ATTACHMENT #5

Technical Brief
Trinity River Restoration Program
Restoration Release Recommendations for WY2012

(Shortened Version – 21 March 2012)

Executive Summary

The Trinity Adaptive Management Working Group (TAMWG) will consider the proposed WY2012 restoration flow releases on March 22, 2012. The Trinity Management Council (TMC) will consider the matter March 27-28, 2012 and make a formal recommendation to the Bureau of Reclamation and US Fish & Wildlife Service for the WY2012 flow release schedule.

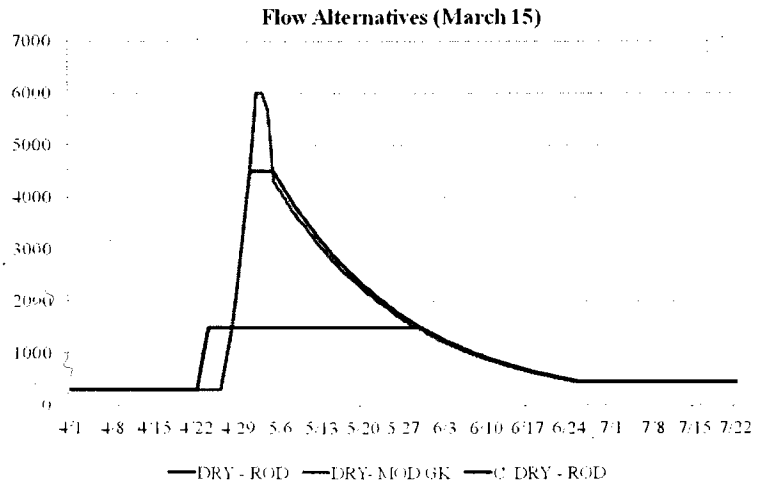
This briefing document informs that decision making process and provides technical details regarding the WY2012 flow release recommendations made by the Flow Scheduling Workgroup (Workgroup).

The predicted annual inflow into Trinity reservoir (as of the March 1, 2012 prediction) is 648 TAF at the 50% exceedance level. Per the 2000 Record of Decision, that volume falls within the range of a Critically Dry water year. The corresponding river allocation for restoration releases is 369 TAF acre-feet. The 10% exceedance inflow prediction is 964 TAF, corresponding to a Dry water year. The restoration release volume for a Dry water year is 453 TAF.

Given these water year predictions, the Workgroup is promulgating hydrograph recommendations for both a Critically Dry and Dry water year. The official April 1 50% forecast will dictate the water year type.

In its deliberations, the Workgroup considered channel rehabilitation construction issues, as well as several other issues listed in Appendix C. The most important consideration by the Workgroup for the potential water year types is temperature target compliance. Consequently, the bulk of the analysis conducted for this year's recommendation was temperature modeling in Trinity and Lewiston Reservoirs, and in the Trinity River between Lewiston Dam and Weitchpec.

The Workgroup considered three alternatives – ROD Dry, Modified Dry, ROD Critically Dry.



Temperature modeling results are practically identical for the three alternatives after May 26. Predicted temperatures from Trinity and Lewiston reservoirs indicate reasonable certainty for meeting temperature targets from July through the end of the water year. Modeling results indicate that in a series of extreme meteorological weeks in July temperature targets at Douglas City may be exceeded by a maximum of roughly 1°F. The probability of this occurrence is low.

In addition to the ROD Dry hydrograph, the Workgroup considered the modified Dry water year alternative described in Section 3.2.2. The Physical Work Group representatives raised these considerations for that alternative:

- It is generally important to evaluate pool dynamics at multiple flows, not 11,000 ft^3/s only.
- This alternative could interfere with the on-going monitoring to map river bathymetry.

This last appeared to be their primary concern.

RECOMMENDATION 1

After consultation with the Physical Work Group, the consensus of the Flow Scheduling Workgroup is that in the event of a Dry water year, the TRRP follow the ROD Dry hydrograph. The modified Dry alternative was considered but *not* adopted.

The volume of the Restoration release to the river in a Dry water year is 453,000 AF.

RECOMMENDATION 2

In the absence of submitted alternatives, the consensus of the Flow Scheduling Workgroup is that in the event of a Critically Dry water year, the TRRP follow the ROD Critically Dry hydrograph.

The volume of the Restoration release to the river in a Critically Dry water year is 369,000 AF.

The Workgroup is confident that all flows in the recommended hydrographs can be scheduled by Reclamation given the predicted reservoir volumes the remainder of this water year.

As of March 16, 2012, the Trinity Dam Auxiliary Outlet Works (AOW) continue to be out of service. Reclamation (NCAO) reports that gate repairs and servicing are scheduled to be complete mid-August, and the AOW returned to service status at that time. Until that time the AOW are not available for temperature management purposes.

Several preparatory steps have been taken to allow for the maximum flow releases including: infrastructure improvements, recent identification of infrastructure of concern, public outreach, and emergency preparedness.

Members of the Trinity Flow Scheduling Workgroup and Temperature Workgroup will regularly track river temperatures this summer, and participate in the Sacramento River Temperature Task Group meetings and conference calls.

1 Flow Scheduling Process

The Flow Scheduling Workgroup of the Trinity River Restoration Program (TRRP) develops annual flow release hydrographs to meet water year specific objectives and broader program goals. Workgroup meetings begin each year upon receipt of the first water forecast of the year in February. The Workgroup begins with the flow release hydrographs specified in the Record of Decision (ROD). Deliberations consider adaptations to ROD hydrographs based on exigent conditions and Adaptive Management alternatives. The Workgroup adjusts the release schedule within the ROD water volume allocation for that water year to meet specific restoration needs. They present alternative release schedules to the Trinity Adaptive Management Working Group (TAMWG) and the Trinity Management Council (TMC) in late March or early April for consideration. The TMC then recommends the annual flow release schedule to the Department of Interior (Interior) who has final responsibility over releases made to the Trinity River.

Figure 1 illustrates the timeline of 2012 flow scheduling meetings. The California Department of Water Resources (DWR) provides updated inflow forecasts on or about the 9th of each month beginning in February. Central Valley Operations (CVO) updates the CVP B2 forecast (allocation) roughly 2-weeks later. The Workgroup analyzes and considers those forecasts as they become available, factoring them into the scheduling process and hydrograph outcomes. All Workgroup recommendations are based on the best and latest available data.

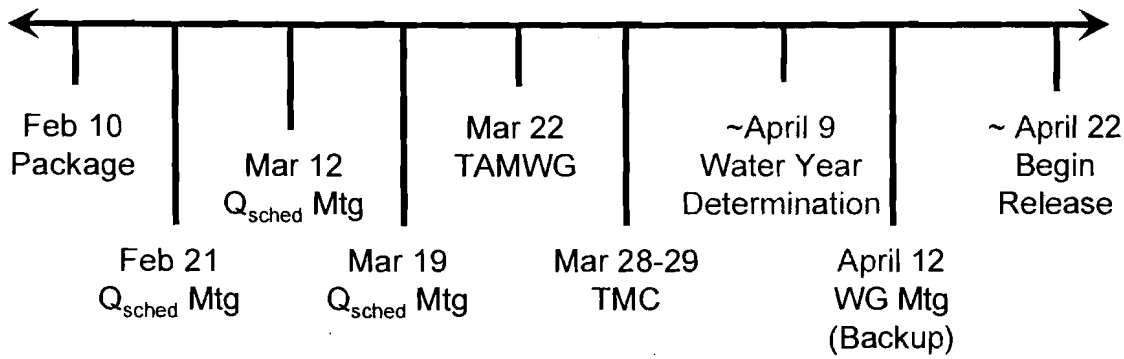


Figure 1. Timeline of flow scheduling meetings and milestones.

2 Water Year Type and ROD Water Volume Allocation

2.1 History of Previous Water Years

Table 1 summarizes ROD flow releases from 2000-2011. In that time TRRP experienced a variety of water-year types, including one Extremely Wet year, six Wet Years, one Normal, and four Dry water-year types. No Critically Dry years have occurred in this time.

2.1 Current Conditions

The Flow Scheduling sub-Workgroup begins tracking precipitation accumulation in December of the water year. The group tracks accumulated rainfall at the Trinity Hatchery, estimated snow water content of the snowpack in the north state (Feather, Truckee, and Trinity watersheds), reservoir storage, accumulated inflow to reservoirs, and precipitation forecasts. The following figure & tables present the latest estimates of those and other related factors.

Table 1. Annual Water Year Summary - Trinity River, California. Updated 10/24/2011.

Water Year	Forecast Water Year Type [G]	Actual Water Year Type [I]	Restoration Water Allocation (acre-feet)	Water Allocation Notes	Actual Restoration Release (acre-feet) [A]	Actual Restoration Release within Allocation given Measurement Uncertainty of ±5%	Safety of Dams Releases (acre-feet) [A,B]	Ceremonial Releases (acre-feet) [A,B]	Other Releases (acre-feet) [A,B]	Total Release to Trinity River (acre-feet) [A]	Peak Release Magnitude (cfs) [A]	Total Diversion thru Carr Tunnels (acre-feet) [C]	Total Inflow into Trinity Reservoir (acre-feet) [C,F]
2000	Wet	Wet	340,000	[D]	359,600	No	200,400	-	-	560,000	5,310	1,108,600	1,660,200
2001	Dry	Dry	369,000	[E]	379,600	Yes	-	4,200	-	383,800	1,760	669,400	786,700
2002	Normal	Normal	470,000	[E]	482,700	Yes	-	-	-	482,700	6,040	629,000	1,243,800
2003	Wet	Wet	453,000	[E]	448,100	Yes	68,300	5,700	34,000	556,100	2,610	857,600	1,795,700
2004	Wet	Wet	647,000	[E]	651,000	Yes	81,100	-	36,200	768,300	6,200	987,500	1,443,000
2005	Normal	Wet	647,000	[H]	647,600	Yes	-	3,600	-	651,200	6,970	466,700	1,412,400
2006	Ex Wet	Ex Wet	815,000	[H]	809,900	Yes	406,300	-	-	1,216,200	10,100	1,350,600	2,396,500
2007	Dry	Dry	453,000	[H]	453,700	Yes	-	4,100	-	457,800	4,750	614,400	715,300
2008	Normal	Dry	647,000	[H]	648,700	Yes	-	-	-	648,700	6,470	555,000	835,800
2009	Dry	Dry	453,000	[H]	445,500	Yes	-	11,100	-	456,600	4,410	539,200	797,200
2010	Normal	Wet	647,000	[H]	656,700	Yes	-	-	-	656,700	6,840	274,700	1,538,000
2011	Wet	Wet	701,000	[H]	721,800	Yes	-	10,800	-	732,600	11,600	473,100	1,780,800
TOTAL			*6,642,000*		*6,704,900*		*756,100*	*39,500*	*70,200*	*7,570,700*		*8,525,800*	*16,405,400*

Notes: All water volume values are rounded to the nearest 100 acre-feet.

A Computed from daily average flow record reported by the US Geological Survey for the Trinity River at Lewiston Streamgage # 11525500. The accuracy of the flow records ranges from +/- 5 percent to +/- 15 percent on a time variable basis.

B Volume estimate for flows above the summer or winter baseflow release for restoration.

C Computed from daily average record provided by the Bureau of Reclamation. Reported negative daily inflow values included "as is" in calculations.

D Restoration water allocation prior to implementation of the 2000 Trinity River Mainstem Fishery Restoration Record of Decision.

E Restoration water allocation limited by Court order 2001-2004. Court ordered volumes varied by year.

F Long-term average annual inflow to Trinity Reservoir (acre-feet/year) from 1911-2007 as provided by the Bureau of Reclamation = 1,254,000

G Water year type based on the April forecast (50% exceedence) from the Water Supply Outlook - California and Northern Nevada published by the California Nevada River Forecast Center, National Weather Service.

H Restoration water allocation as prescribed by the Trinity River Mainstem Fishery Restoration 2000 Record of Decision.

I Actual water year type based the total basin runoff above the Lewiston stream gage. Computed by multiplying inflow to Trinity Reservoir

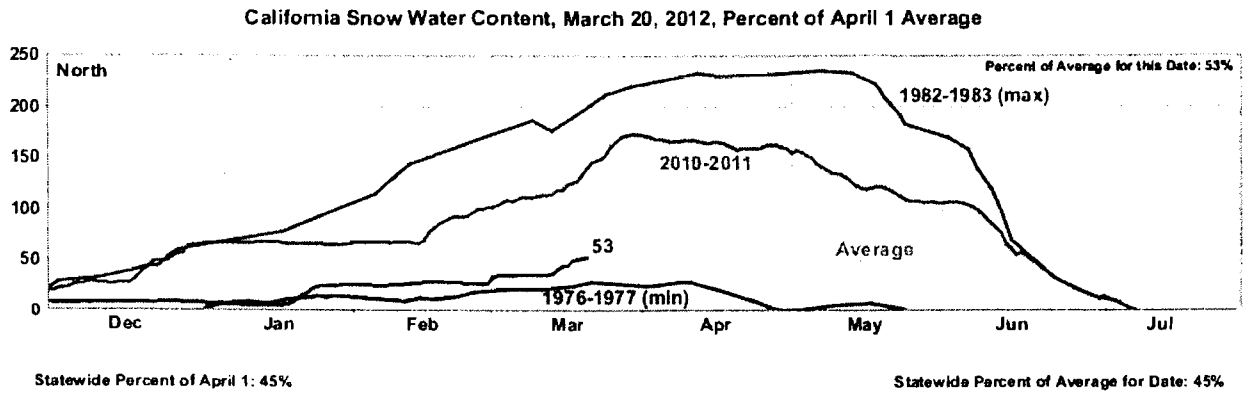


Figure 2. Snow Water Content.
(Latest chart from http://cdec.water.ca.gov/cgi-progs/products/PLOT_SWC.2012.pdfweb)

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

DAILY CVP WATER SUPPLY REPORT

MARCH 19, 2012 RUN DATE: March 20, 2012

STORAGE IN MAJOR RESERVOIRS IN THOUSANDS OF ACRE-FEET

RESERVOIR	CAPACITY	15YR AVG	WY 2011	WY 2012	% OF 15 YR AVG
TRINITY	2,448	1,846	2,012	1,995	108
SHASTA	4,552	3,615	4,211	3,477	96
OROVILLE (SWP)	3,538	2,448	2,994	2,799	114
FOLSOM	977	608	688	569	94
NEW MELONES	2,420	1,719	1,817	1,977	115
FED. SAN LUIS	966	879	967	729	83
MILLERTON	520	384	412	288	75
TOT. N. CVP	11,360	8,666	9,695	8,747	101

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

RESERVOIR	CURRENT WY 2012	DRIEST WY 1977	WETTEST WY 1983	15 YR AVG	% OF 15 YR AVG
TRINITY	239	68	1,113	552	43
SHASTA	1,640	1,301	6,215	3,211	51
FOLSOM	602	183	3,171	1,145	53
NEW MELONES	258	0	1,032	389	66
MILLERTON	301	105	1,442	450	67

ACCUMULATED PRECIPITATION FOR WATER YEAR TO DATE IN INCHES

RESERVOIR	CURRENT WY 2012	DRIEST WY 1977	WETTEST WY 1983	AVG (N YRS)	% OF AVG	LAST 24 HRS
TRINITY AT FISH HATCHERY	17.28	8.67	45.38	25.98 (50)	67	0.00
SACRAMENTO AT SHASTA DAM	28.43	9.78	90.94	49.87 (55)	57	0.00

Figure 3. CVO Daily Report (Latest tables from www.usbr.gov/mp/cvo).

2.2 Trinity Reservoir Inflow Forecast

DWR estimates the annual Trinity Reservoir inflow on April 1. The observed April 1 Trinity Reservoir inflow volume is added to an estimate of the average inflow for the remainder of the Water Year, through September 30, for an estimate of the total annual Trinity Reservoir inflow. An estimate of runoff is then added to account for the small watershed area between Trinity Dam and Lewiston Dam (Figure 4). Table 2 contains the 2012 inflow forecasts at the 90%, 50%, and 10% exceedance levels. Table 3 lists the water year types and associated restoration release volumes.

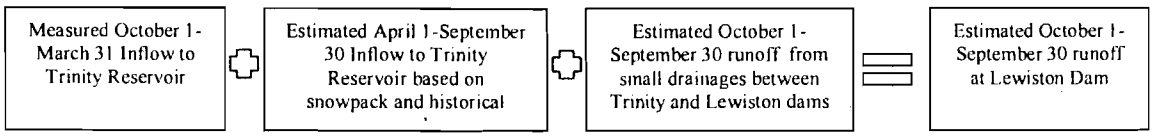


Figure 4. April 1 computations of annual inflow to determine Water Year type.

The official water-year type is based on the April 1 forecast (50 percent exceedance) of unimpaired annual basin runoff above the Trinity River at Lewiston streamgage (USGS streamgage #11525500) for the entire water year (October to September). The water forecast is jointly developed by the National Weather Service (NWS) and DWR. Identical forecasts are published in the Water Supply Outlook for California and Northern Nevada produced by the NWS, and in Bulletin 120 produced by DWR.

Table 2. 2012 CNRFC & DWR estimates of annual inflow into Trinity Reservoir.

Trinity Inflow Forecast	**Water Year 2012 – Thousands of Acre Feet (TAF)**											
Exceedence Probability		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Apr-Jul	**WY-12**	**TYPE**
	Observed											
Feb 1, 2012	*Oct-Jan*											
90%	*116*	42	80	65	75	30	10	5	2	180	**425**	**CD**
50%	*116*	100	135	155	165	60	20	6	3	400	**760**	**D**
10%	*116*	140	200	305	325	120	50	11	8	800	**1,275**	**N**
Mar 1, 2012	*Oct-Feb*											
90%	*179 (158)*		60	100	75	25	10	4	3	210	**456**	**CD**
50%	*179 (216)*		110	160	125	35	20	12	7	340	**648**	**CD**
10%	*179 (256)*		160	200	250	110	40	15	10	600	**964**	**D**
Apr 1, 2012	*Oct-Mar*											
90%	*(239)*											
50%	*(289)*											
10%	*(339)*											

Table 3. Water year type and restoration release water volume

Water Year	**Trinity Reservoir Inflow (thousand acre-feet)**	**Restoration Release Volume (thousand acre-feet)**	**Probability of Occurrence**
Extremely Wet	> 2,000	815	12%
Wet	1,350 – 2,000	701	28%
Normal	1,025 – 1,350	647	20%
Dry	650 – 1,025	453	28%
Critically Dry	< 650	369	12%

2.3 CVP B2 Forecasts

CVO plans and forecasts operations of the Central Valley Project (CVP), including the Trinity River Division (TRD). CVO maintains a monthly forecast with a 12-month forecast period on their website www.usbr.gov/mp/cvo. The title of the forecast on that page is 'Water Operations Analysis', followed by the current month of the rolling forecast. Two forecasts titled 'B2 Operations Summary' are presented, one at the 50% exceedance level, the other at the 90% exceedance level. TRRP follows the 50% B2 Operations Summary.

The forecasts track planned reservoir Storages, Monthly River Releases, Trinity Diversions, a Delta Summary, and Hydrology.

Key information contained in these forecasts includes end of September storage in Trinity Reservoir, Carr Powerplant diversions, planned monthly river releases to the Trinity River, and the Water Year Inflow (TAF) to Clair Engle Lake (Trinity Reservoir). The same figures for Shasta Reservoir factor heavily into our evaluation of current and forecast conditions and releases.

The Workgroup deliberations in 2012 focused finally on the 50% and 90% February forecasts. The March forecasts were not available at the time of the preparation of this report. The 50% forecast assumed a Dry water year on the Trinity; The 90% forecast assumed a Critically Dry water year on the Trinity.

The end-of-September storage according to the 90% forecast for Trinity is 1,265 TAF. The end-of-September storage per the 50% forecast for Trinity is 1,536 TAF.

The estimated WY Carr diversions (Feb – Sept) under the 90% forecasts are roughly 662 TAF.

The estimated WY Carr diversions (Feb – Sept) under the 50% forecasts are roughly 439 TAF.

3 WY2012 Flow Release Alternative Development

The Workgroup invited adaptive management based ideas for alternative hydrographs this water year. Hydrographs differing from the ROD hydrographs go through a vetting process by the Workgroup. The vetting process requires descriptive information and considers several factors related to the alternative.

Alternative Submittal Instructions

The Flow Workgroup Coordinator transmitted instructions for submittal of WY 2012 flow schedule alternatives on February 10 and further discussed those instructions in detail at the February 21 Flow Workgroup meeting in Weaverville. Program partners submitted a single flow schedule alternative for consideration to the Workgroup. The Workgroup coordinators compiled the alternative and presented it at the March 12 & 19 meetings in Weaverville.

The Workgroup selected two Dry water year flow schedules (ROD & Alternative), and one Critically Dry water year flow schedule (ROD), for detailed evaluation of water temperature effects during the StreamTemp model workshop. The workshop was held at the U.S. Fish and Wildlife Service office in Arcata on March 15. The Workgroup met again on March 19 in Weaverville to consider water temperature relationships to the proposed Dry year alternatives and the Critically Dry ROD hydrograph. Then the group made final its final deliberations to reach a consensus recommendation for consideration by the TAMWG and the TMC.

3.1 Considerations and Constraints

The Workgroup concluded that the primary considerations for their deliberations this year centered on temperature target compliance in the Trinity River. The following section contains the temperature

targets. The objective of the temperature modeling analysis is to ascertain the relative performance of alternative flow schedules in meeting the temperature targets.

3.1.1 Water Temperature Targets

Table 4 lists the river temperature targets specified by either the Regional Water Quality Control Board in WR 90-5 or the Trinity Record of Decision.

Table 4. River temperature targets from the Trinity River Flow Evaulation Study.

Source	Target Reach	Dates	Target
Basin Plan for the North Coast Region (Regional Water Quality Control Board, 1994) *WR 90-5*	• Lewiston to Douglas City • • Lewiston to Douglas City • Lewiston to the confluence with the North Fork Trinity River	All Years • July 1 to Sept. 15 • *Sept. 15 – 30* • *Oct. 1 to Dec. 31*	 ≤ 60° F ≤ 56° F ≤ 56° F
Spring-Time Objectives of the Record of Decision for the Trinity River EIS/EIR (USFWS et. al., 2000)	• Lewiston to Weitchpec • Lewiston to Weitchpec	Normal and Wetter Water Years • April 15 to May 22 • May 23 to June 4 • June 5 to July 9 Dry and Critically Dry Water Years • April 15 to May 22 • May 23 to June 4 • June 5 to July 9	Optimal ≤ 55° F ≤ 59° F ≤ 62.5° F Marginal ≤ 59° F ≤ 62.5° F ≤ 68° F

Reclamation and CVO have the responsibility to meet these targets through the management of flow releases from Trinity & Lewiston Dams. The Temperature Workgroup tracks river temperature during the compliance periods and coordinates with the Sacramento River Temperature Task Group when necessary.

Temperature modeling output is compared with these targets to assess the performance of flow schedules in meeting the targets under various synthetic meteorological conditions ranging from average or normal to extreme.

3.1.2 Restoration Implementation

The Rehabilitation & Implementation Group Branch Chief informed the Workgroup that there were no obvious construction constraints on the restoration release flow schedule this year.

3.1.3 Other

There were no other monitoring conflicts or constraints brought to the attention of the Workgroup. There is a constraint on the use of the Auxiliary Outlet Works, discussed in Section 5.

3.2 Hydrograph Compilation and Deliberation

The 2012 flow scheduling calendar specified submission of alternative hydrographs or components by 9 March 2012. The Workgroup received one alternative flow schedule from TRRP partners prior to the

deadline. The following sections describe the ROD Dry, modified Dry, and ROD Critically Dry flow schedules, associated management objectives, targets, and benefits.

3.2.1 Description & Summary of ROD Critically Dry & Dry Hydrographs

Figure 5 illustrates the ROD Critically Dry and Dry water year hydrographs. The total annual restoration release volume for a Dry water year is 453,000 acre-ft. The total annual restoration release volume for a Critically Dry water year is 369,000 acre-ft.

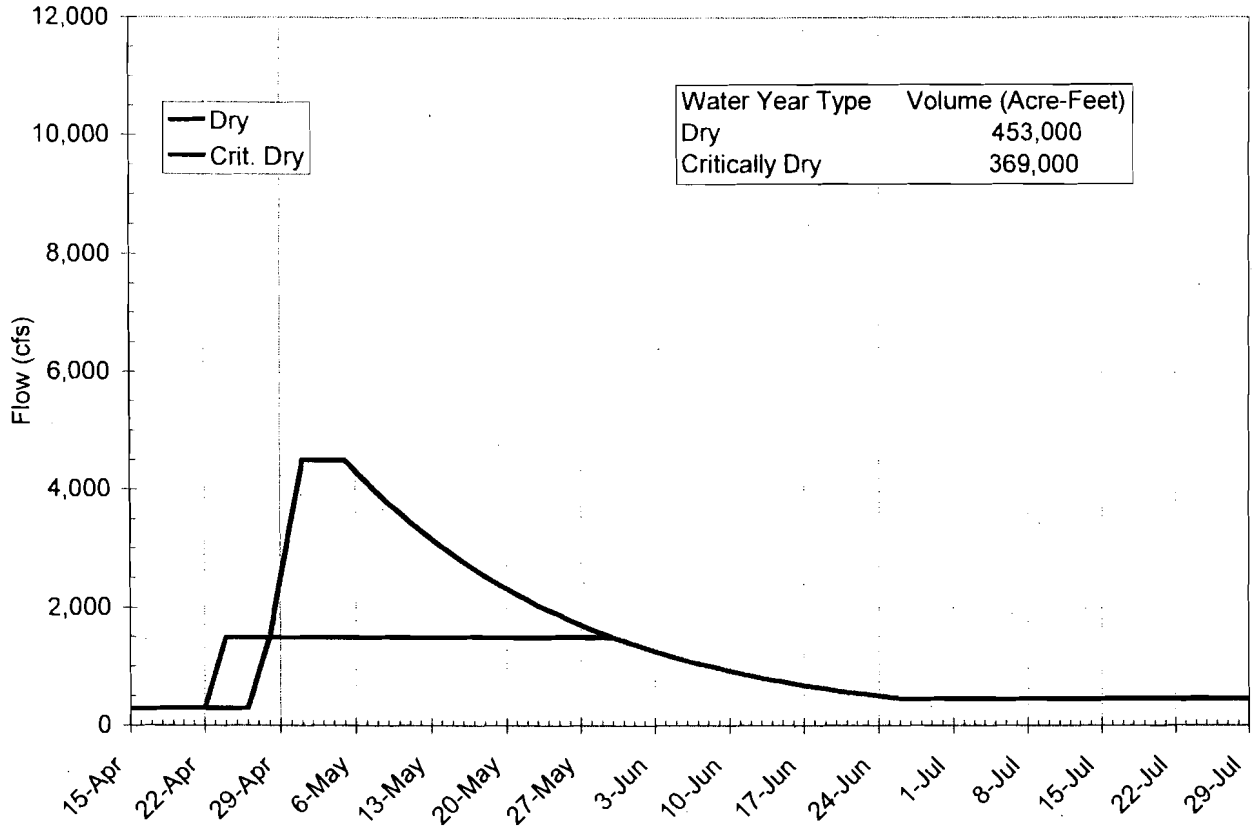


Figure 5. ROD Dry & Critically Dry Hydrographs.

TRFEFR Tables 8.8 & 8.9 list the hydrograph components, dates, flows, management targets, purposes, and benefits for both ROD Dry and Critically Dry hydrographs. The values in the tables are supported by the science performed for the Flow Evaluation, and updated since that time.

The monitoring associated with these two hydrographs is described in the IAP and the Program monitoring plan for 2012.

The Geomorphic objectives for a Dry water year hydrograph are:

1. Channelbed surface mobilization of in-channel alluvial features (e.g., spawning gravel deposits)
2. Transport sand out of the reach at a volume greater than input from tributaries to reduce instream sand storage
3. Transport coarse bed material at a rate near equal to input from tributaries to route coarse sediment, create alluvial deposits, and eliminate tributary aggradation
4. Discourage germination of riparian plants on lower bar surfaces for a portion of the seed release period
5. Maintain variable water table for off-channel wetlands and side channels.

The Geomorphic objectives for a Critically Dry water year hydrograph are:

1. Discourage germination of riparian plants on lower bar surfaces for the early portion of the seed release period
2. Minimally recharge groundwater

The Microhabitat & Temperature objectives for a Dry or Critically Dry water year hydrograph are:

1. Provide the greatest amount of spawning and rearing microhabitat for anadromous salmonids in the existing channel, given the needs of the various life-stages.
2. Provide suitable temperatures for holding spring chinook and spawning spring and fall chinook by meeting temperature targets listed in Table 4.
3. Facilitate early outmigration of smolts by allowing water temperatures to warm and provide at least marginal temperatures for anadromous salmonids throughout most of their outmigration by meeting temperature targets at Weitchpec (RM 0.0), as listed in Table 4.

3.2.2 Dry Water Year AEAM Flow Release Alternatives

One alternative hydrograph was proposed for a DRY water year (Figure 6). This alternative is identical to the TRFEFR and ROD DRY water year release, with the following exception: the 5-day release of 4,500 ft^3/s is shortened to a 2-day release of 6,000 ft^3/s and a 1-day release of 5,700 ft^3/s , which results in the total water volume being identical to the TRFEFR and ROD DRY water year release (453,000 ac-ft). Table 6 in Appendix B lists the daily restoration release flows out of Lewiston reservoir.

The objective of the proposed flow schedule is to evaluate how a high flow release that is sufficient to mobilize gravels and cobbles will cause pool depths and volumes to change in the absence of coarse sediment augmentation in 2012. A 6,000 ft^3/s release magnitude is recommended over the DRY year 4,500 ft^3/s magnitude because the 6,000 ft^3/s flow exceeds transport thresholds for gravels and cobbles, and would be more likely to cause changes in pool depths and volumes than 4,500 ft^3/s.

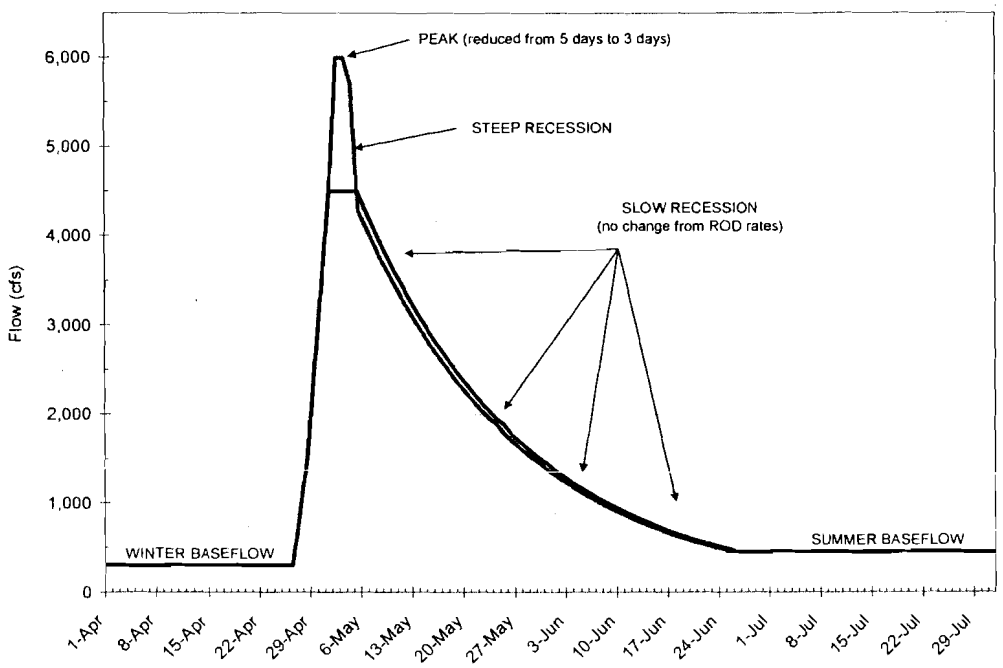


Figure 6. Modified DRY alternative. Water year peak release pattern to evaluate pool depth dynamics in the absence of 2012 coarse sediment augmentation.

The hypothesis is that pools immediately downstream of recent coarse sediment augmentation sites that may have had local filling by the recent augmentation would have stored gravels and cobbles transported out of the pools, and with less gravel input in the absence of coarse sediment augmentation, would result in increased pool depths and volumes.

Because bathymetric data collection begun in 2011, but not completed for all pools in the upper river near coarse sediment augmentation sites, we will soon have the baseline data upon which a comparison could be made after the 2012 release. Therefore, bathymetric surveys of chosen monitoring pools would need to be resurveyed immediately after the 2012 releases. The technical analyses would be a topographic differencing of the 2011 and 2012 bathymetry to evaluate changes in pool depth, topography, volume and other metrics of pool evolution.

Examining the current TRRP budget, bathymetric surveying of pools in 2012 would need to be funded. The approximate survey cost would probably be in the $25,000 range (assuming 3-5 pools are chosen). This assumes TRRP staff would conduct the topographic differencing and analysis, and in a manner consistent with how the pool depth evaluation (currently underway) is being analyzed.

This alternative flow release does deviate slightly from the DRY water year release in the TRFEFR and ROD, in that the 5-day release of 4,500 ft^3/s is converted to a 2-day release of 6,000 and a 1-day release of 5,700 ft^3/s . Thereafter, the receding limb would be identical to that of the DRY year release as shown in the TRFEFR and ROD (Figure 6). The TRFEFR Chapter 8 management objectives for a DRY water year should easily be met by the larger magnitude flow, and the slightly shorter duration (approximately 2 days shorter) should not cause any long-term impacts to meeting TRFEFR management objectives.

Ramping – The major decline in flow occurs from 4-5 May, from 5,700 ft^3/s to 4,300 ft^3/s. If this change occurs over a 24-hour period, the calculated ramping rate is 233 ft^3/s/4-hours, less than the ROD target of 400 ft^3/s/4-hours on a descending hydrograph. (EIS Appendix C, Section 1.7, Table 3)

3.2.3 Critically Dry Water Year AEAM Flow Release Alternatives

None submitted, or considered this year.

3.2.4 Alternatives Forwarded by the Work Group to the Modelers

In the absence of other alternatives, except for one Dry water year alternative, the Workgroup submitted the ROD Dry, Modified Dry (Mod-GK), and ROD Critically Dry hydrographs to the temperature modelers for analysis. Table 5 lists the combinations of hydrographs, predicted Lewiston temperatures at the 50% & 90% exceedance levels, and the types of meteorology's to be modeled.

Table 5. Scenarios for Stream Temp river temperature modeling.

Water Year Alt. Identification		Release Temp @ 50% Exceed.	Release Temp @ 90% Exceed.	Hydro- Meteorology[a]	
WY	Descriptor			Extreme	Avg
DRY	ROD	CVO - generated	CVO - generated	X	X
DRY	Mod-GK	CVO - generated	CVO - generated	X	X
CDRY	ROD	CVO - generated	CVO - generated	X	X

In all, this matrix reduces to three hydrographs, one Lewiston release temperature pattern, and two meteorology's, resulting in 6 combinations (3x1x2 = 6). The three hydrographs are distinct until roughly May 27 when they become coincidental. After that date the flows for each are identical, thus the output results will be as well. Figure 7 illustrates the three hydrographs.

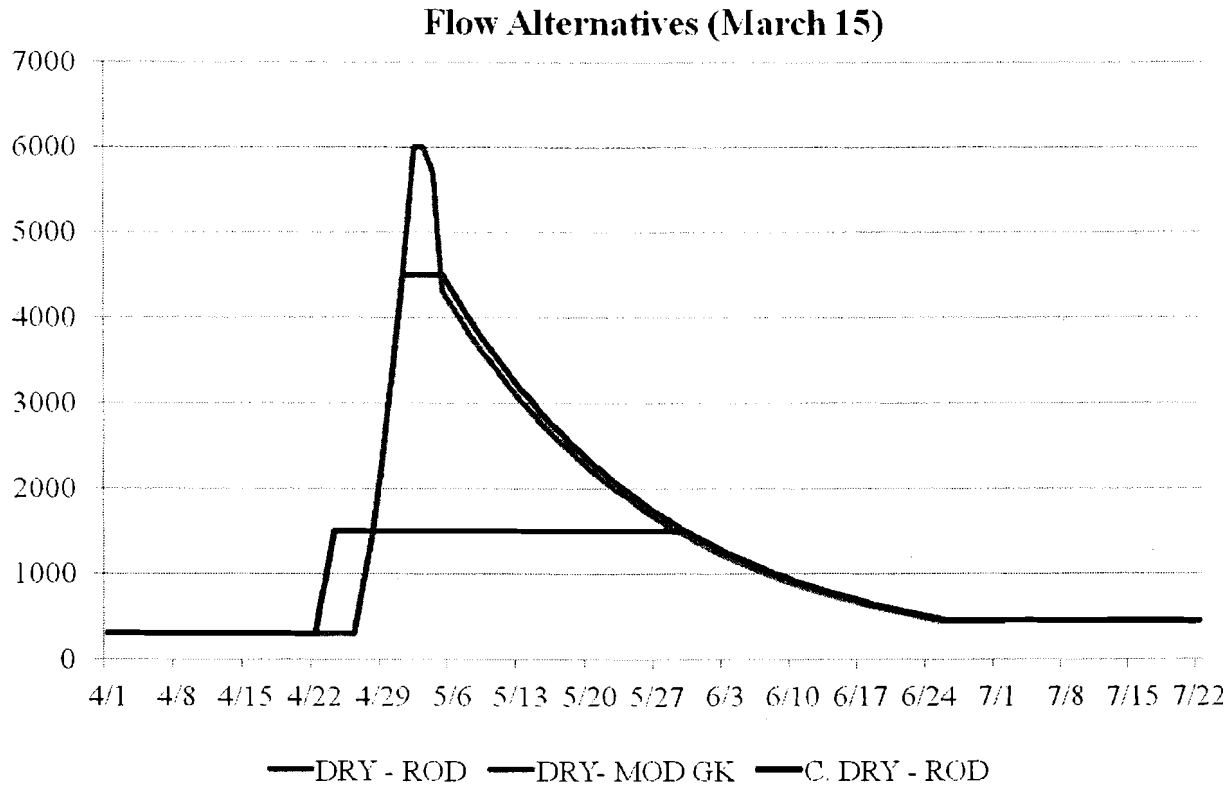


Figure 7. Hydrographs modeled by the HEC-5Q and StreamTemp models for WY2012.

3.3 Modeling Results

The Workgroup follows this process annually, adjusted for dates and other exigencies as needed, in the analysis of hydrograph temperature performance.

1. DWR provides updated inflow forecast on or about the 9th day of Feb, Mar, and April.
2. CVO updates allocation plan (90%) on or about the 23rd day of Feb, Mar, and April.
   a. Includes forecast Carr diversions and Trinity River releases
3. TRRP provides flow schedule alternatives (50%) on or about the 12th of March
4. CVO models Trinity & Lewiston reservoir temperatures within a week of receiving TRRP flow schedule alternatives
5. TRRP models Trinity River temperatures immediately upon receipt of the reservoir modeling output from CVO. The current model, Stream Temp, is maintained and operated by the USFWS Arcata Field Office.

The following sections provide the model output for each of these steps.

3.3.1 Modeled Water Temperature Forecast

Table 2 lists predicted Trinity reservoir inflow. The B2 forecasts list the assumed outflows including restoration releases (TRRP water year type and associated hydrograph) and Carr diversions.

In addition, Reclamation's Northern California Area Office provides temperature profile data of Trinity Reservoir to CVO for the HEC-5Q Trinity Reservoir Temperature model. The meteorology for the HEC-5Q models is based on median and average daily values in the historical record. More information on the HEC-5Q models is available from CVO.

<u>Lewiston Reservoir Temperatures</u> - Figure 8 combines the Lewiston results into one graph showing model results for Lewiston Dam outflow temperatures. This comparison shows the relative similarity of

predicted riverine temperatures, especially following the 1st of August when all flows and diversions are the same, regardless of alternative. The differences in predicted temperatures in the July period stem from the differences in Carr exports.

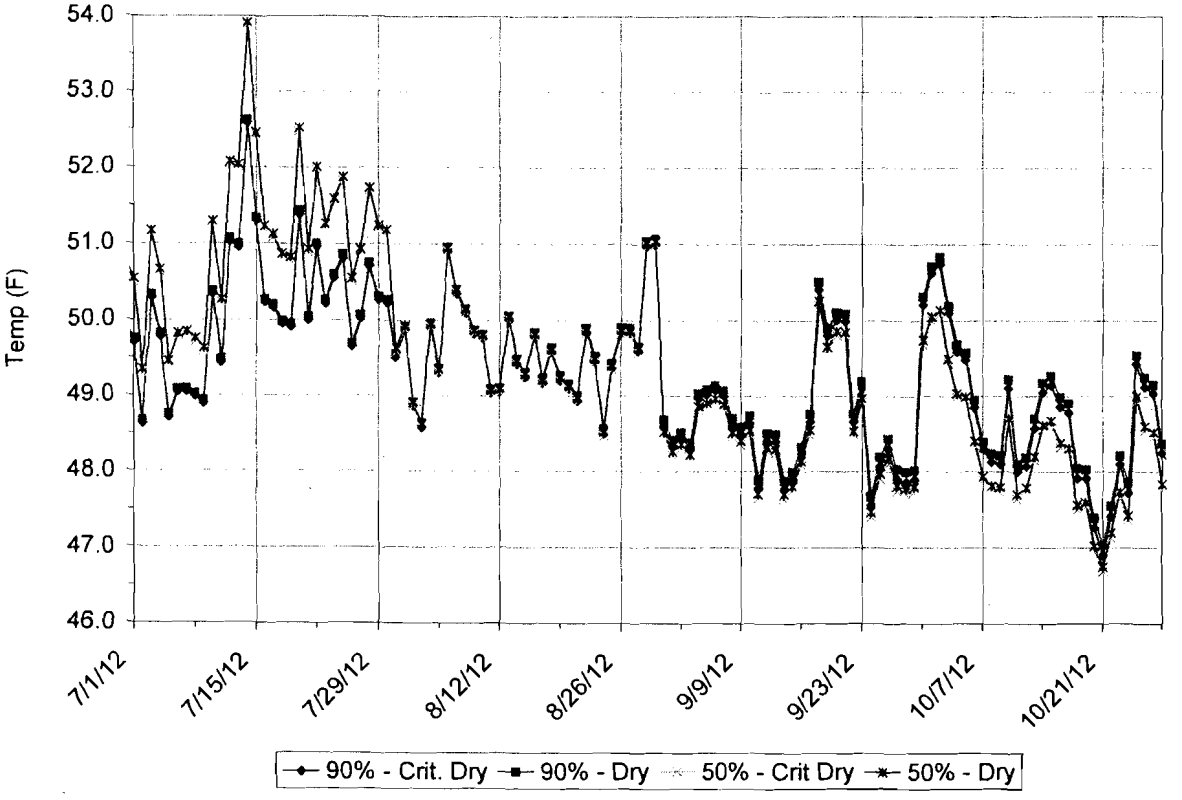


Figure 8. Lewiston Reservoir Temperature model output shows the similarity of model results, especially in the period beginning in August.

Spring Targets at Weitchpec

Figure 9 contrasts temperature model results for both Critically Dry & Dry water year hydrographs under Average and Extreme Hydrometeorological conditions at Weitchpec.

Figure 10 contrasts the two Dry water year hydrographs – the ROD-Dry and the modified Dry – under Average and Extreme Hydrometeorological conditions at Weitchpec.

For comparison purposes, the Flow Study (TRFEFR) graphs for Critically Dry and Dry water years are copied here as Figure 11 and Figure 12. Note the typical dates that the predicted temperature move out of the optimal into the marginal and unsuitable ranges in both year types. Then compare those dates to predicted temperatures this year in Figure 9 and Figure 10.

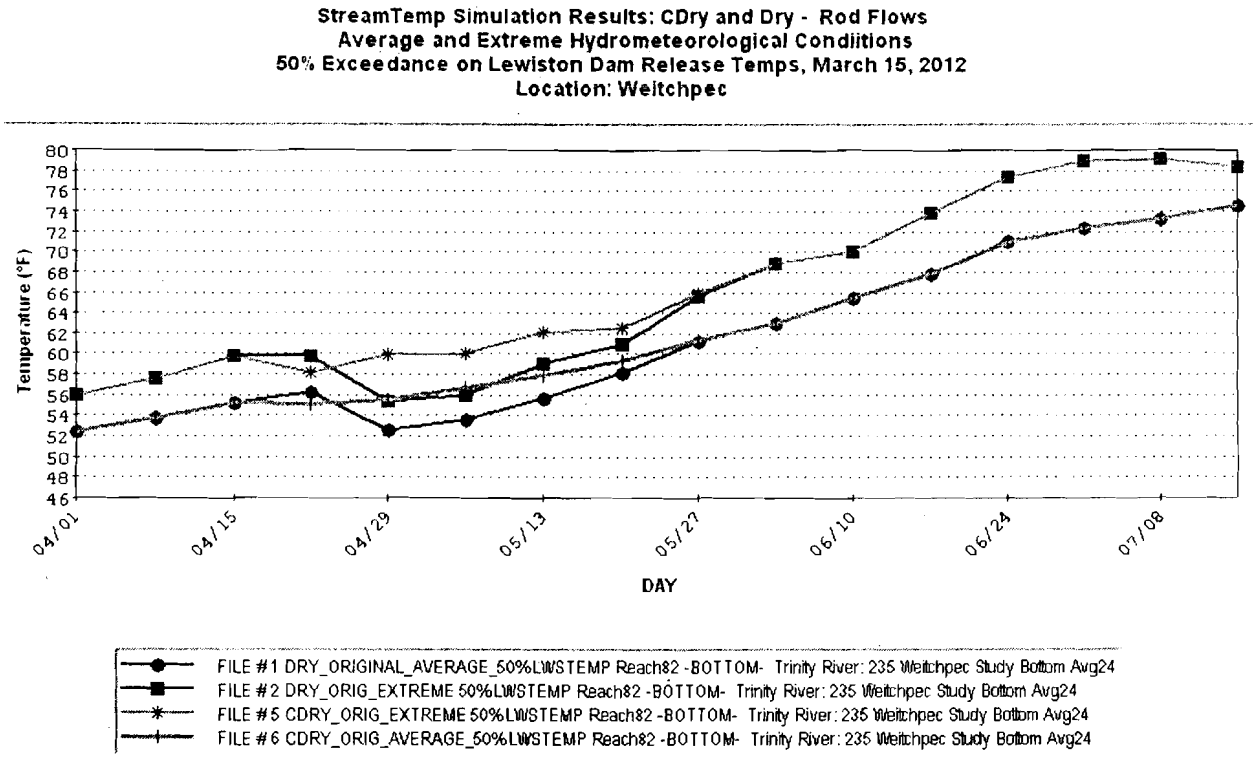


Figure 9. Springtime temperature targets at Weitchpec. Critically Dry & Dry; Average & Extreme meteorology.

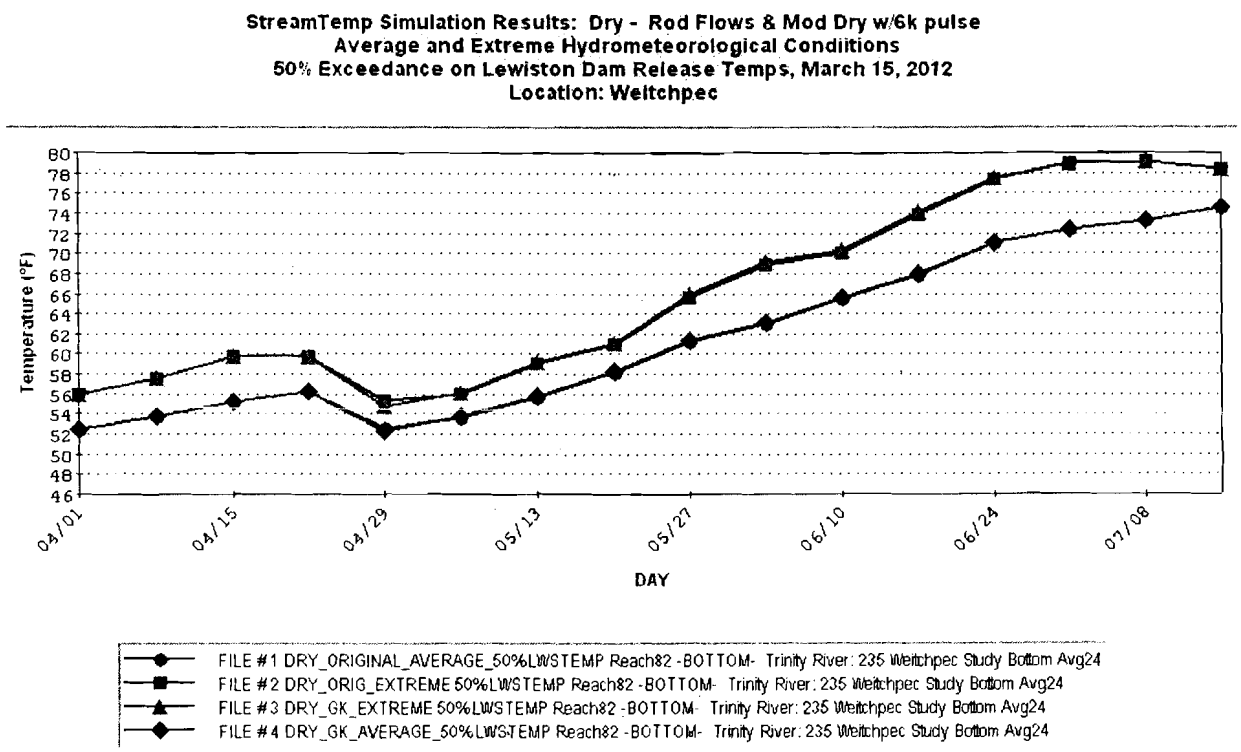


Figure 10. Modified Dry alternative compared to ROD-Dry; Average & Extreme meteorology; @ Weitchpec for Springtime targets.

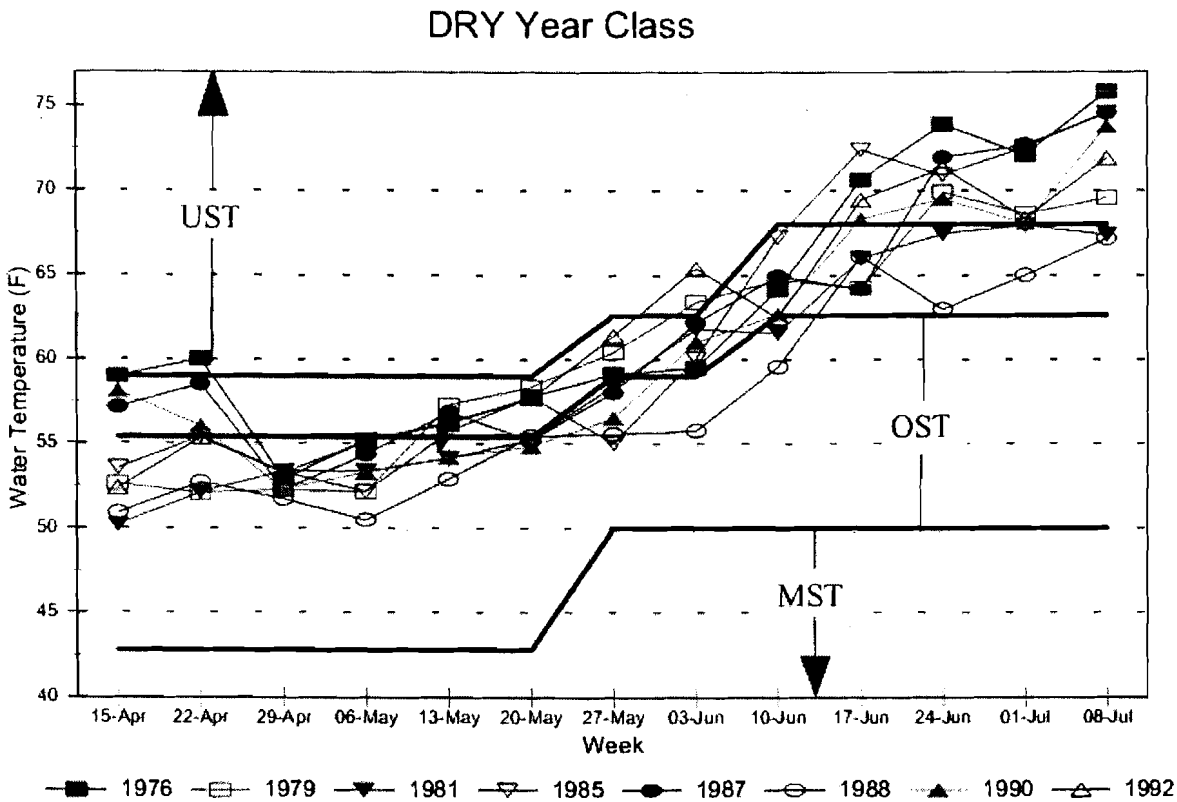


Figure 11. Dry WY temperature prediction from Flow Study. Note that marginal temperatures begin in May and unsuitable temperatures begin in June, for the selected test years.

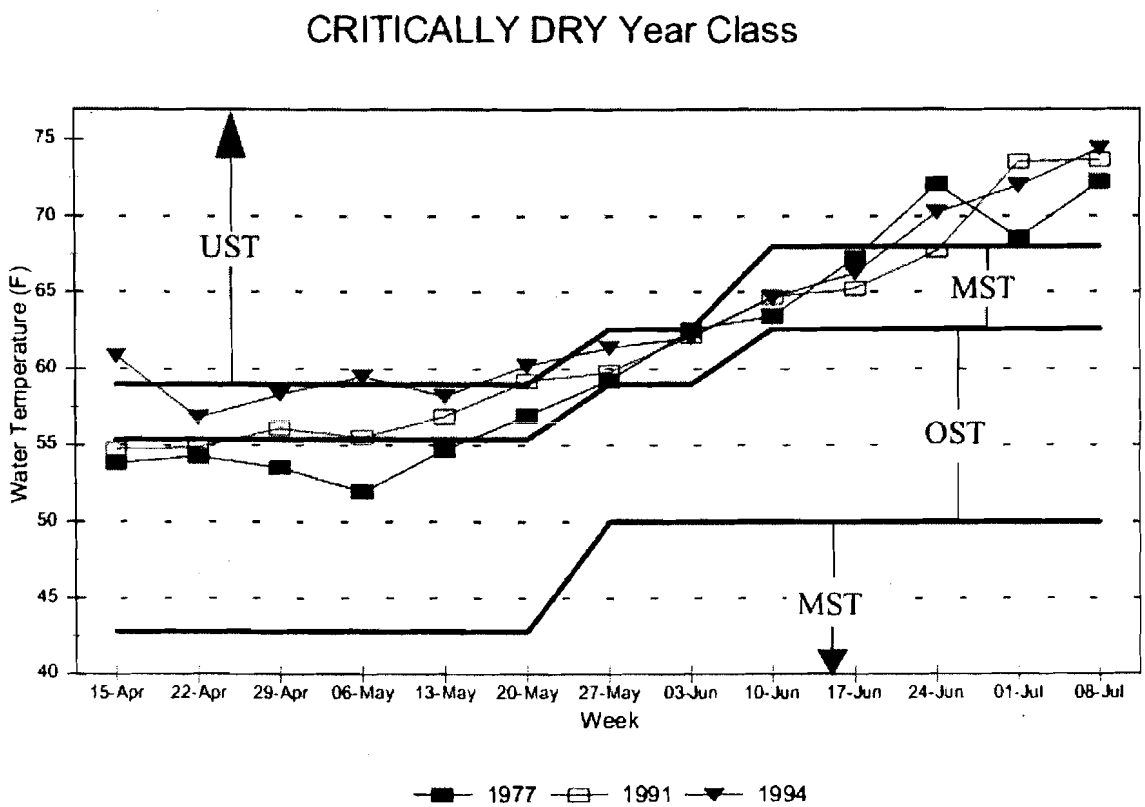


Figure 12. Critically Dry WY temperature prediction from Flow Study. Note that marginal temperatures begin in April and unsuitable temperatures begin mid-June, for the selected test years.

Summer Targets at Douglas City

Figure 13 shows the predicted riverine temperatures at Douglas City from July 1 to September 23. The flow for all three alternatives, Dry, modified Dry, and Critically Dry are the same. The outflow temperatures from Lewiston (Figure 8) are essentially identical after August 1.

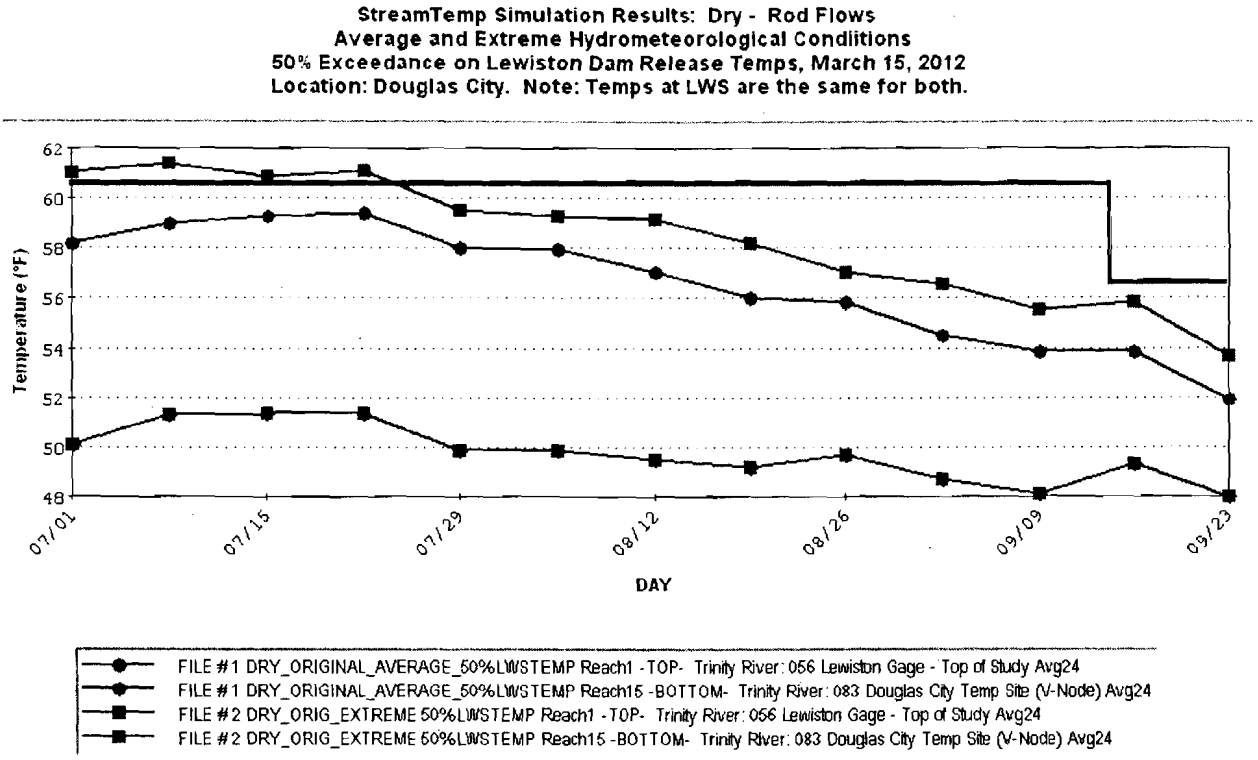


Figure 13. Predicted temperatures for Dry WY at Douglas City, July 1 - Sept 23. Critical Dry WY specifies same discharges, resulting in the same predicted temperatures as the Dry results presented here. The modified Dry alternative is practically indistinguishable from the ROD Dry. Red line is the temperature target specified by WR 90-5.

Based on modeling results, the Workgroup concludes that temperature compliance is probable at both Weitchpec and Douglas City as long as we avoid consecutive days or weeks of extreme hydrometeorological conditions, primarily in the early July timeframe.

Of course short exceedance above temperature targets are always possible dependent on weather conditions. The Temperature Workgroup will be tracking river water temperature performance and coordinating with the Sacramento River Temperature Task Group (STRRG) when conditions warrant.

4 Flow Workgroup Consensus Recommendation for WY2012 Releases

The Flow Scheduling Workgroup used a consensus process to develop its recommendation for 2012 flow schedules to the TAMWG and TMC. The following sections describe the process and outcome.

4.1 Consensus Process

Consensus is a process through which a group makes a decision (w/o voting) that all members can support. It is a group decision, supported by all group members, which is based on:

- A thorough understanding of all relevant information;

- Active participation by all group members;
- An understanding of different perspectives, concerns, and needs;
- A creative effort to accommodate the different needs; and
- A willingness to raise and understand disagreements and address the underlying needs manifested in disagreements.

This document reports on the consensus process and outcome of the Workgroup for the 2012 Flow Hydrograph. It records the major decision points and related information. A complete version, with all of the data replacing the web links, is available at the TRRP office.

4.2 Consensus Outcome

4.2.1 Dry WY

In addition to the ROD Dry hydrograph, the Workgroup considered the modified Dry water year alternative described in Section 3.2.2. The Physical Work Group representatives[1] raised these considerations for that alternative:

- It is generally important to evaluate pool dynamics at multiple flows, not 11,000 ft^3/s only.
- This alternative could interfere with the on-going monitoring to map river bathymetry following high-flow releases in 2011. This appeared to be their primary concern.

RECOMMENDATION 1

After consultation with the Physical Work Group, the consensus of the Flow Scheduling Workgroup is that in the event of a Dry water year, the TRRP follow the ROD Dry hydrograph. The alternative was considered but *not* adopted.

The volume of the Restoration release to the river in a Dry water year is 453,000 AF.

4.2.2 Critically Dry WY

RECOMMENDATION 2

In the absence of submitted alternatives, the consensus of the Flow Scheduling Workgroup is that in the event of a Critically Dry water year, the TRRP follow the ROD Critically Dry hydrograph.

The volume of the Restoration release to the river in a Critically Dry water year is 369,000 AF.

4.2.3 Associated Water Year Specific Monitoring

At this time the Program plans to conduct reconnaissance level modeling of a real-time management schema for managing summer time (July 1-September 30) temperatures in the Trinity River above the confluence with the North Fork Trinity River. Cost of this modeling is ~$20,000.

The remainder of water year specific monitoring funding is available for fish health oriented tasks or other tasks not yet identified by either the Flow Workgroup or RIG.

[1] Short conference call 11:00 a.m. 19 March 2012. Included Connor Shea, Andreas Krause, Dave Gaeuman, Andrea Hilton, Scott Kennedy, Scott McBain.

5 Preparations for the Flow Release

Under the recommended hydrographs, the following are the range of flow releases:

HYDROGRAPH COMPONENT	DATE	FLOW	DURATION
Dry			
Upramp	27 Apr – 1 May	300 - 4,500 ft^3/s	5 days
Peak	1 May – 5 May	4,500 ft^3/s	5 days
Downramp	6 May – 25 May	4,500 – 450 ft^3/s	20 days
Summer Baseflow	26 May – Oct 15	450 ft^3/s	142 days
Critically Dry			
Upramp	23-24 Apr	300 – 1,500 ft^3/s	2 days
Peak	24 Apr – 29 May	1,500 ft^3/s	36 days
Downramp	30 May – 26 Jun	1,500 – 450 cfs	28 days
Summer Baseflow	27 Jun – Oct 15	450 ft^3/s	112 days

5.1 Dam Operations

The Workgroup is confident that all flows in the recommended hydrographs can be scheduled by Reclamation given the predicted reservoir volumes the remainder of this water year.

As of March 16, 2012, the Trinity Dam Auxiliary Outlet Works (AOW) continue to be out of service. Reclamation (NCAO) reports that gate repairs and servicing are scheduled to be complete mid-August, and the AOW returned to service status at that time. Until that time the AOW are not available for temperature management purposes.

5.2 Infrastructure Protection and Emergency Preparedness

Several preparatory steps have been taken to allow for the maximum flow releases including: infrastructure improvements, recent identification of infrastructure of concern, public outreach, and emergency preparedness.

5.2.1 Public Outreach

Reclamation will issue a press release before flows begin ramping up informing the public that a high flow release of 1,500 ft^3/s or 4,500 ft^3/s this year is under consideration. The press release will provide contact information to the Trinity River Restoration Program. The press release will be forwarded to: local newspapers in Weaverville, Hoopa, Eureka, and Redding; the env-trinity list server; the automated trinity river release notification list server; and over 100 landowners for which the Trinity River Restoration Program has email addresses. The marinas located along Lewiston Reservoir will be notified of the high flow release schedule so docks can be adequately secured against the increased water velocity.

Reclamation sends out automated notifications via phone or email of flow releases changes to the Trinity River. The public can sign up to receive these notifications at: http://www.trrp.net/water/index.htm. Reclamation also maintains call-in recorded phone message (530-246-7594) with the current release, and any scheduled changes. For significant flow releases, Reclamation also contacts the Trinity County Sheriff's Office and the Forest Service (Weaverville & Big Bar), as they are the primary agencies tasked with public safety.

5.2.2 Emergency Preparedness

The Trinity River Restoration Program continues to work with the Bureau of Reclamation and Trinity County to develop an emergency response plan in case an unforeseen emergency arises. Additionally,

staff from the Trinity River Restoration Program will be field-monitoring infrastructure between Lewiston Dam and the North Fork Trinity River for releases greater than 8,500 ft^3/s. Staff will be equipped with radios to communicate any unforeseen issues to the appropriate authorities.

5.3 SRTTG Coordination

The Sacramento River Temperature Task Group (SRTTG): The SRTTG is a multiagency group formed pursuant to SWRCB Water Rights Orders 90-5 and 91-1, to assist with improving and stabilizing Chinook population in the Sacramento River. Annually, Reclamation develops temperature operation plans for the Shasta and Trinity divisions of the CVP. These plans consider impacts on winter-run and other races of Chinook salmon, and associated project operations. The SRTTG meets initially in the spring to discuss biological, hydrologic, and operational information, objectives, and alternative operations plans for temperature control. Once the SRTTG has recommended an operation plan for temperature control, Reclamation then submits a report to the SWRCB, generally on or before June 1st each year.

After implementation of the operation plan, the SRTTG may perform additional studies and commonly holds meetings as needed typically monthly through the summer and into fall to develop revisions based on updated biological data, reservoir temperature profiles, and operations data. Updated plans may be necessary for summer operations protecting winter-run, or in fall for fall-run spawning season. If there are any changes in the plan, Reclamation submits a supplemental report to SWRWQCB.

Members of the Trinity Flow Scheduling Workgroup and Temperature Workgroup regularly participate in the SRTTG meetings and conference calls.

Appendix B

Alternative for a Dry Water Year

Table 6. Date listing of flows for alternative Dry WY hydrograph.

Date	Day	River Release	Date	Day	River Release	Date	Day	River Release
1-Oct-11	Sat	450	15-May-12	Tue	2773	6-Jun-12	Wed	1053
15-Oct-11	Sat	450	16-May-12	Wed	2653	7-Jun-12	Thu	1007
16-Oct-11	Sun	300	17-May-12	Thu	2539	8-Jun-12	Fri	964
26-Apr-12	Thu	300	18-May-12	Fri	2430	9-Jun-12	Sat	922
27-Apr-12	Fri	900	19-May-12	Sat	2325	10-Jun-12	Sun	883
28-Apr-12	Sat	1500	20-May-12	Sun	2225	11-Jun-12	Mon	845
29-Apr-12	Sun	2500	21-May-12	Mon	2129	12-Jun-12	Tue	808
30-Apr-12	Mon	3500	22-May-12	Tue	2037	13-Jun-12	Wed	774
1-May-12	Tue	4500	23-May-12	Wed	1950	14-Jun-12	Thu	740
2-May-12	Wed	6000	24-May-12	Thu	1886	15-Jun-12	Fri	708
3-May-12	Thu	6000	25-May-12	Fri	1785	16-Jun-12	Sat	678
4-May-12	Fri	5700	26-May-12	Sat	1708	17-Jun-12	Sun	649
5-May-12	Sat	4306	27-May-12	Sun	1635	18-Jun-12	Mon	621
6-May-12	Sun	4121	28-May-12	Mon	1564	19-Jun-12	Tue	594
7-May-12	Mon	3943	29-May-12	Tue	1497	20-Jun-12	Wed	568
8-May-12	Tue	3773	30-May-12	Wed	1443	21-Jun-12	Thu	544
9-May-12	Wed	3611	31-May-12	Thu	1371	22-Jun-12	Fri	521
10-May-12	Thu	3455	1-Jun-12	Fri	1312	23-Jun-12	Sat	498
11-May-12	Fri	3307	2-Jun-12	Sat	1255	24-Jun-12	Sun	477
12-May-12	Sat	3164	3-Jun-12	Sun	1201	25-Jun-12	Mon	450
13-May-12	Sun	3028	4-Jun-12	Mon	1150	30-Sep-12	Sun	450
14-May-12	Mon	2897	5-Jun-12	Tue	1100			

Appendix C

Considerations Listed – Not Acted On in 2012

These considerations and associated Champions originated at the initial Workgroup meeting on 21 Feb 2012. They were added to and modified at the 12 March and 19 March meetings, as well as through other communications. These are the considerations and constraints the Workgroup thought we should focus on given the exigent circumstances of the unfolding water year. They remain here in the Appendix as a record for future years consideration.

Consideration	Champion	Disposition
Real-time temperature management ROD volume neutral	Andreas Krause	Under analysis in a modeling exercise using RMA 2/11.
Riparian Ramping	John Bair	Not highly relevant in Dry or Critically Dry WY's.
Ramping in October – 450-300 ft^3/s 3- day ramp down Make 3-day ramp normal operating procedure	Andreas Krause	Under consideration by the Flow Workgroup beginning at May 9 meeting. These flows occur in the next WY.

<u>Considerations as Revised by the Work Group on February 21, March 12, and March 19, 2012</u>

Real-time temperature management (Andreas Krause champion)

ROD volume neutral

Riparian Ramping (John Bair champion)

Ramping in October – 450-300 ft^3/s

3-day ramp-down?? (Andreas Krause champion)

Make 3-day ramp normal operating procedure? Recommend to TMC in June (refer to previous year write-up) (Andreas Krause champion)

Ceremonial flows (not this year)

Back to 450 by July 15

Monitoring considerations

Habitat (Aaron Martin champion)

Spawning habitat suitability study at varied base flow (other than 300 – say 3 weeks each at 500 and 700)

2 other flows in fall/early winter period (WY2013)

Other?

Bench in Dry year (1000-2000 range) for bathymetric monitoring (Andreas Krause champion)

Variable/Constant summer base flow experiment

Variable flows to manage riparian initiation for increasing vulnerability to subsequent scour

Emulate diurnal fluctuations

PowerPoint that demonstrates concepts

Coupled conceptually with real-time temperature management

ROD volume neutral