Public Comment
Instream Flow Criteria- Phase 4
Deadline: 4/18/14 by 12:00 noon

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SWRCB Clerk

April 16, 2014

State Water Resources Control Board
Attn: Jeanine Townsend, Clerk to the Board
1001 I Street, 24th Floor
Sacramento, CA 95814

via Email: *commentletters@waterboards.ca.gov*

The East Bay Municipal Utility District (District) appreciates the opportunity to provide information to the State Water Resources Control Board (SWRCB) on the Delta Stewardship Council – Delta Science Program's (Delta Science Program) Recommendation on the Method to Develop Flow Criteria for Priority Tributaries to the Bay – Delta. This effort will support Phase 4 of the Water Quality Control Plan for the Bay – Delta. As part of a public workshop held March 19, 2014 the SWRCB requested that entities provide comments and/or information relative to the proposed methodology to establish instream flow criteria. The District is responding to that request.

The flow criteria on the Mokelumne River, which were included in the District's water right under D-1641, are monitored and adaptively managed through a joint partnership between EBMUD, DFW and USFWS. Beginning in the early 1990's, EBMUD, DFG, and USFWS engaged in a multi-year, comprehensive examination of the Mokelumne River fishery ecosystem. These efforts included extensive monitoring of fishery populations and exploration of potential flow and habitat measures to benefit Mokelumne River fisheries. The culmination of these combined efforts was the 1998 Joint Settlement Agreement between EBMUD, DFG and USFWS, which set forth a comprehensive package of flow and non-flow measures on the Mokelumne River. These measures are to protect and enhance the anadromous fishery resources of the lower Mokelumne River. In 2008, the Partnership engaged in a 10-year summary review of the JSA. The resultant report summarized the findings of the Partnership Steering Committee with respect to the progress and accomplishments resulting from the first ten years of the JSA and recommended strategies and measures for continued implementation, including continued implementation of the flow requirements specified in the JSA.

The recommended hybrid approach using components and/or principles from the Instream Flow Incremental Methodology (IFIM) and Ecological Limits of Hydrologic Alteration (ELOHA) considers and mitigates the limitations of each method. The hybrid approach represents a broader approach that can scale up existing site specific data to achieve the regional criteria desired. Attached is a summary of how current management of the Mokelumne River compares to the recommended stepwise process. The summary illustrates that the Partnership's approach to managing the river has proven successful and the results achieved and data collected are adaptable for use in the proposed hybrid approach. We look forward to working with the SWRCB and Delta Science Program to further refine and improve the methodology. If you have any questions or require further information please contact me at 510-287-2021 or jsetka@ebmud.com .

Sincerely,

Jose D. Setka, Manager
EBMUD Fisheries & Wildlife Division

East Bay Municipal Utility District comments on the Development of Flow Criteria for Priority Streams

Introduction

In Phase 4 of the State Water Resources Control Board (SWRCB) of the Water Quality Control Plan for the Bay Delta, the SWRCB will develop and implement tributary specific policies for priority tributaries. This includes 1) development of non-binding flow criteria; 2) development of flow objectives and implementation plans; 3) development of policies that incorporate flow objectives, methods for adaptive management, and implementation plans; and 4) implementation of policies through conditioning of water rights and other measures as appropriate.

As part of the Phase 4 process, the SWRCB requested that the Delta Science Program provide written recommendations for identifying methods to determine instream flow criteria that are 1) scientifically defensible, 2) cost-effective, 3) applicable at the watershed scale, and 4) capable of implementation in a timely manner. Additionally the SWRCB requested input on how recommended methodology can be augmented or refined in the future, and how to develop flow criteria that apply to the majority of the watershed within a tributary that addresses multiple species, different life stages, and different fluvial processes.

The resultant recommendation called for a hybrid approach to using elements of both Instream Flow Incremental Methodology (IFIM) and Ecological Limits of Hydrologic Alterations (ELOHA) methodology. The recommended approach included a seven step process. East Bay Municipal Utility District's comments are provided to describe the Mokelumne River system and the species it supports as well as clarify how current management of the Mokelumne River compares to the recommended stepwise process.

The Mokelumne River is listed under Schedule 1 (Table B) "High Priority Rivers and Streams Tributary to the Sacramento River and Delta" as a priority 1 stream. Inclusion in this priority ranking is based on the presence of Central Valley Spring Chinook Salmon, Fall Chinook Salmon, Central Valley Steelhead Trout, Sierra Nevada Yellow-Legged Frog, California Red-Legged Frog, and Western Pond Turtle. Additionally the Mokelumne is identified by NMFS in its 2009 Draft Recovery Plan and the USFWS in its 2001 Restoration Plan (SWRCB 2010).

Background

The lower Mokelumne supports a population of fall run Chinook salmon and central valley steelhead trout. Both populations are supplemented by an anadromous fish hatchery located downstream of Camanche Dam , the lowest non-passable dam on the Mokelumne River. Operations of Camanche Dam are guided by a Federal Energy Regulatory Commission (FERC) ordered settlement agreement. The FERC November 27, 1998 Order "Approving Settlement Agreement and Amending License for the East Bay Municipal Utility District's Lower Mokelumne River Project No. 2916" approved the Joint Settlement Agreement (JSA) entered into by East Bay Municipal Utility District (EBMUD), U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (now Fish and Wildlife or CDFW). The JSA included flow and non-flow measures, and required EBMUD, USFWS, and CDFW to develop a plan Water Quality and Resource Management Program (WQRMP) for FERC approval.

Under the JSA, the Partnership Steering Committee, composed of one representative each from CDFW, USFWS and EBMUD, developed the WQRMP to define reasonable goals, measures, performance criteria and responsive actions associated with the implementation of the JSA. It includes a comprehensive monitoring and applied research program integrated with a well-coordinated program to adaptively manage water and power supply operations, flood control, hatchery operations and ecosystem rehabilitation actions. It was approved by FERC in 2001.

The goals of the JSA were to provide, to the extent feasible, habitat quality and availability in the lower Mokelumne River to maintain fishery, wildlife and riparian resources in good condition, contribute towards the state and federal fishery restoration goals as defined in the California Salmon, Steelhead Trout and Anadromous Fisheries Program Act and the Central Valley Project Improvement Act, sustain the long-term viability of the salmon and steelhead fishery while protecting the genetic diversity of naturally producing populations in the lower Mokelumne River

The JSA specifies minimum flow releases from Camanche Dam and expected flow below the Woodbridge Irrigation District Dam (WIDD) based on salmonid life history timing and water year types. Water year types are determined based on combined storage in Camanche and Pardee reservoirs for the October through March period and based on the unimpaired runoff into Pardee Reservoir for the April through September time period. The JSA also contains an adaptive management provision related to minimum flows. The flow schedule may be changed to optimize fishery habitat and other ecosystem values so long as the total quantity of water released in any given year will not be less than the quantity of water provided by the flow requirements for that type of year.

Figure 1. Water Year Type Determination on the Mokelumne River

WATER YEAR TYPE DETERMINATION

Year Type	Normal/Above	Below Normal	Dry	Critically Dry
Oct. - Mar. (1) (Pardee/Camanche Storage)	Max Allowable (2)	Max Allowable to 400 TAF	399 TAF to 270 TAF	269 TAF or Less
Apr. - Sep. (3) (Unimpaired runoff)	890 TAF or More	889 TAF to 500 TAF	499 TAF to 300 TAF	299 TAF or Less (4)

Notes:

(1) October through March minimum flows are determined by total Pardee and Camanche storage on November 5th. Year type storage limits are based on the capacities of Pardee and Camanche Reservoirs in 1995.

(2) Maximum allowable storage on November 5th, shall be determined in accordance with the Army Corps of Engineer's Water Control Manual for Camanche Dam and Reservoir dated September, 1981.

(3) April through September minimum flows are determined by the water year unimpaired runoff into Pardee Reservoir as forecasted by DWR in the April 1st Bulletin 120 Report except when combined Pardee/Camanche Nov. 5 storage is projected to be less than 200 TAF.

(4) April through September minimum flows shall be critically dry whenever Nov. 5 combined Pardee/Camanche storage is projected to be 200 TAF or less based on the runoff forecast in DWR bulletin 120, beginning April 1st.

Comparison of Recommended 7-Step Process with current Mokelumne River Management

Step 1) Stream Segment Classification – The recommendation describes the characteristics needed to classify streams in order to apply regional flow criteria and includes watershed size, hydrologic regime, dominant geomorphology, and faunal assemblages. East Bay Municipal Utility District has compiled and developed the following information related to Mokelumne stream segment classification, and agrees with the overall utility of stream segment classification as an important step in applying regional flow criteria.

The Mokelumne River is a snow-fed system that drains approximately 1,624 km^2 of the central Sierra Nevada. Its headwaters begin in the Eldorado National Forest, some 65 km south of Lake Tahoe, at approximately 3,050 m above mean sea level. It enters the Delta approximately 48 km southeast of Sacramento. The Mokelumne presently has 16 major water impoundments, including Salt Springs (141,857 acre feet, completed 1931), Pardee (197,951 acre feet, completed 1929) and Camanche (417,122 acre feet, completed 1963) reservoirs.

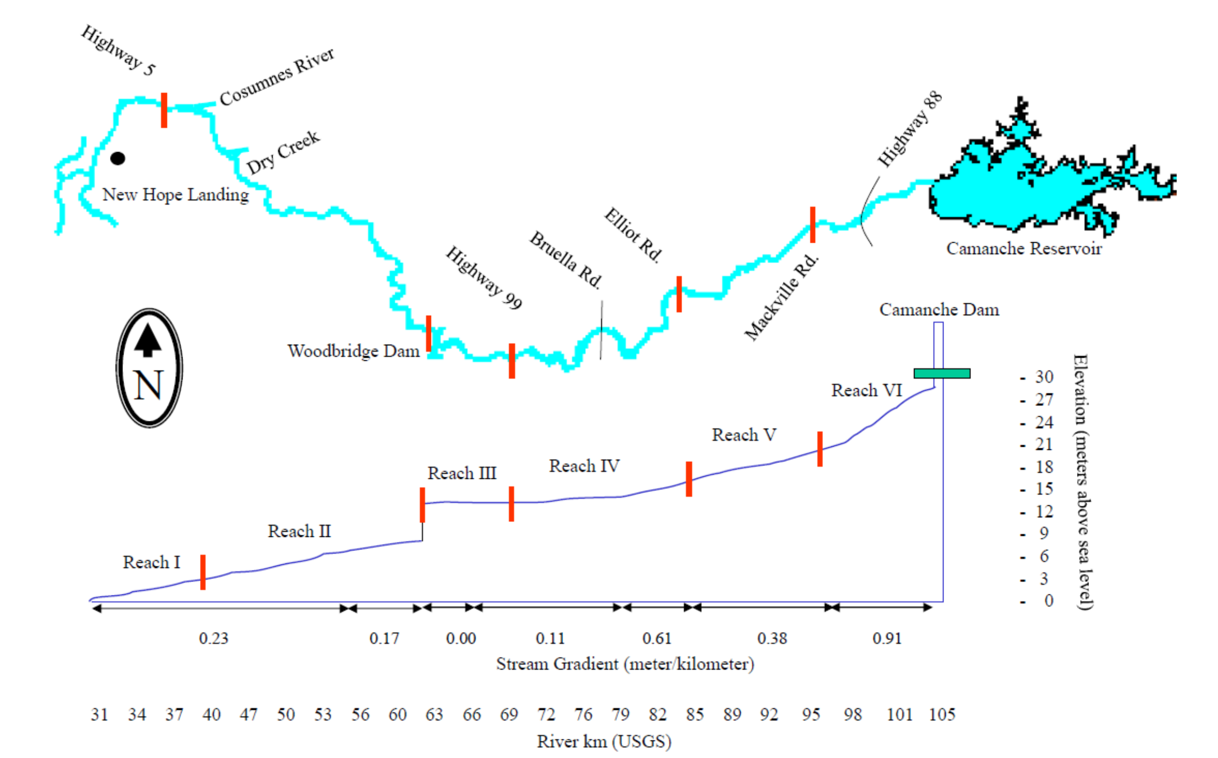
The anadromous portion of the river, the lower Mokelumne River (LMR), ranges in elevation from approximately 30 m at Camanche Dam, the lowest non-passable barrier to anadromous fish, to sea level at Thornton. Gradient of this river section ranges from 0.10% near Camanche to 0.02% near the Cosumnes River confluence (Merz et al. 2006). Tidal influence is observed up to river kilometer 53, downstream of Woodbridge Irrigation District Dam (WIDD), which forms Lodi Lake, a small impoundment with a fish passage facility. Similar to many other tributaries of the system, hydraulic mining, gravel extraction, dam construction, water diversions, altered flow regimes, deforestation, artificial bank protection, channelization and levee construction have resulted in depleted, degraded and otherwise, inaccessible gravel beds within the main-channel and greatly reduced floodplain connection and channel complexity (Edwards et al. 2004). Channel widths within the LMR range from 19 to 43 m with a mean of 30 m, approximately half its former width (Pasternack et al. 2003). The river tends to be wider in the first 9.5 km below Camanche Dam with channel narrowing downstream attributable primarily to flood control levees built to protect homes and farmland on the historical river floodplain (Edwards et al. 2004).

LMR channel substrates include limited amounts of gravel and cobbles for about 9.5-14.5 km below Camanche Dam and sand, mud, sandstone or highly compacted alluvium in downstream reaches. Substrate types are associated with channel width, river gradient and hydraulic conditions.
The LMR is separated into six reaches based on stream confluences, gradient, tidal influence, and substrate characteristics (Figure 2):

- Reach I (Mokelumne River Mouth to Cosumnes River confluence),
- Reach II (Cosumnes River confluence to Woodbridge Irrigation District Dam basin at Lake Lodi),
- Reach III (Woodbridge Irrigation District Dam to Highway 99),
- Reach IV (Highway 99 to Elliott Road),

- Reach V (Elliott Road to Mackville Road), and
- Reach VI (Mackville Road to Camanche Dam).

Figure 2. Reach Designation for the Lower Mokelumne River, Camanche Dam to the Delta



The lower Mokelumne River, separated by river-reach, general gradient and elevation.

2) Hydrologic Analysis – The recommendation discusses separation of key flow regime components (blocking) and an analysis of historical changes. Much of this data can be data mined from existing systems, and the Mokelumne System has a valuable record of information to provide.

Construction of Pardee Dam and Reservoir (1929) and Camanche Dam and Reservoir (1963) altered the hydrologic regime of the Mokelumne River, and the historic 100 year floodplain of the Mokelumne River is now within the area permanently flooded by Pardee and Camanche Reservoirs (EBMUD 2008). Watershed runoff is captured in three major impoundments (Camanche, Pardee, and Salt Springs Reservoirs) operated by EBMUD and PG&E. These impoundments have a combined storage capacity of more than 750 thousand acre feet (taf). One other small impoundment in the watershed, Lower Bear River Reservoir, stores 52 taf. Minimum flows below Camanche Dam range from between100 to 325 cubic feet per second (cfs), as specified in FERC 2916-029, 1996 Joint Settlement Agreement. Minimum flows below the Woodbridge Diversion Dam range from between 25 to 300 cfs.

According to Pasternack et al. (2003), prior to Camanche Dam, flow exceeded 200 m^3 sec^{-1} (7,062 cfs) for 21 of 57 years. Since 1964, annual peaks have not exceeded 200 m^3 sec^{-1}. Pre-dam mean monthly flow had a typical snow-melt hydrograph, with highest flow during May and June, well after peak precipitation. The post-dam hydrograph has a significant reduction in late spring runoff. Flood frequency analysis using annual extreme pre- and post-dam data shows a flow reduction for all recurrence intervals after the dam was built. Estimated using Log Pearson III distributions, Q_2, Q_5, Q_{10} and Q_{100} decreased by 67, 59, 73 and 75%, respectively (Wang and Pasternack 2000). Camanche release has a step hydrograph, with lows near 4.3 m^3 sec^{-1} (151 cfs). Average annual discharge for the Mokelumne River before Camanche Dam (period 1905 – 1963) was 26.3 m^3 sec^{-1} (928 cfs)(minimum=0 m^3 sec^{-1}, maximum=761.7 m^3 sec^{-1}(26,900 cfs)) at the town of Clements (Figure 1). Post-dam average daily flow (period 1964 – 2000) is 22.6 m^3 sec^{-1} (798 cfs)(minimum=0.7 m^3 sec^{-1}, maximum=162.8 m^3 sec^{-1}(25 – 5,720 cfs)) with US Army Corps of Engineers flood flows set at 142 m^3 sec^{-1} (5,014 cfs). Edwards et al. (2004) found that 80% of seasonal lakes and 23.8 hectares (100%) of secondary channels along the LMR were lost between 1910 and 2001.

The JSA flow schedules blocks flow periods to support specific salmonid life history stages. While required flows in the JSA are not extremely variable, the format is set to block flows for adult migration (October 1-15), spawning and incubation (October 16-December 31), incubation and alevin (January 1-February 28), fry rearing (March 1-April 30), Fry and juvenile rearing and outmigration (May 1-June 30), and oversummering (July1- September 30) (Figures 3 and 4). The adaptive management clause in the JSA which will be discussed more thoroughly under Step 7, has been initiated many times to modify this this block structure to optimize environmental conditions based on recent research, current river conditions and predictive models.

Figure 3. Mokelumne River Joint Settlement Agreement Flow Schedule for Camanche Releases

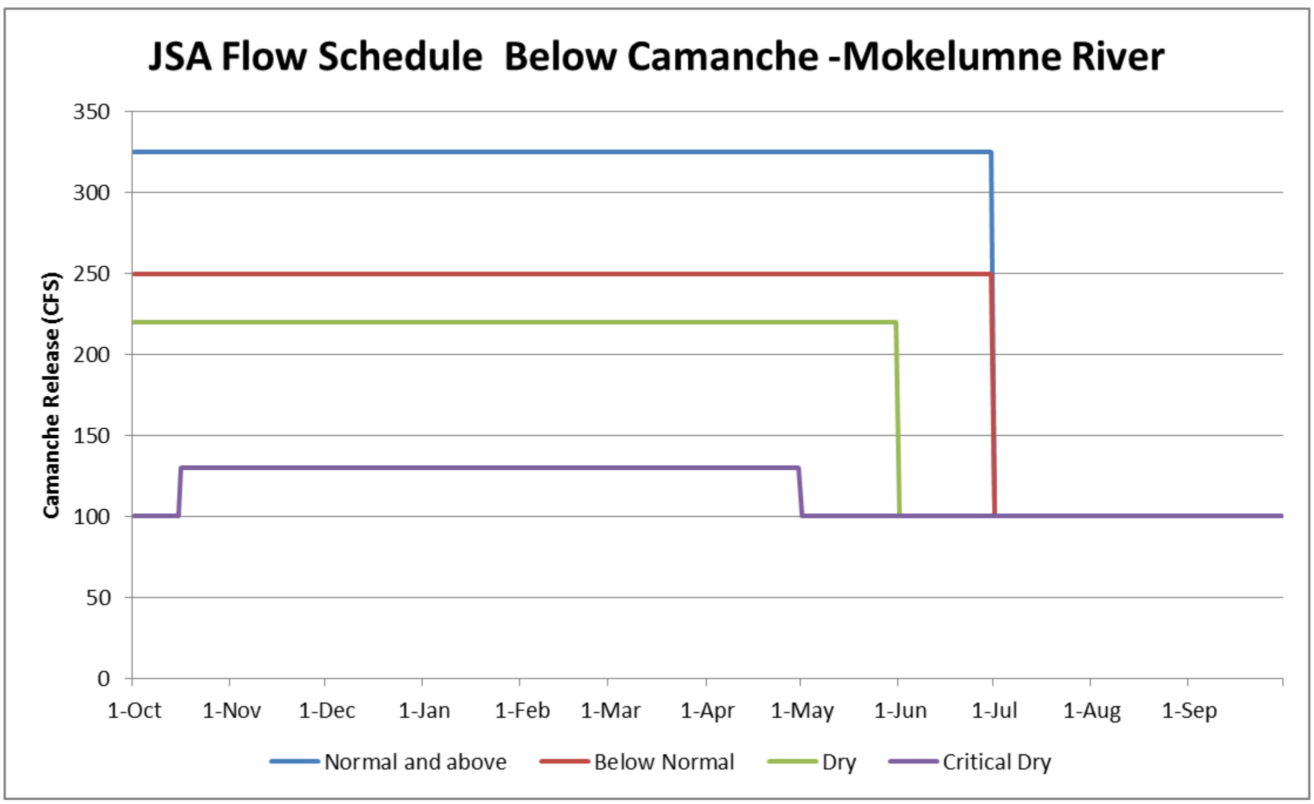
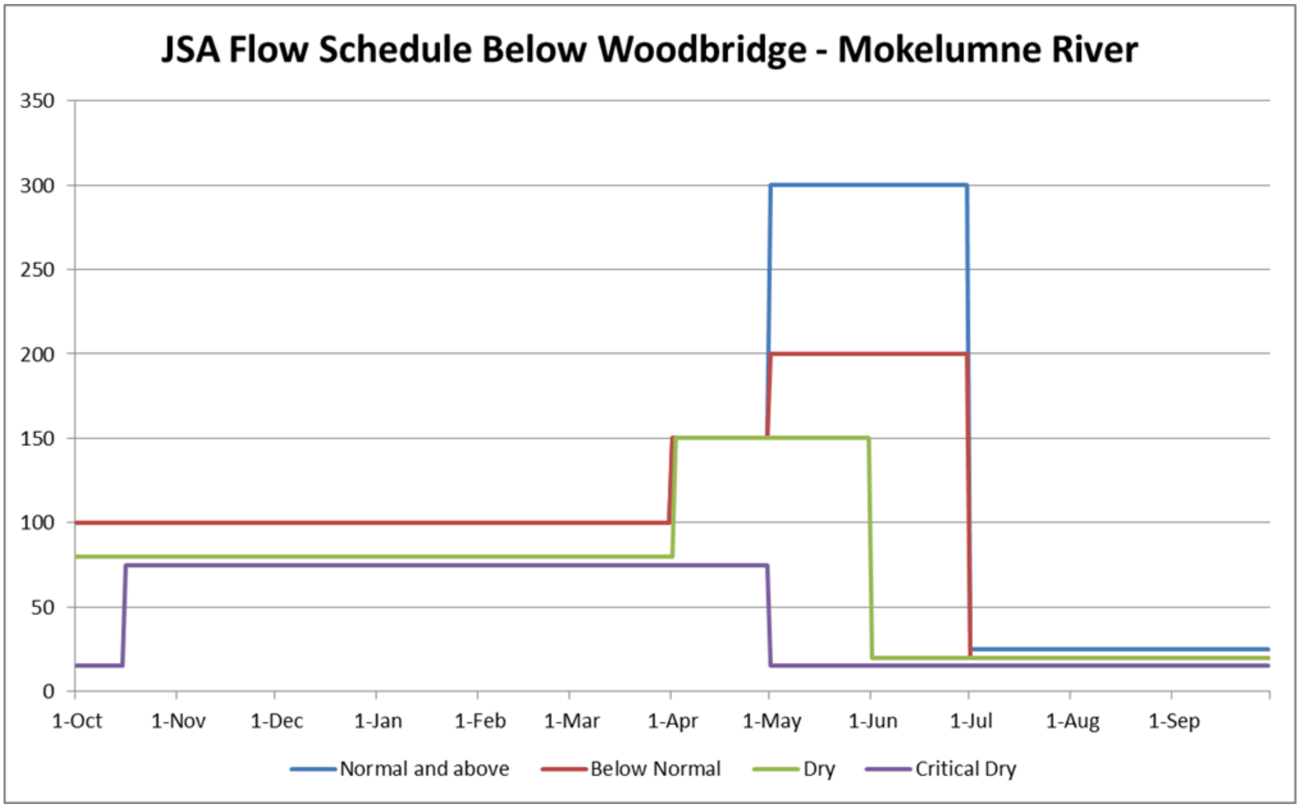


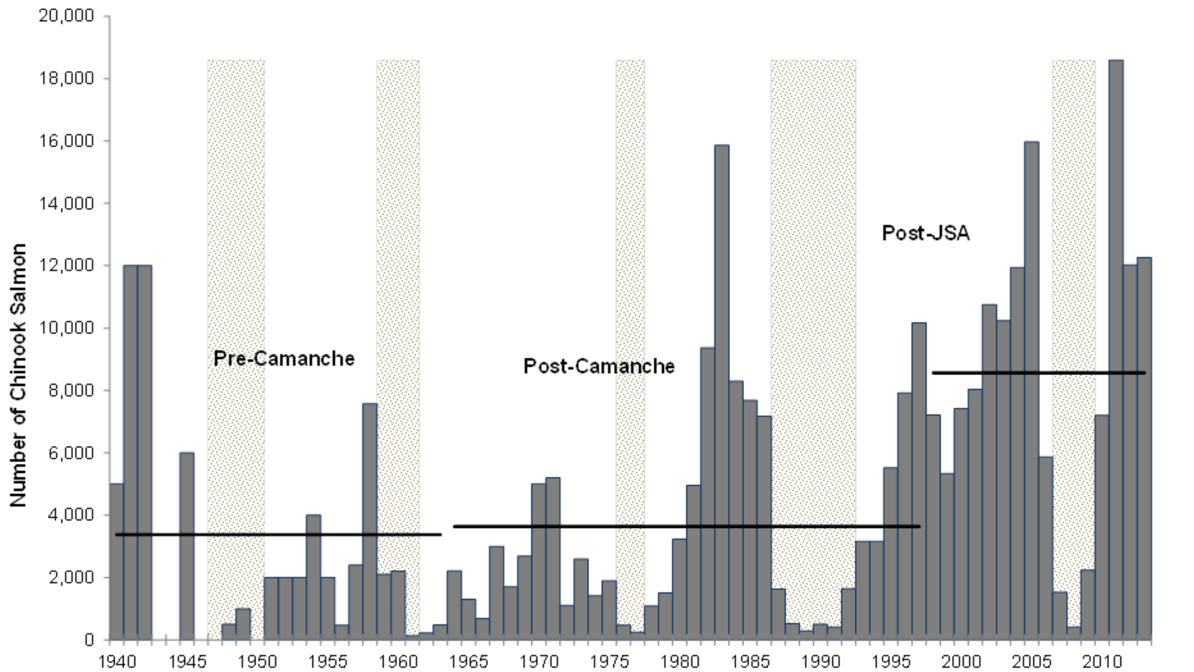
Figure 4. Mokelumne River Joint Settlement Agreement Flow Schedule for Below Woodbridge



3) Site Specific Field Work – The recommendation is to use site specific field work that addresses key information gaps. The lower Mokelumne River and its habitats have been studied extensively by EBMUD and others. The recommendation calls for a thorough analysis of what data exists and what information gaps remain to ensure additional data collection results in better understanding the hydrological regime and ecological response.

EBMUD has been evaluating the timing and abundance of anadromous fish use in the Lower Mokelumne River since the early 1990s. Documentation of adult salmonid migration timing into the river has been accomplished using visual counts, ladder traps, and passive video monitoring equipment at Woodbridge Irrigation District Dam. Data are summarized in annual reports and used to manage contributing factors including providing pulse flows for adult attraction, negotiating Delta Cross Channel operations to improve escapement into the Mokelumne River. Annual escapement estimates are tied to operational conditions (pre-Camanche, post-Camanche, and post-JSA) time periods, as well as related to CVPIA baseline and doubling periods (Figure below). Through the 1990s and into 2013, the lower Mokelumne River Chinook salmon population continues to demonstrate characteristics consistent with long-term sustainability. The fall-run Chinook salmon escapement of 12,265 in 2013 was well above the long term average and was the third largest for the lower Mokelumne River during the period 1990 - 2013 (see

Table 1 and Figure 1). EBMUD and Woodbridge Irrigation District (WID) continue to work cooperatively in managing operations to maximize the accuracy of monitoring systems.



Horizontal lines indicate pre-Camanche, post-Camanche, and post-JSA periods, respectively.
1. "Pre-Camanche" escapement (3,374) is the average estimate at Woodbridge Dam for the period from 1940 through 1963 (excluding years when no data were recorded: 1943, 1944, 1946, 1947, and 1950).
2. "Post-Camanche" escapement (3,636) is the average estimate at Woodbridge Dam for the period 1964 through 1997.
3. "Post-JSA" escapement (8,564) is the average estimate at Woodbridge Dam since implementation of the JSA in 1998.
4. Dithered shaded areas are periods of drought in California (California Department of Water Resources, California's Drought Update. November 30, 2009).

In addition to escapement monitoring, redd surveys, carcass surveys and hatchery monitoring of the population are also conducted, providing detailed population level information that can be assessed by water year type, or operations scenarios.

Juvenile salmonid outmigration timing is also assessed at the Woodbridge Irrigation District Dam site. Annual reports summarize numbers and timing, and Workman (1999) conducted an analysis of environmental variables and their relationship to juvenile outmigration timing on the Mokelumne River. Annual assessment of emigration patterns and numbers related to hydrologic conditions over time have shown relationships to size at outmigration and operations that provide management direction that can possibly be used in adaptive management scenarios (Figure 5 and 6).

Figure 5. Dry year example of juvenile salmon outmigration on the Mokelumne River, 2002.

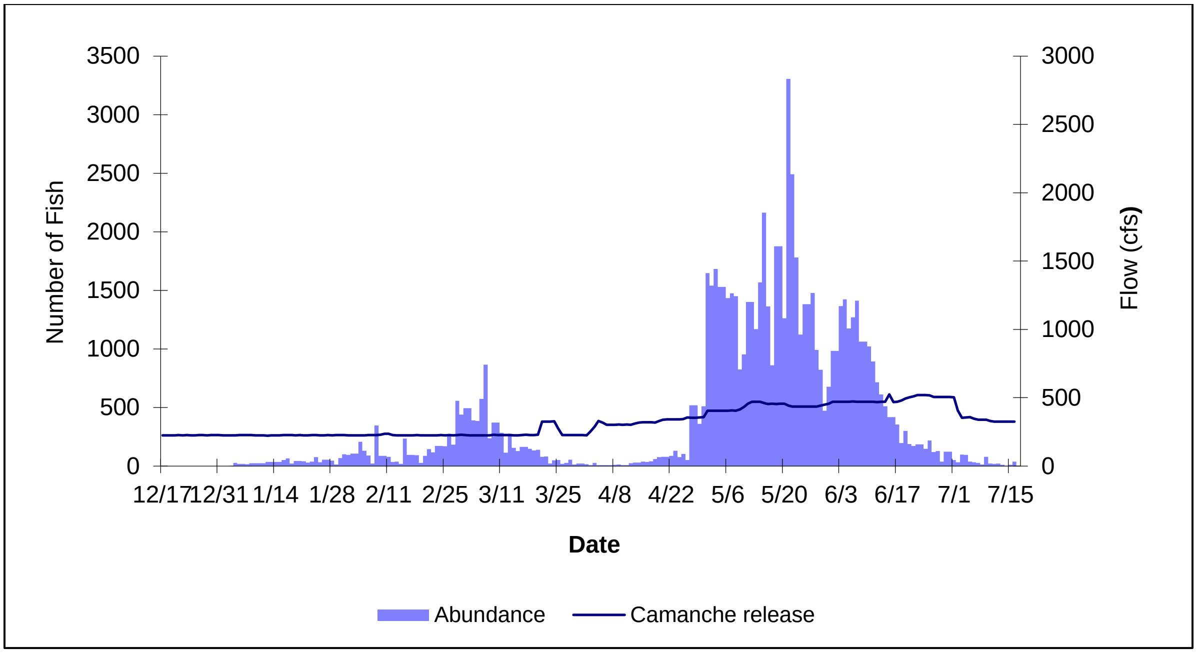
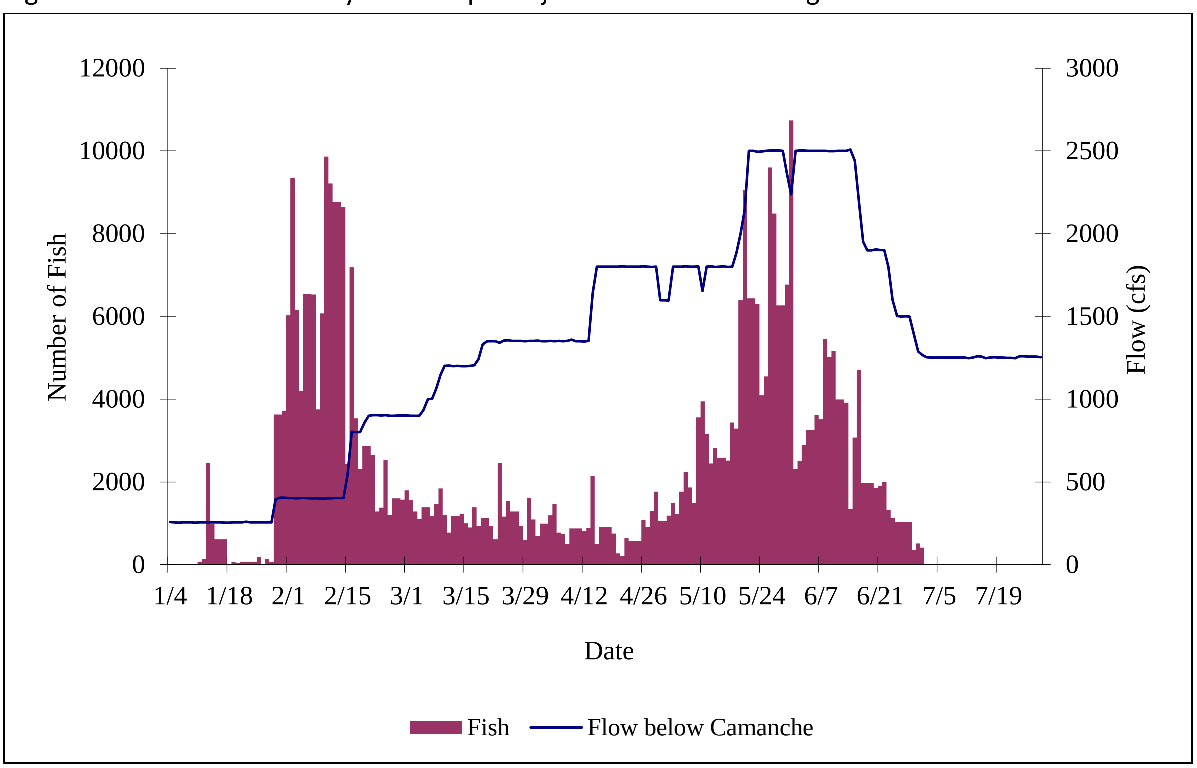


Figure 6. Normal and Above year example of juvenile salmon outmigration on the Mokelumne River.



These data are summarized and reported to FERC as part of the JSA, as well as annually reported through Interagency Ecological Program (IEP) Project Work Team collaboration.

Table 1. Summary of Fall Run Chinook Salmon counts on the Mokelumne River 1989-2013

Year	Outmigration		Total Escapement	Hatchery Returns	Natural Spawners	Percent Natural Spawners of Total	Number of Redds
	Fry	Smolts					
1989	no data	no data	280	81	199	71	no data
1990	See note 3	78,179	497	68	429	86	71
1991	See note 3	31,025	410	42	368	90	127
1992	See note 3	69,993	1,645	710	935	57	345
1993	11,006	172,442	3,157	2,164	993	31	530
1994	554	142,670	3,157	1,919	1,238	39	777
1995	260,103	174,103	5,517	3,323	2,194	40	888
1996	103,270	80,744	7,921	3,883	4,038	51	929
1997	405,350	135,116	10,175	6,494	3,681	36	1,325
1998	1,336,768	511,771	7,213	3,091	4,122	57	1,116
1999	1,232,958	302,481	5,333	3,150	2,183	41	627
2000	107,134	61,391	7,423	5,450	1,973	27	987
2001	37,754	81,580	8,035	5,728	2,307	29	843
2002	11,791	66,132	10,753	7,913	2,840	26	848
2003	8,297	132,174	10,239	8,117	2,122	21	807
2004	45,467	42,187	11,944	10,356	1,588	13	835
2005	197,390	235,484	15,969	5,563	10,406	65	2,170
2006	1,008,289	179,264	5,871	4,139	1,732	30	755
2007	10,349	29,278	1,521	1,051	470	31	306
2008	1,835	16,512	412	239	173	42	63
2009	960	29,654	2,233	1,553	680	30	248
2010	4,243	63,106	7,195	5,275	1,920	27	314*
2011	228,829	52,288	18,596	15,922	2,674	14	564
2012	13,888	38,049	12,027	6,556	5,471	45	1,287
2013	49,102	98,488	12,265	5,170	7,095	58	1,823

Notes:
1. Escapement monitoring generally occurs from August through January, but dates vary each year.
2. Hatchery Returns: count by CDFW at the Mokelumne River Fish Hatchery.
3. Estimates were not segregated into fry and smolts.
4. The data for the most recent year may change as estimates are finalized and new information is analyzed.
* Redd survey incomplete due to high flows

Step 4) Extrapolation – The committee recommendation suggests extrapolating processes rather than specific numbers (target flows, inundation depths, peak magnitude flows, etc.). While the Mokelumne uses a more site specific approach in determining management actions related to data gathered and appropriate flow regimes, these site specific evaluations could be rolled up into a more regional approach as suggested by the committee. For example, the Mokelumne has found that providing attraction flows for adult salmon improves returns to and reduces straying from the Mokelumne. While we provide the timing, magnitude and duration of pulses directly as a result of site specific information gathered, the concept can be incorporated into a regional criteria for the provision of pulse flows to be coordinated on a watershed by watershed basis.

Step 5) Production of an Environmental Flow Regime – The recommendation is for developing an environmental flow regime that benefits critical species and crucial physical, chemical and hydrologic processes. For the Mokelumne, the basis of the current environmental flow regime is the fall-run Chinook salmon and steelhead populations it supports. Future effort could be well spent on not only beneficial environmental flows for key species, but also considering environmental flows targeted to reduce habitat availability and success on detrimental non-natives in the system.

Current flow management strategies on the Mokelumne River include pulses for fish attraction, as well as pulses to stimulate migration downstream, temperature management from Camanche Reservoir (maintaining cold-water pool levels). Beneficial flows have been scheduled to mobilize sediment and dislodge invasive aquatic vegetation (Merz et al. 2008). Timed pulse flows with Delta Cross Channel closures have been implemented experimentally to reduce straying for the benefit of not only the Mokelumne fishery, but to meet the goals of both the Mokelumne and Nimbus Hatcheries genetics management programs (Johnson et al. 2011).

The Water Quality and Resource Management Plan identifies a performance criterion to "Use best efforts to maintain a minimum of 28,000 acre-feet of hypolimnetic volume (the volume of water colder than 16.4º C as determined by weekly hydro-lab at CAMD) in Camanche Reservoir through October whenever Pardee Reservoir total volume is in excess of 100,000 acre-feet." This reservation of cold-water pool is directly tied to maintaining an acceptable fall spawning and incubation temperature for fall run Chinook salmon. Additional operations aimed at managing downstream temperatures include the operation of the upper and lower level outlets in Camanche Reservoir to maintain the best possible release temperatures to meet the life-history needs of aquatic organisms based on EBMUD's operation plan prepared annually in March (WQRMP 2010).

Step 6) Interaction between scientists and stakeholders – The recommendation states the high degree of importance in the step, and EBMUD agrees with this assessment. EBMUD current flow regime was a collaborative effort between EBMUD, CDFW, and USFWS in developing the JSA as part of the FERC process. Moving forward the Mokelumne River has the Mokelumne River Partnership that has continual joint decision making roles in the adaptive approach to managing our limited water supply. This collaboration has been a model for other systems currently working on developing FERC relicensing provisions. Additionally, EBMUD works closely with local landowners, non-governmental organization, and neighboring Central Valley scientists and managers though the Interagency Ecological Program (IEP). The IEP project work teams may provide a valuable resource to this process of setting regional environmental flow criteria, by providing representation from each priority watershed with the expertise on local conditions to contribute to meaningful discussion on moving this process forward. EBMUD looks forward to participating in a process such as that.

Step 7) Adaptive Management Protocol

The JSA contains an adaptive management provision related to minimum flows. The flow schedule may be changed to optimize fishery habitat and other ecosystem values so long as the total quantity of water released in any given year will not be less than the quantity of water provided by the flow requirements for that type of year. Adaptive management actions have been implemented in recent years on the Mokelumne. Examples include deviating from the minimum cold-water pool level. In 2008, EBMUD obtained JSA Partnership concurrence to allow the Camanche hypolimnion to fall below 28,000 acre feet in order to provide more suitable temperatures in the fall. In 2014, the JSA Partnership agreed to reduce spring period releases to below JSA minimums to preserve water for a fall attraction flow (Figures 7a and 7b)) to provide the appropriate benefit for our system on a sub-annual basis to achieve our fisheries goals. Without the ability to conduct adaptive management flow manipulation, operational flexibility has proven beneficial to Mokelumne salmonid populations would be lost.

Figure 7a. Example of adaptive management releases on the Lower Mokelumne River to provide a fall pulse for salmon attraction

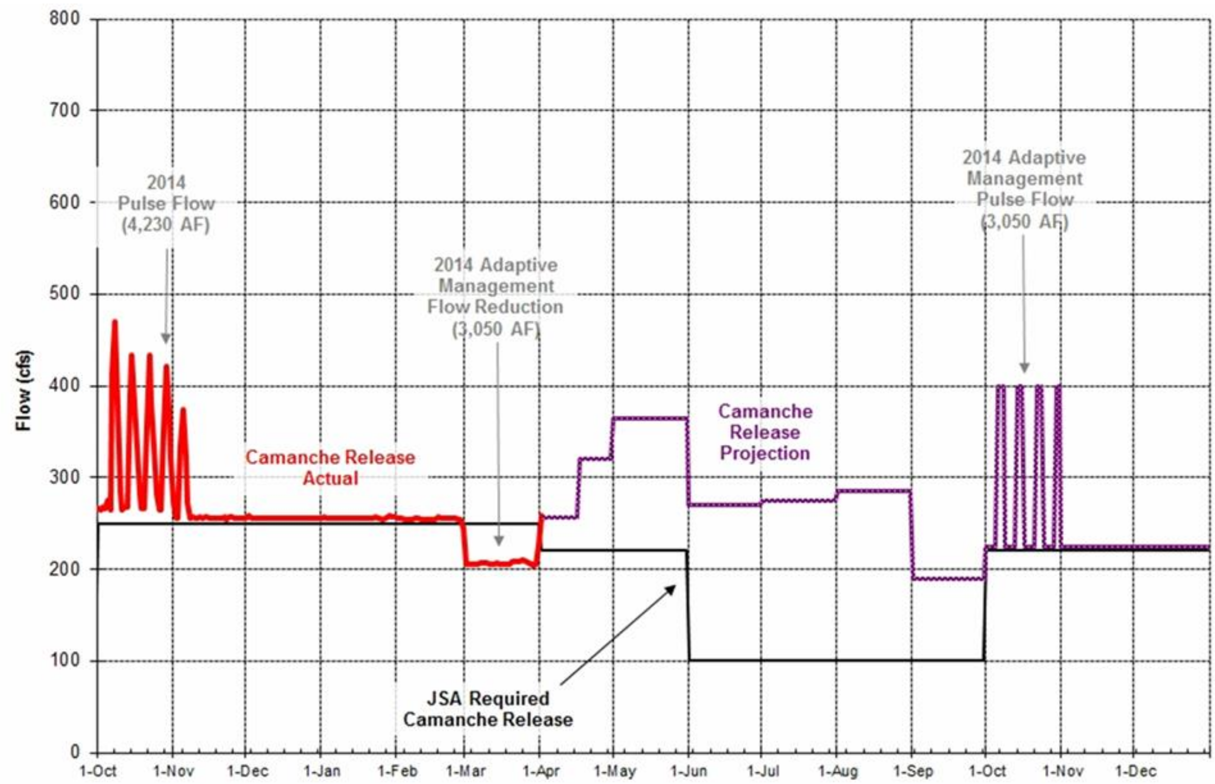
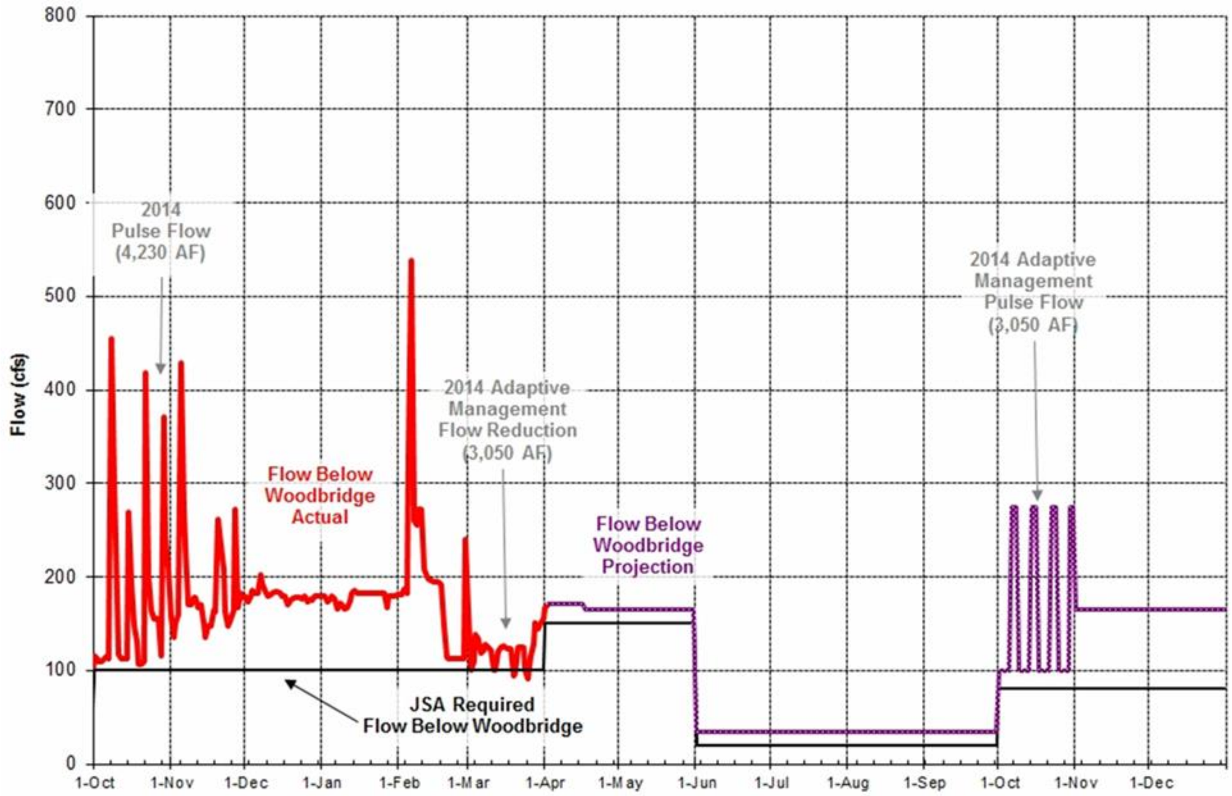


Figure 7b. Example of adaptive management releases on the Lower Mokelumne River to provide a fall pulse for salmon attraction



Summary

EBMUD has reviewed the committee recommendation and has provided the above information to describe our belief that data currently being managed on the Mokelumne River is consistent with the hybrid approach recommended. The Mokelumne River has a rigorous monitoring and research program implementing the WQRMP, and collaborates extensively with the Partnership Committee and other stakeholders including landowners, NGOs, as well as regulatory and fisheries agencies not signatory to the JSA. While we have an abundance of site specific level data, we believe the information we currently have could easily be incorporated into a regional framework as is suggested by the hybrid approach presented. EBMUD looks forward to participating in the development of the flow criteria.

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