EWA upstream actions - water year 2002 (October 2001-September 2002)

Background:

In water year 2002, EWA water was purchased from water districts on several Central Valley streams for the primary purpose of it from upstream reservoirs to San Luis Reservoir for EWA Delta fish actions in the winter and spring. These EWA water acquisitions included: (1) 25,000 acre-feet (AF) from Merced Irrigation District (Merced ID) on the Merced River; (2) 20,000 AF from Placer County Water Agency (PCWA) on the American River; and (3) 135,000 AF from Yuba County Water Agency (YCWA) on the Yuba River. The EWA transfers occurred in October and November, 2001 from the Merced and American rivers and June-September 2002 from the Yuba River. Also, during November 2001 EWA power credits were used to Apay@ for bypassing power generation at Folsom Dam to provide colder water for spawning fall-run chinook salmon in the lower American River. See Figure 1 for a map of these rivers and their proximity to the Delta.

In general, the window of opportunity for transferring the EWA water into San Luis Reservoir was determined by the Project Agencies based on when: (1) the SWP has pumping capacity at Banks pumping plant; (2) the Delta is in Abalanced@ conditions; (3) the agricultural barriers, or their functional equivalent, are in place to avoid impacts to water levels in the southern Delta, consistent with the water level response plan; and (4) there are no adverse impacts to listed Delta fish species. The Management Agencies coordinated closely with the Project Agencies to identify (1) the timing, magnitude and duration of the water transfers to improve instream habitat conditions to the extent practicable, and ensure no adverse impacts on riverine fish; and (2) the export pumping schedule for the transferred water to ensure no adverse impacts to listed Delta fish species.

When EWA water is acquired, stored or moved under a project water right the existing regulatory actions are utilized. This includes the incidental take statements under the existing biological opinions. See the 2002 EWA Interim Protocols in the attached April 12, 2002 letter from the Project Agencies to the Management Agencies. To date, no EWA water has been released from upstream reservoirs without the expectation that it would be pumped in the Delta. Instream habitat improvements have been an incidental benefit of transferring EWA water. Each of the EWA upstream actions are described below in chronological order.

Merced River transfer of EWA water (October and November 2001)

In August 2001, the Project and Management Agencies purchased 25,000 AF of EWA water from Merced ID. The EWA water was released from New Exchequer Reservoir (Lake McClure) during a time when the increased flow would provide habitat benefits to the fall-run chinook salmon in the lower Merced River and also could be exported by the SWP into San Luis Reservoir.

The EWA transfer was coordinated with the release of another 12,500 AF of water acquired from Merced ID using CVPIA and State funds pursuant to the San Joaquin River Agreement (SJRA). The EWA transfer began October 16 and increased flows from a base flow of

approximately 85 cubic-feet per second (cfs) to approximately 700 cfs for a two week pulse flow providing upstream migration benefits to adult salmon. On November 1 flows were ramped down to a salmon spawning flow of approximately 425 cfs compared to a base flow of approximately 220 cfs. The EWA release concluded on November 11. From November 12 through the end of December the spawning flows were maintained at approximately 400 cfs using the SJRA water to supplement the base flow. See Table 1 and Figure 2.

When EWA water is transferred from upstream reservoirs in the Sacramento River basin to the Delta export facilities, less water is pumped from the Delta than was purchased due to carriage water losses. Carriage water losses are associated with the movement of water from upstream sources through the Delta to the SWP export facilities, depending on water quality in the Delta. Modeling is performed in order to determine what the corresponding carriage water losses should be for water transfers. See the attached 2002 EWA Interim Protocols. For past EWA transfers the carriage water losses have been 15-25 percent. Water purchased upstream in the San Joaquin basin is not subject to carriage water losses, however, there is a reduction in transferable quantity (conveyance loss) that occurs as the water flows from the source to the Delta. For the EWA transfer from the Merced River, the conveyance losses were estimated at 10 percent. Consequently, of the approximately 25,000 AF of EWA water released from New Exchequer Reservoir (Lake McClure), approximately 22,500 AF was pumped into San Luis Reservoir for potential EWA Delta fish actions in the winter and spring.

Biological benefits of the EWA upstream action on the Merced River

The biological benefits of the EWA water released in the lower Merced River include improved habitat conditions for fall-run chinook salmon upstream migration, spawning and egg incubation. The CDFG salmon spawning escapement survey for the Merced River estimated that approximately 10,800 adult salmon returned to spawn in fall 2001. This continues a trend of increased escapement in the Merced River since 1992. See Figure 3. The approximately 700 cfs of EWA water released from October 16-31 provided upstream migration benefits to adult salmon. Seasonal increases in streamflow and associated lower water temperatures in the fall provide an important migration cue and upstream migration habitat for adult salmon. The approximately 400 cfs in November and December provided improved spawning and egg incubation habitat. Streamflow influences the quantity, quality, and distribution of chinook salmon spawning habitat. Streamflow directly affects the amount of available spawning habitat by defining the stream area with appropriate combinations of water depths, velocities, and streambed characteristics (e.g., substrate composition). Indirect effects of flow on spawning habitat include effects on water temperature and water quality, which influence the longitudinal extent and seasonal availability of suitable spawning habitat.

The rationale and scientific basis for the improved flows are found in a variety of sources (including Anadromous Fish Restoration Program (AFRP) documents, published literature, CDFG reports, and other restoration programs) and are generally based on results of instream flow and temperature studies conducted by the FWS, CDFG or others, as well as relationships between flow and adult returns, correlation analyses, and other life history information. The Merced River flows supplemented by the EWA water are consistent with the AFRP flow objectives. The AFRP flow objectives are higher than the current existing minimum flow

requirements and will contribute to the AFRP goal of doubling natural production of anadromous fish in the Central Valley rivers and streams.

American River transfer of EWA water (October and November 2001)

In summer 2001, the Project and Management Agencies purchased 20,000 AF of EWA water from PCWA and released it from Folsom Reservoir into the lower American River in October and November for transfer to San Luis Reservoir. Approximately 300 cfs of EWA water was released between October 1 and 5 in coordination with approximately 500 cfs of (b)(2) water to increase flows to approximately 1,500 cfs compared to a base flow of approximately 700 cfs. The (b)(2) water comes from the 800,000 AF of CVP yield dedicated and managed pursuant to the CVPIA, Section 3406(b)(2) for fish, wildlife and habitat restoration purposes and to help achieve the AFRP goals and flow objectives. The implementation of (b)(2) fish actions was coordinated with the EWA upstream and Delta actions. Approximately 300-500 cfs of EWA water was transferred between October 28 and November 14 to help maintain flows of approximately 1,000 cfs. See Figure 4.

Based upon modeling results, a Delta carriage water loss of 25 percent was assessed to this EWA water. Consequently, of the 20,000 AF of EWA water released from Folsom Reservoir, 15,000 AF was subsequently pumped into San Luis Reservoir for potential EWA Delta fish actions in the winter and spring. For more details see the EWA fish action summaries in Appendix ____.

Biological benefits of the EWA upstream action on the American River

The biological benefits of the EWA water released in the lower American River include helping to maintain adequate water temperatures for over-summering juvenile steelhead, as well as provide holding water habitat for fall-run chinook salmon waiting to spawn. The juvenile steelhead temperature objective for the lower American River is to maintain, to the extent possible, a daily average temperature of less than or equal to 65^{o}F between Nimbus Dam and Watt Avenue bridge. The October 2001 water temperatures averaged 67^{o}F at Nimbus Dam and 68^{o}F at Watt Avenue. The CDFG preliminary estimate of salmon spawning escapement for the American River is that approximately 140,000 adult salmon returned to spawn in fall 2001. This continues a trend of increased escapement in the American River since 1992. See Figure 5. Unfortunately, water temperatures in the lower American River exceeded 60^{o}F through mid-November, reducing the flow-related benefits for the adult salmon. Consequently, EWA power credits were used to access cold water in Folsom Reservoir while bypassing power generation.

American River power bypass (November 2001)

One of the AFRP flow objectives is to provide flows of suitable quality, quantity and timing to protect all life stages of anadromous fish. This includes maintaining suitable river temperatures and instream flows for spawning salmon in the lower American River. Mature female salmon subjected to prolonged exposure to water temperatures above 60^{o}F have poor survival rates and may die before spawning or produce less viable eggs than females subjected to lower water temperatures. CDFG reported that thousands of salmon were holding in the lower American River and a significant number of salmon carcasses recovered in the escapement surveys in early

November were fish that had not spawned, likely due to high water temperatures (in excess of 64°F). Furthermore, maximum survival of incubating eggs and yolk-sac larvae occurs at water temperatures between 41°F and 56°F. Survival through emergence decreases at water temperatures exceeding 56°F with no survival occurring at 62°F or higher.

Generally, the temperature shutters (penstock inlet ports)at Folsom Dam are used to manage Folsom Reservoir=s coldwater pool and provide suitable water temperatures for over-summering juvenile steelhead and spawning salmon, while releasing water through the penstocks and generating power. Due to low Folsom Reservoir storage and a significantly diminished coldwater pool last fall, the remaining coldwater was below the elevation of the shutters and was accessible only via Folsom Dam=s lower river outlets. Releases through the river outlets bypass power production facilities. The Project and Management Agencies in coordination with the American River Operations Group (AROG) proposed to release the coldwater through the river outlets to reduce water temperatures for spawning salmon. Arrangements were made to use EWA power credits to compensate Western Area Power Administration (WAPA) for the foregone power generation.

From November 9-26 approximately 500 cfs of coldwater was released through the river outlets of Folsom Dam and blended with 500 cfs of warmer water released through the powerhouse. The water released through the river outlets was approximately 50°F. When it was blended with the warmer water it resulted in the Folsom Dam release temperature cooling from approximately 64°F to 58°F in one day. This led to Nimbus Dam release temperature cooling from approximately 64°F to 60°F by November 13. When the power bypass was concluded on November 26 the water temperature in the lower American River was approximately 56°F. The temperature modeling showed that without the release of the coldwater, Nimbus Dam release temperatures would have exceeded 60°F through November 23 or 24. See Figure 6. For more details see the attached report prepared by the AROG.

Biological benefits of the EWA upstream power bypass

The biological benefit of providing cooler water to the river through the power bypass was improved salmon spawning conditions downstream from Nimbus Dam within a few days and approximately nine days earlier than if the power bypass had not been done. As the water temperature approached less than 60°F, CDFG reported that salmon started spawning and redds were observed. High water temperatures and low flows in October and November 2001 appear to have significantly impacted salmon spawning success in the lower American River. CDFG estimates that approximately two-thirds of the female salmon died without spawning. Without the use of EWA assets to bypass power, the pre-spawning mortality of female salmon would likely have been much higher.

Yuba River transfer of EWA water (June through September 2002)

The Project and Management Agencies purchased 135,000 AF of EWA water from YCWA and released it from Englebright Dam into the lower Yuba River from June through September 2002

for transfer to San Luis Reservoir. The EWA transfer began on June 16 and increased flows to approximately 1,400 cfs compared to a base case of approximately 400 cfs in June and 250 cfs in July and August. It is important to note that YCWA provided additional water in the river before the transfer to avoid large flow fluctuations. The EWA release concluded on September 30. See Figure 7. Based upon modeling results, a Delta carriage water loss of 20 percent was assessed to this EWA water. Consequently, of the 135,000 AF of EWA water released in the lower Yuba River approximately 107,000 AF was subsequently pumped into San Luis Reservoir for EWA Delta fish actions implemented in the winter and spring.

Biological benefits of the EWA upstream action on the Yuba River

The Management Agencies coordinated the EWA transfer schedule with the Project Agencies and YCWA to ensure no adverse impacts on Yuba River fisheries. YCWA has worked collaboratively with the Management Agencies to modify flow release schedules and provided funding and cooperation for monitoring of the transfer. These actions by YCWA, in coordination with the Management Agencies, provide instream fishery benefits and an opportunity to gather more data to evaluate the short- and long-term effects of water transfers on the lower Yuba River. Water temperature and fish movement have been monitored to evaluate potential effects (direct and indirect) of the EWA and DWR Dry Year Program transfers, particularly on over-summering juvenile steelhead.

Literature cited

U.S. Fish and Wildlife Service. 2001. Final Restoration Plan for the Anadromous Fish Restoration Program. January 9, 2001. U.S. Fish and Wildlife Service, Stockton, CA.

U.S. Fish and Wildlife Service. 1995. Working paper on restoration needs: Habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volumes 1-3. May 9, 1995. U.S. Fish and Wildlife Service, Stockton, CA.

Reynolds, F.L., T.J. Mills, R. Benthin and A. Low. 1993. Restoring Central Valley Streams: A Plan for Action. November 1993. California Department of Fish and Game, Inland Fisheries Division. Sacramento, CA.

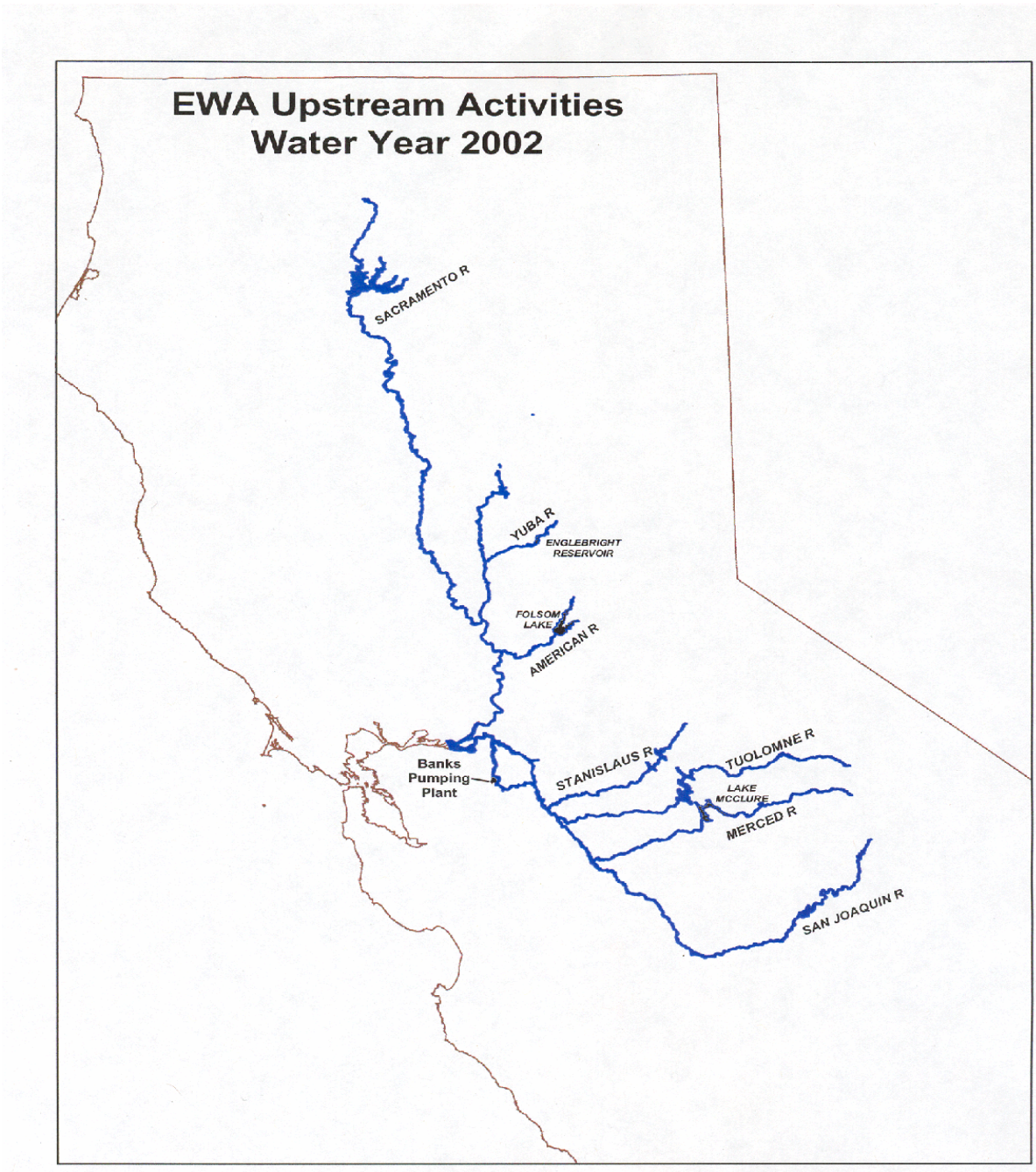
Personal Communications

CDFG personnel concerning preliminary CDFG data for the fall 2001 spawning surveys on the Merced River.

CDFG personnel concerning preliminary CDFG data for the 2001 spawning surveys on the lower American River.

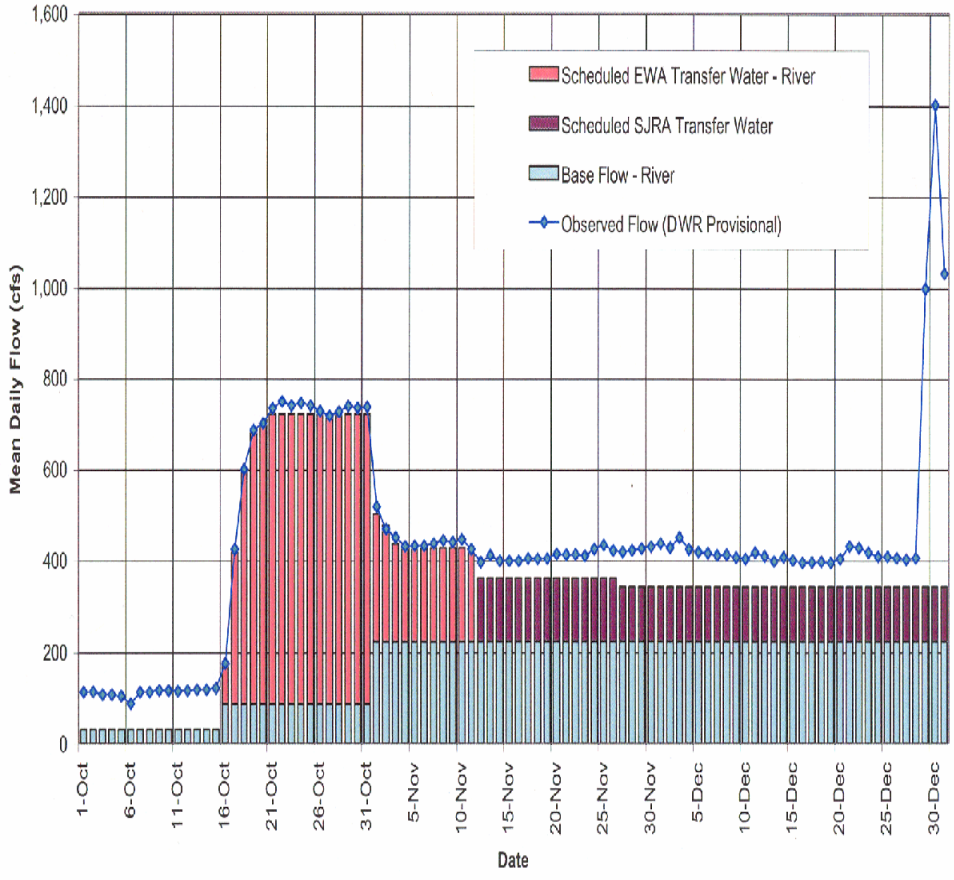
Attachments

April 12, 2002 letter from the Project Agencies to Management Agencies
April 12, 2002 letter from Management Agencies to Project Agencies
EWA Fish Action summaries (www.oco.water.ca.gov/calfedops/2002ops.html)
Report prepared by the American River Operations Group concerning the power bypass for the lower American River, March 7, 2002


EWA Upstream Activities
Water Year 2002
SACRAMENTO R
YUBA R
ENGLEBRIGHT RESERVOIR
FOLSOM LAKE
AMERICAN R
Banks Pumping Plant
STANISLAUS R
TUOLOMNE R
LAKE MCCLURE
MERCED R
SAN JOAQUIN R

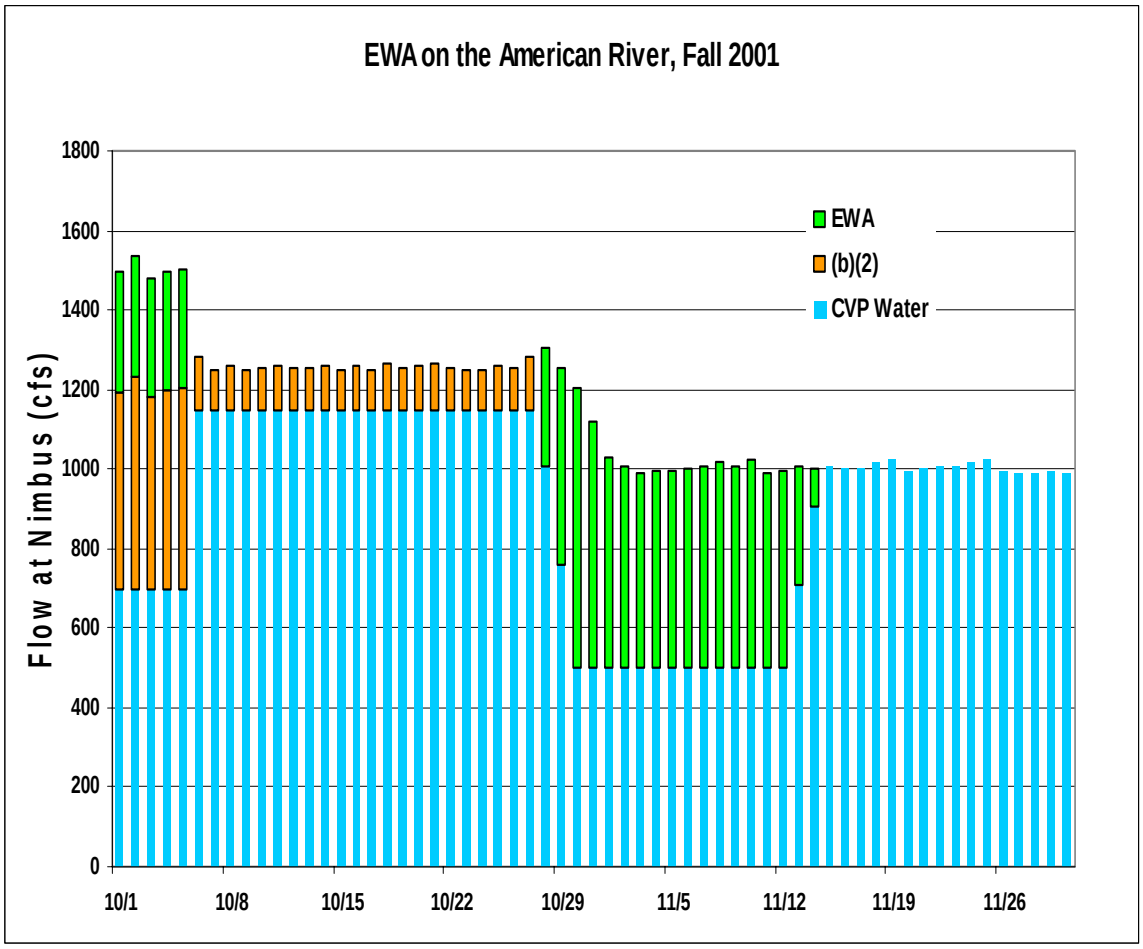
SJRA and EWA Fall 2001 Water Transfer

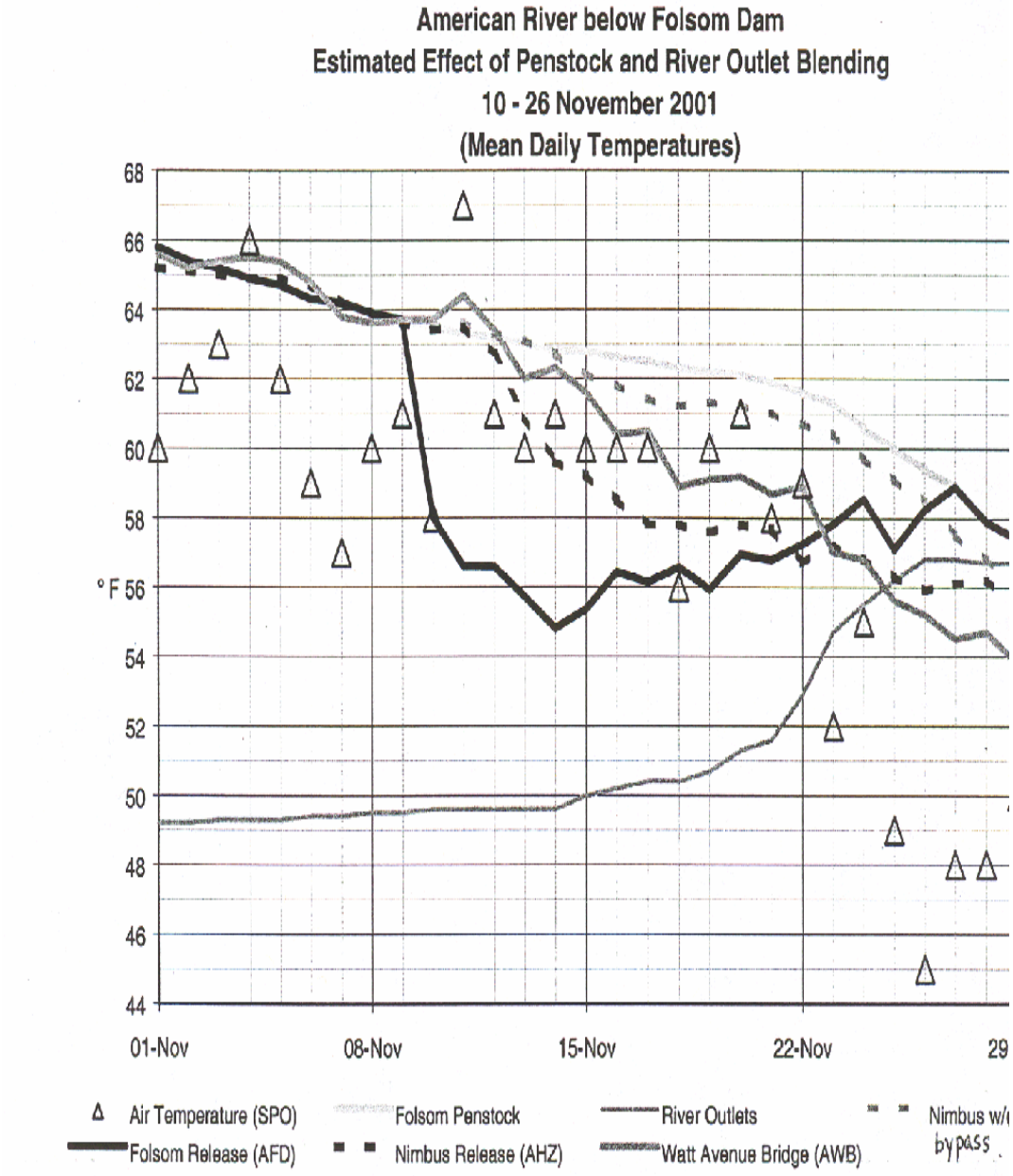
Merced River Flow at Cressey



MBK Engineers
Fall 2001 xfer daily table.xls

10/4/02


EWA on the American River, Fall 2001
Flow at Nimbus (cfs)
1800
1600
1400
1200
1000
800
600
400
200
0
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
EWA
(b)(2)
CVP Water


American River below Folsom Dam
Estimated Effect of Penstock and River Outlet Blending
10 - 26 November 2001
(Mean Daily Temperatures)
68
66
64
62
60
58
°F 56
54
52
50
48
46
44
01-Nov
08-Nov
15-Nov
22-Nov
29
Air Temperature (SPO)
Folsom Penstock
River Outlets
Nimbus w/
bypass
Folsom Release (AFD)
Nimbus Release (AHZ)
Watt Avenue Bridge (AWB)