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Mr. Noah Oppenheim, Pacific Coast Federation of Fishermen's Association (PCFFA)
Mr. Thomas Stokely, Save California Salmon

Subject: Review of Draft Environmental Impact Report/Statement
Sites Reservoir Project

Dear Mr. Oppenheim and Mr. Stokely:

I have reviewed the Draft Environmental Impact Report/Draft Environmental Impact Statement (DEIR/S) for the Sites Reservoir (Sites) Project located in Glenn and Colusa Counties, California. The focus of my review was to evaluate if the Sites Project and associated Trinity River Division (TRD) of the Central Valley Project (CVP) operations would potentially impact the hydrology and water quality of the Trinity River. I am familiar with how TRD operations affect water temperatures as I have completed numerous water temperature modeling studies related to alternative operations of Trinity and Lewiston reservoirs with a focus on effects on downstream temperatures in the Trinity River. These studies were completed from 1997 through 2004. A copy of my resume is attached.

The DEIR/S indicates that the project poses less than significant impacts on the water quality to the Trinity River downstream of Trinity and Lewiston reservoirs. However, based on my review and analysis of the DEIR/S and other available information, I have identified a number of notable deficiencies in the water quality assessment that fail to identify and correctly analyze revised water operation impacts on Trinity River water quality (temperature) and, in turn, biological resources. Therefore, it is my opinion that the information presented in the DEIR/S is inadequate in evaluating potential adverse impacts to the water quality of the Trinity River. Nor does it propose mitigation measures for reasonably foreseeable adverse impacts to water quality and aquatic resources of the Trinity River. A discussion of the identified deficiencies is provided below.

1. Foreseeable Impacts to Trinity River Associated with Sites Project Operations

Based on my knowledge and experience in analyzing water temperature conditions of the TRD of the CVP, it is my opinion that the revised TRD water operations associated with the Sites Project will lead to increased water temperatures in Lewiston Reservoir and releases to the Trinity River. Any increase in the temperature of water released to the Trinity River would degrade water quality conditions and increase the potential for violations of North Coast Basin Plan[1] water quality (temperature) objectives as well at the water temperature objectives

[1] "Water Quality Control Plan for the North Coast Region" Footnote 5, Table 3-1, page 3-8.00: Accessed at http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/083105-bp/04_water_quality_objectives.pdf

established under the Trinity River Record of Decision (USDOI 2000) to protect outmigrating juvenile salmonids[2].

I reached this conclusion through analysis of water resources system modeling results provided in Appendix 6B of the DEIR/S. Tables 1 through 3 are taken from Appendix 6B and present Trinity Reservoir storage, Trinity River flow and Clear Creek Tunnel diversion modeling results for both the Sites Project No Action Alternative and Alternative D under a variety of water year types. Table 1 presents a comparison of end of month (EOM) storage in Trinity Reservoir. The DEIR/S suggests incorrectly that the small differences between the No Action Alternative and Alternative D are not significant per the following statement (page 6-36).

> *The CALSIM II model monthly simulation of real-time daily (or even hourly) operation of the CVP and SWP results in several limitations in use of the CALSIM II model results. The model results must be used in a comparative manner to reduce the effects of use of monthly assumptions and other assumptions that are indicative of real-time operations, but do not specifically match real-time observations. Given the CALSIM II model uses a monthly time step, incremental flow and storage changes of 5 percent or less are generally considered within the standard range of uncertainty associated with model processing, and as such flow changes of 5 percent or less were considered to be similar to Existing Conditions/No Project/No Action flow levels in the comparative analyses using CALSIM II conducted in this EIR/EIS.*

Table 2 presents the monthly average releases to the Trinity River from Lewiston Reservoir. Apart from the 8.9% decline during December of Wet years, 8.6% to 31.2% decline in flows during February and March of Above Average water year-types, and the 24.2% drop during February of the Below Average water year-type, there are no reductions in flow under Alternative D that are considered significant in the DEIR/S.

Table 3 presents the changes in flow through the Clear Creek Tunnel, which represent diversions from Lewiston Reservoir (via the Carr power plant) to the Sacramento River and potentially Sites Reservoir. A general pattern seen in the these data is a shift in operations under the Project Alternative that increase the rate of diversions through the winter months (December-March) and reduce diversion rates through the summer/fall months (July-November) during dry and critically dry year types. I assume this change in operations is intended to provide more water to the Sacramento River during the winter to enhance

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Daily Average Not to Exceed	Period	River Reach
60°F	July 1- Sept 15	Lewiston to Douglas City Bridge
56°F	Sept 15-Oct 1	Lewiston to Douglas City Bridge
56°F	Oct 1- Dec 31	Lewiston to North Fork Confluence

[2] Trinity River Outmigrant Juvenile Salmonid objectives at Weitchpec (Trinity River Flow Evaluation (USFWS and HVT 1999) accessed at http://www.trrp.net/library/document/?id=226

Normal, Wet and Extremely Wet	April 1-May 22	<13.0 C (<55.4 F)
	May 23-June 4	<15.0 C (<59.0 F)
	June 5-July 9	<17.0 C (<62.6 F)
Dry and Critically Dry	April 1-May 22	<15.0 C (<59.0 F)
	May 23-June 4	<17.0 C (<62.6 F)
	June 5-July 9	<20.0 C (<68.0 F)

the opportunity for diversion to Sites Reservoir. However, this change in operations would have a significant negative effect on the water temperatures in Lewiston Reservoir as well as the temperature of releases to the Trinity River.

Table 4 was developed in order to compare the total average flow through Lewiston Reservoir under the Sites Project No Action Alternative and Alternative D operations. The total flow through Lewiston Reservoir was computed by summing the average monthly flow values of releases to the Trinity River (Table 1) and flow through Clear Creek Tunnel (Table 3).

Due to its geometry and operations of the TRD, water temperatures in Lewiston Reservoir are highly variable. During the summer when there are relatively low and constant releases to the Trinity River and Carr power plant diversions are at capacity, the rate of flow through Lewiston Reservoir is sufficient to displace its entire volume in about 2.5 days and water temperatures remain relatively cool (Brown et al., 1992)[3]. On the other hand, when the Carr power plant is not operating, flow through Lewiston Reservoir stagnates and thermal stratification develops within days, typically leading to the warming of summer surface waters to between 60 and 70 F (15.6 and 21.1 C) (Ibid).

Modeling that I have completed suggests that total flow rates through Lewiston Reservoir (i.e. the sum of Carr power plant diversions and river releases) should be between approximately 800 cubic feet per second (cfs) during the late summer/early fall months of normal year-types and up to 1900 cfs during the summer/fall months of critically dry year-types in order to comply with downstream temperature objectives (Kamman, 1999a)[4]. The maximum late summer/early fall daily releases for releases to the Trinity River under the Trinity ROD range from 300 to 450 cfs. Thus, Carr power plan diversions (i.e., flow through Clear Creek Tunnel) would need to be maintained between 1450 and 1600 cfs to meet summer/early fall temperature needs during normal and critically dry years, respectively.

Based on this this information, it can be inferred that any decrease on total flow through Lewiston Reservoir during the summer/fall period would lead to increased temperatures in water released to the Trinity River as well as that diverted via the Carr power plant and Clear Creek Tunnel. Comparison of total flow rates through Lewiston Reservoir for Alternative D (Table 4) indicates significant reductions during most summer/fall months of the representative dry and critically dry year-types. Most notable are the reductions in flow and likely reservoir heating during the month of October, where flow through Lewiston Reservoir is reduced by 165% and 56% during dry and critically dry year-types, respectively, a time when meeting downstream temperature objectives is already compromised (Kamman, 1999b)[5].

Evaluation of average monthly temperature results for releases to the Trinity River presented in Appendix 7E (River Temperature Modeling) of the DEIR/S do not corroborate the anticipated increase in Lewiston Reservoir temperatures. Table 5 presents the DEIR/S temperature modeling results and

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[3] Brown, R., Yates, G., and Field, J. (1992) "Temperature Modeling of Lewiston Lake with the BETTER two-dimensional reservoir flow mixing and heat exchange model." *Rep*., Department of Transportation and Planning, Trinity County, Weaverville, CA.
[4] Kamman, G.R., 1999a, Temperature Analysis of Proposed Trinity River Fish and Wildlife Restoration Flow Alternatives using the BETTER Model: Prepared for: Trinity County Planning Department, June, 80p.
[5] Kamman, G.R., 1999b, Addendum to Temperature Analysis of Proposed Trinity River Fish and Wildlife Restoration Flow Alternatives using the BETTER Model: Cumulative Effects. Prepared for: Trinity County Planning Department, September, 7p.

suggests (contrary to the discussion above) that water temperatures in Lewiston Reservoir (i.e., temperature of releases to Trinity River) would decrease as total flow through the reservoir decreases. In fact, the temperature decreases are most pronounced during some dry and critically dry months of greatest reduction in flow rates through Lewiston Reservoir, when water temperatures would be increasing. This leads me to call into question the validity of the temperature model analysis of TRD operations presented in the DEIR/S.

More important is that the proposed change in TRD operations by the Sites Project directly conflicts with and reverses intended operations stipulated in the Secretary of Interior's 2000 Record of Decision (ROD) for the Trinity River Mainstem Fishery Restoration project. As you are aware, the modeling and temperature analysis work I completed for Trinity County back in the late 1990's contributed significantly to development of the instream flow and Carr power plant and Clear Creek Tunnel diversion schedules for the Trinity Preferred Alternative in order to better meet downstream temperature objectives. This work was accomplished through lengthy and focused analyses and meetings with project stakeholders and resulted in final preferred alternative operations with increased late summer CVP diversions to the Sacramento River. Acknowledging that even the river releases and temperatures from Lewiston Reservoir associated with the Preferred Alternative may not satisfy downstream temperature objectives, the Trinity Project ROD stipulates the following (page 20): "*Under the Preferred Alternative, the TRD would be operated to release additional water to the Trinity River, and the timing of exports to the Central Valley would be shifted to later in the summer to help meet Trinity River instream temperature requirements*". By proposing to reduce late summer CVP diversions to the Sacramento River, the Sites Project creates a foreseeable potential impact on Trinity River water quality by reversing the very operations associated with the Trinity River ROD that are intended to satisfy downstream water temperatures objectives and protect instream beneficial uses, particularly for salmon and steelhead.

This potential shift in TRD operations is concerning due to the fact that there are frequent exceedances of water temperature objectives under the current TRD ROD operations and flows. Recent studies completed by the U.S. Fish and Wildlife Service[6] provide data on how the TRD operations and ROD flows comply with downstream Basin Plan and Restoration Project temperature objectives. Appendix A from David and Goodman (2017), presented below, summarizes the exceedances to the Basin Plan (DGC and NFH locations) and Trinity River Restoration Project (TRWEI location) temperature objectives for the period 2001 through 2016.

[6] David, A.T. and Goodman, D.H., 2017, Performance of water temperature management on the Klamath and Trinity Rivers, 2016. U.S. Fish and Wildlife Service, Arcata Fisheries Technical Report TR 2017-29, November, 72p; and
Polos, J. 2016. Adult salmon water temperature targets. Trinity River Restoration Program Performance Measure. Trinity River Restoration Program.

Appendix A. Number of days exceeding numeric water temperature objectives for the three specified locations on the Trinity River, 2001-2016. DGC = Trinity at Douglas City; NFH = Trinity above the North Fork Trinity; TRWE1 = Trinity above the Klamath.

	Objective locations			Forecast water year type	Actual water year type
Year	DGC	NFH	TRWE1		
2001	--	--	33[a]	Dry	Dry
2002	0	--	54	Normal	Normal
2003	11	--	34	Wet	Wet
2004	0	--	43	Wet	Wet
2005	--	1	21[b]	Normal	Wet
2006	6	0	18	Ex. Wet	Ex. Wet
2007	3	0	19	Dry	Dry
2008	1	4	0	Normal	Dry
2009	31	2	21	Dry	Dry
2010	6	7	10	Normal	Wet
2011	0	0	7	Wet	Wet
2012	0	1	25	Normal	Normal
2013	0	0	26	Dry	Dry
2014	18	15	53	Crit. Dry	Crit. Dry
2015	--	18	65	Dry	Dry
2016	14	3	52	Wet	Wet

[a] Data unavailable prior to 5/3 for TRWE1 in 2001. We assumed mean daily temperatures did not reach or exceed 15.0 C before this date.
[b] Data unavailable prior to 4/4 for TRWE1 in 2005. We assumed mean daily temperatures did not reach or exceed 13.0 C before this date.

These exceedances occur during all water year types, but with highest frequency during dry and critically dry year types. Of note in this Appendix are the high number of exceedances during the wet water year 2016. As reported by David and Goodman, the exceedances during 2016 are, in part, due to depletion of the cool water pool (carry-over storage) during the preceding 3-year drought period (2013-2015).

2. Foreseeable Impacts to Trinity River Associated with Trinity Lake Carryover Storage

Ordinarily in late summer, water temperatures in Trinity Reservoir are well stratified, displaying a layer of warm water above a deeper pool of much colder water. During this time, releases from Trinity Reservoir to Lewiston Reservoir occur through a submerged powerhouse outlet. If the reservoir is drawn down to a relatively low level, the upper warm layer may intersect the powerhouse outlet, releasing warm water to Lewiston Reservoir. In turn, these warm temperatures are propagated through Lewiston Reservoir to the Trinity River. As presented below, a number of studies have been completed to quantify the minimum October 1st carryover storage volume that is needed to protect against the introduction of warm summer water releases during various water year types and droughts.

In 1998, Trinity County retained KHE to evaluate how an intense multi-year drought would affect carryover storage in Trinity Reservoir (Kamman, 1998)[7]. The study approach included an

[7] Kamman, G.R., 1998, Carryover Storage Analysis – Simulated (1928-1934) period. Prepared for: Trinity County Planning Department, May 22, 3p

interannual accounting of Trinity Reservoir storage during a series of representative water year-types similar to those experienced during the 1928-1934 drought.[8] Water releases from Trinity Lake were based on the water year type for Trinity Division operations[9] under the ROD Flows. A series of interannual Trinity Reservoir water budgets were developed with initial carryover storage volumes ranging from 750- to 2000-TAF.

Study results (Kamman, 1998) indicate that under CVP operations to meet ROD Flows, there is a net annual increase in Trinity Reservoir storage during normal (1928) year-types, but decrease during dry (-17.5 TAF) and critically dry (-341 TAF) year-types. Thus, when starting with 750 TAF of storage, Trinity Reservoir storage would have dropped below 200 TAF after the third year of the drought, primarily driven by storage reductions experienced during critically dry years. Study results also indicate that a starting storage volume of 1250 TAF is required to maintain a minimum carryover storage of 600 TAF through the drought. However, modeling results (Kamman, 1999a and 1999b) indicate that even 600 TAF of carryover storage does not fully achieve compliance with temperature objectives during dry and critically dry year types. This study suggests that a minimum carryover storage volume of between 1250- and 1500-TAF during the first year of drought is likely required in order to provide the necessary water release temperatures to the Trinity River to meet downstream temperature objectives during subsequent years.

In addition to the work cited above, I am aware of other studies focused on identifying the minimum Trinity Reservoir carryover storage to provide the necessary cold water releases to satisfy river temperature objectives. In their 1992 testimony to the State Water Board, Finnerty and Hecht (1992)[10] concluded that Trinity Reservoir carryover storage of 900 TAF or slightly more may be needed to meet downstream temperature objectives during 90% of all years. Their conclusion was based on analysis of hydrology, reservoir operations and temperatures for 1991, a single critically dry year-type. The second study, completed by Deas in 1998[11] on behalf of Trinity County, included water temperature simulations of Trinity Reservoir using the Water Temperature Simulation Model (WTSM). Deas evaluated temperature compliance under 1990 dry year-type conditions assuming initial reservoir storage volumes of 750-, 1250- and 1500-TAF. Model simulation results indicated elevated water temperatures at the powerhouse intake elevation for the 750 TAF carryover storage scenario and minimal to no temperature concerns at initial carryover storage volumes of 1250- and 1500-TAF, respectively. Deas' findings of elevated temperatures associated with 750 TAF of carryover storage are corroborated in the 2012 report by Reclamation[12], which found that a September 30 carryover storage requirement of less than 750 TAF is "problematic" in meeting state and federal Trinity River temperature objectives

[8] The interannual water budget accounting started in 1928, a normal water year type.

[9] It is likely that CVP operations would change during drought periods. However, we did not have the knowledge or expertise to define such changes. Thus, the analysis used operations consistent with the earlier PROSIM simulations.

[10] Hecht, B. and Finnerty, A.A., 1992, Testimony to the State Water Resources Control Board regarding Carryover Storage in Trinity and Lewiston Reservoirs to Protect Public-interest Resources. State Water Resources Control Board Water Right Phase of the Bay-Delta Estuary Proceedings, June 26, 7p.

[11] Deas, M.L., 1998, Trinity Reservoir Carryover Analysis. Prepared for: Trinity County Planning Department, Natural Resources Division, August, 26p.

[12] U.S. Department of Interior, Bureau of Reclamation, 2012, Trinity Reservoir Carryover Storage Cold Water Pool Sensitivity Analysis – Technical Service Center (TSC) Technical Memorandum No. 86-68220-12-06. August 20, 7p.

protective of the fishery.

The Sites Project water operation and temperature analyses assume a minimum Trinity Reservoir carryover storage volume of 600TAF. The study findings presented above indicate that initial October 1 carryover storage volumes of 600- and 750-TAF are not sufficient to satisfy Trinity River temperature objectives for a single dry/critically dry water year-type, let alone multi-year droughts. Thus, it is reasonable to foresee that current implementation of the ROD Flows without sufficient carryover storage will not achieve Trinity River temperature objectives during critically dry year-types. Modeling results indicate that critically dry water year-types deplete reservoir carryover storage volumes at much higher rates than occurs during dry years. Whether dealing with dry or critically dry year-types, reservoir storage has no chance of being replenished during multi-year droughts under the current and proposed Sites Project CVP operations.

As determined by Finnerty and Hecht, a minimum baseline carryover storage volume of 900 TAF is required to meet Basin Plan temperature objectives on the Trinity River during a single dry year. Studies by Deas and Kamman suggest this baseline carryover storage volume is likely higher for critically dry year-types. Significantly higher carryover storage volumes over the baseline value are required to preserve the necessary reservoir cool water pool during multi-year drought periods, in order to achieve temperature objectives. Modeling studies suggest first year drought carryover storage volumes of around 1750 TAF are sufficient to maintain adequate carryover storage to meet temperature objectives during multi-year droughts. Thus, a single minimum carryover storage volume cannot be developed without revising CVP operations that focus on preserving Trinity Reservoir carryover storage, most likely by reducing water that is diverted out of the Trinity River basin.

The Sites Project DEIR/S presents the results of their modeling analyses as monthly average values of flow, storage and water temperature for multiple years within designated water-year type classifications. This presentation masks the impacts from a single extreme dry year as well as repeated impacts associated with a continuous multi-year drought. These are the periods of greatest concern and potential damage to aquatic resources, but they are not identified or described in the DEIR/S. Prior to 2016, the USGS[13] developed a water temperature model that accurately simulates daily mean water temperature along the course of the Trinity River, from Lewiston Dam to the Klamath River confluence. This model would be a more appropriate tool to evaluate how changes in TRD water operations associated with the Sites Project would satisfy water temperature objectives in the Trinity River.

3. Inaccurate Existing (Baseline) TRD Water Operations

The water operations analysis for Sites Project EIR/S did not include an analysis considering use of Humboldt County's 50 thousand acre feet (TAF) water contract included as a provision of the Trinity River Division Act. The following is an excerpt from the Statutory Authority Appendix contained in the DEIS for the Long-Term Plan to Protect Adult Salmon in the Lower Klamath River (Lower Klamath LTP)[14] describing Humboldt County's 50 TAF water contract.

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[13] Jones, E.C., Perry, R.W., Risley, J.C., Som, N.A. and Hetrick, N.J., 2016, Construction, calibration and validcation of the RBM10 water temperature model for the Trinity River, Northern California. U.S. Department of Interior, U.S. Geological Survey, Open-File Report 2016-1056, prepared in cooperation with the U.S. Fish and Wildlife Service and the Bureau of Reclamation, 56p.

[14] U.S. Department of Interior, Bureau of Reclamation, 2016, Long-Term Plan to Protect Adult Salmon in the Lower Klamath River, Humboldt County, California Draft Environmental Impact Statement, October.

Construction of the Trinity River Division (TRD) of the Central Valley Project (CVP) was authorized by the Act of August 12, 1955 (Public Law 84-386) (TRD Act). In section 2 of the 1955 TRD Act, Congress directed that the operation of the TRD should be integrated and coordinated with the operation of the CVP, subject to two conditions set forth as distinct Provisos in section 2 of that Act. The first of these two Provisos states that the Secretary of the Interior is authorized and directed to "adopt appropriate measures to insure the preservation and propagation of fish and wildlife" including certain minimum flows in the Trinity River deemed at the time as necessary to maintain the fishery. The second Proviso directs that not less than 50,000 acre-feet of water shall be released and made available to Humboldt County and other downstream users[15].

The recently released Solicitor's Opinion, M-37030, concludes that each of the two Provisos in section 2 of the TRD Act are "separate and independent limitations on the TRD's integration with, and thus diversion of water to, the CVP" and that the two Provisos may "require separate releases of water as requested by Humboldt County and potentially other downstream users pursuant to Proviso 2 and a 1959 Contract between the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and Humboldt County."[16] M- Opinion 37030 at 2. Formal 18 opinions of the Solicitor are binding on the Department of the Interior and its bureaus.

Chapter 6 and Appendix 6A of the Sites Project DEIR/S state that the project water operations modeling analyses adhered to 2000 Trinity River ROD releases to the Trinity River downstream of Lewiston Reservoir to meet instream flow requirements. The DEIR/S states, "The total volume of water released to the Trinity River ranges from approximately 368,600 AF in critically dry years to 815,000 AF in extremely wet years, depending on the annual water-year type (hydrology) determined as of April 1st (DOI, 2000). Table 6-2 shows the annual volumes, peak flows, and peak flow duration by water type." Table 6-2 from the DEIR/S is presented below. However, there is no mention of Humboldt County's 50 TAF annual water contract being integrated into the DEIR/S water resources system modeling and analysis. It is not possible to compare total annual modeled Trinity River releases from the DEIR/S (Table 2, attached) to the annual Trinity River ROD flow volumes (Table 6.2 below) as they represent different water year type classification schemes[17]. The USFWS report by David and Goodman (2017) indicates how the Humboldt County 50 TAF water contract has been especially important for flow augmentation during dry years to meet flow and temperature targets in the lower Klamath River to reduce the probability of an adult fish kill. The omission of the Humboldt County 50 TAF contract in the DEIR/S analyses could have significant effects on the water quality conditions and potential impacts

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[15] Reclamation's water permits from the State of California includes the following condition:
"Permittee shall release sufficient water from Trinity and/or Lewiston Reservoirs into the Trinity River so that not less than an annual quantity of 50,000 acre-feet will be available for the beneficial use of Humboldt County and other downstream users." Condition 9

[16] The 1959 water delivery contract between Reclamation and Humboldt County includes the following:
"The United States agrees to release sufficient water from Trinity and/or Lewiston Reservoirs into the Trinity River so that not less than an annual quantity of 50,000 acre-feet will be available for the beneficial use of Humboldt County and other downstream users."
Contract, Article 8.

[17] The water year types included in the Trinity ROD are probability-based and classified by ranges of annual upper Trinity River Basin water year runoff. This classification is different from the water year types presented in all other tables in Appendix 6B of the DEIR/S, which are based on the historical record of WY1922 through WY2003 and defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 2000).

to both the Trinity and Sacramento Rivers. Therefore, the DEIR/S should be considered incomplete in the analysis of the effects of the Site Project operations on the Trinity River.

Table 6-2
Trinity River Record of Decision
Annual Flow Volumes and Peak Flows

Water Year Type	Volume (AF)	Peak Flow (cfs)	Peak Flow Duration (days)
Extremely Wet	815,000	11,000	5
Wet	701,000	8,500	5
Normal	647,000	6,000	5
Dry	453,000	4,500	5
Critically Dry	369,000	1,500	36

Notes:
cfs = cubic feet per second
Source: DOI, 2000.

4. Incomplete Cumulative Impact Assessment

In addition to the omission of the Humboldt County 50 TAF water delivery contract on the Trinity River, the Sites Project DEIR/S fails to consider and incorporate the Lower Klamath LTP operations into the water resources system modeling analyses. Under CEQA, a cumulative impact assessment must consider development projects within the cumulative study area, which includes past projects, projects under construction and approved, and pending projects that are anticipated to be either under construction or operational by the time of the completion of the proposed project. The Sites DEIR/S states the following (pg. 6A-2, Appendix 6A).

> *The Existing Conditions/No Project/No Action Condition simulation was developed assuming Year 2030 level of development and regulatory conditions. The Existing Conditions/No Project/No Action Condition assumptions include existing facilities and ongoing programs that existed as of March 2017 (publication of the Notice of Preparation) that could affect or could be affected by implementation of the alternatives. The Existing Conditions/No Project/No Action Condition assumptions and the models do not include any restoration actions or additional conveyance over the current conditions.*

Although the ROD for the Lower Klamath LTP[18] wasn't signed until April 2017, it was certainly a well-known and defined pending project and should have been incorporated into the baseline condition of the water resource system modeling analysis. Tables 6 through 8 provide average monthly storage and flow values for the TRD under the Lower Klamath LTP. Comparison of the Lower Klamath LTP Alternative 1 conditions presented in Table 6 through 8 to the Sites Project No Action Alternative conditions presented in Tables 1 through 3 indicate significant differences in project operations and hydrologic conditions when including the Lower Klamath LTP in the water resource impact assessment. For example, under the Lower Klamath LTP, diversions to

[18] U.S. Department of the Interior, Bureau of Reclamation, 2017, Record of Decision for the Long Term Plan to Protect Adult Salmon in the Lower Klamath River, April, Accessed at https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=28314

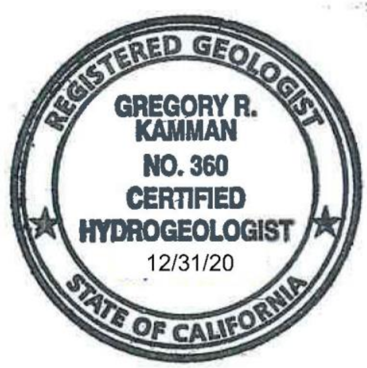
the Sacramento River are reduced by an average of 13 TAF per year, while Sites DEIR has diversions increasing, on average, by 4 TAF per year. The main reason for this difference is the August and September Trinity River release rates: as a result of flow augmentations, the Lower Klamath LTP increases average releases to Trinity River by 20% and 42% (presumably using the Humboldt County 50TAF water) above No Action flows, respectively (see Table 7). Alternative D of the Sites Project maintains a constant 450 cfs baseline ROD flow during these months for all water year types. The Lower Klamath LTP introduces significant project operations, not included in the Sites Project DEIR/S analyses, which could have significant effects on the anticipated water supply available to the project as well as impacts to temperature on the Sacramento River. Because of this omission in the impact analysis, the Sites Project DEIR/S should be considered incomplete.

Another cumulative impact that is not evaluated in the Sites Project DEIR/S is the influence of climate change on the meteorology and hydrology of northern California rivers. The water temperature modeling of Alternatives completed as part of DEIR/S analyses uses historic meteorologic and hydrologic data and do not consider the predicted warmer future temperatures in the Trinity and Klamath River basins under climate change (USBR, 2011)[19]. Warmer air temperatures under climate change will result in warmer reservoir and river water temperatures. Anticipated changes to the timing and magnitude of spring snowmelt hydrograph and associated tributary accretion (flow and water temperature) are likely to increase river water temperatures, which will reduce the attainment of water temperature objectives on the Trinity River, especially those established for outmigrant juvenile salmonids. Thus, the DEIR/S fails to evaluate the cumulative impact of climate change conditions.

Please feel free to contact me with any questions regarding the material and conclusions contained in this letter.

Sincerely,

Greg Kamman, PG, CHG
Principal Hydrologist



[19] U.S. Department of the Interior, Policy and Administration, Bureau of Reclamation, 2011, SECURE Water Act Section 9503(c) – Reclamation Climate Change and Water. April, 226p.

TABLE 1: Trinity Lake end of month storage. Source: Table SW-01-9a, Appendix 6B of Sites Project DEIR/S.

Table SW-02-9a
Trinity Lake, End of Month Elevation
Long-term Average and Average by Water Year Type

	End of Month Elevation (FEET)											
Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[1]												
No Action Alternative	2,278	2,280	2,285	2,292	2,302	2,313	2,325	2,324	2,321	2,310	2,297	2,286
Alternative D	2,281	2,283	2,288	2,294	2,304	2,314	2,325	2,325	2,322	2,310	2,298	2,287
Difference	2	3	3	2	2	1	1	1	1	1	1	1
Percent Difference[3]	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Water Year Types[2]												
Wet (32%)												
No Action Alternative	2,322	2,323	2,325	2,324	2,337	2,347	2,357	2,359	2,358	2,350	2,342	2,332
Alternative D	2,322	2,323	2,324	2,325	2,338	2,348	2,358	2,360	2,358	2,350	2,341	2,331
Difference	-1	0	0	1	1	1	0	0	0	0	-1	-1
Percent Difference	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Above Normal (15%)												
No Action Alternative	2,305	2,305	2,307	2,298	2,313	2,329	2,341	2,342	2,340	2,331	2,321	2,309
Alternative D	2,307	2,307	2,309	2,305	2,319	2,334	2,345	2,346	2,344	2,335	2,323	2,311
Difference	2	2	2	7	6	5	4	4	4	4	2	2
Percent Difference	0.1%	0.1%	0.1%	0.3%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%
Below Normal (17%)												
No Action Alternative	2,275	2,278	2,285	2,281	2,289	2,298	2,313	2,313	2,310	2,298	2,287	2,277
Alternative D	2,275	2,278	2,286	2,281	2,289	2,298	2,314	2,313	2,310	2,298	2,286	2,277
Difference	0	1	0	0	0	0	0	0	0	0	0	0
Percent Difference	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dry (22%)												
No Action Alternative	2,260	2,261	2,270	2,283	2,291	2,304	2,316	2,312	2,307	2,293	2,277	2,266
Alternative D	2,261	2,263	2,273	2,284	2,292	2,304	2,316	2,312	2,306	2,291	2,277	2,266
Difference	2	2	2	1	1	0	0	-1	-1	-1	0	0
Percent Difference	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
Critical (15%)												
No Action Alternative	2,189	2,190	2,198	2,240	2,246	2,255	2,263	2,260	2,258	2,239	2,218	2,203
Alternative D	2,203	2,206	2,211	2,242	2,248	2,257	2,265	2,262	2,260	2,242	2,224	2,208
Difference	14	16	13	2	2	2	2	2	2	2	6	5
Percent Difference	0.6%	0.7%	0.6%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.2%

1 Based on the 82-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999)

3 Relative difference of the monthly average

TABLE 2: Monthly flow on Trinity River below Lewiston Reservoir. Source: Table SW-04-9a, Appendix 6B of Sites Project DEIR/S.

Table SW-04-9a
Trinity River below Lewiston Reservoir, Monthly Flow
Long-term Average and Average by Water Year Type

Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
						Monthly Flow (CFS)						
Long-term												
Full Simulation Period[1]												
No Action Alternative	368	360	522	655	645	575	554	3,779	2,091	923	450	450
Alternative D	373	360	498	638	621	570	561	3,779	2,091	923	450	450
Difference	5	-1	-24	-17	-24	-5	6	0	0	0	0	0
Percent Difference[3]	1.2%	-0.2%	-4.6%	-2.6%	-3.7%	-0.9%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Water Year Types[2]												
Wet (32%)												
No Action Alternative	373	300	852	1,412	1,026	1,096	627	4,636	3,318	1,289	450	450
Alternative D	373	300	775	1,351	1,052	1,143	647	4,636	3,318	1,289	450	450
Difference	0	0	-76	-61	26	47	20	0	0	0	0	0
Percent Difference	0.0%	0.0%	-8.9%	-4.3%	2.5%	4.3%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Above Normal (15%)												
No Action Alternative	373	713	621	316	831	436	469	4,462	2,488	1,048	450	450
Alternative D	373	709	621	332	760	300	469	4,462	2,488	1,048	450	450
Difference	0	-5	0	16	-72	-136	0	0	0	0	0	0
Percent Difference	0.0%	-0.7%	0.0%	5.1%	-8.6%	-31.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Below Normal (17%)												
No Action Alternative	373	300	300	300	517	319	507	3,774	1,672	869	450	450
Alternative D	373	300	300	300	392	319	507	3,774	1,672	869	450	450
Difference	0	0	0	0	-125	0	0	0	0	0	0	0
Percent Difference	0.0%	0.0%	0.0%	0.0%	-24.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Dry (22%)												
No Action Alternative	373	300	300	300	300	300	529	3,216	1,251	667	450	450
Alternative D	373	300	300	300	300	300	529	3,216	1,251	667	450	450
Difference	0	0	0	0	0	0	0	0	0	0	0	0
Percent Difference	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Critical (15%)												
No Action Alternative	342	300	300	300	300	300	575	2,092	783	450	450	450
Alternative D	373	300	300	300	300	300	575	2,092	783	450	450	450
Difference	31	0	0	0	0	0	0	0	0	0	0	0
Percent Difference	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

1 Based on the 82-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999)

3 Relative difference of the monthly average

TABLE 3: Monthly flow through Clear Creek Tunnel. Source: Table SW-05-9a, Appendix 6B of Sites Project DEIR/S.

Table SW-05-9a
Clear Creek Tunnel, Monthly Flow
Long-term Average and Average by Water Year Type

Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	Monthly Flow (CFS)											
Long-term												
Full Simulation Period[1]												
No Action Alternative	1,033	344	257	420	95	269	389	168	551	1,812	1,926	1,666
Alternative D	900	261	269	460	155	341	373	163	576	1,862	1,957	1,675
Difference	-133	-83	12	40	61	71	-16	-5	25	50	30	9
Percent Difference[3]	-12.9%	-24.2%	4.7%	9.4%	64.2%	26.4%	-4.2%	-3.2%	4.6%	2.8%	1.6%	0.5%
Water Year Types[2]												
Wet (32%)												
No Action Alternative	1,593	481	536	430	81	344	483	278	421	1,742	1,678	2,135
Alternative D	1,571	448	585	437	118	355	493	268	439	1,765	1,882	2,142
Difference	-22	-32	49	7	36	12	10	-10	18	23	204	6
Percent Difference	-1.4%	-6.7%	9.1%	1.6%		3.4%	2.0%	-3.5%	4.3%	1.3%	12.1%	0.3%
Above Normal (15%)												
No Action Alternative	964	437	304	269	58	302	588	0	167	1,417	1,875	1,958
Alternative D	1,088	340	237	269	71	468	564	21	166	1,500	2,313	1,875
Difference	124	-98	-67	0	12	166	-24	21	-1	83	438	-83
Percent Difference	12.9%	-22.4%	-22.1%	0.0%		54.9%	-4.1%		-0.5%	5.9%	23.3%	-4.3%
Below Normal (17%)												
No Action Alternative	429	186	65	295	80	384	265	61	660	1,538	1,796	1,361
Alternative D	433	68	96	334	212	406	171	61	660	1,698	1,714	1,342
Difference	4	-118	32	39	132	22	-94	0	0	161	-82	-18
Percent Difference	1.0%	-63.5%	48.6%	13.4%		5.8%	-35.3%	0.0%	0.0%	10.5%	-4.6%	-1.4%
Dry (22%)												
No Action Alternative	884	333	100	408	166	141	222	221	905	2,100	2,322	1,468
Alternative D	676	205	81	551	265	295	252	200	978	2,147	2,119	1,420
Difference	-209	-128	-20	143	99	154	29	-22	73	47	-203	-48
Percent Difference	-23.6%	-38.4%	-19.7%	35.2%	59.9%	109.4%	13.1%	-9.8%	8.1%	2.2%	-8.7%	-3.3%
Critical (15%)												
No Action Alternative	818	156	62	715	70	135	385	147	561	2,245	2,075	1,012
Alternative D	142	84	99	710	90	174	342	143	585	2,200	1,802	1,235
Difference	-676	-72	37	-5	21	39	-43	-4	25	-45	-272	222
Percent Difference	-82.6%	-46.2%		-0.8%		28.5%	-11.2%	-2.5%	4.4%	-2.0%	-13.1%	22.0%

1 Based on the 82-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999)

3 Relative difference of the monthly average

TABLE 4: Estimated Monthly flow through Lewiston Reservoir.

Flow through Lewiston Lake (cfs)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Full Simulation Period1												
No Action Alternative	1401	704	779	1075	740	844	943	3947	2642	2735	2376	2116
Alternative D	1273	621	767	1098	776	911	934	3942	2667	2785	2407	2125
Difference	(128)	(83)	(12)	23	36	67	(9)	(5)	25	50	31	9
Percent Difference	-9.1%	-11.8%	-1.5%	2.1%	4.9%	7.9%	-1.0%	-0.1%	0.9%	1.8%	1.3%	0.4%
Wet (32%)												
No Action Alternative	1966	781	1388	1842	1107	1440	1110	4914	3739	3031	2128	2585
Alternative D	1944	748	1360	1788	1170	1498	1140	4904	3757	3054	2332	2592
Difference	(22)	(33)	(28)	(54)	63	58	30	(10)	18	23	204	7
Percent Difference	-1.1%	-4.2%	-2.0%	-2.9%	5.7%	4.0%	2.7%	-0.2%	0.5%	0.8%	9.6%	0.3%
Above Normal (15%)												
No Action Alternative	1337	1150	925	585	889	738	1057	4462	2655	2465	2325	2408
Alternative D	1461	1049	858	601	831	768	1033	4483	2654	2548	2763	2325
Difference	124	(101)	(67)	16	(58)	30	(24)	21	(1)	83	438	(83)
Percent Difference	9.3%	-8.8%	-7.2%	2.7%	-6.5%	4.1%	-2.3%	0.5%	0.0%	3.4%	18.8%	-3.4%
Below Normal (17%)												
No Action Alternative	802	486	365	595	597	703	772	3835	2332	2407	2246	1811
Alternative D	806	368	396	634	604	725	678	3835	2332	2567	2164	1792
Difference	4	(118)	31	39	7	22	(94)	0	0	160	(82)	(19)
Percent Difference	0.5%	-24.3%	8.5%	6.6%	1.2%	3.1%	-12.2%	0.0%	0.0%	6.6%	-3.7%	-1.0%
Dry (22%)												
No Action Alternative	1257	633	400	708	466	441	751	3437	2156	2767	2772	1918
Alternative D	1049	505	381	851	565	595	781	3416	2229	2814	2569	1870
Difference	(208)	(128)	(19)	143	99	154	30	(21)	73	47	(203)	(48)
Percent Difference	-16.5%	-20.2%	-4.8%	20.2%	21.2%	34.9%	4.0%	-0.6%	3.4%	1.7%	-7.3%	-2.5%
Critical (15%)												
No Action Alternative	1160	456	362	1015	370	435	960	2239	1344	2695	2525	1462
Alternative D	515	384	399	1010	390	474	917	2235	1368	2650	2252	1685
Difference	(645)	(72)	37	(5)	20	39	(43)	(4)	24	(45)	(273)	223
Percent Difference	-55.6%	-15.8%	10.2%	-0.5%	5.4%	9.0%	-4.5%	-0.2%	1.8%	-1.7%	-10.8%	15.3%

TABLE 5: Monthly temperatures of Trinity River below Lewiston Dam. Source: Table SQ-33-9a, Appendix 7E of Sites Project DEIR/S.

Table SQ-33-9a
Trinity River below Lewiston Dam, Monthly Temperature
Long-term Average and Average by Water Year Type

Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	Monthly Temperature (DEG-F)											
Long-term												
Full Simulation Period[1]												
No Action Alternative	49.4	44.7	40.0	39.4	42.7	47.0	50.2	46.6	50.9	51.3	51.7	50.7
Alternative D	49.3	44.6	39.9	39.5	42.7	46.9	50.3	46.6	50.8	51.1	51.3	50.7
Difference	-0.1	-0.1	-0.1	0.2	0.0	-0.2	0.1	0.0	-0.1	-0.2	-0.4	0.1
Percent Difference[3]	-0.2%	-0.2%	-0.2%	0.4%	0.0%	-0.4%	0.2%	-0.1%	-0.2%	-0.4%	-0.7%	0.1%
Water Year Types[2]												
Wet (32%)												
No Action Alternative	47.0	44.6	41.5	40.6	43.0	45.9	49.1	45.8	48.3	50.8	51.6	48.6
Alternative D	47.0	44.6	41.3	40.5	43.0	45.8	49.1	45.8	48.3	50.7	50.9	48.8
Difference	0.1	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.2	-0.7	0.2
Percent Difference	0.1%	0.1%	-0.3%	-0.2%	-0.1%	-0.3%	-0.1%	0.0%	0.0%	-0.3%	-1.4%	0.4%
Above Normal (15%)												
No Action Alternative	48.2	43.3	40.2	38.6	42.6	47.3	49.9	45.9	50.6	51.6	50.9	48.8
Alternative D	47.7	43.2	39.8	38.8	42.6	47.2	50.0	45.9	50.5	51.2	49.6	49.4
Difference	-0.5	-0.1	-0.4	0.1	0.0	-0.1	0.1	-0.1	-0.1	-0.4	-1.3	0.6
Percent Difference	-1.1%	-0.2%	-1.1%	0.3%	0.0%	-0.2%	0.2%	-0.2%	-0.2%	-0.8%	-2.5%	1.3%
Below Normal (17%)												
No Action Alternative	50.2	44.7	39.0	38.7	41.9	46.8	51.1	46.4	51.3	52.0	52.0	51.3
Alternative D	50.2	44.7	39.1	38.8	41.9	46.7	51.6	46.5	51.3	51.6	52.2	51.5
Difference	0.0	0.0	0.2	0.1	0.0	-0.2	0.5	0.0	0.0	-0.3	0.1	0.2
Percent Difference	-0.1%	0.1%	0.4%	0.3%	0.0%	-0.4%	1.0%	0.1%	0.0%	-0.6%	0.3%	0.4%
Dry (22%)												
No Action Alternative	49.5	45.0	39.6	38.4	42.4	47.9	51.4	46.7	51.9	50.7	50.1	50.3
Alternative D	49.7	44.7	39.4	39.0	42.4	47.6	51.1	46.6	51.7	50.5	50.5	50.4
Difference	0.2	-0.2	-0.2	0.6	0.0	-0.4	-0.2	-0.1	-0.2	-0.3	0.4	0.1
Percent Difference	0.4%	-0.5%	-0.4%	1.5%	0.1%	-0.8%	-0.4%	-0.2%	-0.5%	-0.5%	0.8%	0.2%
Critical (15%)												
No Action Alternative	54.5	45.7	38.2	39.4	43.1	48.0	50.2	49.3	55.5	52.5	54.4	56.6
Alternative D	53.8	45.5	38.4	39.7	43.2	47.8	50.4	49.2	55.3	52.6	53.9	55.6
Difference	-0.7	-0.2	0.1	0.2	0.1	-0.2	0.2	-0.1	-0.2	0.1	-0.5	-1.0
Percent Difference	-1.3%	-0.5%	0.3%	0.6%	0.2%	-0.3%	0.4%	-0.2%	-0.3%	0.2%	-0.9%	-1.8%

1 Based on the 82-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999)

3 Relative difference of the monthly average

TABLE 6: Monthly Trinity Lake Storage. Source: Table 4-1, Lower Klamath LTP DEIS.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Action (TAF)												
Extremely Wet	1,197	1,258	1,399	1,618	1,839	1,998	2,208	2,300	2,236	2,105	1,993	1,850
Wet	1,373	1,393	1,507	1,621	1,806	1,952	2,114	2,090	2,018	1,896	1,752	1,606
Normal	1,322	1,324	1,346	1,415	1,529	1,669	1,843	1,773	1,689	1,534	1,386	1,276
Dry	1,096	1,089	1,113	1,127	1,189	1,292	1,403	1,361	1,302	1,159	1,005	901
Critically Dry	1,051	1,016	1,014	988	1,012	1,068	1,087	1,048	985	836	676	598
Average All Years	1,233	1,242	1,306	1,385	1,511	1,637	1,779	1,755	1,686	1,548	1,403	1,283
Alternative 1 (TAF)												
Extremely Wet	1,170	1,236	1,377	1,597	1,821	1,981	2,191	2,285	2,221	2,090	1,979	1,839
Wet	1,362	1,382	1,497	1,613	1,798	1,946	2,107	2,083	2,011	1,890	1,743	1,595
Normal	1,319	1,321	1,343	1,415	1,528	1,669	1,842	1,772	1,689	1,536	1,387	1,266
Dry	1,092	1,085	1,109	1,123	1,184	1,288	1,399	1,357	1,298	1,148	992	881
Critically Dry	1,044	1,007	1,005	979	1,004	1,058	1,078	1,039	976	848	677	576
Average All Years	1,224	1,233	1,298	1,377	1,504	1,631	1,772	1,749	1,680	1,544	1,396	1,269
No Action compared to Alternative 1 (TAF)												
Extremely Wet	-27	-22	-22	-21	-17	-17	-17	-15	-15	-15	-15	-11
Wet	-11	-11	-10	-9	-8	-7	-7	-7	-6	-6	-8	-11
Normal	-3	-2	-3	0	0	0	0	0	0	3	1	-10
Dry	-4	-4	-4	-4	-4	-4	-4	-4	-4	-11	-13	-20
Critically Dry	-7	-9	-9	-9	-8	-9	-9	-9	-9	11	1	-22
Average All Years	-9	-9	-9	-8	-7	-6	-6	-6	-6	-5	-8	-14
No Action compared to Alternative 1 (%)												
Extremely Wet	-2%	-2%	-2%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
Wet	-1%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%	-1%
Normal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%
Dry	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-2%
Critically Dry	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	1%	0%	-4%
Average All Years	-1%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	-1%	-1%

Key:
TAF = thousand acre-feet

TABLE 7: Monthly flow on Trinity River below Lewiston Reservoir. Source: Table 4-3, Lower Klamath LTP DEIS.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Action (cfs)												
Extremely Wet	373	796	930	1,264	1,525	2,458	1,042	4,570	4,626	1,241	450	450
Wet	373	300	1,023	1,175	915	510	481	4,687	2,862	1,102	450	450
Normal	373	300	300	300	385	302	477	4,189	2,120	1,102	450	450
Dry	337	286	300	300	300	300	543	2,848	847	481	450	450
Critically Dry	368	267	300	300	300	300	600	1,498	783	450	450	400
Average All Years	363	359	605	696	668	654	584	3,753	2,210	890	450	445
Alternative 1 (cfs)												
Extremely Wet	373	719	930	1,248	1,455	2,458	1,042	4,570	4,626	1,241	460	477
Wet	373	300	1,024	1,151	910	505	481	4,687	2,862	1,102	503	533
Normal	373	300	300	300	358	302	477	4,189	2,120	1,102	508	632
Dry	337	286	300	300	300	300	543	2,848	847	481	574	725
Critically Dry	332	267	300	300	300	300	600	1,498	783	450	699	861
Average All Years	359	349	605	687	652	652	584	3,753	2,210	890	538	630
No Action compared to Alternative 1 (cfs)												
Extremely Wet	0	-77	0	-16	-69	0	0	0	0	0	10	27
Wet	0	0	1	-24	-5	-5	0	0	0	0	53	83
Normal	0	0	0	0	-27	0	0	0	0	0	58	182
Dry	0	0	0	0	0	0	0	0	0	0	124	275
Critically Dry	-37	0	0	0	0	0	0	0	0	0	249	461
Average All Years	-4	-10	0	-9	-16	-2	0	0	0	0	88	185
No Action compared to Alternative 1 (%)												
Extremely Wet	0%	-10%	0%	-1%	-5%	0%	0%	0%	0%	0%	2%	6%
Wet	0%	0%	0%	-2%	-1%	-1%	0%	0%	0%	0%	12%	18%
Normal	0%	0%	0%	0%	-7%	0%	0%	0%	0%	0%	13%	40%
Dry	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	28%	61%
Critically Dry	-10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	55%	115%
Average All Years	-1%	-3%	0%	-1%	-2%	0%	0%	0%	0%	0%	20%	42%

Key:
% = percent
cfs = cubic feet per second

TABLE 8: Monthly flow on Trinity River Diversion to Sacramento River at Lewiston Reservoir. Source: Table 4-3, Lower Klamath LTP DEIS.

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Action (cfs)												
Extremely Wet	827	233	235	410	7	329	278	498	407	1,836	1,526	2,079
Wet	945	541	376	482	97	322	591	0	290	1,190	1,952	2,065
Normal	792	355	193	418	243	396	228	0	472	1,553	1,991	1,471
Dry	712	418	166	385	134	153	229	247	1,011	1,973	2,098	1,358
Critically Dry	598	609	132	748	168	157	426	378	736	2,028	2,178	949
Average All Years	802	439	241	464	131	276	367	172	575	1,640	1,965	1,648
Alternative 1 (cfs)												
Extremely Wet	766	234	233	410	7	329	278	465	407	1,836	1,513	1,984
Wet	904	551	355	482	100	303	586	0	290	1,181	1,937	2,025
Normal	767	344	196	378	270	396	228	0	469	1,510	1,957	1,471
Dry	636	415	162	387	134	152	229	247	1,008	2,092	2,009	1,196
Critically Dry	521	642	132	753	143	177	426	373	736	1,701	2,092	880
Average All Years	748	443	234	457	134	272	366	167	573	1,623	1,920	1,573
No Action compared to Alternative 1 (cfs)												
Extremely Wet	-61	1	-2	0	0	0	0	-33	0	0	-13	-95
Wet	-42	10	-21	0	3	-20	-5	0	0	-9	-14	-41
Normal	-25	-10	4	-40	27	0	0	0	-3	-43	-34	0
Dry	-75	-3	-4	2	0	-1	0	0	-3	119	-89	-163
Critically Dry	-77	32	0	5	-25	20	0	-4	0	-327	-86	-69
Average All Years	-53	4	-7	-7	3	-4	-2	-5	-2	-16	-45	-74
No Action compared to Alternative 1 (%)												
Extremely Wet	-7%	0%	-1%	0%	0%	0%	0%	-7%	0%	0%	-1%	-5%
Wet	-4%	2%	-6%	0%	3%	-6%	-1%	0%	0%	-1%	-1%	-2%
Normal	-3%	-3%	2%	-10%	11%	0%	0%	0%	-1%	-3%	-2%	0%
Dry	-11%	-1%	-3%	1%	0%	0%	0%	0%	0%	6%	-4%	-12%
Critically Dry	-13%	5%	0%	1%	-15%	13%	0%	-1%	0%	-16%	-4%	-7%
Average All Years	-7%	1%	-3%	-1%	3%	-1%	0%	-3%	0%	-1%	-2%	-5%

Key:
% = percent
cfs = cubic feet per second

Greg Kamman, PG, CHG
Principal Hydrologist

EDUCATION	1989	M.S. Geology - Sedimentology and Hydrogeology Miami University, Oxford, OH
	1985	A.B. Geology Miami University, Oxford, OH
REGISTRATION	No. 360 No. 5737	Certified Hydrogeologist (CHG.), CA Professional Geologist (PG), CA
PROFESSIONAL HISTORY	1997 - Present	Principal Hydrologist/Vice President Kamman Hydrology & Engineering, Inc. San Rafael, CA
	1994 - 1997	Senior Hydrologist/Vice President Balance Hydrologics, Inc., Berkeley, CA
	1991 - 1994	Project Geologist/Hydrogeologist Geomatrix Consultants, Inc., San Francisco, CA
	1989 - 1991	Senior Staff Geologist/Hydrogeologist Environ International Corporation, Princeton, NJ
	1986 - 1989	Instructor and Research/Teaching Assistant Miami University, Oxford, OH

SKILLS AND EXPERIENCE

As a Principal Hydrologist with over 25 of technical and consulting experience in the fields of geology, hydrology, and hydrogeology, Mr. Kamman routinely manages projects in the areas of surface- and ground-water hydrology, stream and wetland habitat restoration, water supply, water quality assessments, water resources management, and geomorphology. Areas of expertise include: stream and wetland habitat restoration; characterizing and modeling basin-scale hydrologic and geologic processes; assessing hydraulic and geomorphic responses to land-use changes in watersheds and causes of stream channel instability; evaluating surface- and ground-water resources and their interaction; and designing and implementing field investigations characterizing surface and subsurface conditions; and stream and wetland habitat restoration feasibility assessments and design. In addition, Mr. Kamman commonly works on projects that revolve around sensitive fishery, wetland, wildlife and/or riparian habitat enhancement. Thus, Mr. Kamman is accustomed to working within a multi-disciplined team and maintains close collaborative relationships with biologists, engineers, planners, architects, lawyers, and resource and regulatory agency staff. Mr. Kamman is a prime or contributing author to over 80 technical publications and reports in the discipline of hydrology – the majority pertaining to ecological restoration. Mr. Kamman routinely teaches courses on stream and wetland restoration through U.C. Berkeley Extension and San Francisco State University's Romberg Tiburon Center.

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3.0 PUBLICATIONS AND PRESENTATIONS

Kamman, G.R. and Kamman, R.Z., 2015, Landscape Scale Urban Creek Restoration in Marin County, CA - Urban Creek Restoration: Interfacing with the Community. 33rd Annual Salmonid Restoration Conference, March 11-14, Santa Rosa, CA.

Kamman, G.R., R.Z., 2015, Enhancing Channel and Floodplain Connectivity: Improving Salmonid Winter Habitat on Lagunitas Creek, Marin County, CA - Beyond the Thin Blue Line: Floodplain Processes, Habitat, and Importance to Salmonids. 33rd Annual Salmonid Restoration Conference, March 11-14, Santa Rosa, CA.

Kamman, G.R., 2012, The role of physical sciences in restoring ecosystems. November 7, Marin Science Seminar, San Rafael, CA.

King, N. and Kamman, G.R., 2012, Preferred Alternative for the Chicken Ranch Beach/Third Valley Creek Restoration Project. State of the Bay Conference 2012, Building Local Collaboration & Stewardship of the Tomales Bay Watershed. October 26, Presented by: Tomales Bay Watershed Council, Inverness Yacht Club, Inverness, CA.

King, N. and Kamman, G.R., 2010, Chicken Ranch Beach Restoration Planning by TBWC. State of the Bay Conference 2010, A Conference about Tomales Bay ant its Watershed. October 23, Presented by: Tomales Bay Watershed Council, Inverness Yacht Club, Inverness, CA.

Higgins, S. and Kamman, G.R., 2009, Historical changes in Creek, Capay Valley, CA. Poster presented at American Geophysical Union Fall Meeting 2009, Presentation No. EP21B-0602, December.

Kamman, G.R. and Higgins, S., 2009, Use of water-salinity budget models to estimate groundwater fluxes and assess future ecological conditions in hydrologically altered coastal lagoons. Coastal and Estuarine Research Federation 20th Biennial Conference, 1-5 November, Portland, OR

Bowen, M., Kamman, G.R., Kaye, R. and Keegan, T., 2007, Gualala River Estuary assessment and enhancement plan. Estuarine Research Federation, California Estuarine Research Society (CAERS) 2007 Annual Meeting, 18-20 March, Bodega Marine Lab (UC Davis), Bodega Bay, CA

Bowen, M. and Kamman, G.R., M., 2007, Salt River Estuary enhancement: enhancing the Eel River Estuary by restoring habitat and hydraulic connectivity to the Salt River. Salmonid Restoration Federation's 25th Salmonid Restoration Conference, 7-10 March, Santa Rosa, CA.

Magier, S., Baily, H., Kamman, G., and Pfeifer, D, 2005, Evaluation of ecological and hydrological conditions in the Santa Clara River Estuary with respect to discharge of treated effluent. In: Abstracts with Programs, The Society of Environmental Toxicology and Chemistry North America 26th Annual Meeting, 13-17 November, Baltimore Convention Center, Baltimore, Maryland.

Baily, H., Magier, S., Kamman, G., and Pfeifer, D, 2005, Evaluation of impacts and benefits associated with discharge of treated effluent to the Santa Clara River Estuary. In: Abstracts with Programs, The Society of Environmental Toxicology and Chemistry North America 26th Annual Meeting, 13-17 November, Baltimore Convention Center, Baltimore, Maryland.

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Cordilleran Section Meeting, Vol.37, No. 4, p. 104, Fairmont Hotel, April 29-May1, 2005, San Jose, CA.

Kamman, G.R., 2001. Modeling and its Role in the Klamath Basin – Lewiston Reservoir Modeling. Klamath Basin Fish & Water Management Symposium, Humboldt State University, Arcata, CA, May 22-25.

Kamman, G.R., 1998, Surface and ground water hydrology of the Salmon Creek watershed, Sonoma County, CA. Salmon Creek Watershed Day, May 30, Occidental, CA.

Kamman, G.R., 1998. The Use of Temperature Models in the Evaluation and Refinement of Proposed Trinity River Restoration Act Flow Alternatives. ASCE Wetlands Engineering and River Restoration Conference Proceedings, Denver, Colorado (March 22-23, 1998).

Hecht, B., and Kamman, G.R., 1997, Historical Changes in Seasonal Flows of the Klamath River Affecting Anadromous Fish Habitat. In: Abstracts with Programs Klamath Basin Restoration and Management Conference, March 1997, Yreka, California.

Hanson, K.L, Coppersmith, K.J., Angell, M., Crampton, T.A., Wood, T.F., Kamman, G., Badwan, F., Peregoy, W., and McVicar,T., 1995, Evaluation of the capability of inferred faults in the vicinity of Building 371, Rocky Flats Environmental Technology Site, Colorado, in Proceedings of the 5th DOE Phenomena Hazards Mitigation Conference, p. 185-194, 1995.

Kamman, G.R. and Mertz, K.A., 1989, Clay Diagenesis of the Monterey Formation: Point Arena and Salinas Basins, California. *In:* Abstracts with Programs, The Geological Society of America, 85th Annual Cordilleran Section Meeting, Spokane Convention Center, May 1989, Spokane, Washington, pp.99-100.

4.0 ENGINEERING DESIGNS AND SPECIFICATIONS

Kamman G.R., Kamman R.Z., Hayes, C., Lapine, S.L. and Fiori Geoscience, 2017, Lagunitas Creek Salmonid Winter Habitat Enhancement Plans, Marin County, CA., Project Sites 1-9: – Issued for Bid. Prepared for: Marin Municipal Water District, April 17, 25 sheets.

Kamman G.R., Kamman R.Z., Hayes, C., 2017, Mana Plain Wetland Restoration Plan, Mana, Kauai, Hawaii. Prepared for: State of Hawaii, Board of Land and Natural Resources, April 15, 18 sheets.

Kamman G.R., Kamman R.Z., and Hayes, C., 2017, Home Ranch Pond #2 and #9 Design, Point Reyes National Seashore. Prepared for: Jacobs Engineering, February 3, 5 sheets.

Kamman G.R. and Kamman R.Z., 2015, Plans for Construction of Conlon Avenue Parking Lot – 90% Design. Prepared for: Golden Gate National Recreation Area, Muir Woods National Monument, December 3, 10 sheets.

Kamman G.R. and Kamman R.Z., 2015, Plans for Construction of Conlon Avenue Parking Lot – 90% Design. Prepared for: Golden Gate National Recreation Area, Muir Woods National Monument, December 3, 10 sheets.

Kamman G.R. and Kamman R.Z., 2014, Plans for construction of Lower Miller Creek Channel Maintenance Project – 30% Design. Prepared for: Las Gallinas Valley Sanitary District, November, 11 sheets.

Kamman G.R., Lapine, S.L., and Hayes, C., 2014, Rheem Creek Wetland Restoration Design. Prepared for: Olberding Environmental, Inc., October 22, 1 sheet.

Kamman G.R., Kamman R.Z. and Lapine, S.L., 2014, East Arm Mountain Lake Wetland Restoration Plan, The Presidio of San Francisco, CA. Prepared for: The Presidio Trust, June 30, 11 sheets.

Kamman, G.R., 2014, John West Fork Fish Passage Repair Project. Prepared for: Point Reyes National Seashore, June, 6p.

Kamman G.R., Kamman R.Z., Lapine, S.L. and Oberkamper Associates Civil Engineers, Inc., 2014, YMCA Reach of Tennessee Hollow Creek Wetland Restoration Construction Documents, The Presidio of San Francisco, CA. Prepared for: The Presidio Trust, April, 15 sheets.

Kamman G.R., Kamman R.Z., and Oberkamper Associates Civil Engineers, Inc., 2014, Technical Specifications for YMCA Reach of Tennessee Hollow Creek Wetland Restoration, The Presidio of San Francisco, CA. Prepared for: The Presidio Trust, April, 133p.

Kamman G.R., and Kamman R.Z., 2014, Technical Specifications for East Arm Mountain Lake Wetland Restoration, The Presidio of San Francisco, CA. Prepared for: The Presidio Trust, March, 127p.

Kamman G.R., Kamman R.Z., Lapine, S.L., Oberkamper Associates Civil Engineers, Inc., and Roth LaMotte Landscape Architecture, 2014, MacArthur Meadow Wetland Restoration Plan, The Presidio of San Francisco, CA – 30% Design. Prepared for: The Presidio Trust, March 10, 12 sheets.

Kamman G.R., 2013, Suisun Creek Preserved Mitigation Wetland, Solano County, CA. Prepared for: Las Gallinas Valley Sanitary District, November, 11 sheets.

Kamman G.R., Kamman R.Z. and Lapine, S.L., 2013, Cayatano Creek Preserve Mitigation Wetland, Livermore Area, Alameda and Contra Costa Counties, CA – 50% Design. Prepared for: Grizzly Bay LLC., July 16, 2 sheets.

Miller Pacific Engineering Group and Kamman, G.R., 2013, Landslide stabilization retaining wall and rip-rap cascade, Green Gulch Zen Center, Muir Beach, CA. Prepared for: Green Gulch Zen Center, July, 8 sheets.

Kamman G.R., Kamman R.Z. and Lapine, S.L., 2013, Kellogg Creek and Deer Valley East Restoration Project, Contra Costa County, CA. Prepared for: Contra Costa Water District, June, 15 sheets.

Kamman G.R. and Kamman R.Z., 2013, Technical Specifications for Kellogg Creek and Deer Valley East Restoration Project, Contra Costa County, CA. Prepared for: Contra Costa Water District, June, 91p.

Kamman, G.R., 2012, John West Fork Repair Project, Point Reyes National Seashore, CA. Prepared for: National Park Service, December, 5 sheets.

Kamman G.R. and Lapine, S.L., 2012, Home Ranch Pond #9 Design, Point Reyes National Seashore, CA. Prepared for: Point Reyes National Seashore., October 24, 3 sheets.

Kamman G.R. and Lapine, S.L., 2012, G Ranch Wetland Swale near Abbott's Lagoon, Point Reyes National Seashore, CA. Prepared for: Point Reyes National Seashore., October 3, 3 sheets.

Kamman G.R. and Lapine, S.L., 2012, Eagle Ridge Preserve Property Wetland Design, Livermore Area, Contra Costa and Alameda Counties, CA. Prepared for: Olberding Environmental, Inc., August 31, 2 sheets.

Kamman G.R., 2012, Bear Valley Trail Upper Culvert Replacement and Bank Repair, Point Reyes National Seashore, CA. Prepared for: Point Reyes National Seashore, April, 8 sheets.

Kamman R.Z., Kamman G.R., and Lapine, S., 2012, Salt River Ecosystem Restoration Project, Riverside Ranch Tidal Marsh Restoration Plans, Phase 1 Construction. Prepared for Humboldt County RCD, April, 24 sheets.

Kamman R.Z., Kamman G.R., and Lapine, S., 2012, Technical Specifications for the Salt River Ecosystem Restoration Project, Phase 1 Construction, Riverside Ranch and Salt River Restoration Plans. Prepared for Humboldt County RCD, February, 163p.

Kamman, G.R., Kamman, R.Z., Higgins, S. and Lapine, S., 2010, Las Gallinas Valley Sanitary District (LGVSD) - Miller Creek Sanitary Sewer Easement Restoration (100% construction drawings), San Rafael, California. Prepared for LGVSD, September 1, 8 sheets.

Kamman, G.R., Kamman, R.Z., Higgins, S. and Lapine, S., 2010, Technical Specifications for Las Gallinas Valley Sanitary District (LGVSD) - Miller Creek Sanitary Sewer Easement Restoration, San Rafael, California. Prepared for LGVSD, September 1, 70p.

Kamman, G.R., Kamman, R.Z. and Lapine, S., 2010. Point Reyes National Seashore, Restore Critical Dune Habitat to Protect Threatened and Endangered Species, 100% construction drawings. Prepared for: Point Reyes National Seashore Association and National Park Service, June 1, 13 sheets.

Kamman, G.R. and Lapine, S., 2010. Former Reservoir Fill Site, Restoration at Muir Beach, Golden Gate National Recreation Area (100% Construction drawings). Prepared for Golden Gate National Parks Conservancy, May 12, 2 sheets.

Kamman, G.R. and Lapine, S., 2010. Alluvial Fan Fill Site, Restoration at Muir Beach, Golden Gate National Recreation Area (100% Construction drawings). Prepared for Golden Gate National Parks Conservancy, May 12, 2 sheets.

Kamman, G.R., Kamman, R.Z. and Lapine, S., 2010. Technical Specifications, Point Reyes National Seashore, Restore Critical Dune Habitat to Protect Threatened and Endangered Species, 100% plan set. Prepared for: Point Reyes National Seashore Association and National Park Service, June 1, 132p.

Kamman G.K. and Lapine, S., 2010, Dragonfly Creek Restoration Design, in: State of California, Department of Transportation, Project plans for construction on adjacent to State Highway in the City and County of San Francisco 0.3 mile south of Route 1/101 separation, March 25, 30 sheets.

Kamman G.R. and Lapine, S.L., 2009, Project Plans for Construction on Eastern Tributary of Tennessee Hollow Creek, The Presidio of San Francisco, CA. Prepared for: The Presidio Trust, on behalf of State of California, Department of Transportation., September 23,10 sheets.

Kamman, R.Z., Kamman G.K., and Beahan, C., 2008, 100% Design Drawings, Plans for construction of Vineyard Creek Channel Enhancement Project, from end of Arbor Circle to McClay Road, Project No. 2008-006. Prepared for Marin County Department of Public Works, Flood Control and Water Conservation District Zone 1 and City of Novato, CA, June, 28 sheets.

Kamman G.K., Kamman, R.Z., and Beahan, C., 2008, Contract documents including: notice to contractors, proposals, special provisions and contract documents for Vineyard Creek Channel Enhancement Project, from end of Arbor Circle to McClay Road, Novato California. Prepared for Marin County Department of Public Works, Flood Control and Water Conservation District Zone 1, June, 144p.

Kamman G.K. and Kamman, R.Z., 2008, Giacomini Wetland Restoration Project, Phase 2 (2008) Construction Drawings. Prepared for Golden Gate National Recreation Area and Point Reyes National Seashore, May, 33 sheets.

Kamman G.K., Kamman, R.Z., and Beahan, C., 2007, Giacomini Wetland Restoration Project, Phase I (2007) Construction Drawings. Prepared for Golden Gate National Recreation Area and Point Reyes National Seashore, August, 23 sheets.

Kamman G.K., Kamman, R.Z., and Beahan, C., 2007, Technical Specifications for Giacomini Wetland Restoration Project, Phase I (2007) Construction. Prepared for Golden Gate National Recreation Area and Point Reyes National Seashore, with contributions from Winzler & Kelly, August, 185p.

Kamman G.K. and Kamman, R.Z., 2008, Technical Specifications for Giacomini Wetland Restoration Project, Phase 2 (2008) Construction. Prepared for Golden Gate National Recreation Area and Point Reyes National Seashore, May, 243p.

Kamman, G.R., Kamman R.Z., and Beahan, C., 2007, 100% Specifications, Lower Redwood Creek floodplain and salmonid habitat restoration at the Banducci site, Golden Gate National Recreation

Area, Marin County, CA. Prepared for Golden Gate Parks Conservancy and National Park Service, June 8, 46p.

Kamman, R.Z., Kamman G.K., and Beahan, C., 2007, 100% Design Drawings, Lower Redwood Creek Restoration, The Banducci Site, Golden Gate National Recreation Area, Marin County, CA. Prepared for Golden Gate Parks Conservancy and National Park Service, February 28, 7 sheets.

Kamman G.K. and Kamman, R.Z., 2006, Feasibility Study and Construction Drawings for Freshwater Marsh and High Water Wildlife Refugia on the West Pasture of the Giacomini Dairy. Prepared for Golden Gate National Recreation Area and Point Reyes National Seashore, September.

Kamman, G.R., 2002, Haypress Pond Restoration Grading Plan, Tennessee Valley, Sausalito, CA. Prepared for Golden Gate National Recreation Area, National Park Service, January 10, 15p.

5.0 ACADEMIC APPOINTMENTS

San Francisco State University, 2012 through 2014, Wetland hydrology. SFSU College of Extended Learning, Romberg Tiburon Center, CA, 2-day course, 1.6 CEU.

San Francisco State University, 2011, Introduction to wetland hydrology. Basic Wetland Delineation Training, SFSU College of Extended Learning, Romberg Tiburon Center, CA, March 28-April 1.

University of California, Berkeley Extension, 2001 through 2008, Hydrologic and geomorphic processes in stream restoration. Civil and Environmental Engineering, Certificate Program in California Water Management and Ecosystem Restoration, Berkeley, CA, 2-day course, 1.0 CEU.

San Francisco State University, 2007, Introduction to tidal wetland hydrology. SFSU College of Extended Learning, Romberg Tiburon Center, CA, May 11-12, 1.6 CEU.

City of San Jose, 2005, Hydrologic and geomorphic processes in stream restoration. City of San Jose's Environmental Services Department, Watershed Protection Division, San Jose, CA, January 26.

Miami University Geology Field Station, Dubois, WY, 1989, Instructor, Summer Session, May-July.

Miami University, Oxford, Ohio, 1985-89, Instructor and Research/Teaching Assistant (MS candidate).