-year period into the future at varied hydrologic conditions on a monthly time-step. Because future watershed hydrology is not known with certainty, estimates for inflow are typically updated using a spread of likely outcomes. These values can range anywhere from 1 percent to 99 percent runoff exceedance probabilities by using meteorological or historical precipitation and snow trends. The CVP commonly uses a 90 percent and 50 percent runoff exceedance probability hydrology. The 90 percent runoff exceedance probability hydrology suggests a conservative, or relatively "dry" condition in which it's expected that in any particular year, nine out of ten years the conditions for the year will be "wetter" than presented. Similarly, the 50 percent hydrology suggest a less conservative, or relatively "wet" condition in which it's expected that in any particular year, equal chances or five out of ten years will be "wetter" or "drier" than presented. The designation to view the former a "dry" outlook and the latter a "wet" one can be somewhat misleading. For the months of October and November, there is typically little to no data (snowpack), and the inflow hydrology set which is used is derived from a long term average of historic data. In that case, the 90% is dry and 50% is the median of historic data, which is slightly drier than the long term average due to the skew produced by a few very large events. Once National Weather Service (NWS) and California Department of Water Resources (DWR) forecasts become available (usually December through May), the hydrology switches from long term averages to more specific projections pertaining to the current water year. It is derived from monthly snowpack measurements and statistical runoff curves and is published at several probability levels for the current year. It is important to note that for these hydrology sets, a 90% is not necessarily dry, nor is the 50% (median) necessarily anywhere close to the long term average. They are simply runoff projections based upon probabilities. For example, in a parched year with poor snowpack, the 50% (median) runoff forecast might be very dry by any standard, and conversely, in a year high runoff and large snowpack, the 90% (drier) forecast could be very wet. In summary, for the December through May outlooks, the 90% can be viewed as "drier" (but not necessarily dry) and the 50% (median) as "wetter" but not necessarily wet. Generally, the differences between the NWS/DWR 90% and 50% runoff forecasts diminish as the water year progresses and more information becomes available. In December, with little of the annual snowpack in place there are usually very large differences between the 90% and 50% runoff forecasts. By April or May, much (if not all) of the snowpack has accumulated, and the 90% and 50% runoff forecasts typically have relatively small differences between them.

The assumed uncertain hydrology sets are used to simulate, including, but not limited to, projected storage, releases, exports, and features of the Sacramento and San Joaquin Delta performance. These estimates serve as useful operational guides for both CVP and DWR State Water Project (SWP) operations to jointly manage the system according to shared coordination framework (Coordinated Operations Agreement) for various conditions. This coordinated effort ensures that DWR and Reclamation supply required quantity and quality of water in the Delta to support agricultural, environmental, and water quality goals according to water right permit conditions (D-1641). The CVP system balances available resources to meet regulatory obligations, environmental requirements, senior water right holders, and CVP service contracts including agricultural, municipal and industrial, and wildlife refuge water delivery demands. Reclamation considers the factors that go into the outlooks to guide export opportunities and capabilities. Central Valley Operation staff combine their institutional knowledge and experience, and optimize reservoir and export operations given the system, regulatory, and environmental constraints which are applicable in the current water year. The final step in the analysis process is to select an allocation and demand set which fully utilizes San Luis storage by drawing the reservoir down to absolute minimums in late summer. Per requirements, the 90% outlook is used to determine allocations, and the 50% outlook is provided for informational purposes.

These operation outlooks do not suggest a certain actual future outcome, but rather the statistical likelihood of projected outcomes and represent levels of CVP operational risk. Thus, the outlooks do not provide exact or anticipated end-of-month storages, flow rates, but general projections that would be expected if actual conditions matched this uncertain future hydrology. However, actual operations are generally expected to fall within the bracketed 90 percent and 50 percent hydrology projections. Outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details and releases and export values are represented as monthly averages. Actual operations are based on real-time conditions.

Inputs:

- Reservoir Inflow Hydrology: Final Issue of the Bulletin 120 Water Supply Forecast Update June 10, 2020, DWR
- Sacramento Valley Accretion Depletion Hydrology: Sacramento River at Freeport forecast for June 2020, DWR. Per personal communication with DWR, values were adjusted conservatively due to late season toolset limitations.
- Operations: Personal communication with DWR, SWP Operations

Assumptions:

- Reservoir inflows are adjusted to date of forecasting to approximate actual conditions
- SWRCB D1641 permit conditions for outflow and salinity requirements are met for compliance
- Coordinated Operations Agreement (COA) classification: Dry – CVP 65% Sharing responsibility for meeting Sacramento Valley inbasin use with storage withdrawals during balanced water conditions
- The Delta Outflow requirement for September is 3,000 cfs, however, the Projects have been operating at a higher outflow this month for Delta water quality. The outflow requirement for October is 4,000 cfs.

- Sacramento River water year type classification for requirements: Dry
- San Joaquin River water year type classification for requirements: Dry
- Stanislaus River classification for minimum release: Dry
- American River classification for minimum release: based on forecasted inflows to Folsom reservoir
- Trinity River Record of Decision (ROD) water year type classification: Critically Dry
- Sacramento River Settlement Contractors allocation classification: Shasta Non-Critical 100%
- North of Delta Water Service Contractor allocation for agriculture: 50%
- North of Delta Municipal and Industrial allocation: 75%
- North of Delta Refuge allocation: 100%
- American River Water Rights allocation: 100%
- South of Delta Water Rights allocation: 100%
- South of Delta Water Service Contractor allocation for agriculture: 20%
- CVP South of Delta Municipal and Industrial allocation: 70%
- South of Delta Refuge allocation: 100%
- Feather River Service Area allocation: 100%

Notes:

- A Shasta Non-Critical determination was made June 8, 2020 based on DWR Bulletin 120 Forecast Update June 2, 2020.
- Based on the COA and year classification, the CVP is responsible for 65% of water released from storage to meet all inbasin uses (entitlements) in the Sacramento River watershed under balanced conditions (SWP is responsible for 35%). To determine the magnitude of this responsibility, DWR estimates the Sacramento River watershed inbasin use by applying a mass balance calculation over the entire basin. This is because specific or individual diversion and return flows from the Sacramento River are not metered or measured and an aggregate based on historical information is used instead. Historical water gains (returns or accretion) and uses (diverted, losses or depleted) out of the Sacramento River watershed contain water year type associated patterns. This outlook contains an updated accretion/depletion calculation. The Shasta Non-Critical assumption is imbedded within this mass balance calculation and captures a 100% allocation to the Sacramento River Settlement Contractors (SRSC).
- Sacramento River accretion/depletion assumptions have been crossed checked with diversion estimates from the SRSC. Per personal communication with the SRSC, year 2020 summer (June through September) diversion patterns are similar between the 100% and 75% allocations due to the late season determination. Discussions are on-going to adjust an increase in SRSC demand in October for rice decomposition.
- South of Delta Water Rights and Refuge allocations are assumed to be 100%.
- The North of Delta water service contractor's allocation for agriculture (50%) was set by provisions of the WIIN Act, Section 4005 (e)(1)(A)(iv), which states that allocations shall be not less than 50% of the contract quantity in a Dry year preceded by a Below Normal, Above Normal or Wet year.

Northern CVP Water Temperature Report

September - 2020

BUREAU OF RECLAMATION

All Data in this Report is Preliminary and Subject to Change

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[3]	LWS	DGC	NFH		Shasta Generation	Spring Creek P.P.	Keswick Total	RDD	BSF	RDB
Aug	50.9	50.0	56.7	52.4	53.0	53.6	55.2	56.5	57.2	58.2	59.0	51.0	59.0	64.7		7694	1530	9735	84.5	78.4	78.9
09/01	50.8	? 49.8	56.4	52.8	53.6	54.5	**56.4**	57.7	58.6	59.7	58.9	50.7	58.1	63.4		5501	1508	7538	91.0	87.0	84.7
09/02	51.3	? 49.9	56.4	52.3	53.3	53.8	**56.0**	57.7	58.7	60.2	58.6	50.9	58.0	63.4		5894	1235	7546	82.0	77.2	75.3
09/03	51.0	50.0	56.4	52.6	53.3	53.9	**55.7**	57.2	58.0	59.4	58.7	50.9	57.9	63.2		5576	1532	7524	82.5	76.4	75.4
09/04	50.9	49.7	56.3	53.1	53.6	54.1	**55.8**	57.2	58.1	59.3	58.2	50.8	56.6	62.5		5975	1457	7516	82.0	76.3	78.2
09/05	50.7	49.7	? 56.3	52.3	53.1	53.5	**55.1**	56.6	57.6	59.0	57.9	50.7	56.3	61.5		6530	1072	7537	84.0	75.3	82.2
09/06	50.8	49.7	56.3	52.0	52.7	53.1	**54.8**	56.1	56.9	58.3	58.0	50.4	56.4	60.9		5797	1279	7526	↑ 88.5	78.8	84.9
09/07	? 51.0	49.9	? 56.3	52.2	53.0	53.5	**54.9**	56.0	56.6	57.9	58.1	50.3	55.9	60.6		5798	1222	7526	↑ 91.5	80.1	84.3
09/08	? 51.7	50.1	56.3	52.7	53.5	54.1	**55.6**	56.8	57.6	58.1	58.2	50.4	55.6	60.2		5639	1002	7087	86.5	83.4	84.3
09/09	51.2	49.8	56.3	52.1	52.5	52.7	**53.8**	55.0	55.9	57.1	56.1	50.4	53.3	57.6		5239	1391	7013	72.0	61.5	67.5
09/10	51.1	49.9	56.5	51.8	52.5	52.8	**53.5**	54.1	54.4	54.6	56.5	50.4	51.8	54.9		5130	808	7039	70.5	63.0	65.6
09/11	51.0	50.0	56.4	51.7	52.2	52.4	**53.4**	54.4	55.1	55.6	56.9	49.4	53.7	56.3		5010	1443	7055	73.0	65.1	68.0
09/12	51.3	50.2	56.3	52.2	52.7	53.2	**54.0**	54.8	55.4	55.9	57.1	49.4	53.0	56.4		4894	1663	7058	75.0	67.4	69.6
09/13	51.4	50.1	56.2	52.4	53.0	53.4	**54.4**	55.4	56.1	56.7	57.2	49.3	51.2	53.7		5320	1726	7073	75.0	67.8	70.4
09/14	51.5	50.2	56.1	52.4	53.0	53.4	**54.7**	55.8	56.5	57.2	57.2	49.0	51.0	53.0		5606	1231	7049	75.0	68.0	69.6
09/15	51.5	50.7	56.0	52.4	53.0	53.5	**54.6**	55.7	56.5	57.4	57.3	48.9	50.6	53.0		5699	1844	7039	75.0	68.3	71.5
09/16	51.6	50.5	55.9	52.6	53.1	53.5	**54.7**	55.8	56.6	57.4	56.4	48.9	51.0	53.2		5067	1779	6998	74.0	67.3	70.0
09/17	51.7	50.3	55.8	52.7	53.4	53.8	**55.0**	56.1	56.8	57.5	56.4	48.8	51.2	53.5		4719	1931	7016	73.5	69.3	71.5
09/18	51.8	50.5	55.5	52.9	53.5	53.9	**55.5**	56.8	57.7	58.5	56.2	48.7	50.8	54.0		4532	1866	6801	74.5	71.9	71.0
09/19	51.9	50.7	55.4	52.9	53.6	54.1	**55.4**	56.5	57.4	58.5	56.7	48.8	51.4	53.8		4856	1833	6906	74.0	68.2	71.2
09/20	51.8	50.5	55.3	52.9	53.6	54.1	**55.5**	56.6	57.4	58.4	56.8	48.6	53.1	56.4		4293	1728	6841	80.5	69.8	72.1
09/21	52.4	51.2	55.0	52.9	53.5	53.9	**55.2**	56.4	57.2	58.1	# -	48.8	52.8	56.7		4265	1874	6856	72.5	66.9	69.6
09/22	52.4	51.4	54.9	53.0	53.5	53.9	**55.2**	56.3	57.1	58.0	# -	48.9	52.8	56.7		4104	1943	6821	71.5	67.5	69.0
09/23																					
09/24																					
09/25																					
09/26																					
09/27																					
09/28																					
09/29																					
09/30																					
-																					
Sep	51.4	50.2	56.0	52.5	53.1	53.6	55.0	56.1	56.9	57.8	57.4	49.7	53.8	57.5		5247	1517	7153	78.4	71.6	73.9
															Total CFS	115444	33367	157365			
															Total AF	228978	66182	312127			

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 Sacramento River control point (see page 3 for more details)
[3] IGO thermistor vandalized and out of commission as of 7/29/2020. Data is from nearby temperature logger. A bias has been applied to better represent the IGO location.

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
09/01	62	104	83.0	83	108	95.5	64	102	83.0	65	103	84.0	65	102	83.5	64	106	85.0	68	110	89.0	69	110	89.5	66	106	86.0	63	105	84.0	62	96	79.0	61	92	76.5
09/02	74	108	91.0	66	99	82.5	64	103	83.5	66	103	84.5	65	107	86.0	67	110	88.5	68	109	88.5	67	106	86.5	66	103	84.5	62	101	81.5	64	100	82.0	62	99	80.5
09/03	66	98	82.0	66	100	83.0	64	100	82.0	64	104	84.0	67	109	88.0	69	107	88.0	67	103	85.0	65	99	82.0	67	102	84.5	64	101	82.5	63	95	79.0	60	94	77.0
09/04	65	100	82.5	67	100	83.5	65	105	85.0	72	110	91.0	74	109	91.5	73	100	86.5	64	101	82.5	63	98	80.5	65	99	82.0	61	98	79.5	60	93	76.5	60	94	77.0
09/05	67	97	82.0	69	103	86.0	73	110	91.5	74	109	91.5	74	100	87.0	63	101	82.0	63	99	81.0	63	100	81.5	62	98	80.0	60	97	78.5	59	91	75.0	59	93	76.0
09/06	68	100	84.0	66	110	88.0	70	109	89.5	72	101	86.5	64	101	82.5	62	99	80.5	64	98	81.0	63	98	80.5	60	96	78.0	59	95	77.0	57	90	73.5	59	93	76.0
09/07	66	**111**	88.5	73	112	92.5	67	93	80.0	60	95	77.5	58	94	76.0	60	96	78.0	63	98	80.5	63	99	81.0	61	98	79.5	61	96	78.5	58	92	75.0	58	93	75.5
09/08	71	**112**	91.5	76	93	84.5	61	96	78.5	56	92	74.0	58	94	76.0	60	96	78.0	61	96	78.5	59	91	75.0	60	92	76.0	63	93	78.0	62	89	75.5	58	90	74.0
09/09	75	98	86.5	77	96	86.5	56	94	75.0	58	94	76.0	58	95	76.5	58	92	75.0	57	87	72.0	57	89	73.0	61	90	75.5	58	92	75.0	59	91	75.0	59	92	75.5
09/10	59	85	72.0	53	86	69.5	59	93	76.0	59	94	76.5	58	92	75.0	56	88	72.0	57	88	72.5	58	86	72.0	58	86	72.0	60	92	76.0	60	92	76.0	59	91	75.0
09/11	53	88	70.5	56	91	73.5	62	93	77.5	57	92	74.5	58	90	74.0	57	88	72.5	58	85	71.5	57	84	70.5	57	83	70.0	58	86	72.0	59	89	74.0	58	91	74.5
09/12	55	91	73.0	56	91	73.5	56	92	74.0	57	88	72.5	55	89	72.0	56	87	71.5	57	84	70.5	55	81	68.0	60	89	74.5	61	94	77.5	61	92	76.5	58	91	74.5
09/13	55	95	75.0	57	93	75.0	56	90	73.0	54	90	72.0	56	88	72.0	56	84	70.0	55	80	67.5	54	84	69.0	61	92	76.5	59	94	76.5	59	91	75.0	58	91	74.5
09/14	57	93	75.0	59	89	74.0	54	90	72.0	55	88	71.5	56	83	69.5	54	76	65.0	50	84	67.0	56	90	73.0	59	93	76.0	58	95	76.5	58	91	74.5	58	92	75.0
09/15	59	91	75.0	57	91	74.0	54	91	72.5	56	84	70.0	53	78	65.5	53	88	70.5	57	92	74.5	58	90	74.0	59	90	74.5	57	94	75.5	58	91	74.5	56	89	72.5
09/16	55	95	75.0	57	90	73.5	55	86	70.5	52	78	65.0	52	84	68.0	54	90	72.0	55	89	72.0	54	88	71.0	60	88	74.0	59	86	72.5	58	84	71.0	56	87	71.5
09/17	56	92	74.0	56	88	72.0	54	78	66.0	51	84	67.5	53	90	71.5	54	88	71.0	55	88	71.5	55	90	72.5	59	90	74.5	59	90	74.5	58	87	72.5	58	89	73.5
09/18	55	92	73.5	50	79	64.5	51	84	67.5	54	91	72.5	54	88	71.0	53	86	69.5	55	91	73.0	56	90	73.0	61	83	72.0	58	87	72.5	57	87	72.0	56	88	72.0
09/19	66	83	74.5	58	87	72.5	56	92	74.0	55	88	71.5	54	85	69.5	54	88	71.0	55	86	70.5	54	83	68.5	64	89	76.5	57	92	74.5	58	89	73.5	56	88	72.0
09/20	58	90	74.0	72	94	83.0	57	90	73.5	56	86	71.0	56	86	71.0	55	86	70.5	54	81	67.5	53	86	69.5	65	90	77.5	65	95	80.0	61	92	76.5	59	89	74.0
09/21	65	96	80.5	58	89	73.5	55	85	70.0	54	86	70.0	55	82	68.5	52	86	69.0	56	94	75.0	62	97	79.5	63	97	80.0	60	97	78.5	60	90	75.0	56	86	71.0
09/22	57	88	72.5	59	86	72.5	54	87	70.5	55	83	69.0	52	86	69.0	57	95	76.0	65	99	82.0	65	100	82.5	64	100	82.0	61	97	79.0	61	91	76.0	57	89	73.0
09/23	57	86	71.5	49	86	67.5	54	82	68.0	53	87	70.0	58	94	76.0	64	98	81.0	66	101	83.5	64	102	83.0	63	98	80.5	61	97	79.0	60	91	75.5	57	90	73.5
09/24																																				
09/25																																				
09/26																																				
09/27																																				
09/28																																				
09/29																																				
09/30																																				
-																																				

Web Links

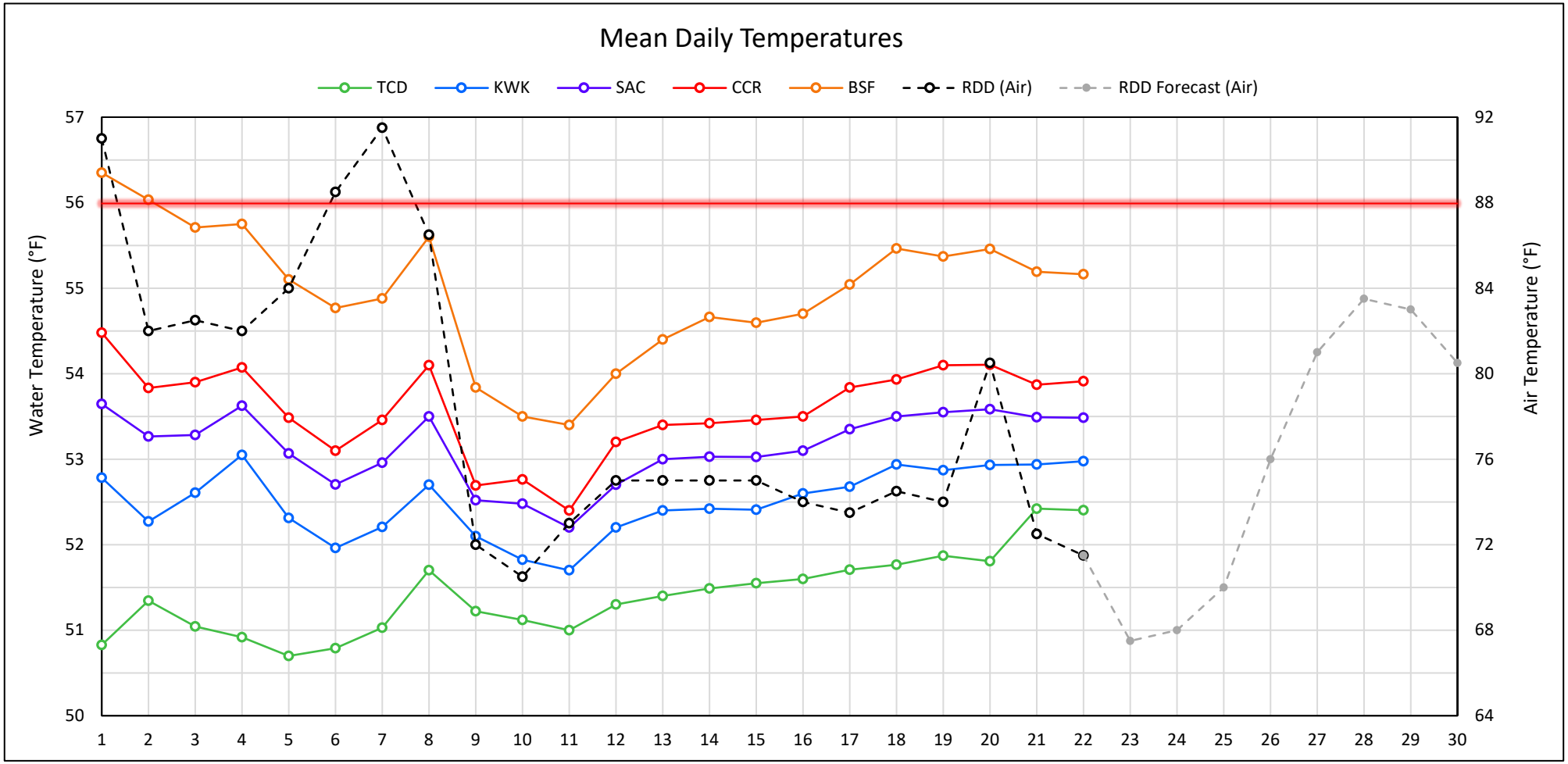
[10-Day Min/Max Forecast]

[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



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	Trinity River	19 miles downstream of Lewiston Dam	Click Here
NFH	Trinity River	38 miles downstream of Lewiston Dam	Click Here

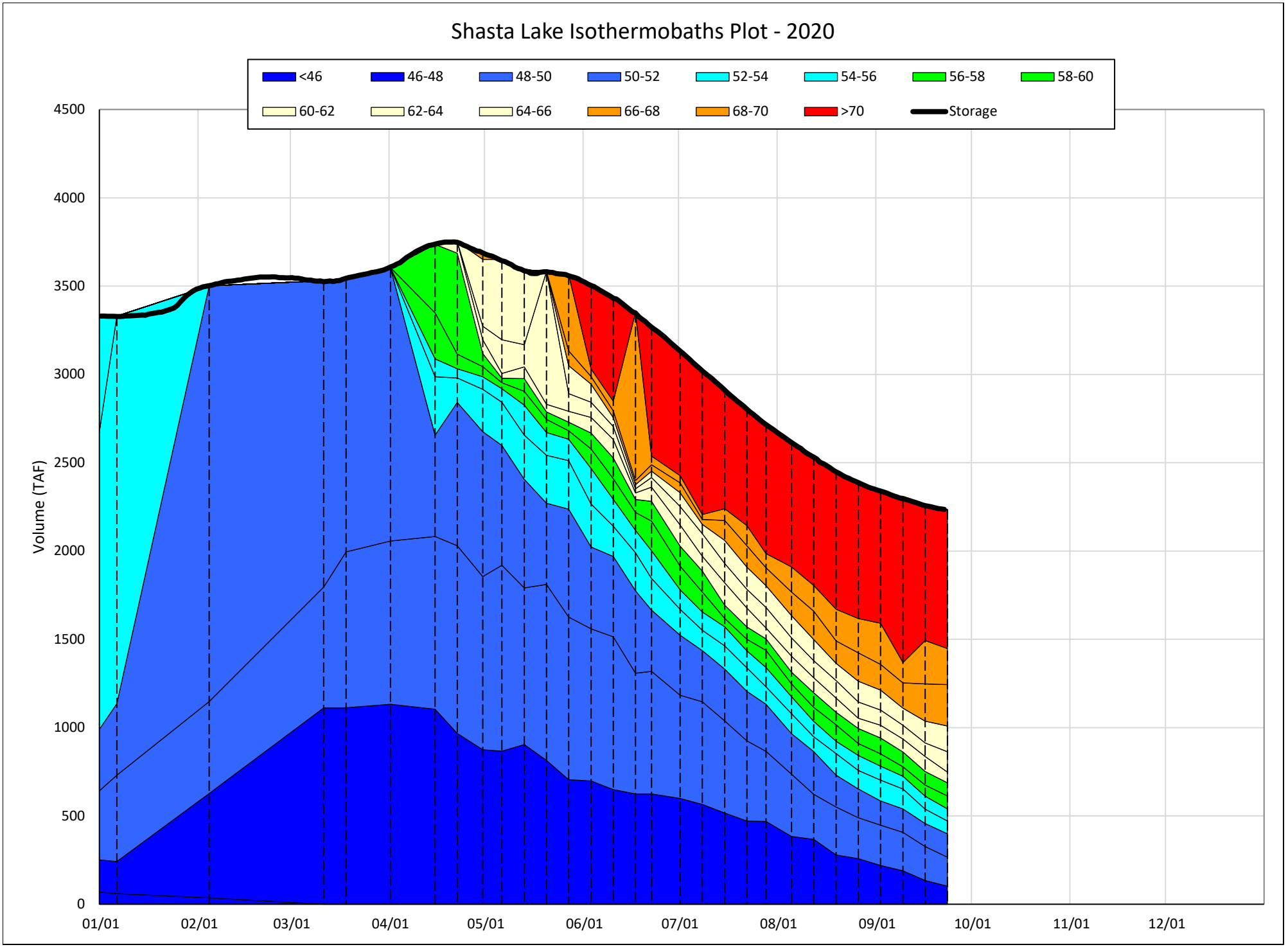
Water Right Temperature Control Points				
River	Point	Temp. (°F)	Begin Date	End Date
Sacramento	BSF	56	05/15/2019	09/20/2020
Sacramento	CCR	56	09/21/2020	TBD
Trinity	DGC	56	09/15/2020	10/01/2020
Trinity	NFH	56	10/01/2020	12/31/2020

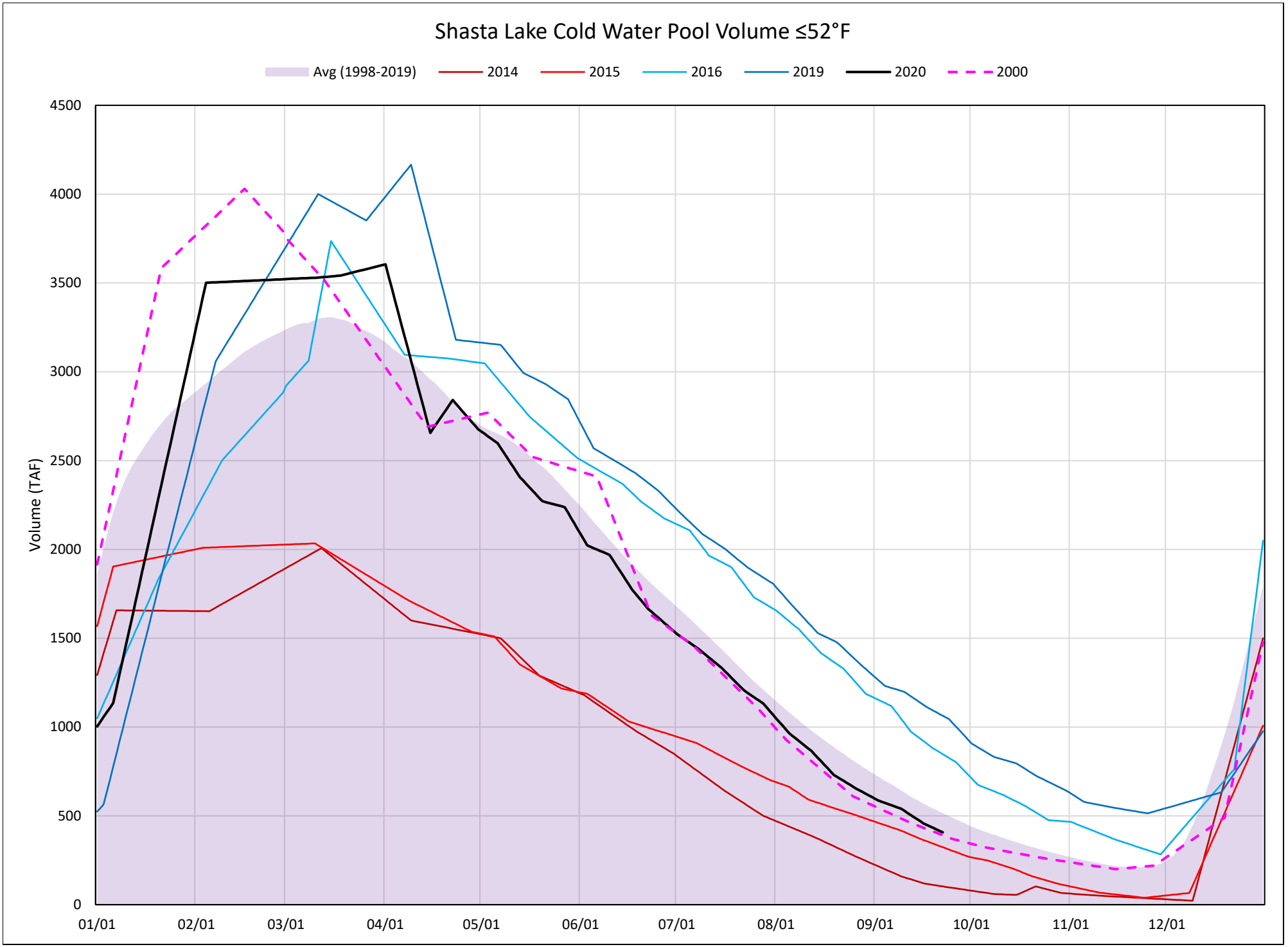
Notes

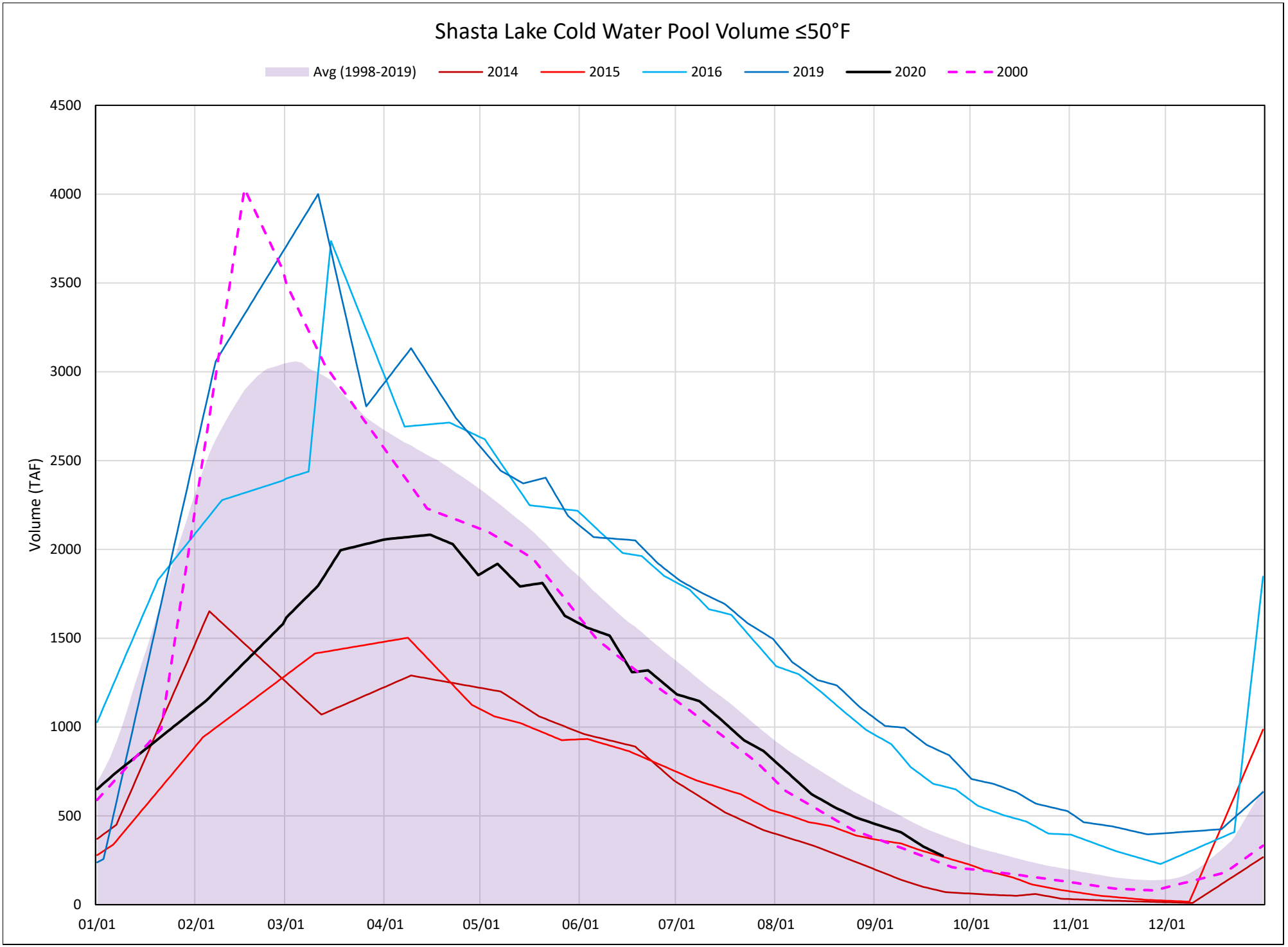
[1] Distances are approximate

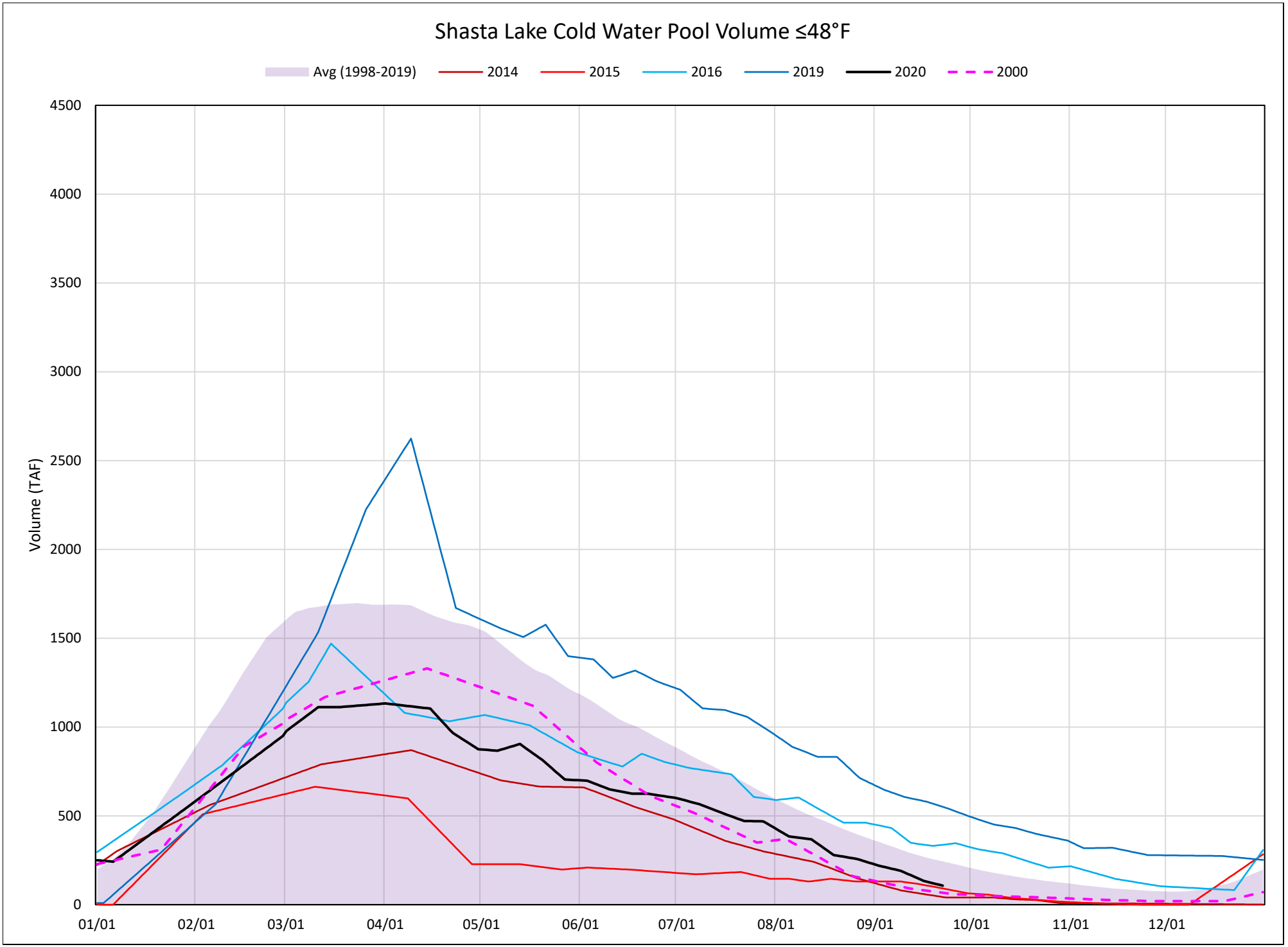
Shasta Lake Isothermobaths & Cold Water Pool Statistics

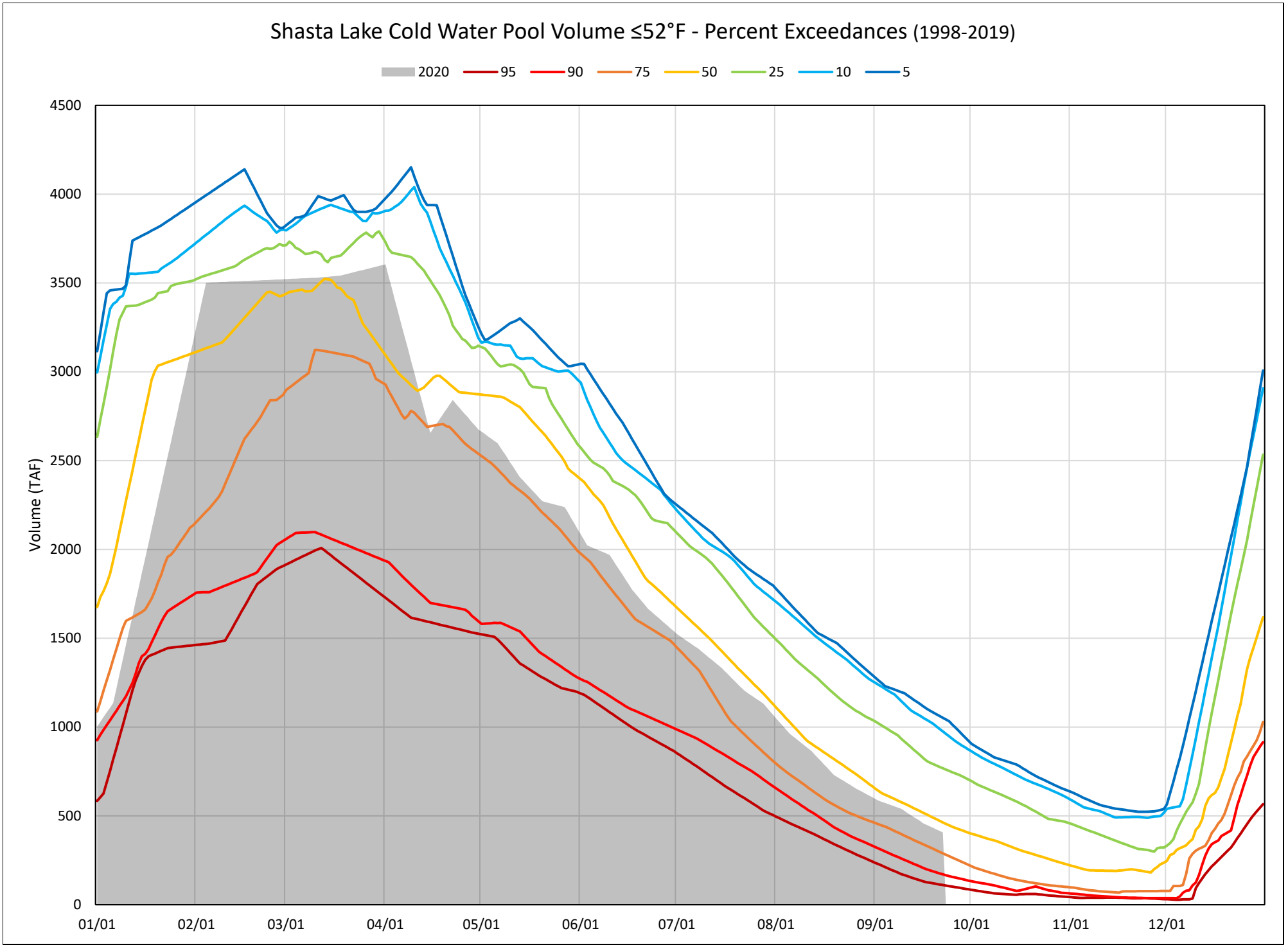
2020

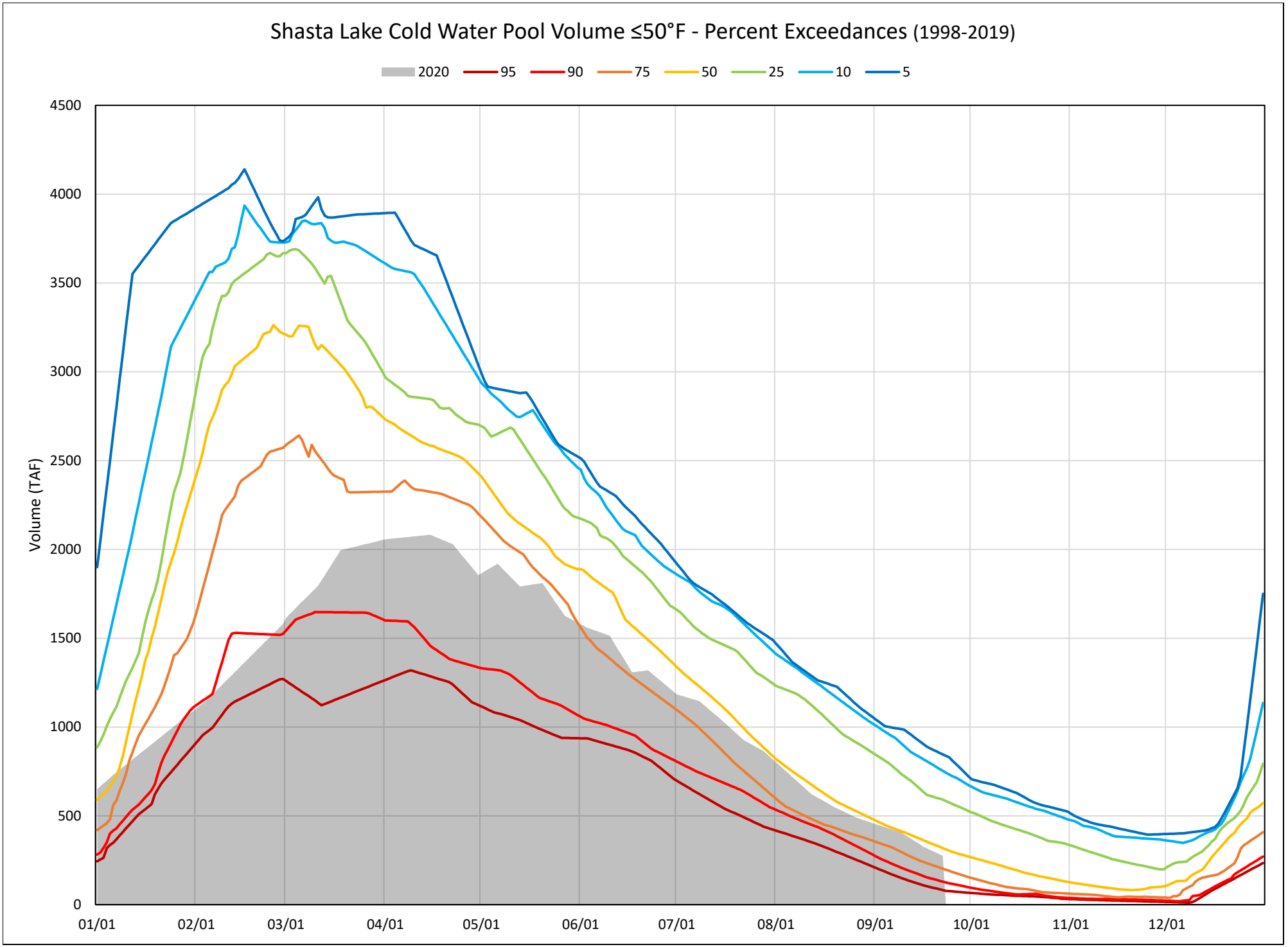

Shasta Lake Isothermobaths Plot - 2020
<46
46-48
48-50
50-52
52-54
54-56
56-58
58-60
60-62
62-64
64-66
66-68
68-70
>70
Storage
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

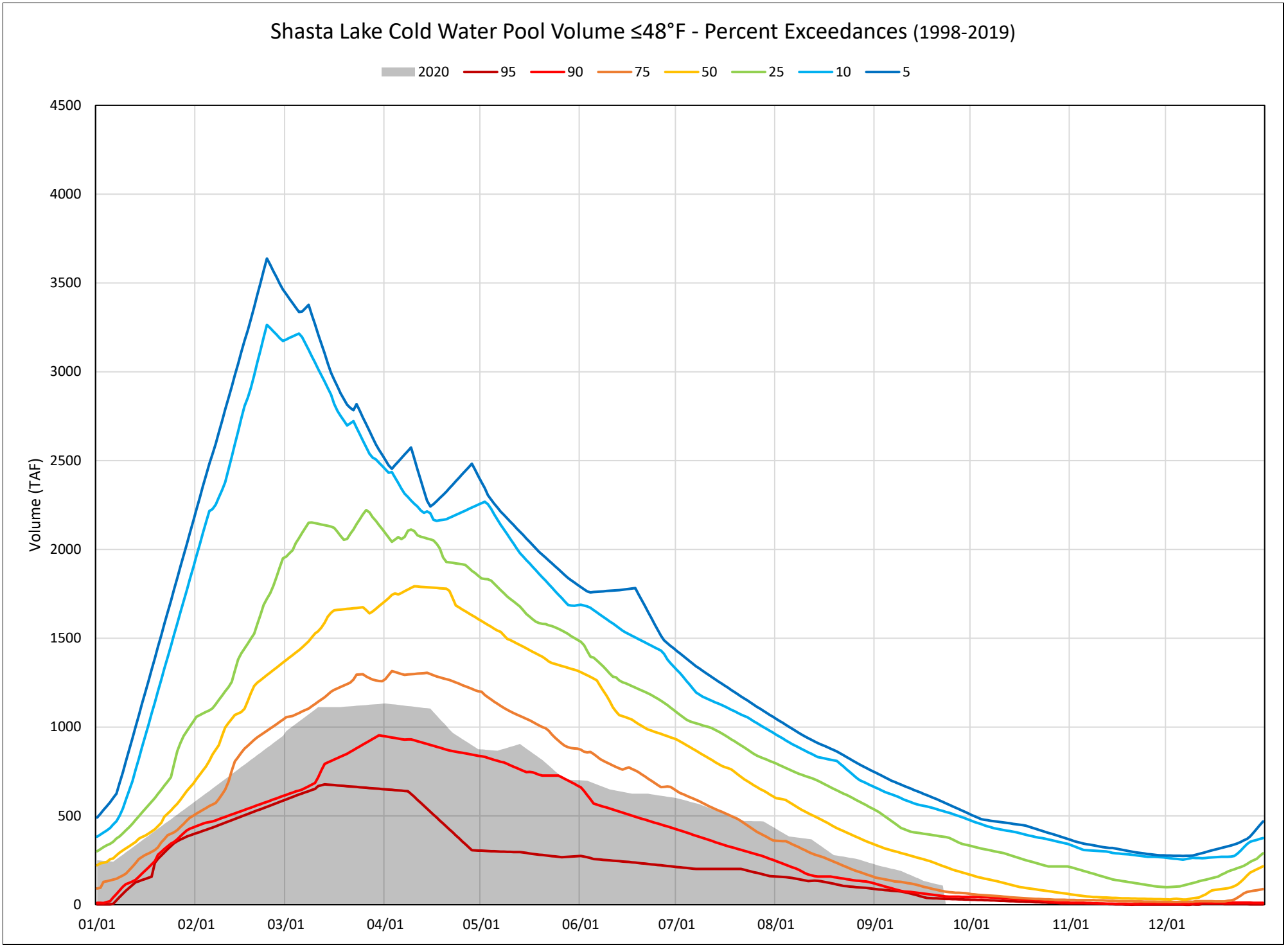

Shasta Lake Cold Water Pool Volume ≤52°F
Avg (1998-2019)
2014
2015
2016
2019
2020
2000
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Shasta Lake Cold Water Pool Volume ≤50°F
Avg (1998-2019)
2014
2015
2016
2019
2020
2000
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Shasta Lake Cold Water Pool Volume ≤48°F
Avg (1998-2019)
2014
2015
2016
2019
2020
2000
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Shasta Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (1998-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Shasta Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (1998-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Shasta Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (1998-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

Shasta Lake Cold Water Pool Comparison by Year (for Specified Date)

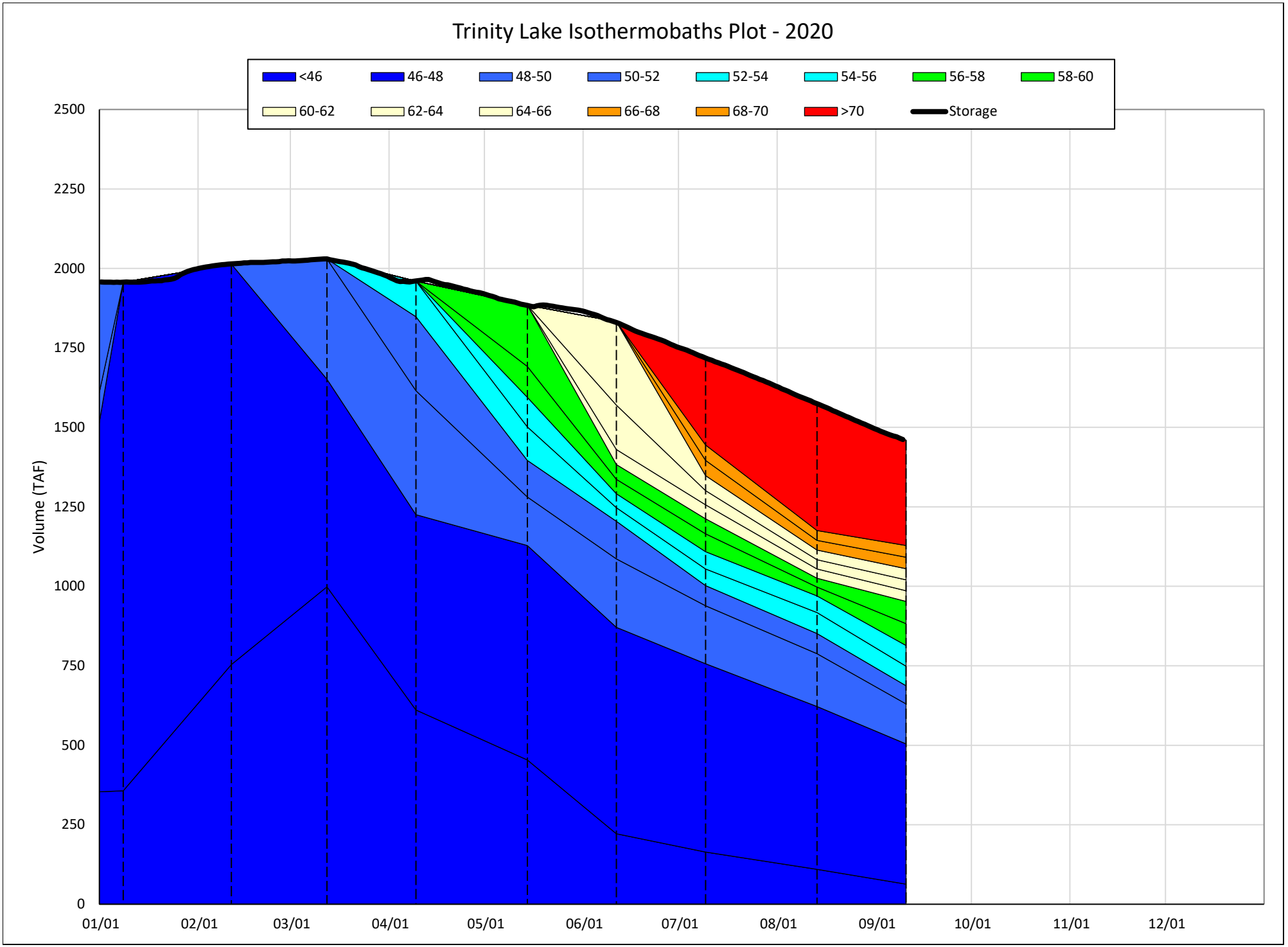
Sep-23 2020	Δ TAF				% Δ			
	≤52°	≤50°	≤48°	Abs. Avg.	≤52°	≤50°	≤48°	Abs. Avg.
1998	-85	-121	-75	94	-21	-44	-70	45
1999	341	317	335	331	84	115	313	171
2000	-17	-44	-40	34	-4	-16	-37	19
2001	-67	-2	98	55	-16	-1	92	36
2002	114	154	284	184	28	56	265	116
2003	111	-10	-46	56	27	-4	-43	25
2004	-200	-139	-32	124	-49	-51	-30	43
2005	-144	-108	-31	94	-35	-39	-29	35
2006	147	159	173	160	36	58	162	85
2007	-111	-32	70	71	-27	-11	65	35
2008	-252	-148	-15	138	-62	-54	-14	43
2009	-137	-60	48	82	-34	-22	45	33
2010	422	316	226	321	104	115	211	143
2011	581	507	476	521	143	184	445	257
2012	265	287	274	275	65	104	256	142
2013	1	89	180	90	0	32	168	67
2014	-304	-201	-64	190	-75	-73	-60	69
2015	-84	-5	-16	35	-21	-2	-15	12
2016	440	393	230	354	108	143	215	155
2017	538	412	367	439	132	150	343	208
2018	164	191	124	160	40	70	116	75
2019	656	583	443	561	161	212	414	262
2020	0	0	0	0	0	0	0	0

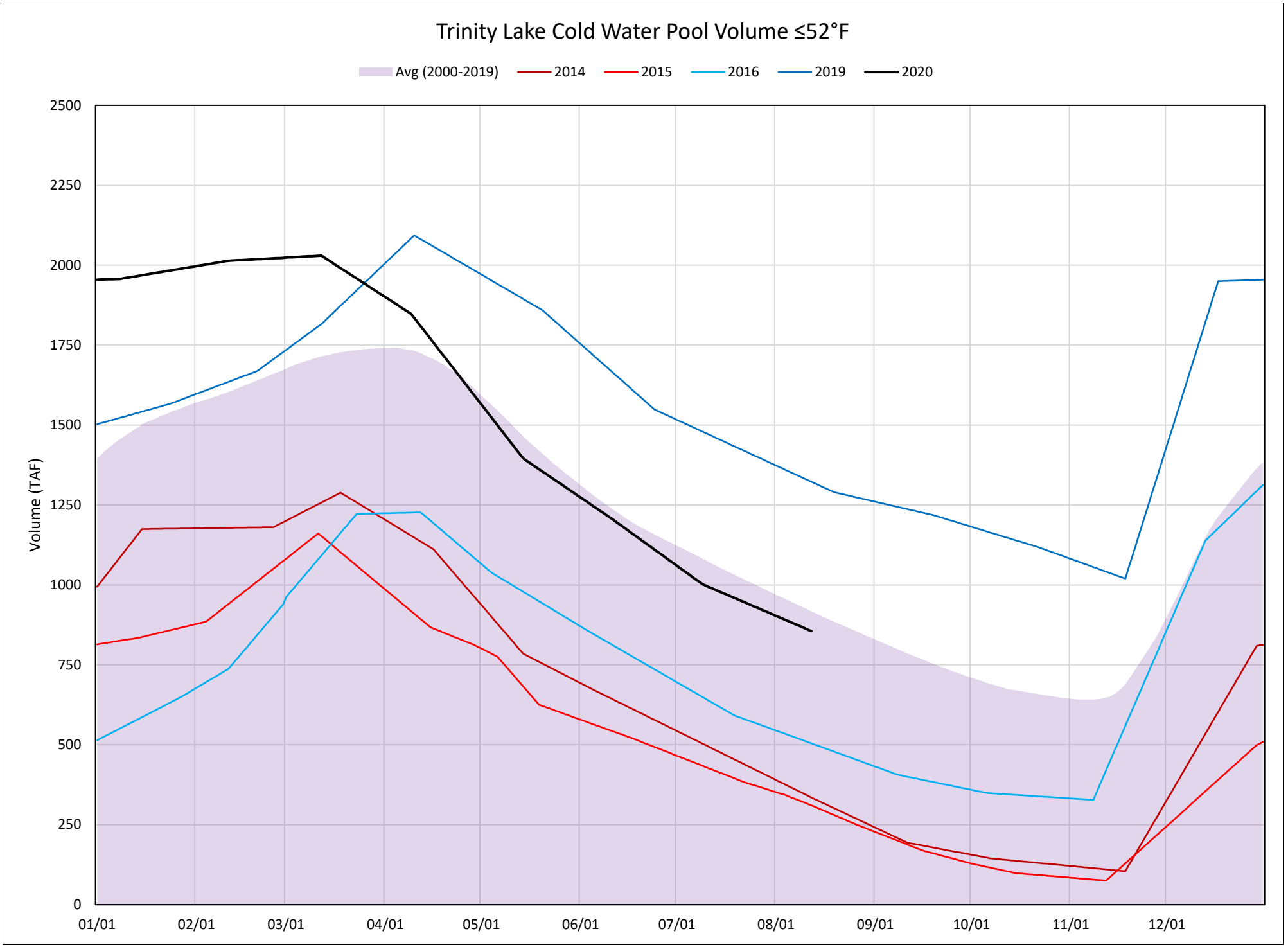
Historic - Current

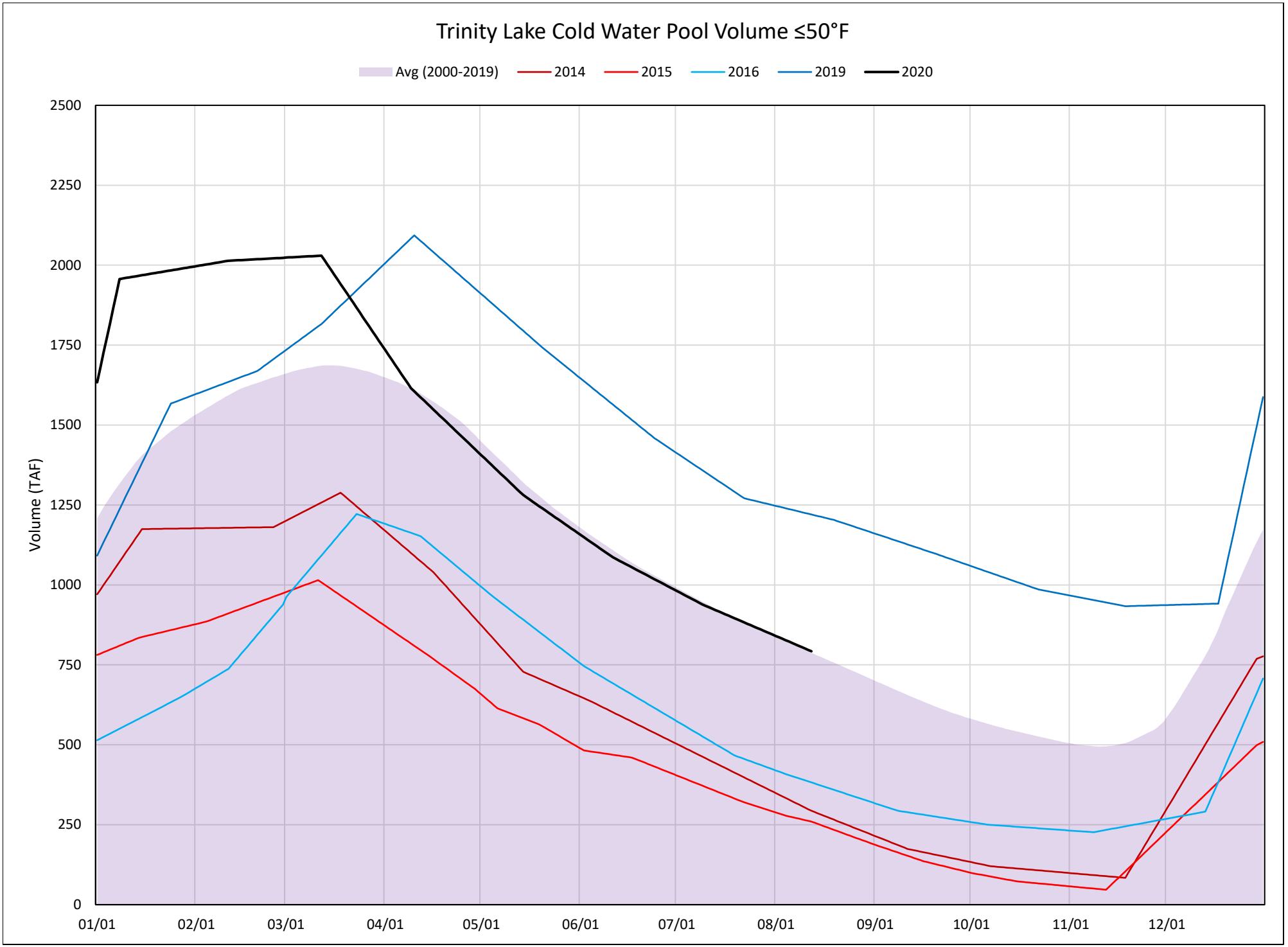
(Historic - Current) / Current

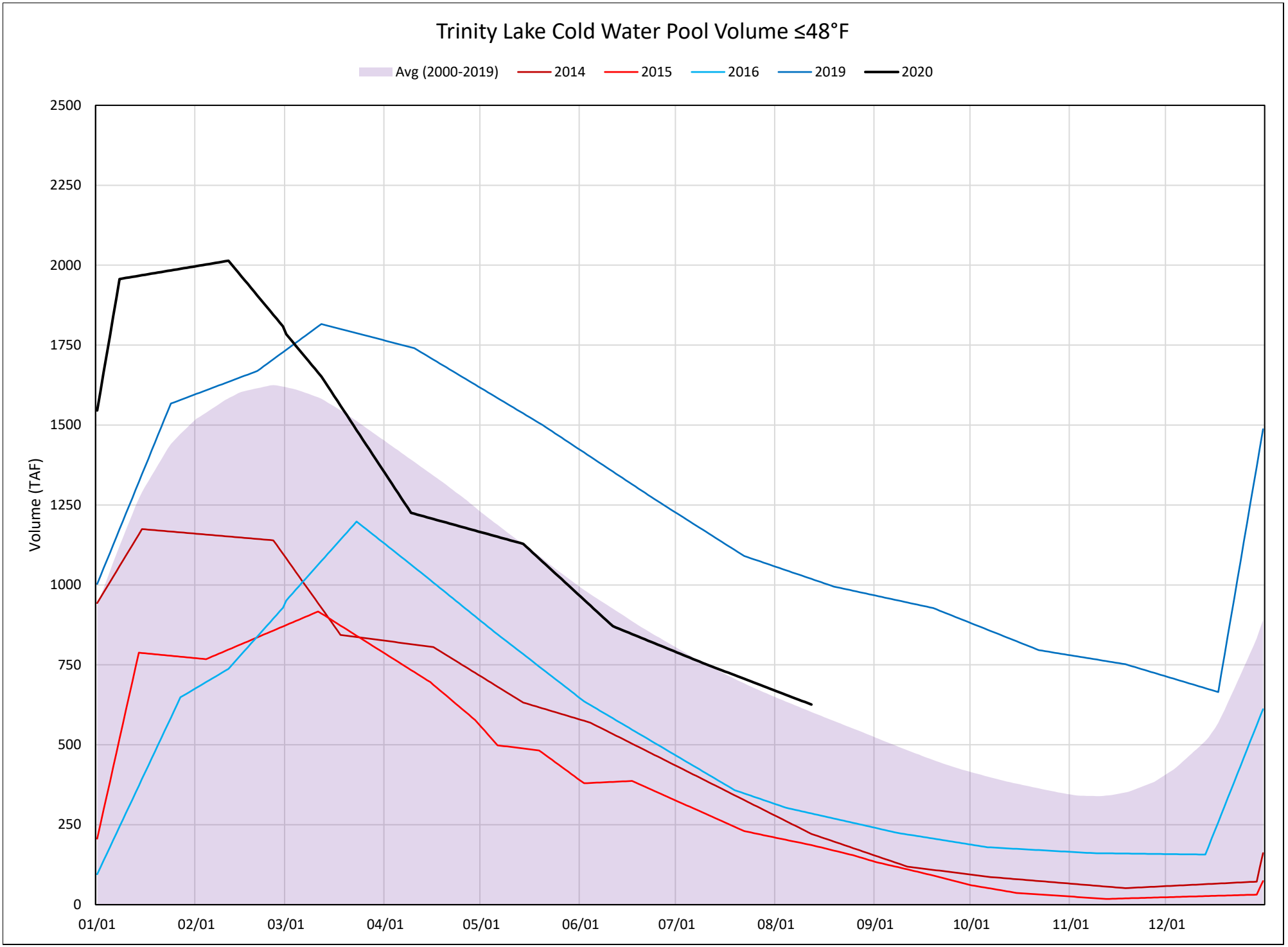
Trinity Lake Isothermobaths & Cold Water Pool Statistics

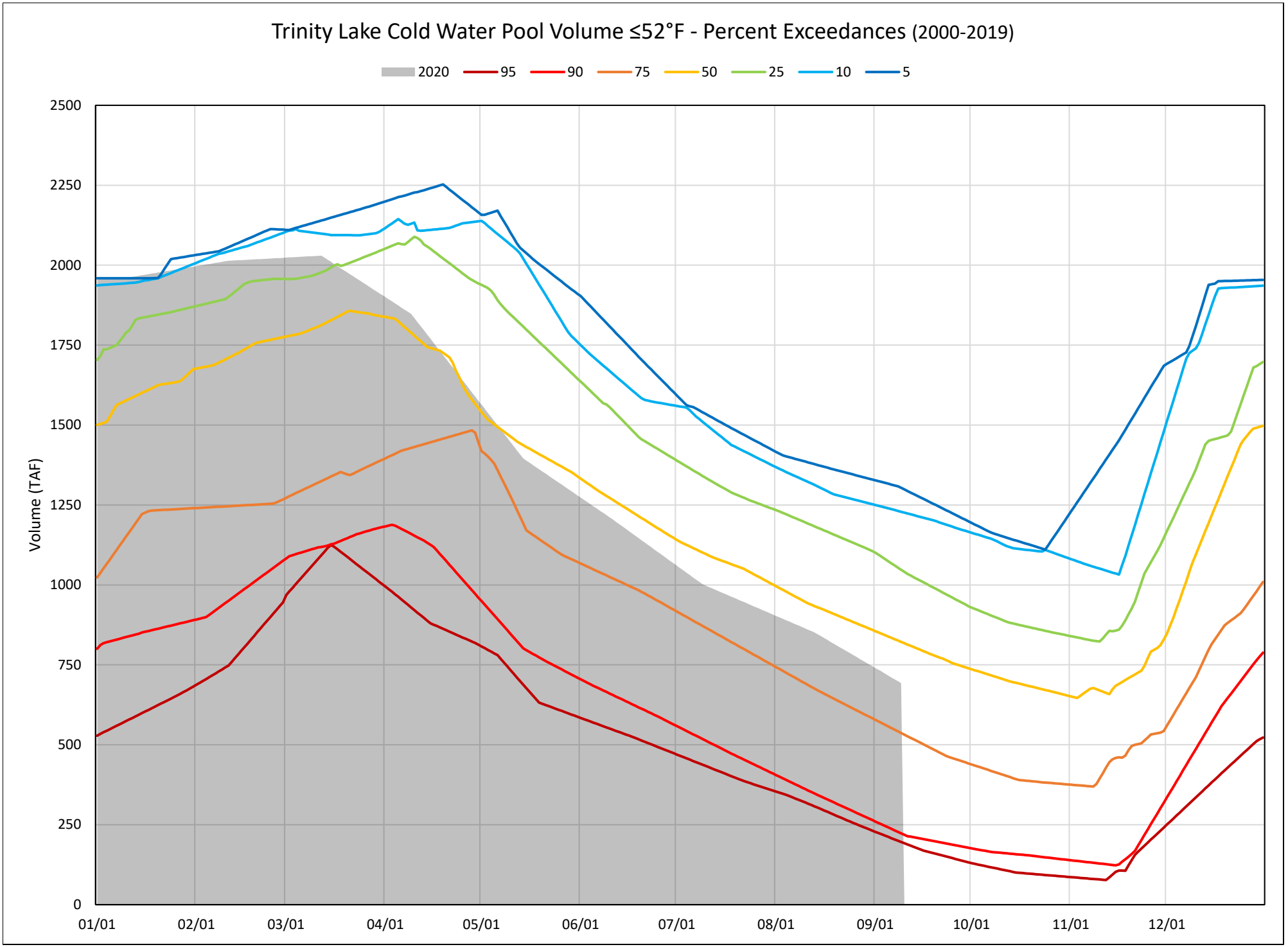
2020

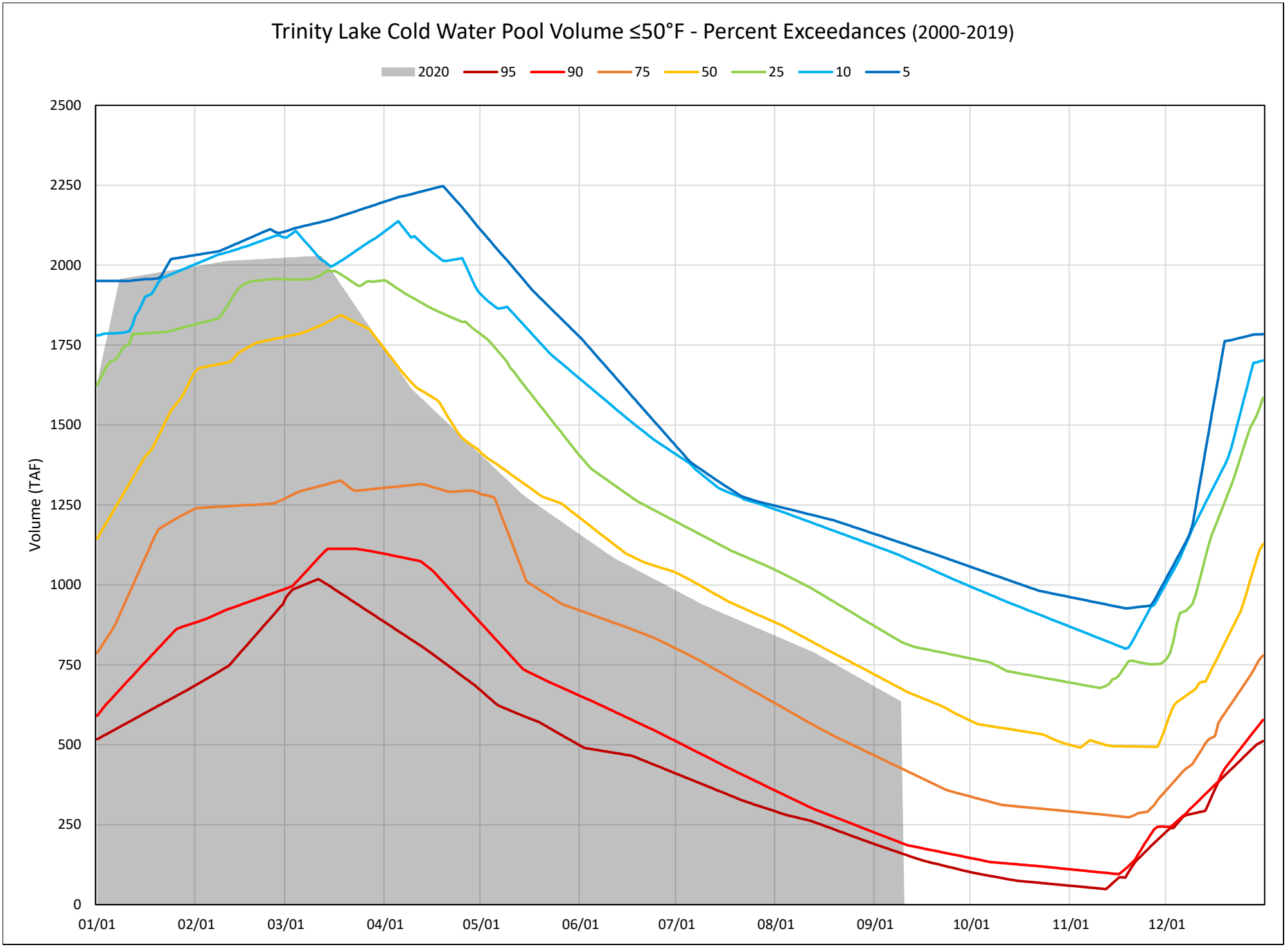

Trinity Lake Isothermobaths Plot - 2020
<46
46-48
48-50
50-52
52-54
54-56
56-58
58-60
60-62
62-64
64-66
66-68
68-70
>70
Storage
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

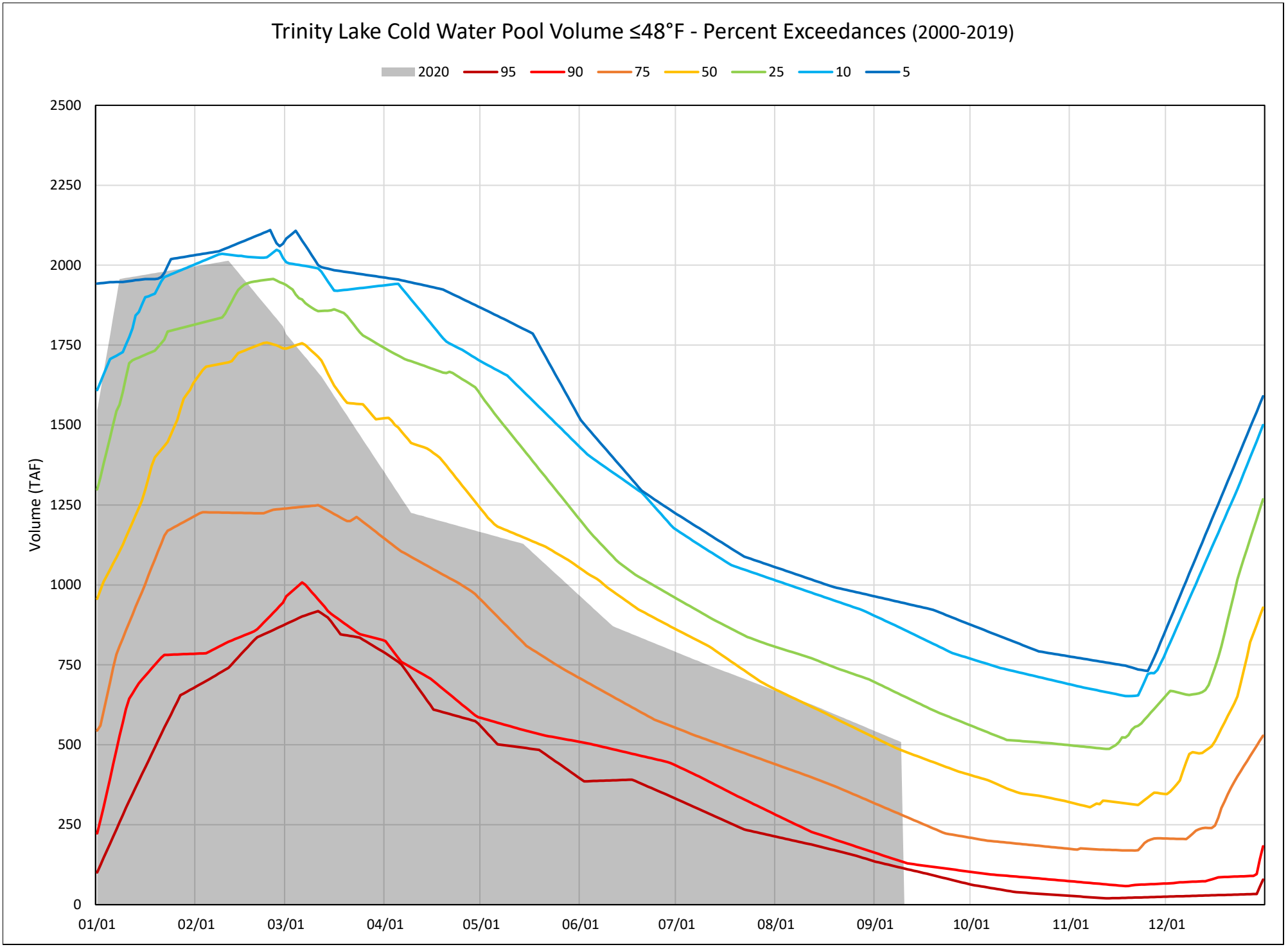

Trinity Lake Cold Water Pool Volume ≤52°F
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Trinity Lake Cold Water Pool Volume ≤50°F
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Trinity Lake Cold Water Pool Volume ≤48°F
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Trinity Lake Cold Water Pool Volume ≤52°F - Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Trinity Lake Cold Water Pool Volume ≤50°F - Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Trinity Lake Cold Water Pool Volume ≤48°F - Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

Trinity Cold Water Pool Comparison by Year (for Specified Date)

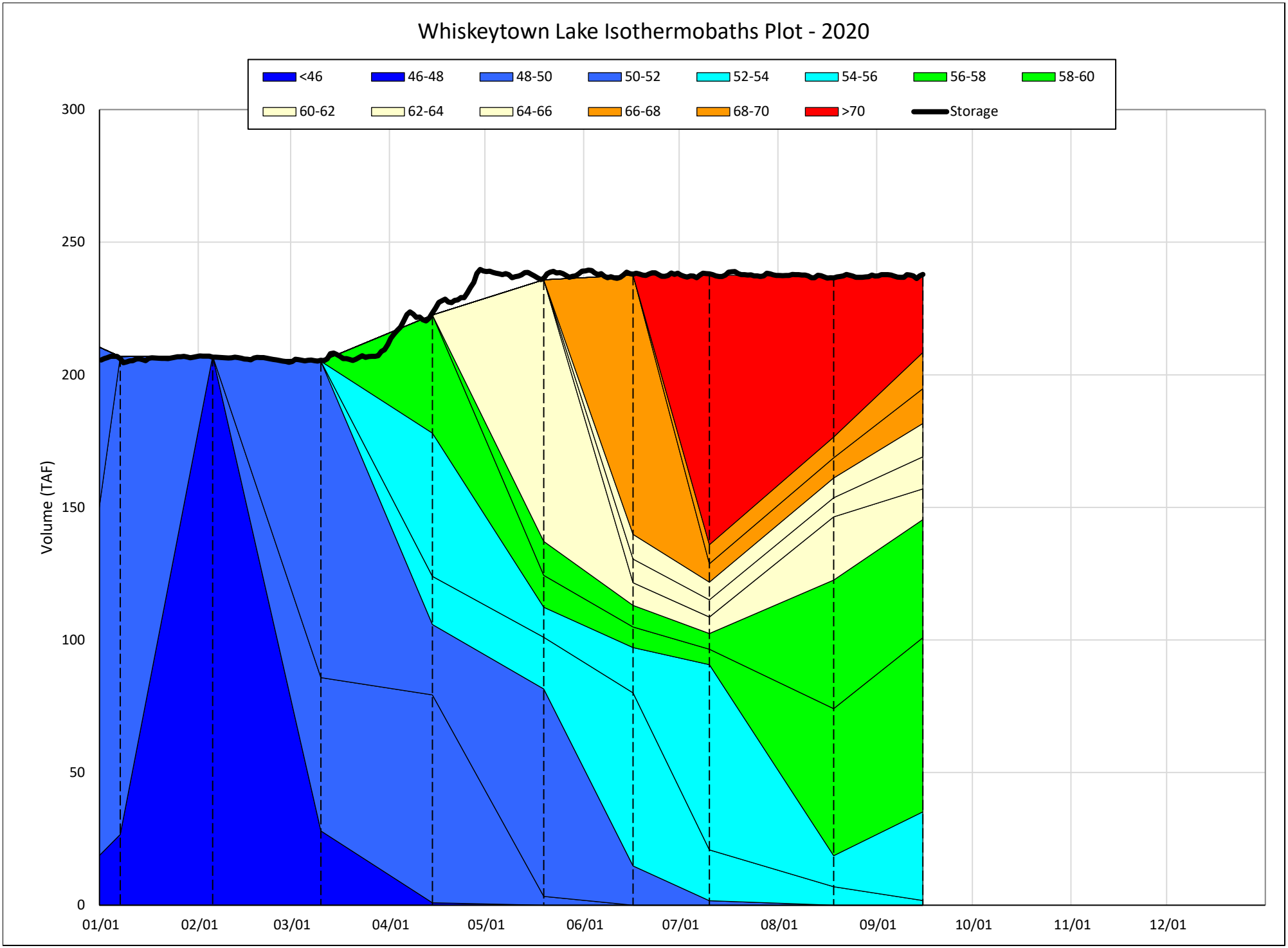
Sep-10 2020	Δ TAF				% Δ			
	≤52°	≤50°	≤48°	Abs. Avg.	≤52°	≤50°	≤48°	Abs. Avg.
2000	186	39	-41	89	27	6	-8	14
2001	61	16	-12	29	9	2	-2	5
2002	73	40	44	53	11	6	9	9
2003	369	186	48	201	53	29	9	31
2004	130	35	-61	75	19	5	-12	12
2005	311	183	-39	178	45	29	-8	27
2006	421	299	166	295	61	47	33	47
2007	128	87	91	102	18	14	18	17
2008	-183	-244	-248	225	-26	-38	-49	38
2009	-255	-275	-284	272	-37	-43	-56	45
2010	120	-15	-162	99	17	-2	-32	17
2011	614	465	337	472	89	73	66	76
2012	393	367	358	373	57	58	70	62
2013	-75	-103	-110	96	-11	-16	-22	16
2014	-490	-453	-383	442	-71	-71	-75	72
2015	-497	-476	-394	456	-72	-75	-77	75
2016	-289	-344	-286	306	-42	-54	-56	51
2017	244	86	9	113	35	13	2	17
2018	216	186	167	190	31	29	33	31
2019	548	498	441	496	79	78	87	81
2020	0	0	0	0	0	0	0	0

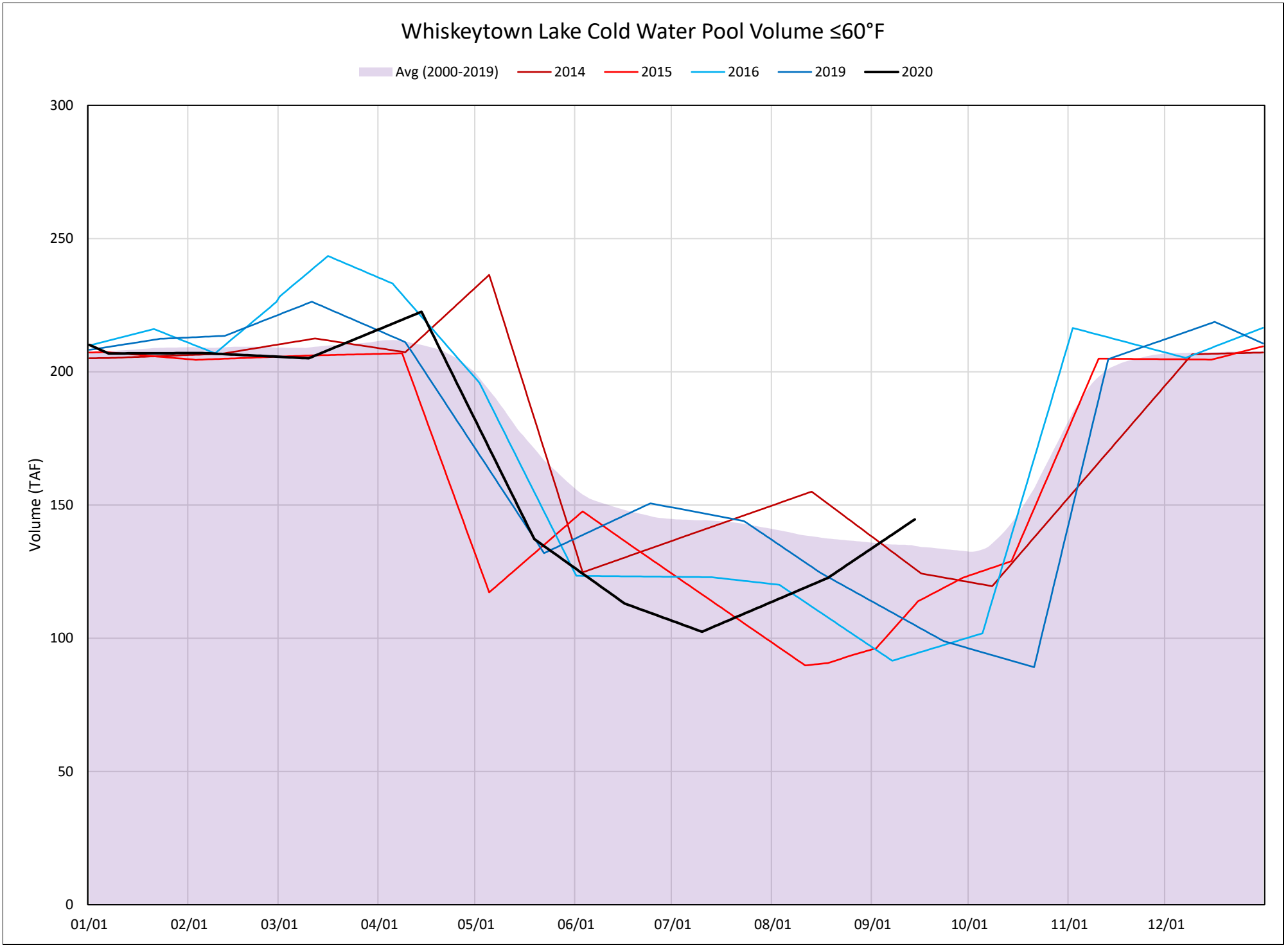
Historic - Current

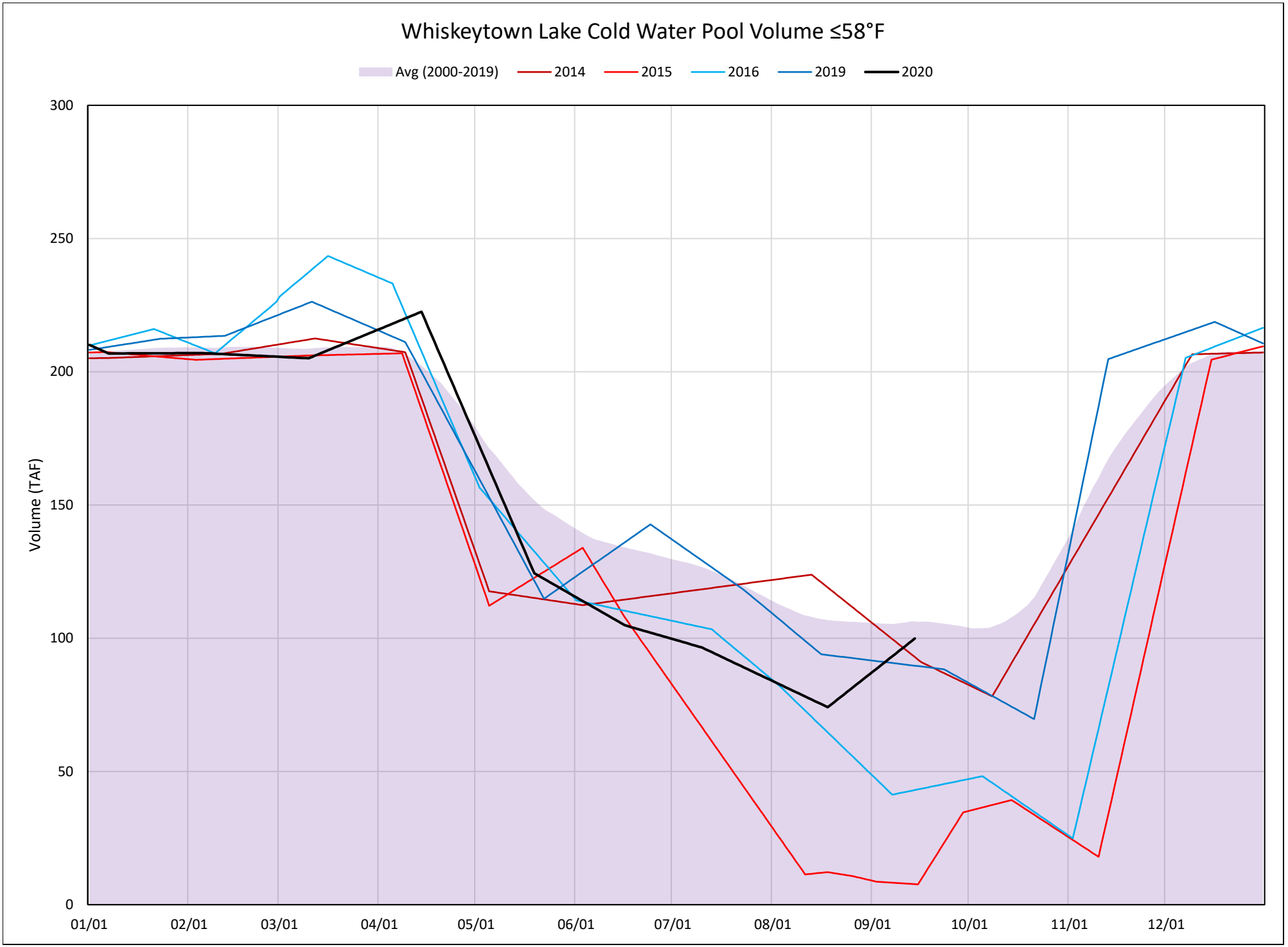
(Historic - Current) / Current

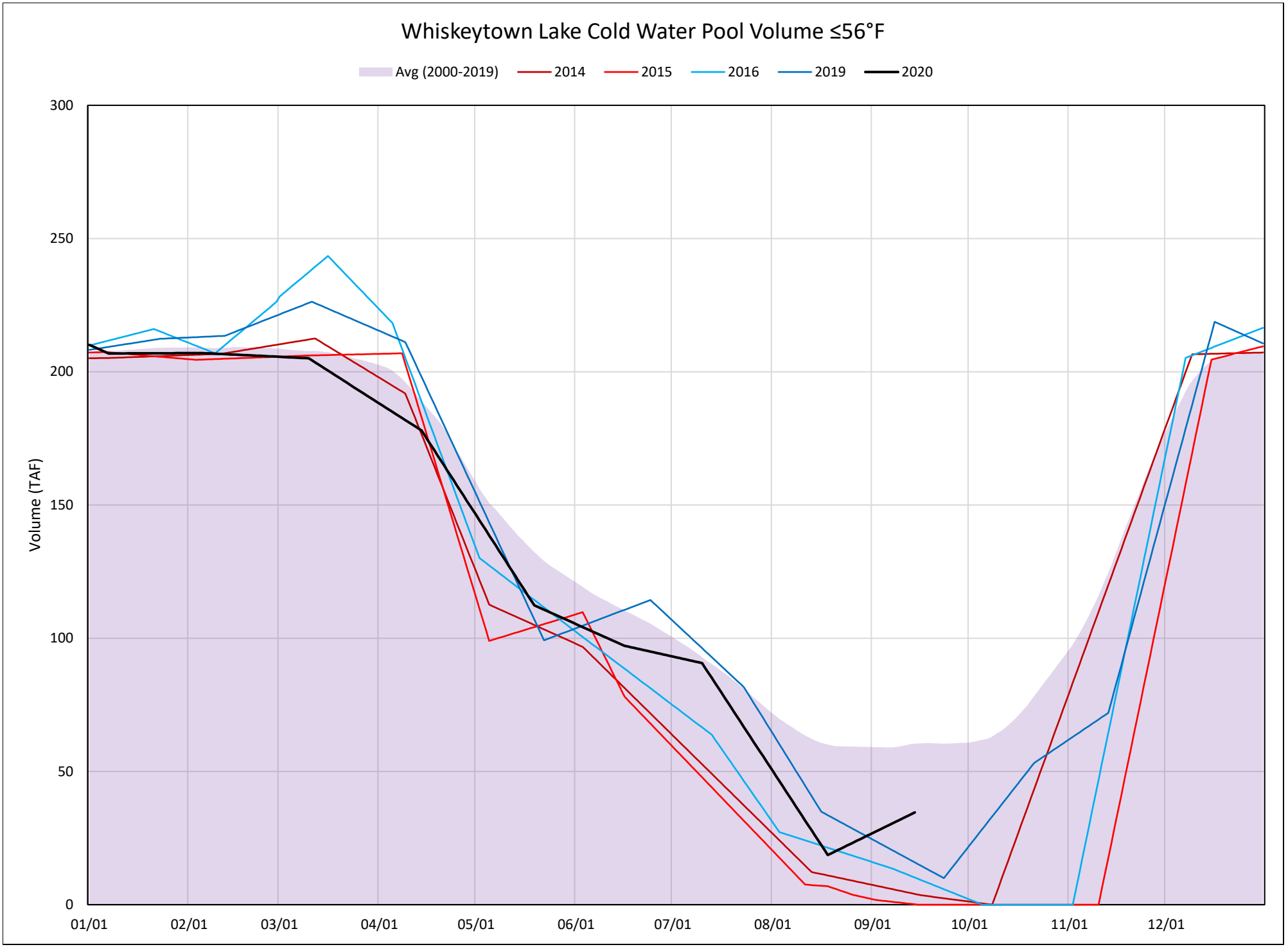
Whiskeytown Lake Isothermobaths & Cold Water Pool Statistics

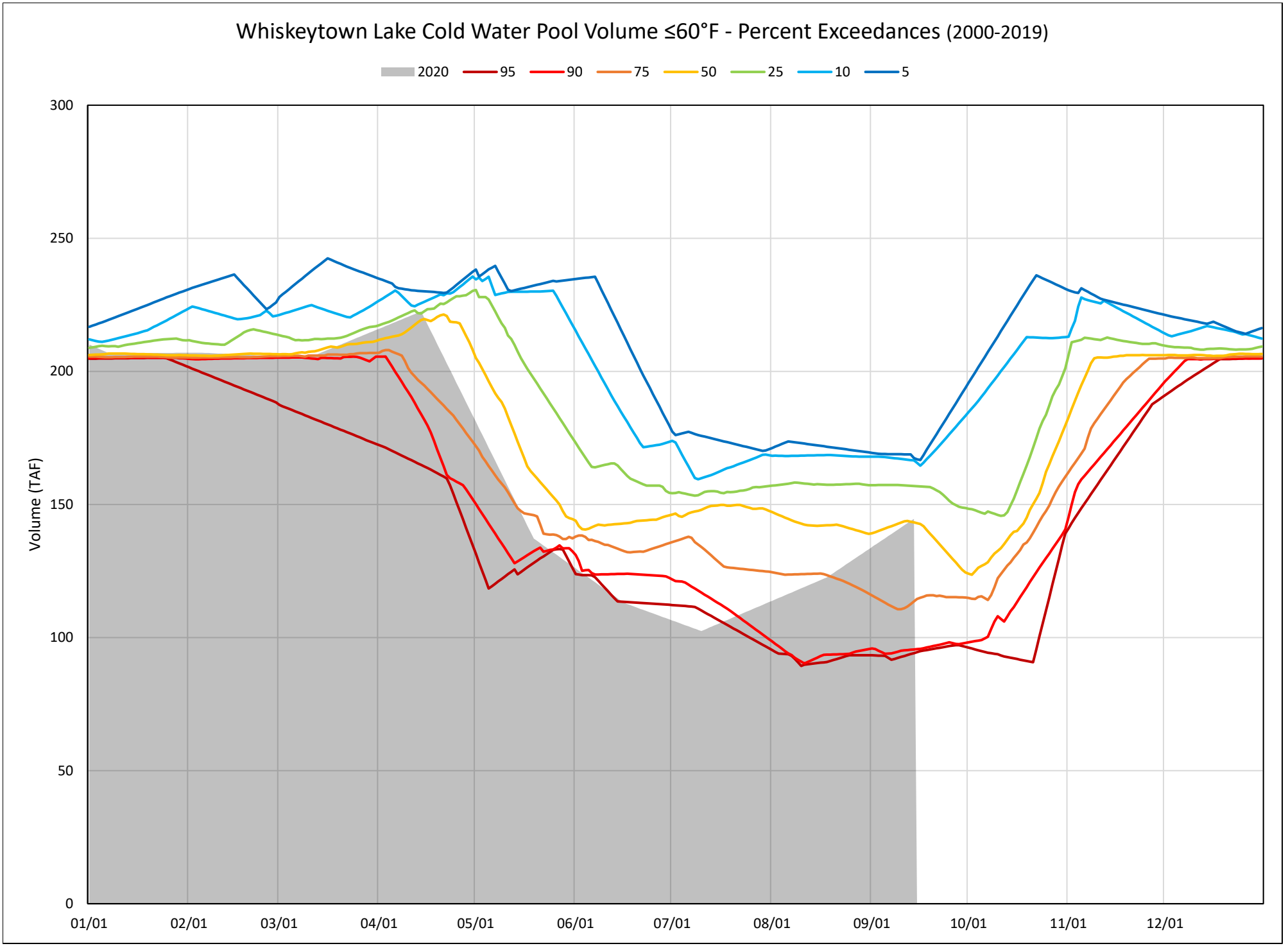
2020

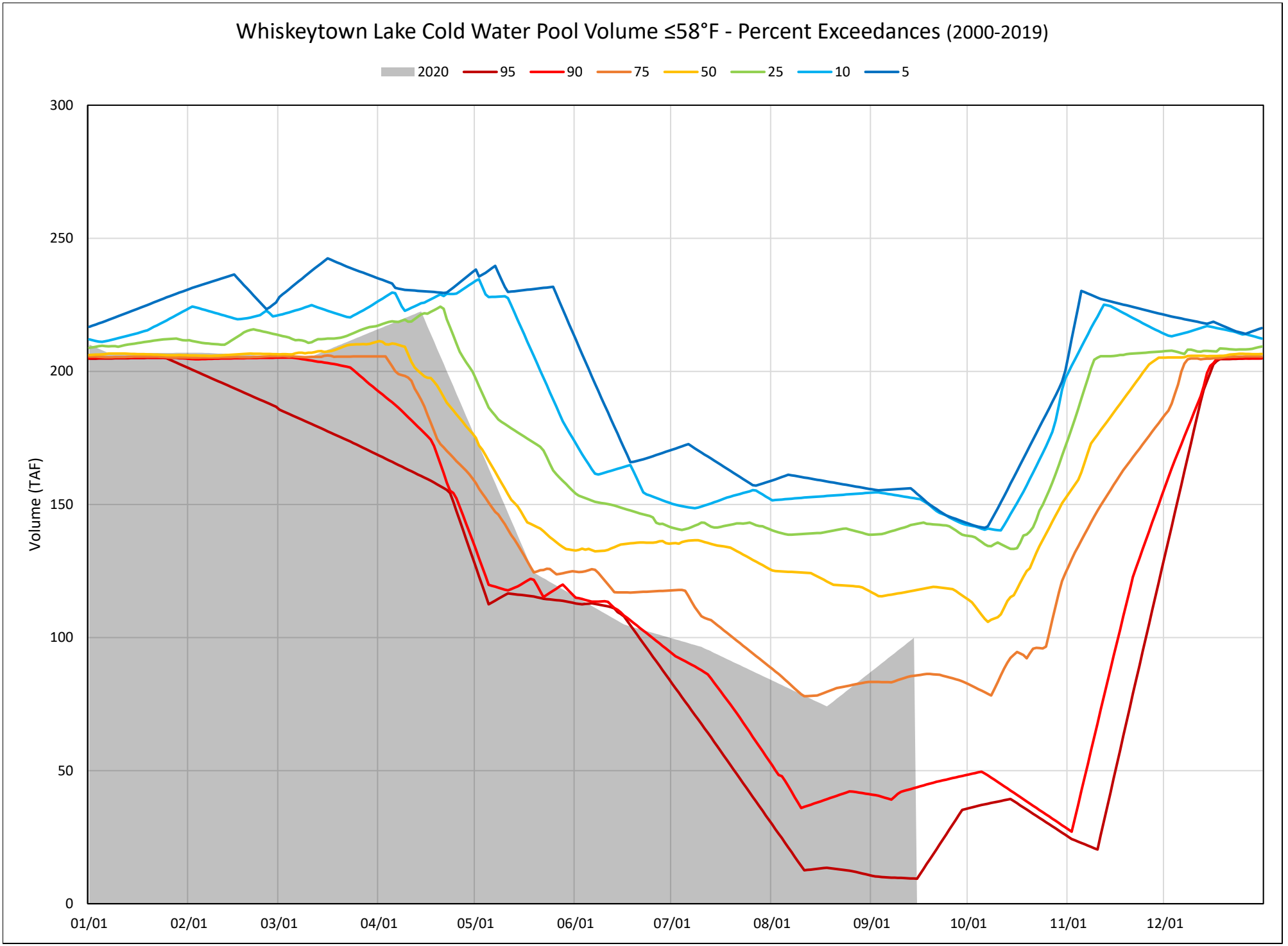

Whiskeytown Lake Isothermobaths Plot - 2020
<46
46-48
48-50
50-52
52-54
54-56
56-58
58-60
60-62
62-64
64-66
66-68
68-70
>70
Storage
Volume (TAF)
300
250
200
150
100
50
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Whiskeytown Lake Cold Water Pool Volume ≤60°F
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
300
250
200
150
100
50
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Whiskeytown Lake Cold Water Pool Volume ≤58°F
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
300
250
200
150
100
50
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Whiskeytown Lake Cold Water Pool Volume ≤56°F
Avg (2000-2019)
2014
2015
2016
2019
2020
Volume (TAF)
300
250
200
150
100
50
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Whiskeytown Lake Cold Water Pool Volume ≤60°F - Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
300
250
200
150
100
50
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01


Whiskeytown Lake Cold Water Pool Volume ≤58°F - Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
Volume (TAF)
300
250
200
150
100
50
0
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
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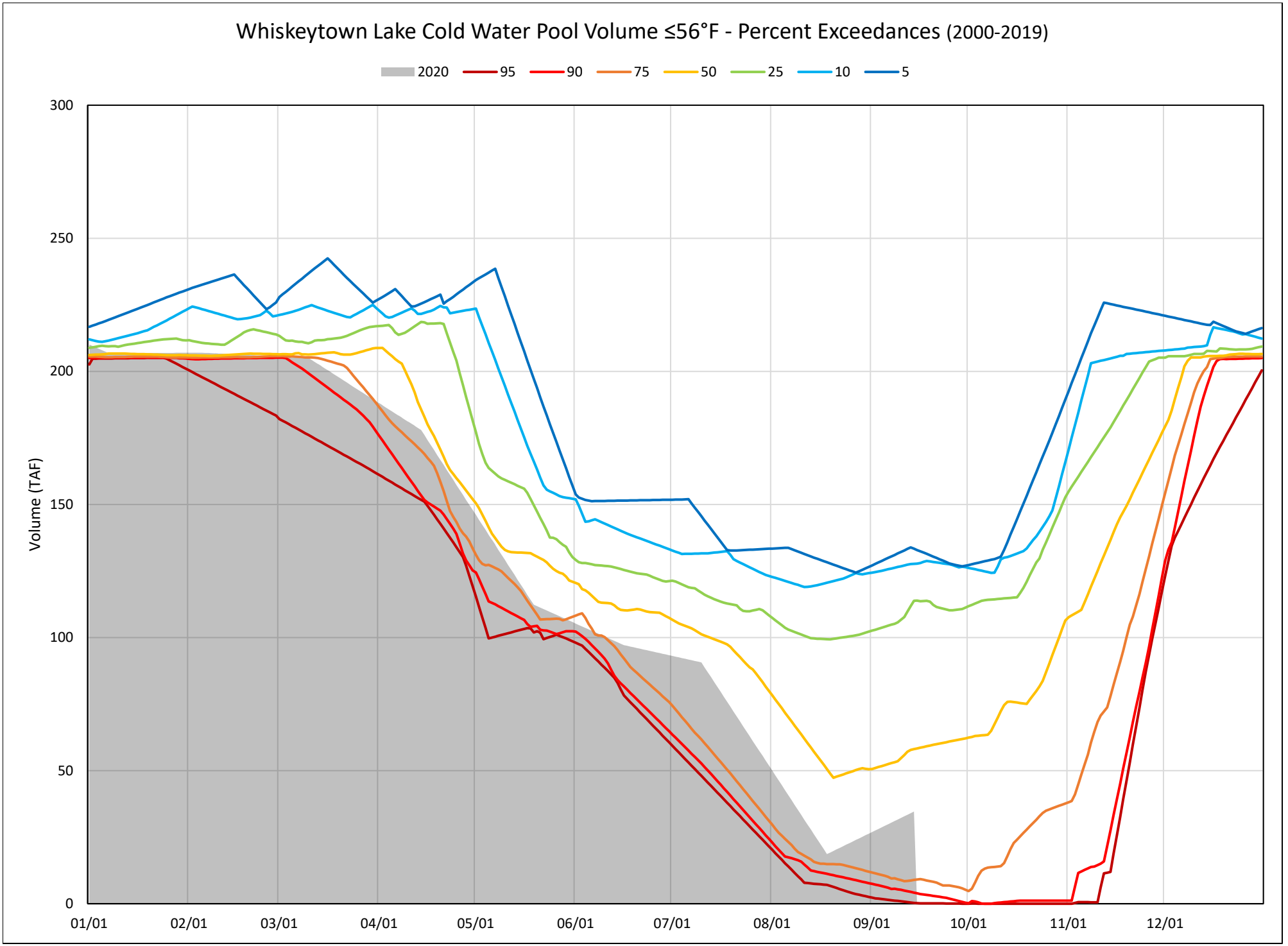
10/01
11/01
12/01


Whiskeytown Lake Cold Water Pool Volume ≤56°F - Percent Exceedances (2000-2019)
2020
95
90
75
50
25
10
5
300
250
200
150
100
50
0
Volume (TAF)
01/01
02/01
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
11/01
12/01

Whiskeytown Cold Water Pool Comparison by Year (for Specified Date)

Sep-15 2020	Δ TAF				% Δ			
	≤60°	≤58°	≤56°	Abs. Avg.	≤60°	≤58°	≤56°	Abs. Avg.
2000	1	41	88	43	1	41	255	99
2001	14	49	94	52	10	49	271	110
2002	13	47	74	45	9	47	215	90
2003	3	43	81	42	2	43	233	93
2004	10	36	46	31	7	36	133	59
2005	-50	-53	-26	43	-35	-53	-75	54
2006	23	55	99	59	16	55	286	119
2007	1	24	43	23	1	24	126	50
2008	0	32	68	33	0	32	196	76
2009	-24	-15	-29	23	-16	-15	-85	39
2010	-34	-48	-28	37	-23	-48	-81	51
2011	-28	-11	-14	18	-19	-11	-39	23
2012	-3	11	3	6	-2	11	10	8
2013	23	53	81	52	16	53	235	101
2014	-19	-7	-31	19	-13	-7	-88	36
2015	-32	-92	-34	53	-22	-92	-100	71
2016	-50	-57	-24	44	-35	-57	-71	54
2017	17	42	55	38	11	42	159	71
2018	-24	-12	-12	16	-17	-12	-35	22
2019	-40	-10	-19	23	-27	-10	-54	31
2020	0	0	0	0	0	0	0	0

Historic - Current

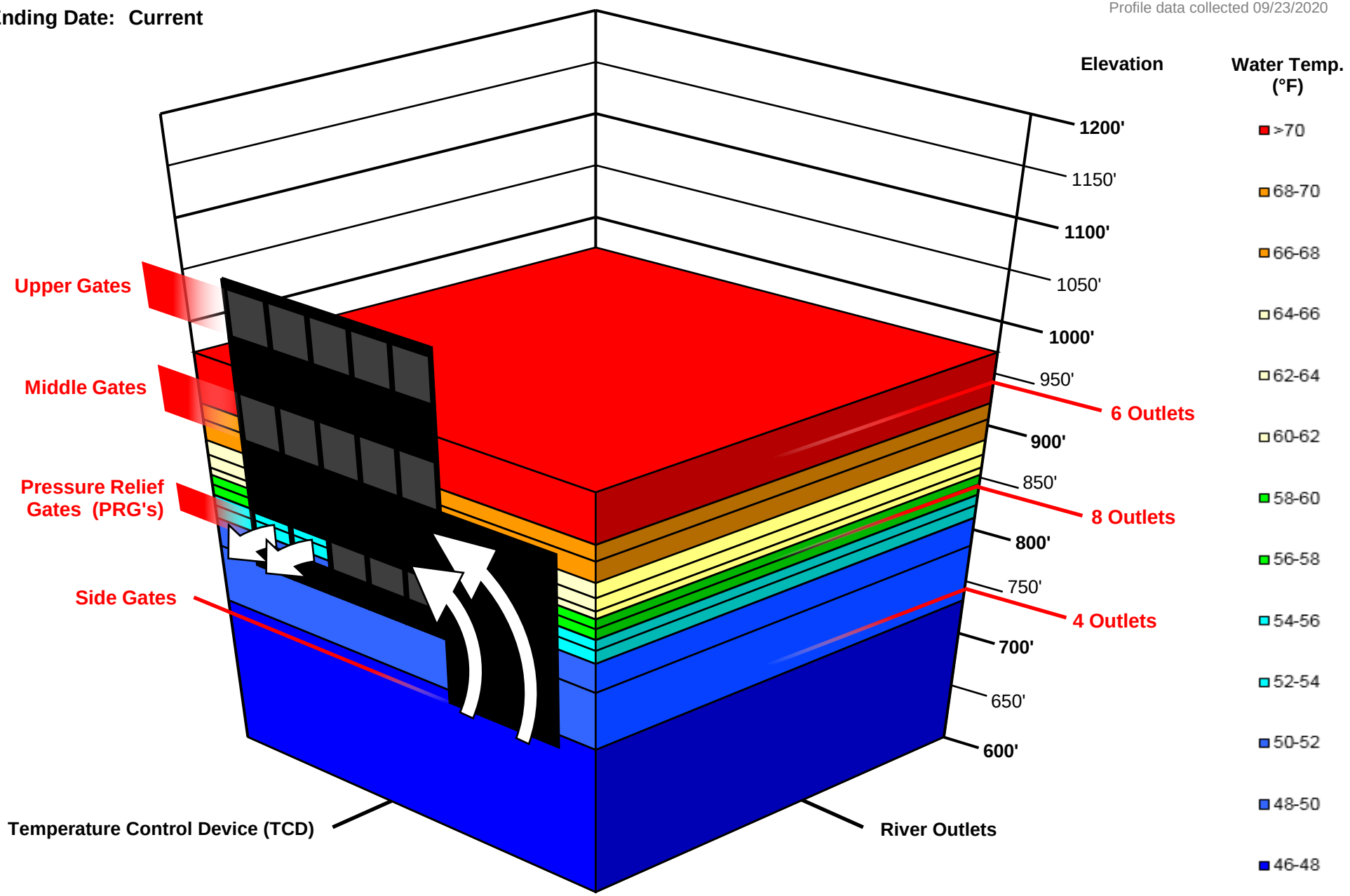
(Historic - Current) / Current

Shasta TCD Configuration

Starting Date: 9/21/2020

Ending Date: Current

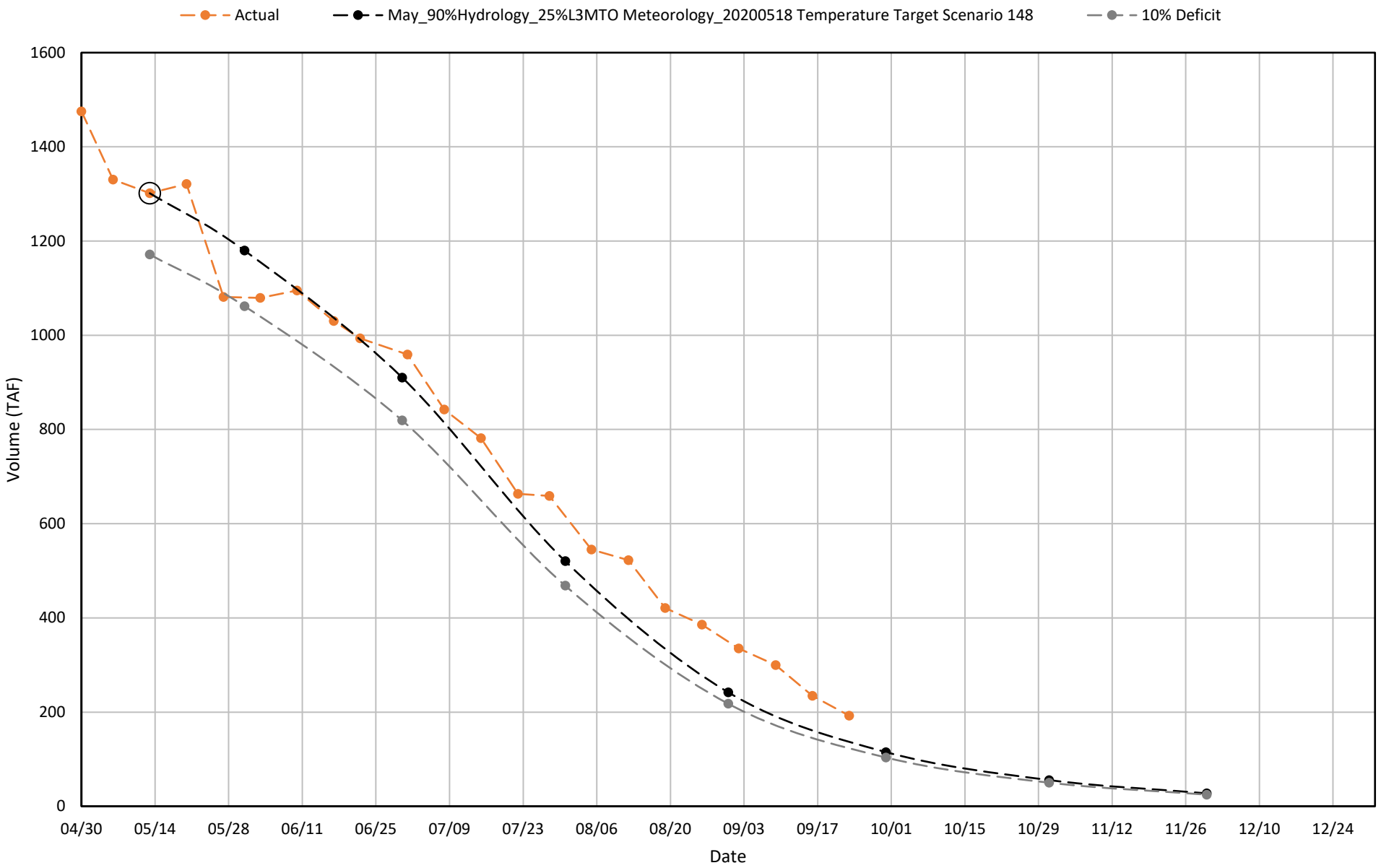
Profile data collected 09/23/2020



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

Printed: 2020.09.23

2020 Shasta Cold Water Pool Volume ≤49°F



September 23, 2020

Upper Sacramento River – September 2020 Preliminary Temperature Analysis

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

Model Run	Location	Sep*	Oct*
90% Hydro. - 25% L3MTO Met. Scenario 148	Keswick Dam KWK	54.3	55.0
	Sac. R. abv Clear Creek CCR	54.5	55.1
	Airport Road	54.9	55.4
	Balls Ferry BSF	55.5	56.0

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% L3MTO Met. Scenario 148	500	8/13	10/30

Model Run Date September 21, 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 3-5). 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 Shasta tailbay temperature targets. The temperature results for the Sacramento River between Keswick Dam and Balls Ferry and the Trinity River are shown in Figures 1-2. 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.

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. The latest available profiles for Shasta, Trinity, and Whiskeytown were taken on September 16, September 10, and September 15, respectively. Initial temperature profiles are adjusted and noted at Whiskeytown and Trinity using simulated results if the length of time between monitoring is large. 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 September 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.). The September Keswick releases in the Operations Outlook were adjusted further to reflect actual releases, the average monthly release used was 7,000 cfs for the month of September. 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 non-exceedance at 25% and 50% (when available) 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 (L3MTO), 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).

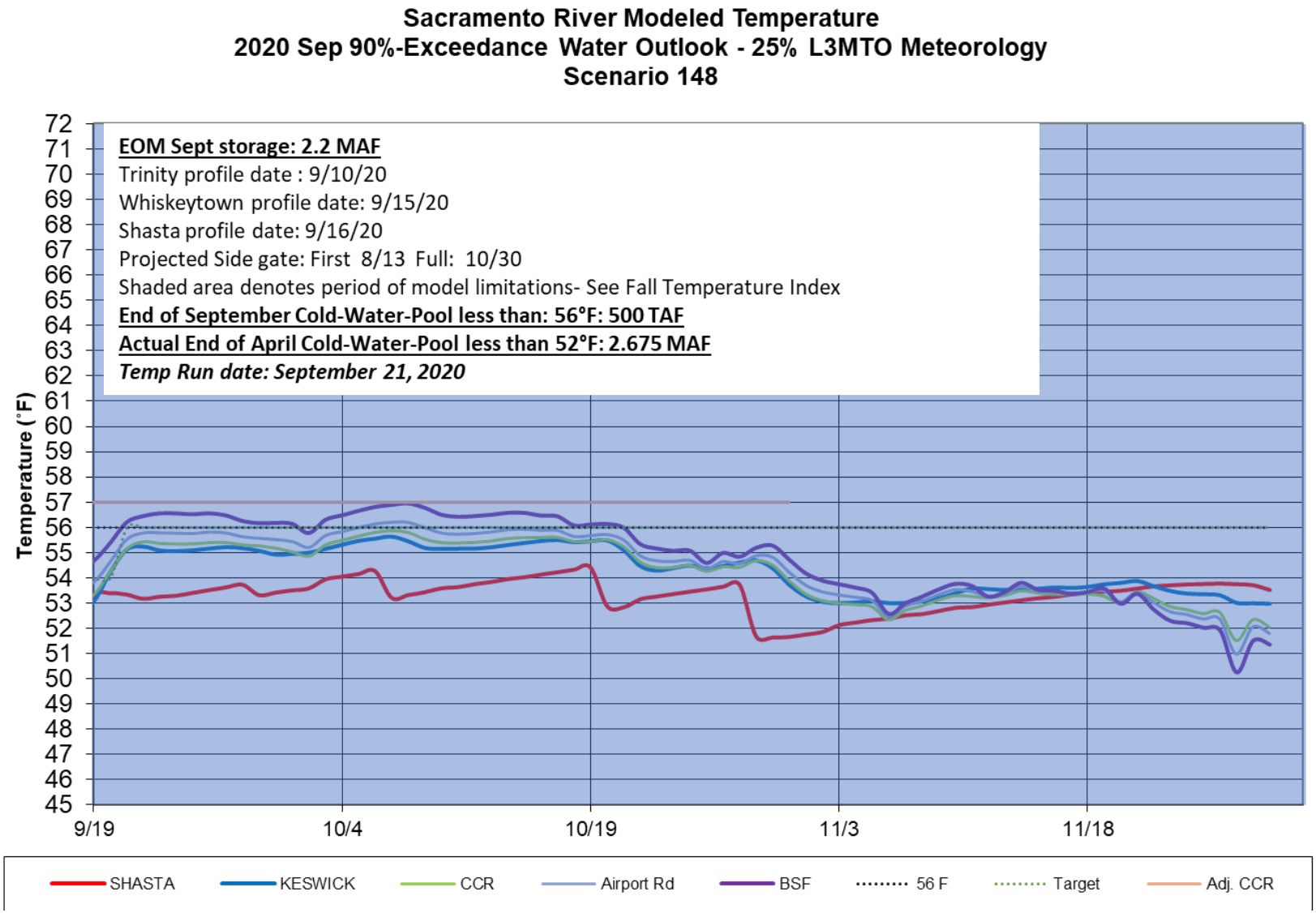


Figure 1. September 2020 simulated Sacramento River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology with Scenario 148.

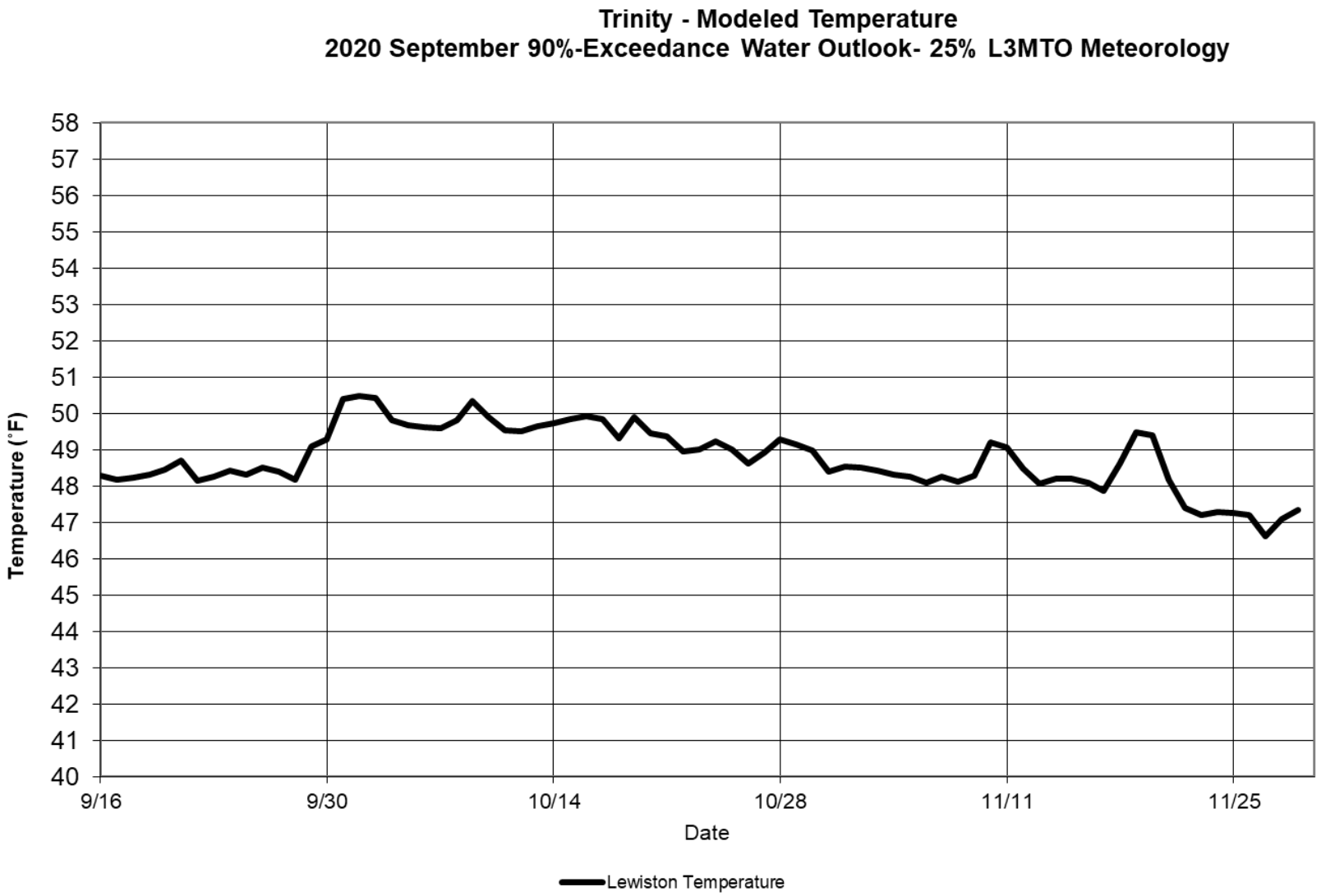


Figure 2. September 2020 simulated Trinity River temperatures 90% runoff exceedance hydrology and 25% L3MTO meteorology with Scenario 148.

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.

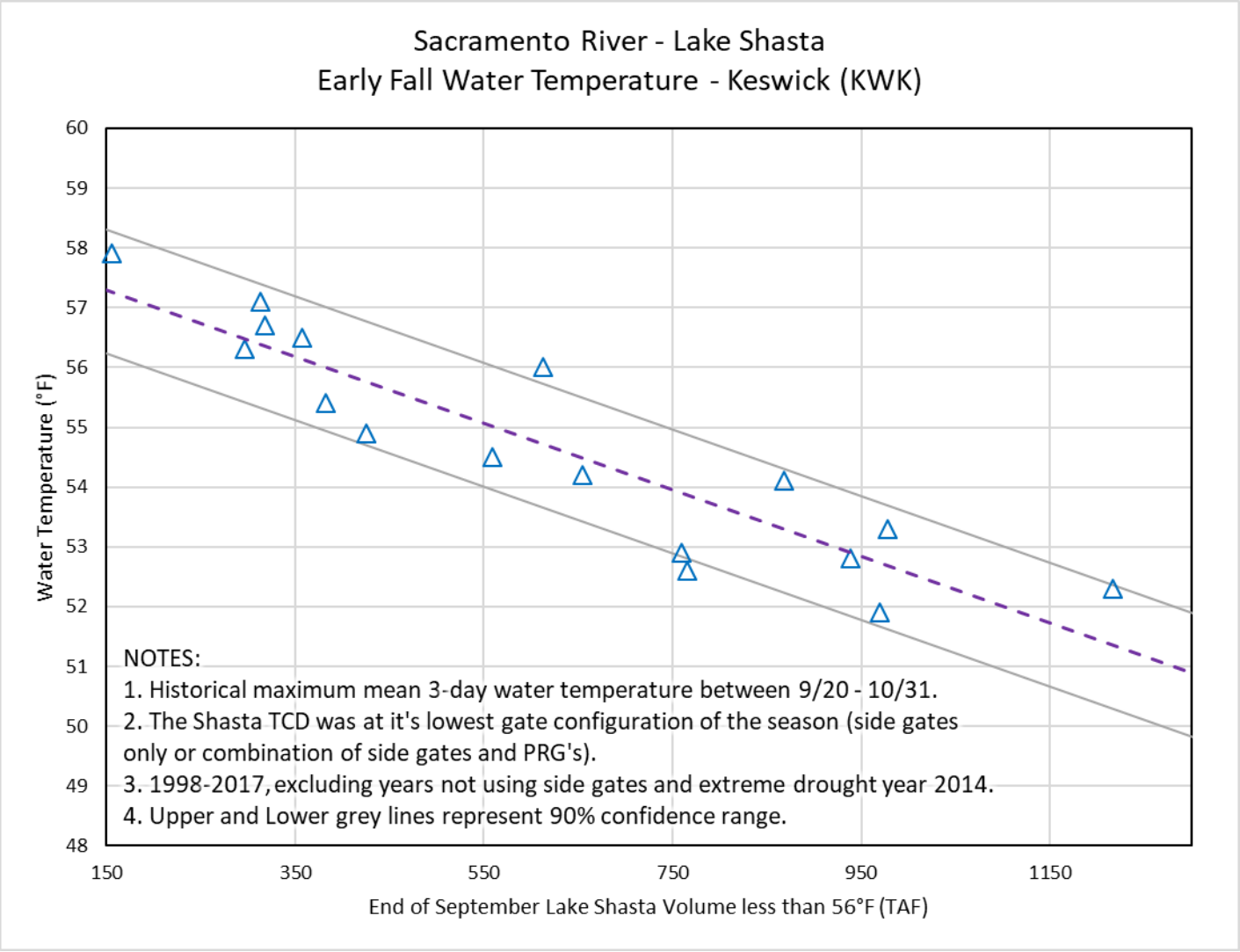


Figure 3. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Keswick water temperature.

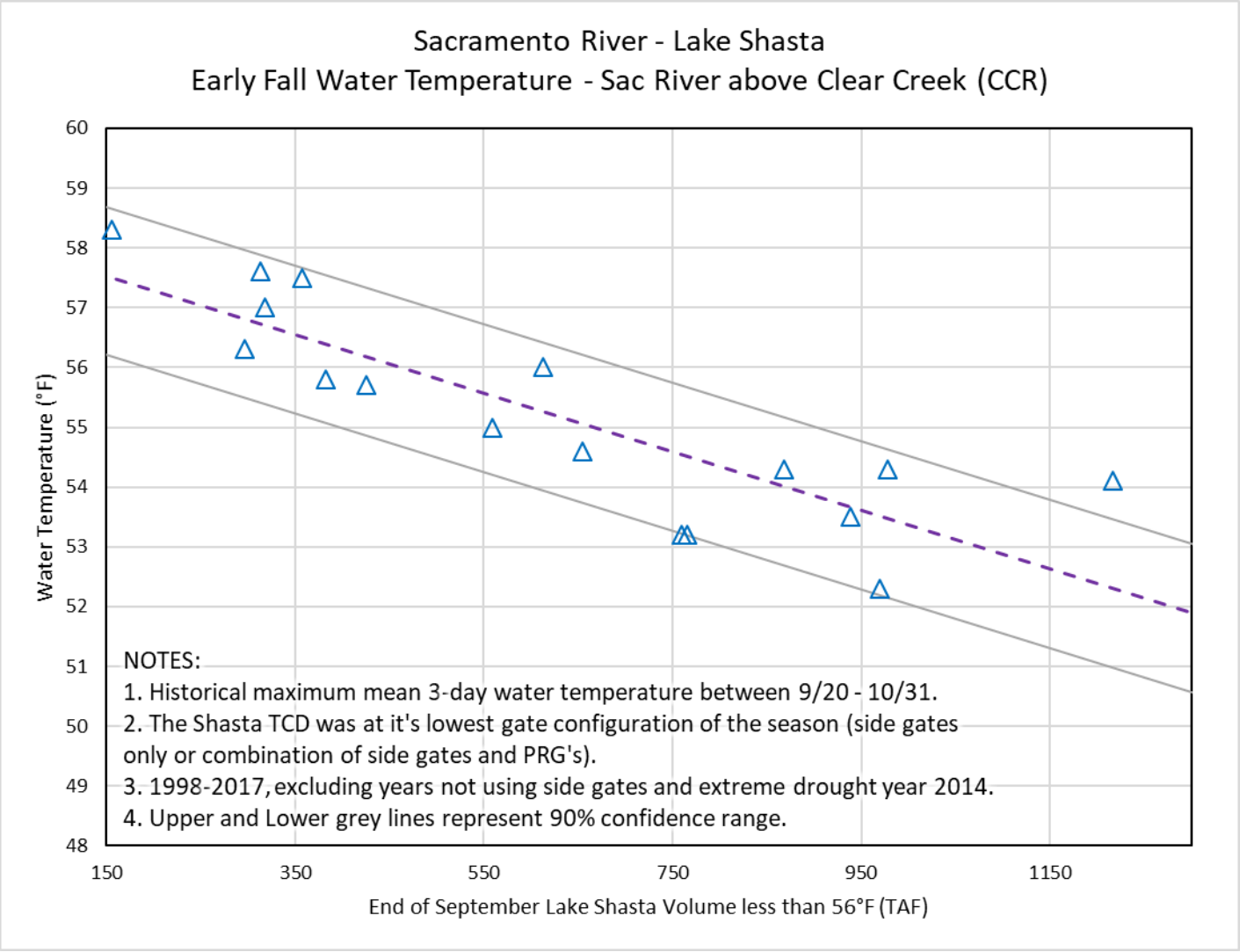


Figure 4. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Sacramento River above Clear Creek confluence water temperature.

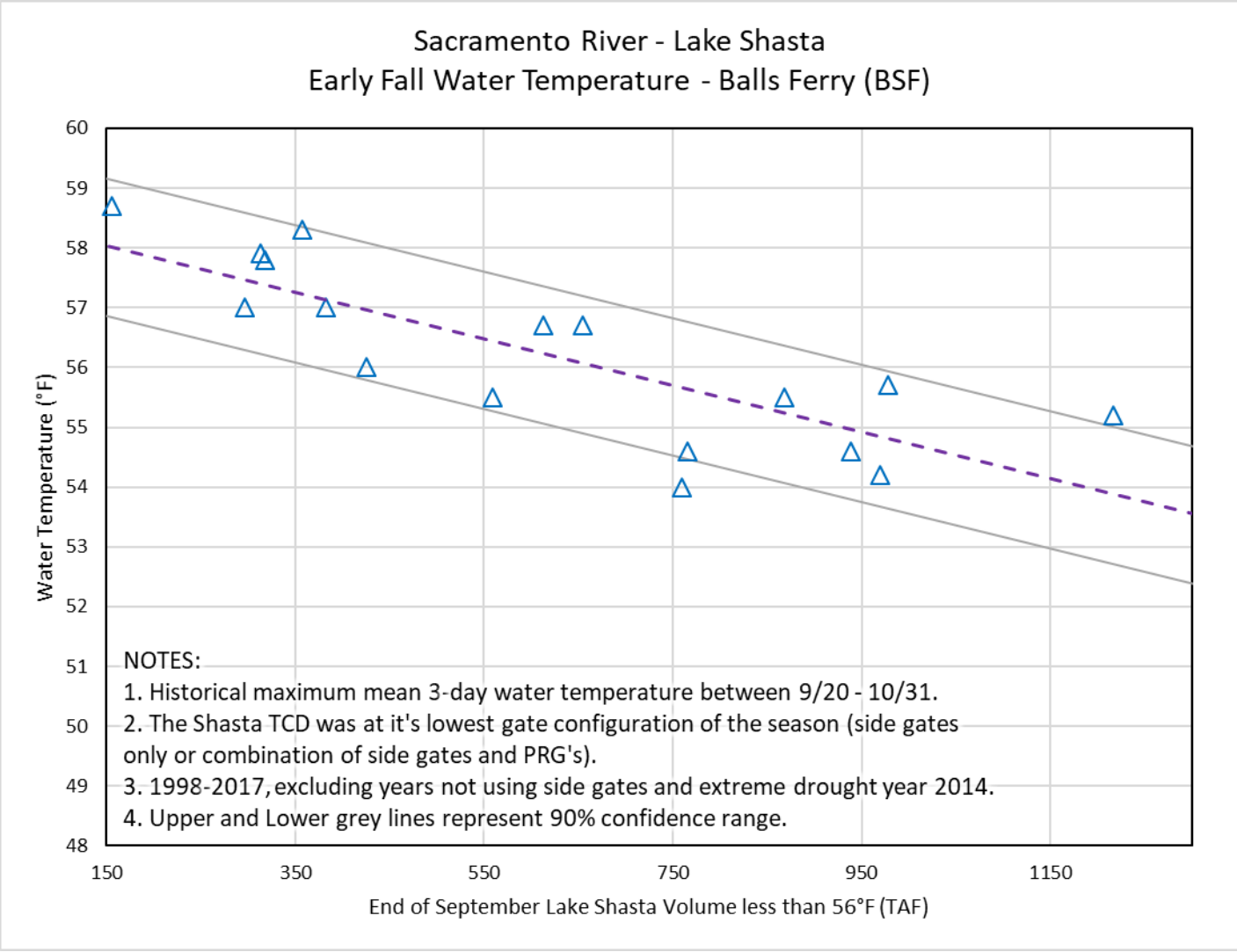
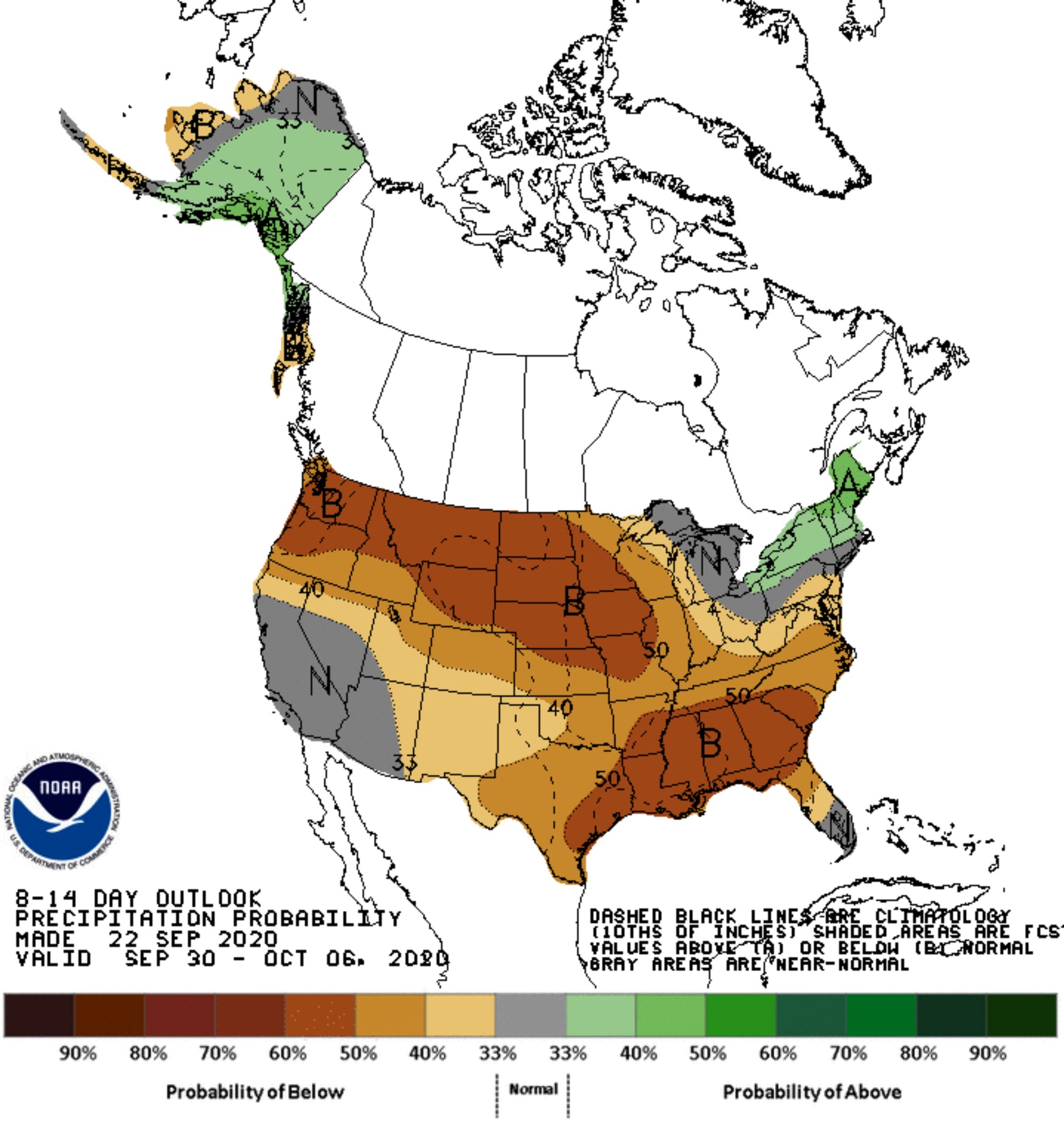
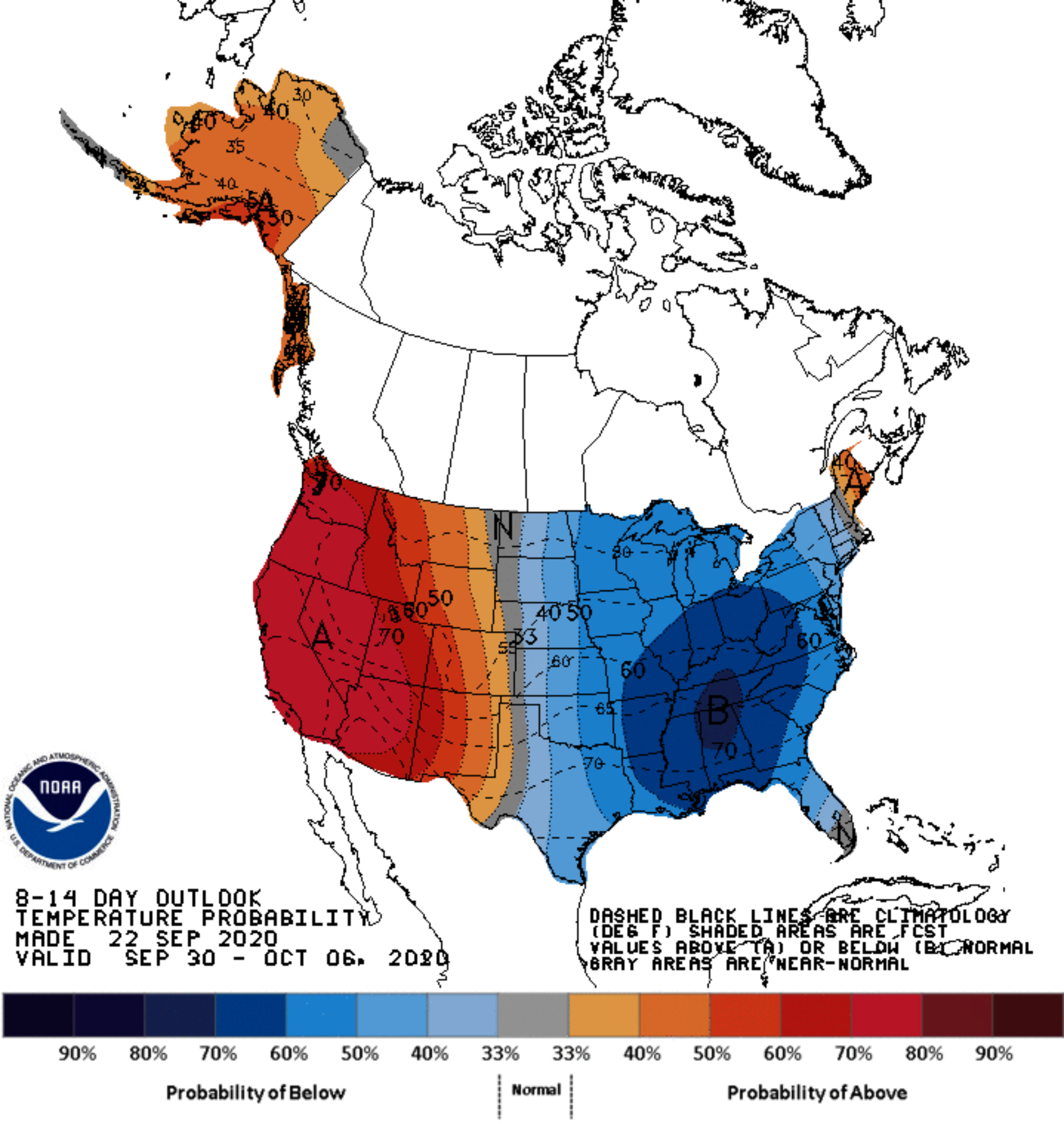


Figure 5. Historical relationship between Lake Shasta cold-water-pool characteristics and early fall Balls Ferry water temperature.


8-14 DAY OUTLOOK
PRECIPITATION PROBABILITY
MADE 22 SEP 2020
VALID SEP 30 - OCT 06, 2020
DASHED BLACK LINES ARE CLIMATOLOGY
(10THS OF INCHES) SHADED AREAS ARE FCST
VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
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 22 SEP 2020
VALID SEP 30 - OCT 06, 2020
DASHED BLACK LINES ARE CLIMATOLOGY (DEG F) SHADED AREAS ARE FCST VALUES ABOVE (A) OR BELOW (B) NORMAL
GRAY AREAS ARE NEAR-NORMAL
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 U.S. Bureau of Reclamation, Bay-Delta Office on September 22, 2020

Below are biological results from the temperature management scenario run September 21, 2020 based on September 16, 2020 Shasta temperature profile. These estimates are from the same planning model used in the Temperature Tier Selection Protocol this spring and summer and used in the May 20 Temperature Management Plan.

Spatially-explicit daily average Sacramento River water temperatures forecasts from the HEC-5Q model results are used as inputs to generate temperature-dependent egg mortality estimates between November 1 and November 30. Between May 12 and September 16, historical temperature data is used to capture actual observed temperature during the early temperature management period. For this period, historical temperatures on the Sacramento River at Shasta Dam, Keswick Dam, above Clear Creek, Balls Ferry, Jelly's Ferry, and Bend Bridge are interpolated to estimate temperatures at river miles where simulated redds were located. Between September 15 and October 31, daily temperatures at the simulated redds' river miles are estimated based on a relationship between cold water pool volume less than 56 degrees F at the end of September in Shasta Lake and water temperatures above Clear Creek derived by Central Valley Operations. Reclamation thinks this relationship is more reliable in that time period than outputs from the HEC-5Q model. The 90% confidence interval value from this analysis was used as a conservative estimate. The average difference between the simulated temperatures above Clear Creek and the simulated temperatures at the redds' river miles during this period are used to adjust above Clear Creek estimated temperatures for each river mile. Temperature-dependent egg mortality estimates are calculated by modeling a redd's lifetime based on the days required to cross a known cumulative degree-day threshold and estimating mortality as an increasing function of temperature past a temperature threshold. Two models were used: 1. Martin et al (2017)[1] for stage independent modeling whereby a single temperature threshold is used from spawning and incubation through emergence; and 2. Anderson et al. (2018)[2] for stage dependent modeling for targeting different temperatures before, during, and after the most sensitive stages during egg incubation. The methods are applied to a set of simulated redds representative of redd construction timing and location from 2007-2014 and the results summarized on a seasonal level for comparison.

Further information about the model's assumptions and methods are described in Reclamation's Final EIS for the Reinitiation of Consultation on the Coordinated LTO of the CVP and SWP: Appendix F- Modeling.

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[1] Martin B.T. et al. (2017). Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters 10:50-59.

[2] Anderson, J. (2018). Using river temperature to optimize fish incubation metabolism and survival: a case for mechanistic models. ResearchGate Preprint. 10.1101/257154.

Table 1: Estimated temperature dependent egg mortality using observed and HEC-5Q interpolated temperature model output and 2007-2014 spatial and temporal redd distribution.

Scenario	Stage Dependent Egg Mortality – Anderson Model (%)	Stage Independent Egg Mortality – Martin Model (%)
Scenario 148	9.5	24.7

Summary Document for Shasta/Keswick Operational Scenarios
Prepared by the Southwest Fisheries Science Center on September 23rd, 2020

Below are results for one USBR scenario ran September 23rd 2020. The scenario has hydrology (Input 90% exceedance) and air temperature (25% exceedance of L3MTO) as inputs. Inputs from the scenario 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 stage-independent temperature mortality model (Martin et al. 2017) for the 2020 temperature management season.

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

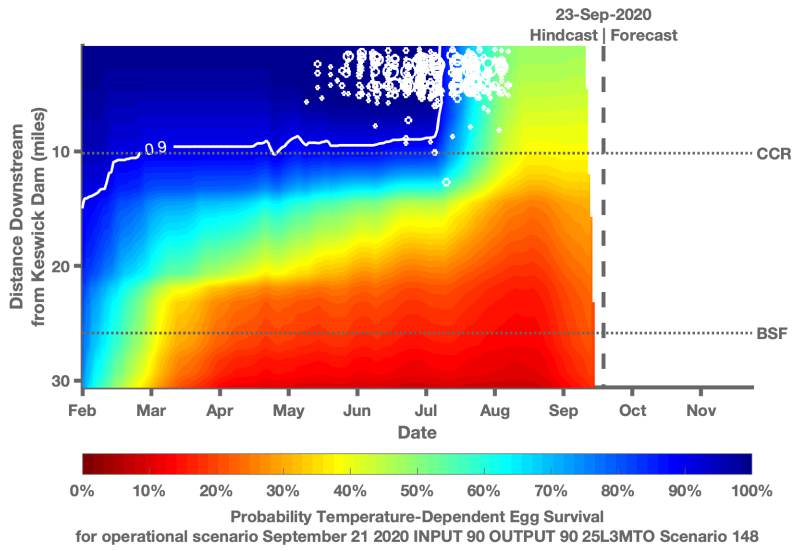

Figure1: Estimated temperature-dependent egg survival produced by the NMFS stage-independent temperature mortality model under the one September 21st 2020 scenario. 2012-2019 redd distributions are used for all plots.

Table 1: Estimated temperature-dependent egg mortality under the one September 21st 2020 scenario assuming a 2012-2019 spatial and temporal redd distribution using output from RAFT model.

Scenario	MODEL	Mean (%)	Median (%)	Lower (%)	Upper (%)
SEPTEMBER_21_2020_INPUT_90_OUTPUT_90_25L3MTO **Scenario 148**	RAFT	19.4	16.9	0.1	56.3

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