

Sacramento River Temperature Task Group Meeting

March 27, 2014

Conference Line: 877-718-6527

Pass code: 1954134

Agenda

1. Introductions
2. Fishery update
3. Hydrology & Operations update
 - a. Daily CVP Water Supply Report ***
 - b. Drought outlook graph***
 - c. Snow water content***
 - d. March 90% and 50% forecasts ***
4. Discussion of recent temperature model runs
 - a. Temperature studies packet ***
5. Next meeting

***handouts

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

DAILY CVP WATER SUPPLY REPORT

MARCH 25, 2014

RUN DATE: March 26, 2014

RESERVOIR RELEASES IN CUBIC FEET/SECOND

RESERVOIR	DAM	WY 2013	WY 2014	15 YR MEDIAN
TRINITY	LEWISTON	320	289	300
SACRAMENTO	KESWICK	4,047	3,077	4,047
FEATHER	OROVILLE (SWP)	2,300	800	1,750
AMERICAN	NIMBUS	1,300	541	1,748
STANISLAUS	GOODWIN	208	428	454
SAN JOAQUIN	FRIANT	649	141	250

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15 YR AVG	WY 2013	WY 2014	% OF 15 YR AVG
TRINITY	2,448	1,816	2,051	1,293	71
SHASTA	4,552	3,598	3,743	2,086	58
OROVILLE (SWP)	3,538	2,424	2,939	1,627	67
FOLSOM	977	614	584	409	67
NEW MELONES	2,420	1,640	1,560	1,048	64
FED. SAN LUIS	966	838	776	470	56
MILLERTON	520	374	321	169	45
TOT. N. CVP	11,360	8,506	8,714	5,306	62

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

RESERVOIR	CURRENT WY 2014	DRIEST WY 1977	WETTEST WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	208	73	1,162	532	39
SHASTA	1,415	1,351	6,574	2,971	48
FOLSOM	422	189	3,355	1,075	39
NEW MELONES	170	0	1,089	371	46
MILLERTON	64	107	1,529	411	16

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2014	DRIEST WY 1977	WETTEST WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	12.81	8.94	47.73	26.43 (52)	48	0.00
SACRAMENTO AT SHASTA DAM	22.12	10.78	96.82	51.03 (57)	43	0.00
AMERICAN AT BLUE CANYON	30.80	15.20	91.33	53.38 (39)	58	0.28
STANISLAUS AT NEW MELONES	10.01	0.00	41.10	22.18 (36)	45	0.00
SAN JOAQUIN AT HUNTINGTON LK	10.60	10.50	72.30	33.77 (39)	31	0.00

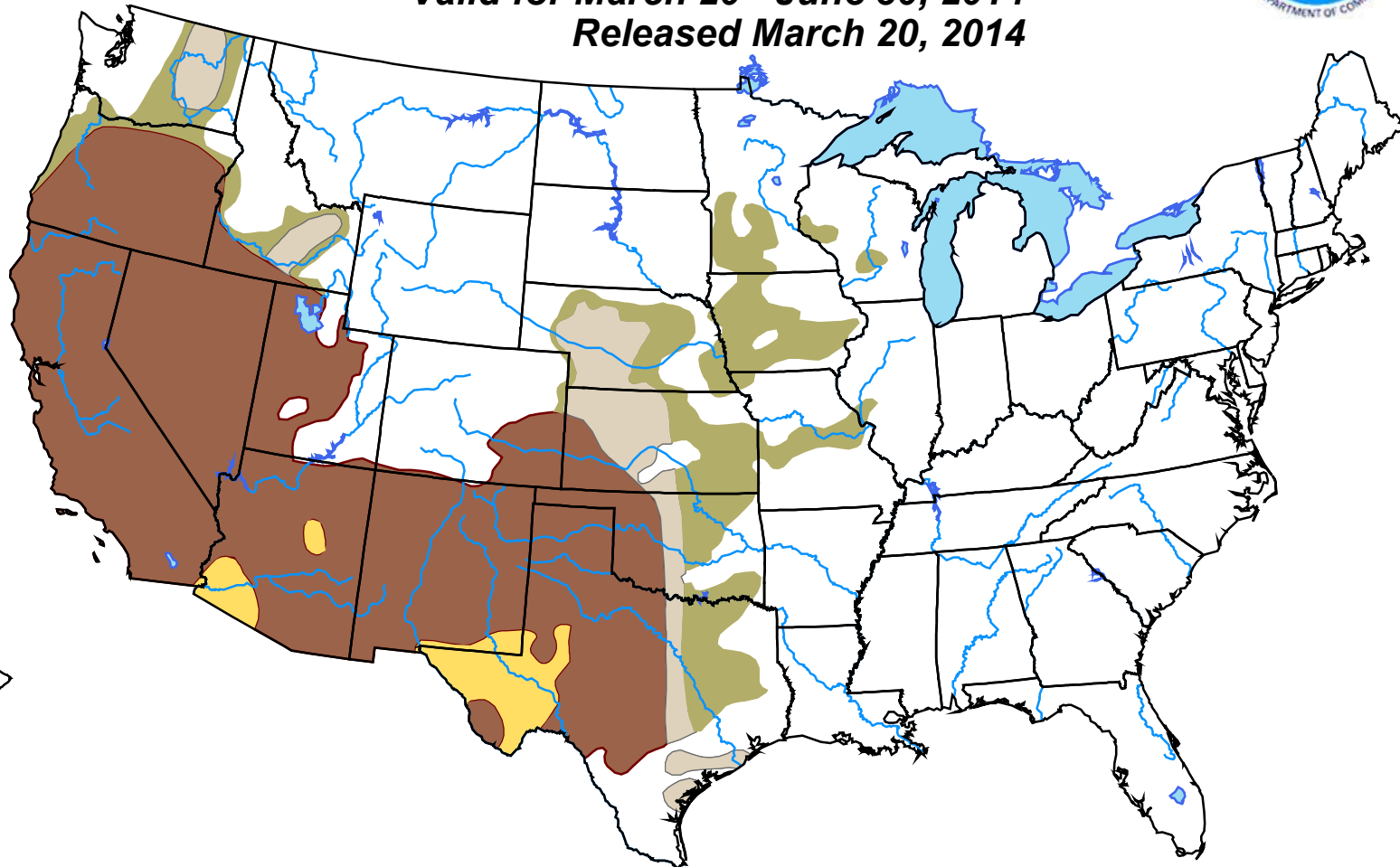


U.S. Seasonal Drought Outlook





Drought Tendency During the Valid Period

Valid for March 20 - June 30, 2014

Released March 20, 2014



KEY:

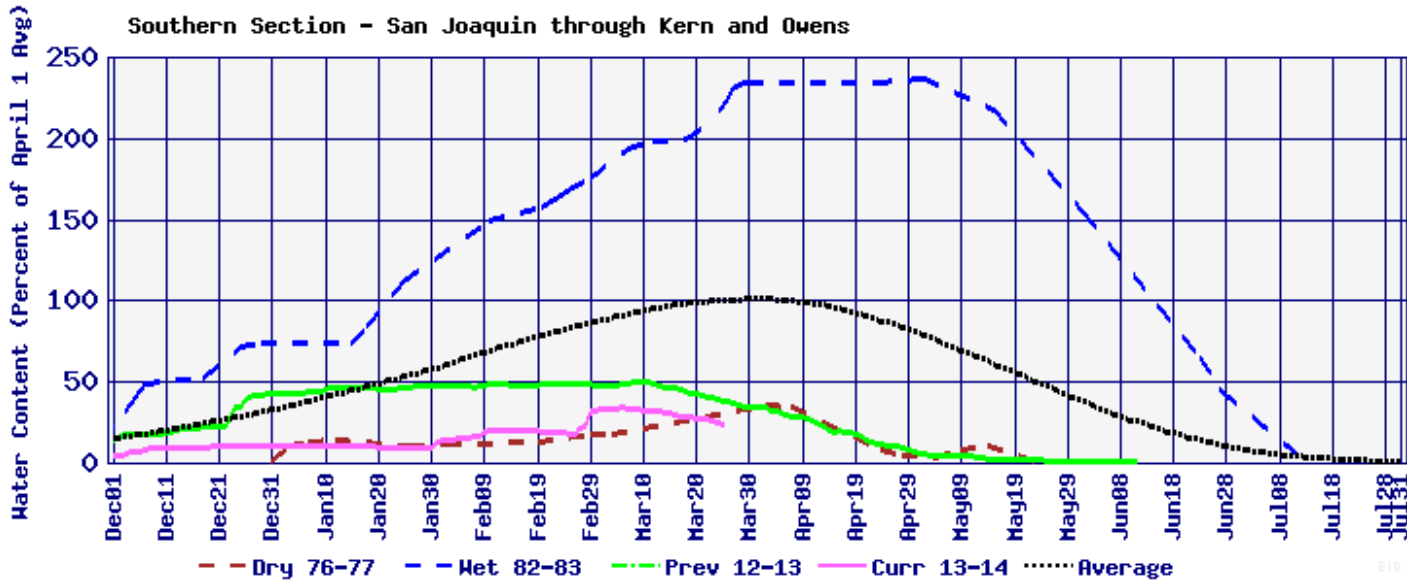
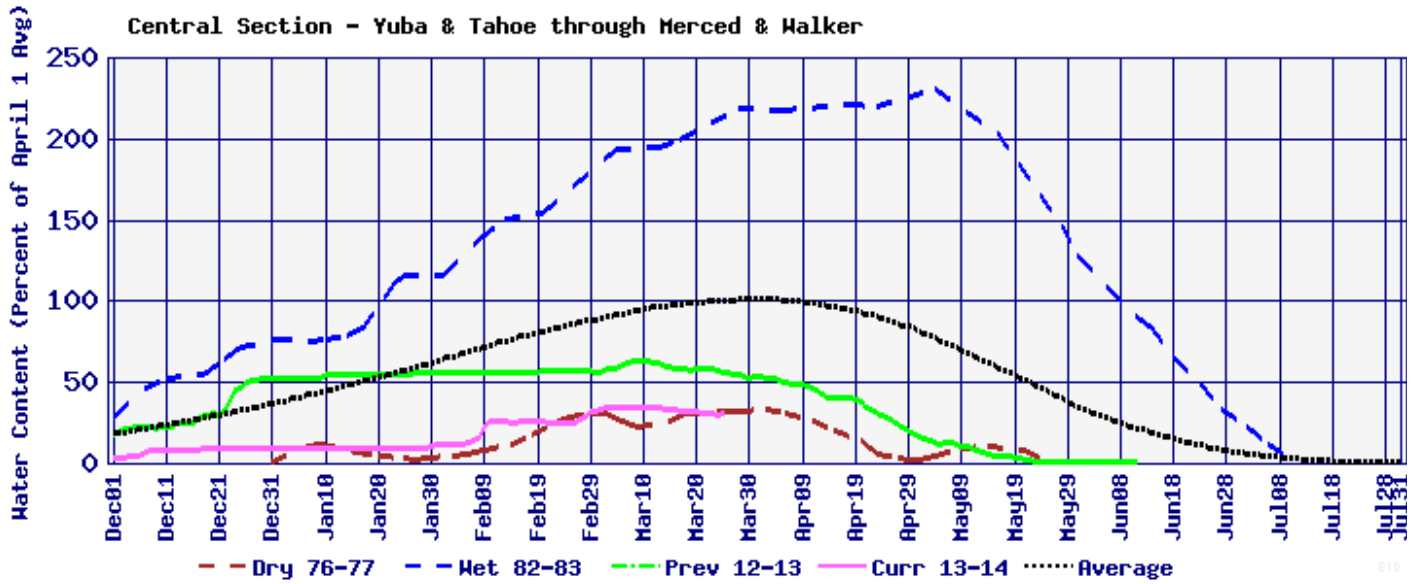
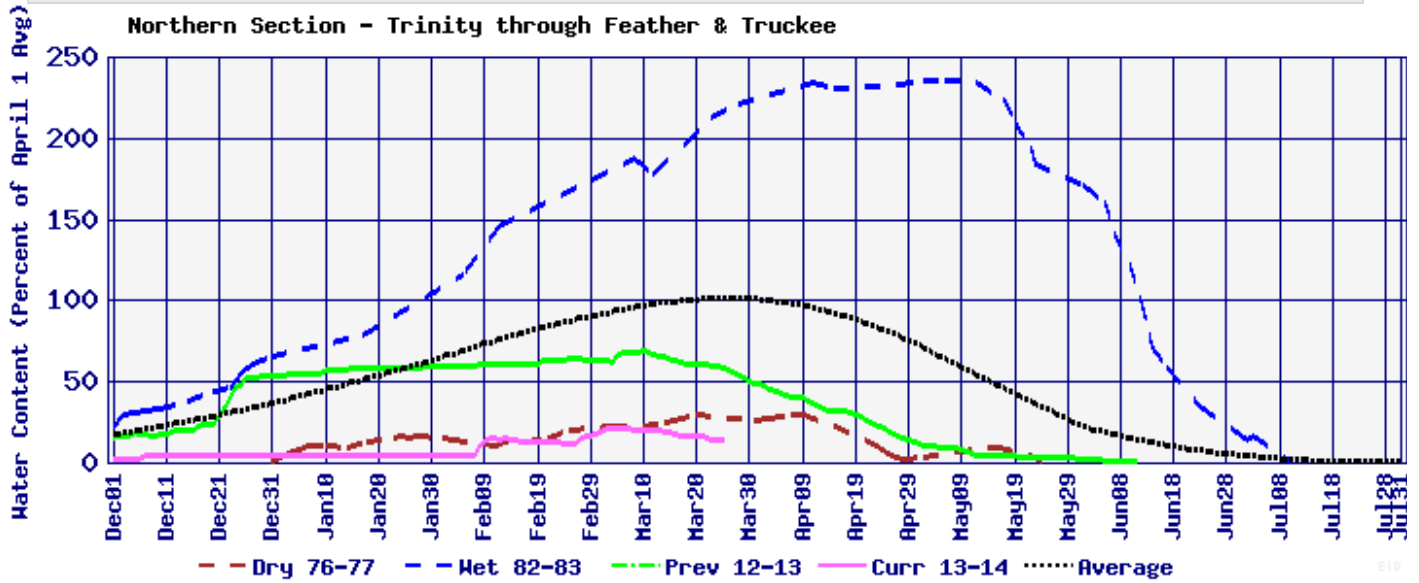
-  Drought persists or intensifies
-  Drought remains but improves
-  Drought removal likely
-  Drought development likely

Author: Anthony Artusa, Climate Prediction Center, NOAA
http://www.cpc.ncep.noaa.gov/products/expert_assessment/season_drought.html

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: The tan area areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period although drought will remain. The Green areas imply drought removal by the end of the period (D0 or none)

California Snow Water Content

PERCENT OF APRIL 1 AVERAGE, MARCH 26, 2014



Storages

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

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
Trinity		1187	1374	1264	1075	912	760	605	455	399	394	391	392	1098
	Elev.	2292	2282	2263	2245	2225	2203	2176	2165	2164	2163	2163	2163	2266
Whiskeytown		206	206	238	238	238	238	230	230	201	182	186	206	
	Elev.	1199	1209	1209	1209	1209	1209	1207	1207	1197	1190	1192	1199	
Shasta		1773	2053	1891	1663	1335	963	717	662	608	626	702	825	1028
	Elev.	960	951	936	913	882	856	850	843	845	854	868	888	
Folsom		305	422	440	447	430	405	390	373	378	387	409	439	513
	Elev.	406	409	410	407	404	402	399	400	401	404	409	418	
New Melones		1060	1064	994	894	789	672	559	474	454	459	464	469	566
	Elev.	951	942	927	911	891	870	852	847	849	850	851	871	
San Luis		369	444	397	313	210	88	39	137	300	433	591	764	771
	Elev.	442	432	414	398	375	360	375	418	449	481	509	531	
Total		5563	5224	4631	3914	3126	2548	2332	2369	2500	2739	3075	4182	

State End of the Month Reservoir Storage (TAF)

Oroville		1407	1434	1446	1318	1129	990	880	864	846	763	707	694	733
	Elev.	723	724	708	683	663	645	642	639	624	614	611	619	
San Luis		307	451	405	323	300	249	206	198	371	525	700	852	1105
Total San Luis (TAF)		676	895	802	636	511	337	245	336	671	959	1290	1616	1876

Monthly River Releases (TAF/cfs)

Trinity	TAF	18	36	92	47	28	28	27	23	18	18	18	17
	cfs	300	600	1,498	783	450	450	450	373	300	300	300	300
Clear Creek	TAF	12	12	12	9	7	5	9	12	12	12	12	11
	cfs	200	200	200	150	120	85	150	200	200	200	200	200
Sacramento	TAF	200	470	510	589	627	483	294	281	230	200	200	180
	cfs	3250	7900	8300	9900	10200	7860	4945	4573	3874	3250	3250	3250
American	TAF	34	30	38	31	37	34	30	31	30	31	31	28
	cfs	550	500	621	529	599	550	508	500	506	500	500	500
Stanislaus	TAF	23	29	25	34	26	21	14	35	12	12	13	12
	cfs	368	480	410	564	425	346	240	577	200	200	213	214
Feather	TAF	49	48	51	65	49	49	48	49	48	49	49	44
	cfs	800	800	822	1100	800	800	800	800	800	800	800	800

Trinity Diversions (TAF)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Carr PP	1	149	126	127	128	127	122	41	0	6	13	-344
Spring Crk. PP	8	120	120	120	120	120	120	30	19	17	4	5

Delta Summary (TAF)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Tracy	153	45	46	45	45	80	172	209	158	175	190	46
USBR Banks	0	0	0	0	0	0	0	0	0	0	0	0
Contra Costa	7	6.4	6.4	6.4	4.9	5.6	6.4	7	8.4	9.2	9.2	7
Total USBR	160	51	53	51	50	86	178	216	166	184	199	53
State Export	153	45	31	50	5	10	30	180	156	175	200	300
Total Export	313	96	83	101	55	96	208	396	322	359	399	353
COA Balance	0	0	0	0	19	19	34	65	30	30	30	30

Old/Middle River Std.												
Old/Middle R. calc.	-4,052	-1,218	-1,075	-1,429	-874	-1,441	-2,937	-4,771	-4,204	-4,538	-5,033	-4,822

Computed DOI	9224	4841	4002	2505	2505	2505	2505	2505	3496	4116	5384	4809
Excess Outflow	33	840	0	0	0	0	0	0	0	618	878	810
% Export/Inflow	32%	18%	16%	19%	11%	23%	45%	71%	61%	64%	56%	57%
% Export/Inflow std.	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%	45%

Hydrology

Water Year Inflow (TAF)	Trinity	433	Shasta	2,367	Folsom	727	New Melones	275
Year to Date + Forecasted % of mean	36%	43%	27%	26%				

Storages

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

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Trinity		1187	1382	1416	1271	1084	907	725	546	522	519	614	725
	Elev.	2293	2296	2283	2264	2244	2221	2193	2189	2188	2194	2204	2221
Whiskeytown		206	206	238	238	238	238	238	206	206	206	206	206
	Elev.	1199	1209	1209	1209	1209	1209	1209	1199	1199	1199	1199	1199
Shasta		1773	2105	1977	1819	1599	1346	1141	1081	1102	1217	1406	1819
	Elev.	963	956	946	932	914	898	893	894	904	919	946	979
Folsom		305	435	521	533	440	355	304	255	279	318	378	453
	Elev.	408	419	421	409	396	388	379	383	390	400	410	426
New Melones		1060	1070	1028	949	855	760	665	597	586	606	631	666
	Elev.	952	946	935	921	906	890	877	875	879	884	890	902
San Luis		369	470	417	307	164	88	159	309	445	602	853	1092
	Elev.	448	435	414	392	371	373	391	417	451	495	522	534
Total		5667	5597	5116	4380	3694	3232	3027	3140	3468	4025	4780	5718

State End of the Month Reservoir Storage (TAF)

Oroville		1407	1496	1562	1449	1240	1064	964	940	970	979	1069	1288
	Elev.	730	738	724	698	674	659	655	660	661	674	705	751
San Luis		307	478	410	329	295	225	163	145	221	384	598	825
Total San Luis (TAF)		676	948	828	637	459	313	323	454	666	987	1450	1917

Monthly River Releases (TAF/cfs)

Trinity	TAF	18	36	92	47	28	28	27	28	18	18	18	17
	cfs	300	600	1,498	783	450	450	450	450	300	300	300	300
Clear Creek	TAF	12	11	12	12	5	5	9	12	13	12	12	11
	cfs	200	190	190	200	85	85	150	200	225	200	200	200
Sacramento	TAF	200	461	530	550	562	505	357	246	193	200	200	194
	cfs	3250	7750	8615	9250	9149	8214	6000	4000	3250	3250	3250	3500
American	TAF	37	59	97	145	125	92	87	52	51	52	77	139
	cfs	600	1000	1571	2437	2035	1504	1455	850	850	850	1250	2500
Stanislaus	TAF	15	29	25	32	22	23	14	35	12	12	13	12
	cfs	243	480	410	536	364	368	240	577	200	200	213	214
Feather	TAF	49	48	68	94	137	108	65	58	57	58	58	53
	cfs	800	800	1100	1575	2225	1750	1100	950	950	950	950	950

Trinity Diversions (TAF)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Carr PP	10	50	117	156	155	156	154	8	17	7	3	2
Spring Crk. PP	35	30	120	150	150	150	145	30	10	10	25	35

Delta Summary (TAF)

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Tracy	185	45	46	64	70	189	280	227	200	282	200	125
USBR Banks	0	0	0	0	0	0	0	0	0	0	0	0
Contra Costa	6.35	6.35	6.35	4.9	5.55	6.35	7	8.4	9.2	9.15	7	7
Total USBR	191	51	52	69	76	195	287	235	209	291	207	132
State Export	185	30	46	71	30	29	45	183	208	300	200	125
Total Export	376	81	99	140	106	224	332	418	417	591	407	257
COA Balance	0	0	0	0	-1	4	5	5	5	5	5	5
Old/Middle R. std.												
Old/Middle R. calc.	-4,404	-746	-923	-1,804	-1,463	-2,964	-4,454	-5,000	-5,242	-7,260	-4,875	-2,575

Computed DOI	12444	8539	6198	4001	4002	2993	3009	3367	4270	6182	13046	22297
Excess Outflow	2294	151	2196	0	0	0	0	374	773	2684	8540	10896
% Export/Inflow	31%	11%	15%	22%	18%	40%	54%	63%	63%	64%	34%	17%
% Export/Inflow std.	35%	35%	35%	35%	65%	65%	65%	65%	65%	65%	65%	35%

Hydrology

	Trinity	Shasta	Folsom	New Melones
Water Year Inflow (TAF)	544	2,732	1,017	413
Year to Date + Forecasted % of mean	45%	49%	37%	39%

March 25, 2014

Upper Sacramento River – March 2014 Preliminary Temperature Analysis

Summary of Temperature Target Results by Month

Initial Target Location	JUN	JUL	AUG	SEP	OCT
90%-Exceedance Outlook (Figure 1)					
Sac. R. above Clear Creek (CCR)	CCR	CCR	Keswick ~ 56°F to 62°F		
50%-Exceedance Outlook (Figure 4)					
Sac. R. above Clear Creek (CCR)	CCR	CCR	CCR	CCR	Kwk~56°F

Temperature Model Inputs, Assumptions, Limitations and Uncertainty:

1. Operation is based on the March 2014 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90% and 50% exceedances.
2. The profiles used for Shasta, Trinity and Whiskeytown were taken on March 12, March 18, and March 12, respectively.
3. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge is not available beyond 5 days. Model input side flows (Cottonwood Cr & Bend Bridge local flow w/o Cottonwood Cr) were selected from the historical record, and are consistent with the forecast exceedance frequency. During spring, the relatively warm creek flows can be a significant percentage of the flows at Bend Bridge.
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.
5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period.
6. Meteorological inputs were derived from a database of 86 years of meteorological data (1920-2005). The meteorological inputs in the model represent "Average" meteorological conditions.
7. Meteorology, as well as 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.

Temperature Analysis Results:

Note that for all exceedances, Lake Shasta storage is too low to utilize the upper gates of the TCD. This TCD limitation, along with the relatively small cold-water pool volume, significantly impacts temperature management.

90%-Exceedance:

A temperature target location at Clear Creek is possible through about mid-August (Figure 1). By early August, the TCD intake level will be through the side gates. Shasta Dam release temperature is expected to exceed 56°F by late August, nearing 62°F by mid-September.

Figure 2 shows temperature results for Clear Creek at Igo.

Figure 3 includes results for the Trinity River at Lewiston Dam. The dashed lines are the 2009 mean daily temperatures at selected locations. **NOTE:** There are no releases through the auxiliary outlet works (AOW) in this analysis.

50%-Exceedance:

A temperature target location at Clear Creek is possible through September (Figure 4). By September, the TCD intake will be through the side gates. Shasta Dam release temperature is expected to approach 56°F by mid-October.

Figure 5 shows temperature results for Clear Creek at Igo.

Figure 6 includes results for the Trinity River at Lewiston Dam. The dashed lines are the 2009 mean daily temperatures at selected locations. **NOTE:** There are no releases through the auxiliary outlet works (AOW) in this analysis.

Sacramento River Modeled Temperature 2014 March 90%-Exceedance Outlook

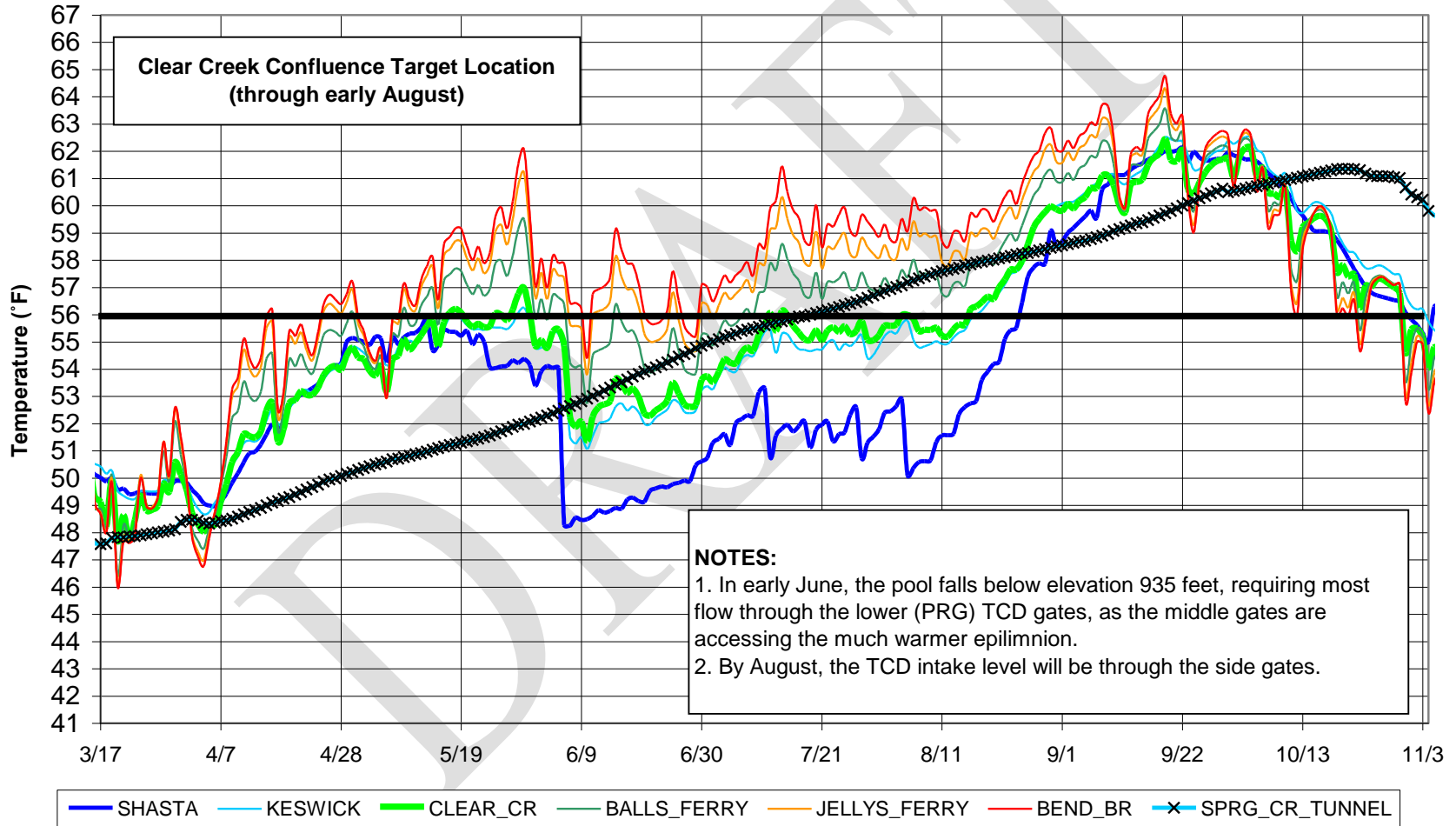


Figure 1

**Clear Creek - Igo Modeled Temperature
2014 March 90%-Exceedance Outlook**

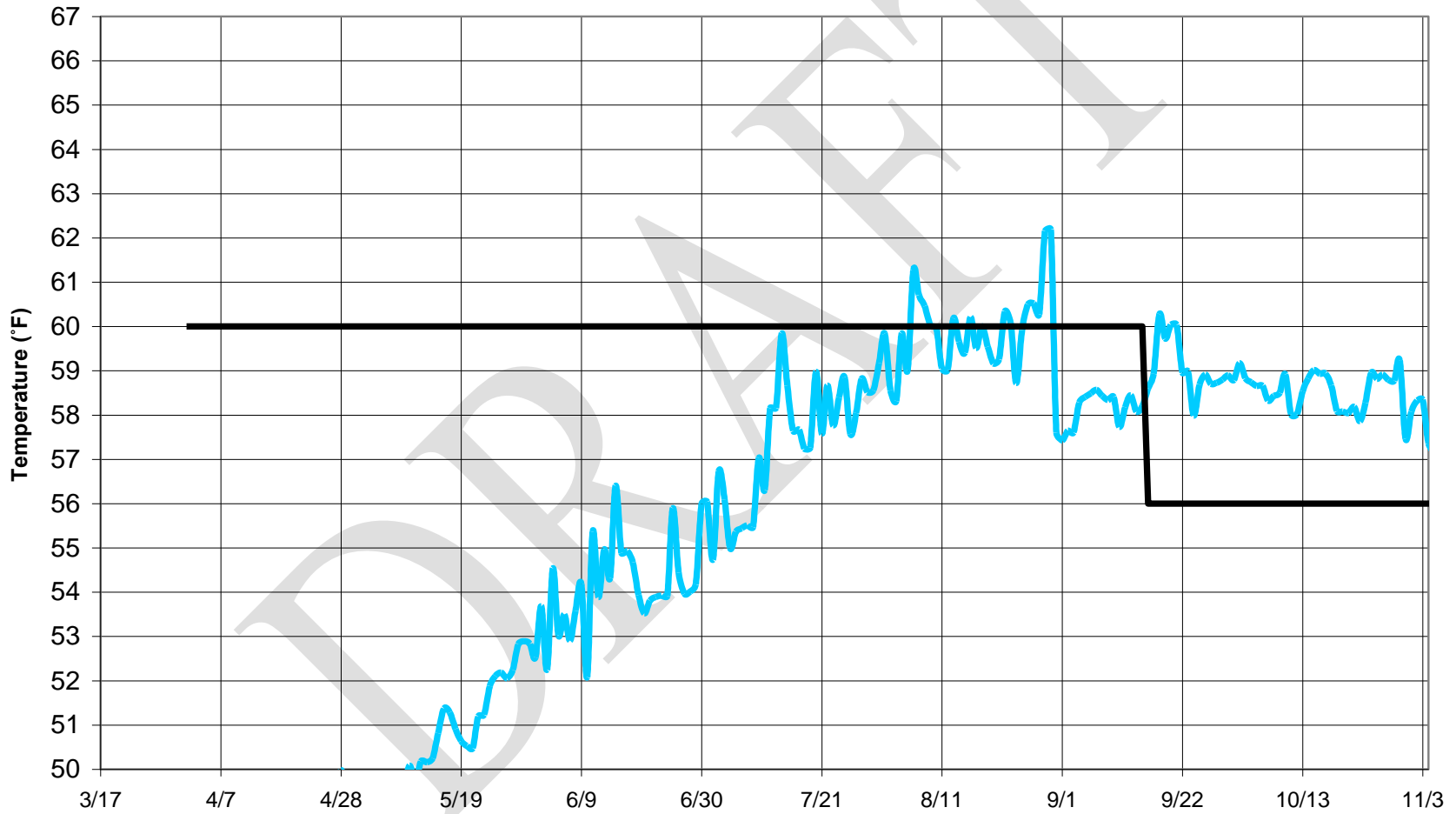


Figure 2

Trinity River - 2014 March 90%-Exceedance Outlook
"Critically Dry Year" Release Schedule
Mean Daily Water Temperature

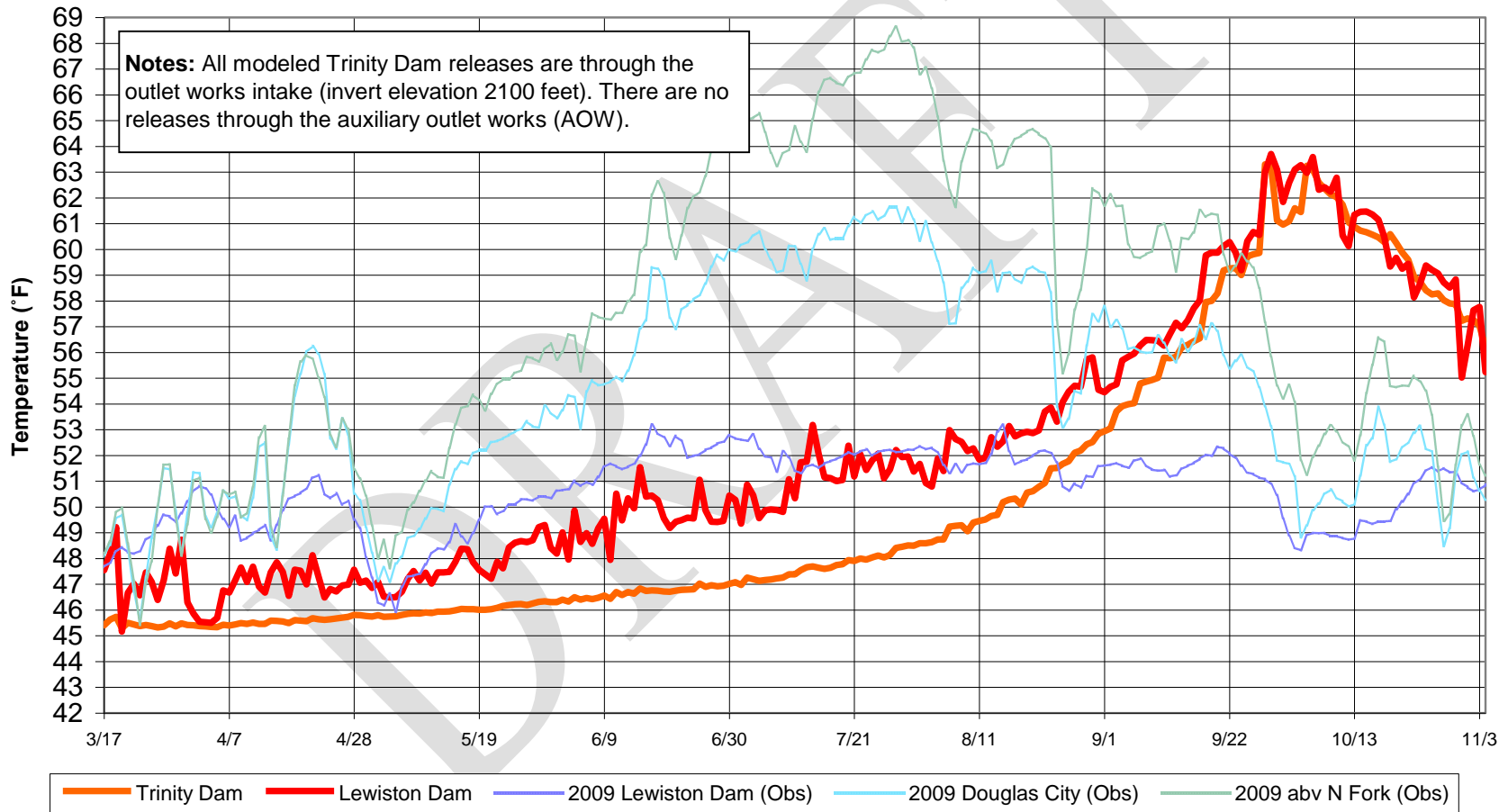


Figure 3

Sacramento River Modeled Temperature 2014 March 50%-Exceedance Outlook

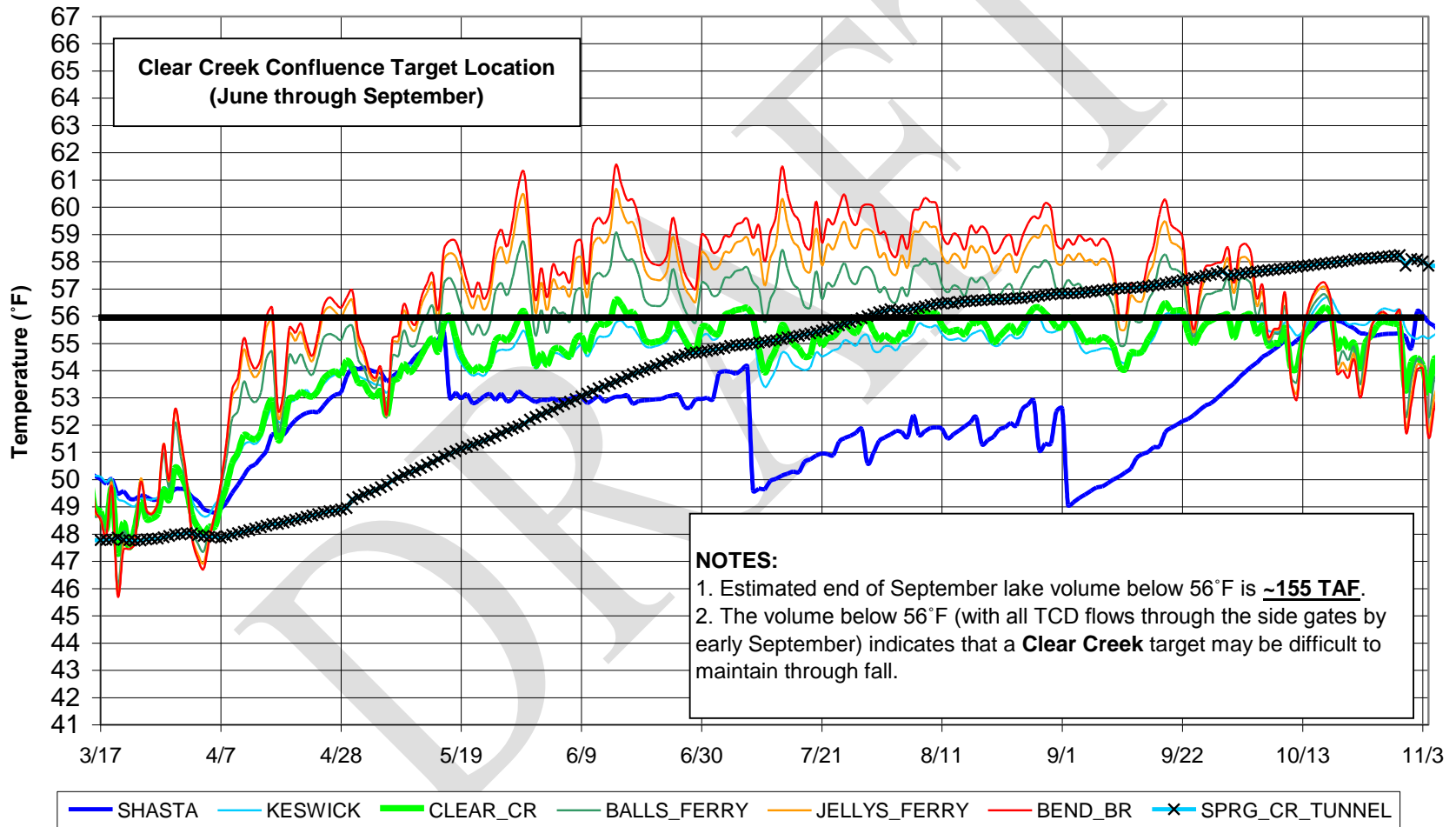


Figure 4

**Clear Creek - Igo Modeled Temperature
2014 March 50%-Exceedance Outlook**

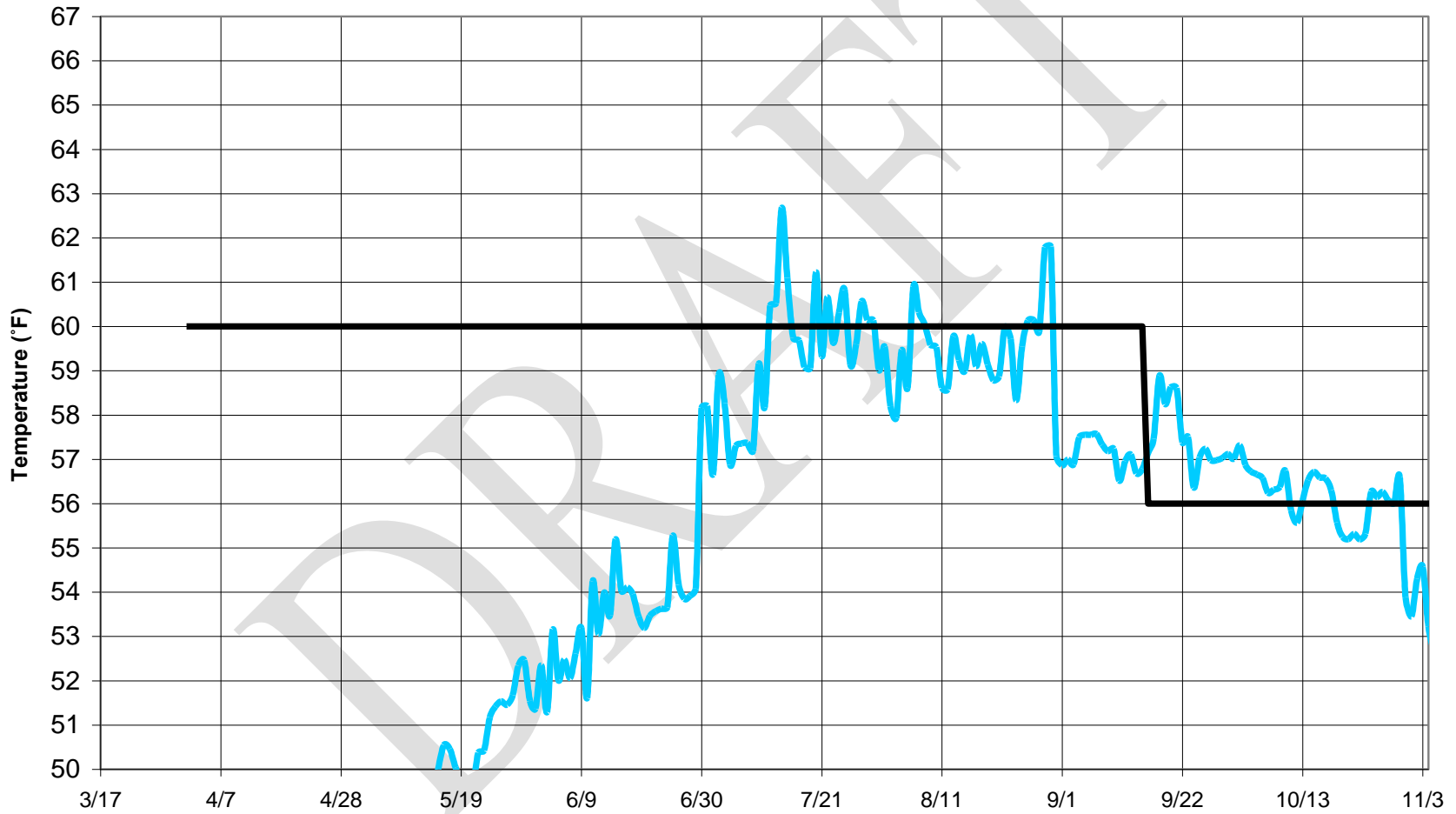


Figure 5

**Trinity River - 2014 March 50%-Exceedance Outlook
"Critically Dry Year" Release Schedule
Mean Daily Water Temperature**

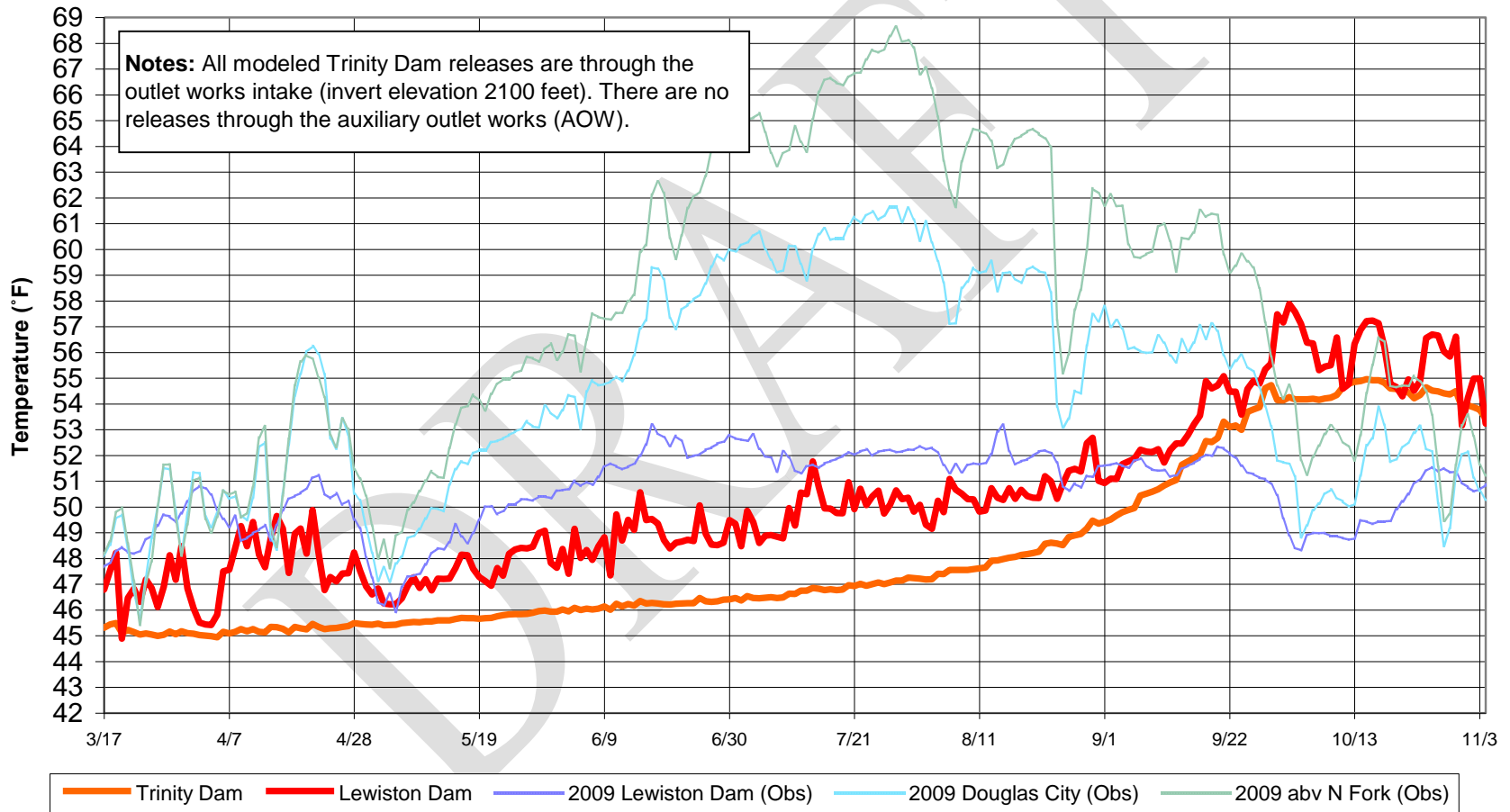
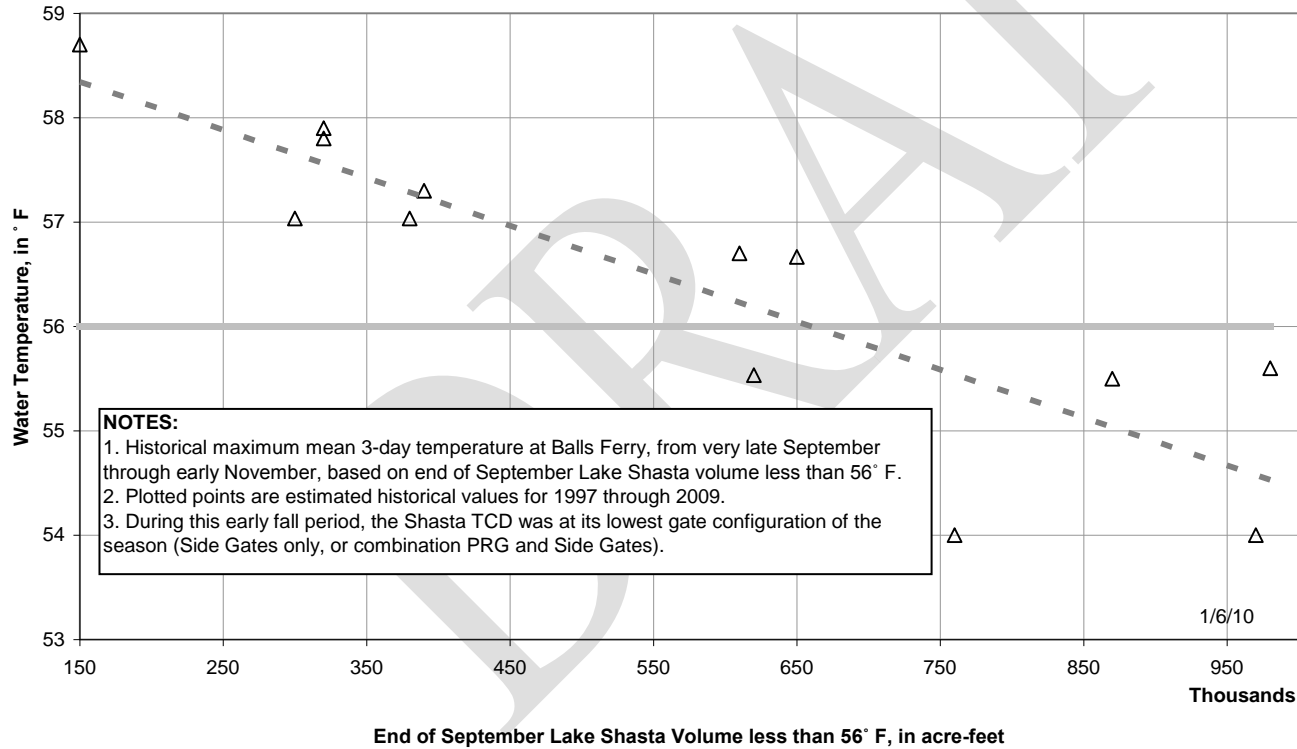


Figure 6

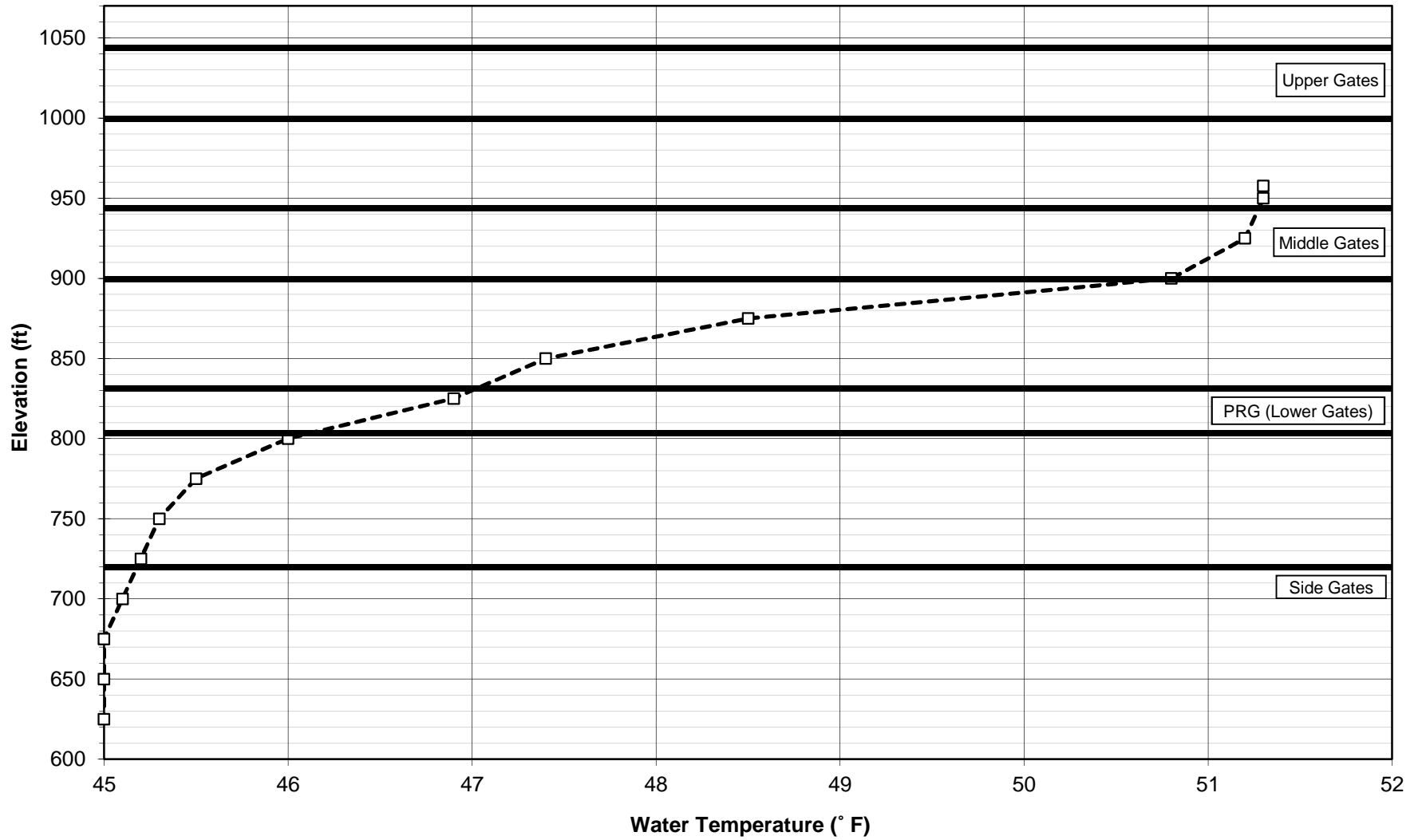
Model Performance and Fall Temperature Index:

1. Based on past analyses, the temperature model does not perform well from late September through fall. 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 reasonable indicator of fall water temperature in the river reach to Balls Ferry.
3. For river temperatures not to exceed 56 °F downstream to Balls Ferry, the end-of-September lake volume less than 56°F should be greater than about 650 TAF, see figure below:

**Sacramento River - Lake Shasta
Early Fall Water Temperature at Balls Ferry**



Lake Shasta Temperature Profile - 3/12/14



Trinity Lake Temperature Profile - 3/18/14

