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NCRWQCB
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February 11, 2016

Matthias St. John
Executive Officer
North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Attention: Ms. Alydda Mangelsdorf
Mr. James Burke

RE: CAL FIRE Comment to NCRWQCB on the "Upper Elk River: Technical Analysis for Sediment" and the "Draft Action Plan for the Upper Elk River Sediment TMDL"

Dear Mr. St. John:

Thank you for the opportunity to comment on the "Upper Elk River: Technical Analysis for Sediment" (Tetra Tech Report) and the "Draft Action Plan for the Upper Elk River Sediment TMDL" (Basin Plan Amendment). The Tetra Tech Report provides technical support for draft "Order No. R1-2016-004, Waste Discharge Requirements for Nonpoint Source Discharges and Other Controllable Water Quality Factors Related to Timber Harvesting and Associated Activities Conducted by Humboldt Redwood Company, LLC, in the Upper Elk River Watershed" (Draft WDR) and the "Draft Action Plan for the Upper Elk River Sediment TMDL" (Basin Plan Amendment). As such, we primarily focused on the technical adequacy of the Tetra Tech Report to ensure that sound science informs regulatory decision-making.

The California Department of Forestry and Fire Protection (CAL FIRE) hopes you find the following comments constructive and helpful. We have organized our remarks into both general and specific comments, which are provided below.

<u>General Comments:</u>

The Need to Identify and Evaluate Alternative Hypotheses in Conceptual Model

CAL FIRE applauds the willingness of the North Coast Regional Water Quality Control Board (North Coast Water Board) to implement an adaptive management framework for addressing water quality impairments in the Upper Elk River watershed. Key steps in adaptive management are to identify and evaluate competing hypotheses about the resource(s) of concern (Williams, 2011). According to Williams (2011), this involves:

- Identification of competing hypotheses to explain observed pattern or process;
- The use of models imbedding these hypotheses to predict responses to management interventions;
- Monitoring of indicators of actual responses; and
- Comparison of actual vs. predicted responses to produce improved understanding.

The Tetra Tech Report presents a conceptual model in Chapter 6 (6.1.3), which includes a number of assumptions regarding cause-and-effect and system response. Rather than rely solely on assumptions in the conceptual model, we recommend that the North Coast Water Board outline areas of uncertainty within the conceptual model where competing hypotheses regarding cause-and-effect and system response can be identified and tested.

Assumption of Dynamic Equilibrium

The goal condition for the Elk River watershed is dynamic equilibrium, and this goal condition also informs numeric instream targets in the Basin Plan Amendment. Chapter 6 of the Tetra Tech Report describes dynamic equilibrium as a state where "inflow and outflow are balanced … and the system remains unchanged" (pg. 40). The Tetra Tech Report goes on to say, "The Elk River is aggrading (Chapter 6.2.4); therefore it is not in dynamic equilibrium." These statements denote a particularly rigid definition of dynamic equilibrium, as Knighton (1998) describes <u>equilibrium</u> as, "not a static state but form displays relatively stable characteristics to which it will return after disturbance."

What the Tetra Tech Report does not mention is that there are alternative hypotheses to dynamic equilibrium in the literature. Besides equilibrium, Knighton (1998) describes additional types of relationships between system inputs and outputs including:

- <u>Non-equilibrium</u> – there is no net tendency toward equilibrium and therefore no possibility of identifying an average or characteristic; and
- <u>Disequilibrium</u> - adjustment is towards equilibrium but, because response times are relatively long, there has not been sufficient time to reach such as state.

Renwick (1992) described non-equilibrium (i.e., metastable equilibrium) landforms as displaying relatively long periods of environmental stability punctuated by sudden or substantial changes in form or mass flux. These rapid changes occur when high magnitude thresholds are exceeded; a condition common in tightly coupled slope-channel systems subject to infrequent landsliding triggered by large storms and/or earthquakes (Renwick, 1992). Management can increase the likelihood that these thresholds are exceeded (Montgomery, 1994; Montgomery et al., 2000) and may even trigger new equilibrium states (Bunn and Montgomery, 2004), but there can still be a natural tendency towards non-equilibrium for some systems. As noted in the Tetra Tech Report, the environmental context of the Elk River watershed is one of high tectonic activity and episodic sediment delivery even in the absence of management. This indicates that the Elk River watershed has a strong likelihood of expressing non-equilibrium behavior.

Consideration of alternative hypotheses of system behavior in the Elk River watershed is crucial, as a different hypothesis might inform the likelihood of achieving a target condition. For example, the Tetra Tech Report and Basin Plan Amendment contain target conditions for bankfull channel capacity in the impacted reach that were derived from historic USGS gage data from 1956 to 1965 (NCRWQCB, 2013; Patenaude, 2004). A system in dynamic equilibrium can achieve this target condition once the land use signal decays significantly (Figure 1a). However, if this system is in non-equilibrium, the system may not reach the target condition, even if the land use signal is reduced to zero (Figure 1b).

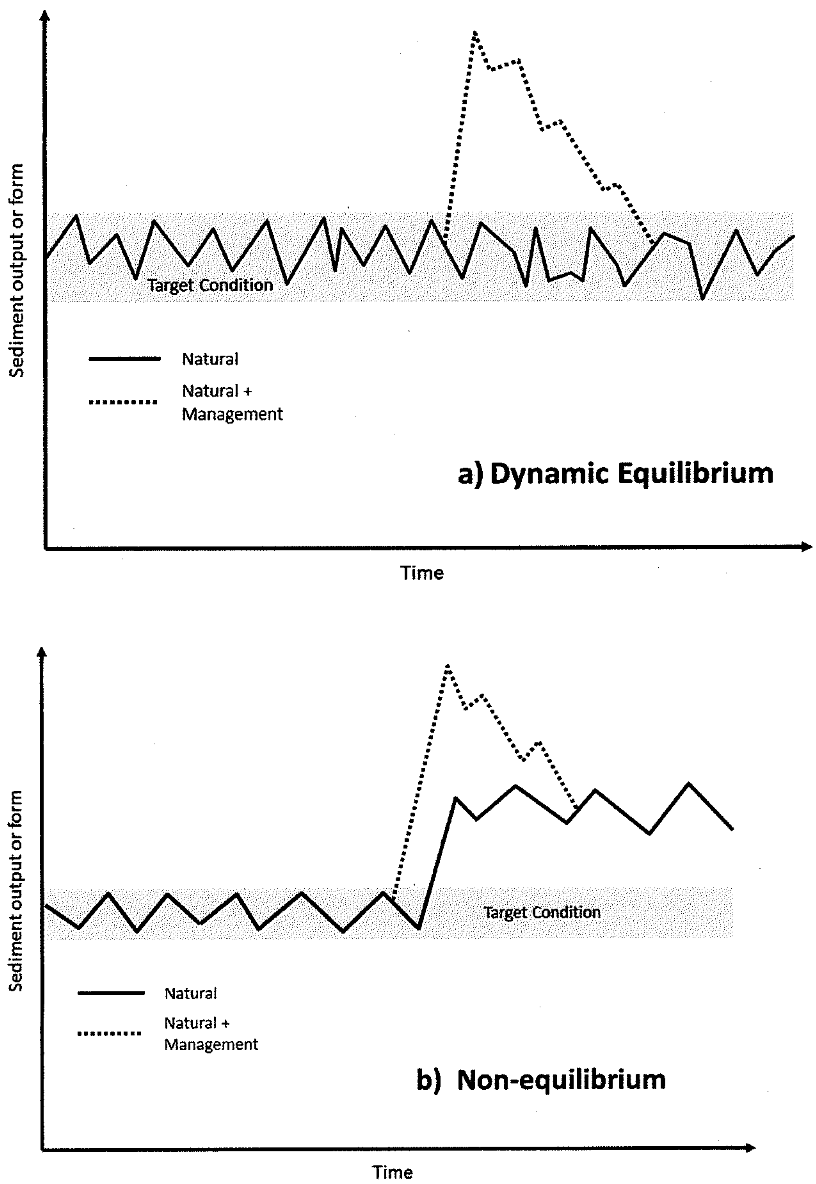

Figure 1. Hypothetical sediment output or form over time for a geomorphic system in a) dynamic equilibrium and b) non-equilibrium. The shaded area represents the target condition. If subject to management-induced perturbation, the system in dynamic equilibrium can still achieve the target condition once the management signal is significantly reduced. However, a non-equilibrium system cannot reach the target condition, even if the management signal is reduced to zero.

Likewise, assumptions regarding system behavior have implications for restoration planning and implementation. Restoration actions may be ill conceived if they are based on unsuitable expectations of geomorphic form and process (Wohl and Merritts, 2007), and expectations of equilibrium conditions are almost never met in the Mediterranean montane rivers of California (Kondolf et al., 2007; Kondolf et al., 2013). Given the fact that evidence suggests that equilibrium conditions may not be the norm in Lower Elk River, it might be necessary to modify current strategies (Chapter 8) to reflect a more feasible target condition.

Linkage of New Sediment Load Reduction Measures to Downstream Recovery

There is a high level of uncertainty regarding the effectiveness of the proposed sediment load reduction measures in achieving desired downstream target conditions. For example, our letter dated January 26, 2016 addressing draft Order R1-2016-0004 indicates that in the absence of mass wasting, 90 percent of wood recruitment occurs within approximately 100 feet of the watercourse. It is uncertain how much additional sediment savings can be provided by doubling the width of the WLPZ from 150 to 300 feet, whether this sediment savings can be tracked through monitoring, and what the response time is for this action to achieve the desired result in the downstream reach. To address these uncertainties, we propose that potential measures or actions be assessed for factors such as their likely benefit, cost, probability of success, and potential impact to both downstream and headwater landowners (Beechie et al., 2008). Projects such as the multi-year BACI study in the Railroad Gulch subwatershed should be encouraged to determine if the assumptions behind load reduction measures are correct.

Uncertainty Regarding Legacy Impacts in the Elk River Watershed

The Tetra Tech report mentions the log pond on the South Fork at Falk (pg. 33), but does not state that the millpond, built around 1884, was not removed with the aid of explosives until 1952 (PALCO 2005) – a duration of almost 70 years. It is unclear how much sediment moved downstream from this site, but historical photos indicate that there were at least two structures (Figure 2), and the height of the structures were approximately 20 feet or taller (Figures 3 and 4). Whether the volume of material stored behind these structures significantly affected downstream aggradation in the impacted reach of the South Fork and main stem of Elk River remains uncertain. However, mobilization of millpond sediments has been documented as a major source of sediment in the eastern United States (Wohl and Merritts, 2007; Schenk and Hupp, 2009; Wegmann et al., 2012). The South Fork Elk River has the highest suspended sediment loads in the Humboldt Bay region (Lewis, 2014; Figure 5), and is recognized as a significant outlier for chronic turbidity as well (Klein et al., 2012). It should be noted that the drainage area above the abandoned town of Falk is approximately 15 square miles, and the duration in which these structures influenced sediment storage was almost 70 years. Simple assumptions regarding unit area sediment yield and sediment trapping efficiency can be made to determine if stored sediment above the dams were a significant source of instream sediment and an unaccounted sediment source in the analysis. As such, this type of information could help to inform a more refined hypothesis for sediment dynamics in the Elk River watershed.

Figure 2. Looking downstream at the town of Falk in the South Fork of the Elk River circa 1900. The picture indicates at least two dam structures (from the Humboldt Room Photographs Collections).

Figure 3. A dam in the town of Falk circa 1894 (from the Humboldt Room Photograph Collections).

Figure 4. Looking upstream at the town of Falk circa 1890 (from the Humboldt Room Photograph Collections).

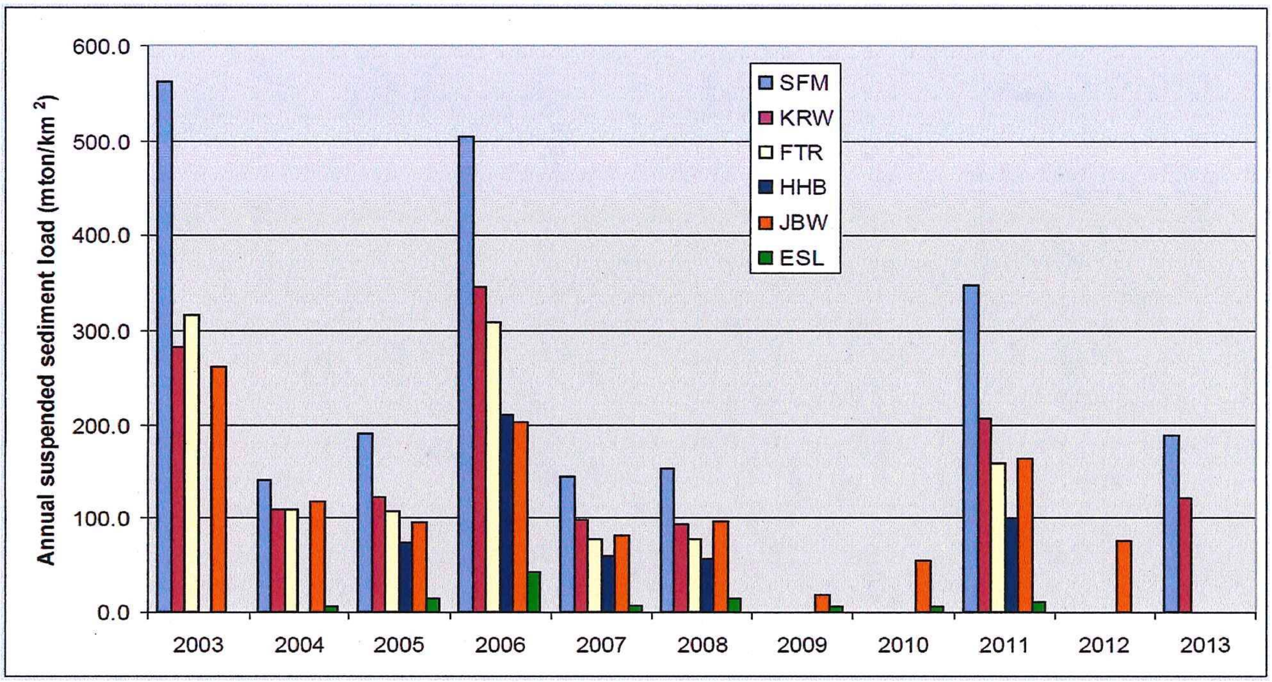

Figure 5. Annual suspended sediment load for gaging stations in the Elk River and Freshwater Creek watersheds. SFM is the gaging station in the South Fork Elk River (from Lewis, 2014).

Specific Comments:

Pg 28, Table 5 - Summary of hillslope water quality indicators. Some of the listed indicators appear to be inappropriate. Having a numeric target of 100% of road segments hydrologically disconnected from watercourses is unrealistic and unachievable, if it is assumed that this means total disconnection. Even with our best efforts, in many cases 10% or slightly more of road network will remain connected. Weaver et al. (2014) state that the goal should be to have less than 10 percent hydrologic connectivity along roads. As stated in the California Forest Practice Rules, Technical Rule Addendum No. 5, *"Not all road segments are hydrologically connected and complete hydrologic disconnection is not possible for most roads. For example, insloped road segments with an inside ditch will generally include a segment that is connected between the watercourse and first road drainage facility or structure located up-grade from the watercourse crossing (Refer to Figure 2). The likelihood of connectivity generally decreases rapidly as the distance between the road and the watercourse increases. Low delivery potential roads also include road segments on flat terrain that do not intersect watercourse channels. For all existing road segments where hydrologic connection may be present, 14 CCR § 923.1(e) [943.1(e), 963.1(e)] requires that an evaluation be conducted to identify which segments need to be disconnected and how the disconnection will occur."* If there will still be a significant sediment discharge even with this level of disconnection work, additional treatment, such as rocking road approaches, will be necessary. If there is a low likelihood of a significant sediment discharge, no further work should be necessary. These concepts should be incorporated into Table 5.

Pg 47 - Increased Turbidity. The report describes turbidity levels in three sub-basins of Upper Elk River, and that turbidity values from the two managed sub-basins were much greater than 20 percent higher than measurements in the reference sub-basin, indicating exceedance of the turbidity WQO. CAL FIRE's letter to the NCRWQCB dated April 4, 2014 addressing the "Peer Review Draft Staff Report to Support the Technical Sediment Total Maximum Daily Load for Upper Elk River" showed how using the Upper Little South Fork Elk River sub-basin for reference conditions for sediment (and hence turbidity) yields was biased due to differing hydrogeomorphic processes operating in this headwater catchment. No acknowledgment of this issue was included in the Tetra Tech report.

Pg 62 - Using annual water yields to relate to annual sediment loading for the Little River watershed is incomplete. An additional analysis, which would complement the data presented in the report, would be to use annual instantaneous peak discharge data for the Little River watershed versus annual sediment yield. Keppeler (2012) reported that regression analysis revealed a strong correlation between annual suspended sediment load and peak flows. For the Little River watershed, the plot of instantaneous annual peak discharges is (Figure 6):

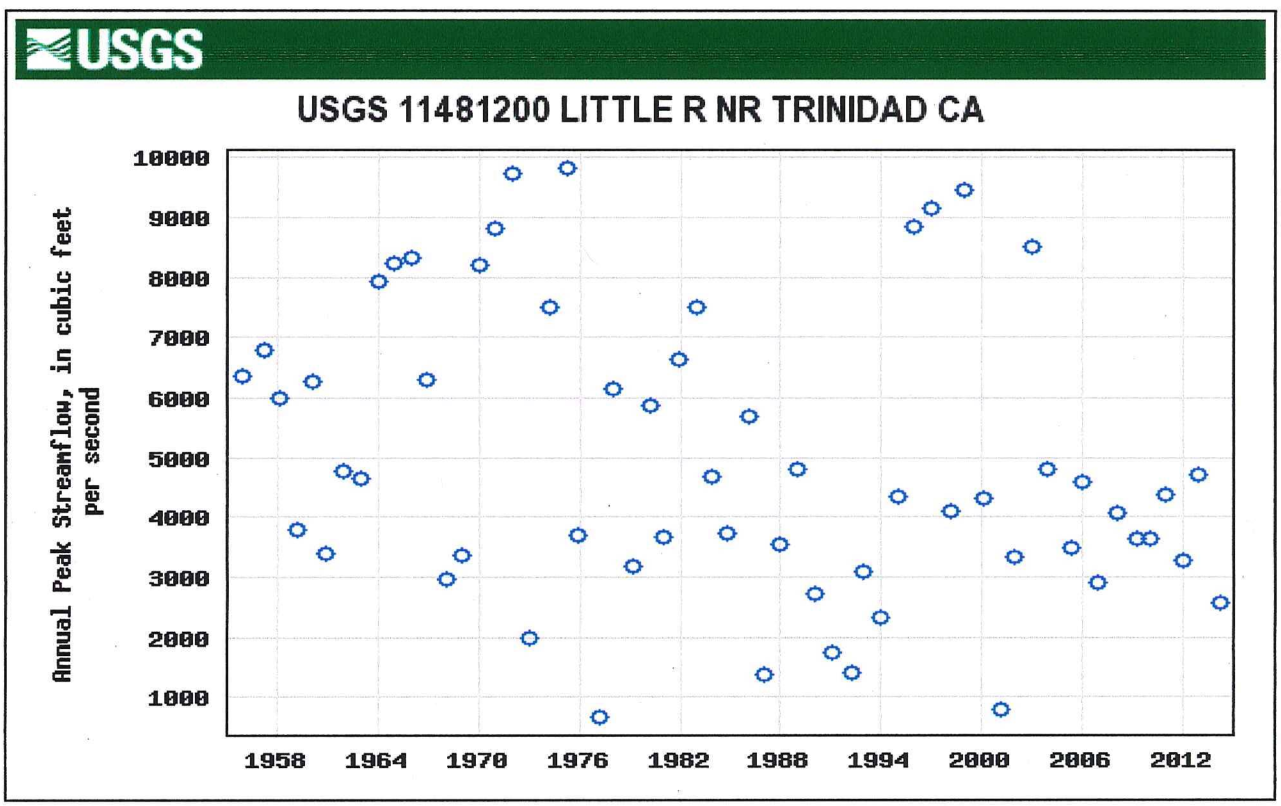

Figure 6. Annual peak stream flow (cfs) for the Little River watershed.

The peak flows that occurred on December 14, 1995, and January 1, 1997, were 14-15 year recurrence interval events, and correspond well with the high sediment yield shown in Figure 15 for the 1988-1997 time period. Conversely, the high peak discharges in the mid-1970's do not correspond to high sediment yields in the 1967-1974 period.

Recommendations

1. Consider alternative hypotheses to dynamic equilibrium for the impacted reach.

2. Explicitly address the uncertainty with achieving downstream objectives for each hillslope-related sediment load reduction measure.

3. Determine if significant sediment was stored in the South Fork Elk River near the abandoned town of Falk, and if this sediment needs to be factored in the sediment source analysis.

4. Modify the numeric target for hydrologic disconnection in the Basin Plan Amendment to reflect more achievable outcomes.

Thank you again for the opportunity to comment on the Tetra Tech Report and Basin Plan Amendment. If you have any questions or comments regarding this letter, please do not hesitate to contact Drew Coe at 530-224-3274 or drew.coe@fire.ca.gov, or Pete Cafferata 916-653-9455 or pete.cafferata@fire.ca.gov.

Sincerely,

Ken Pimlott

KEN PIMLOTT
Director

cc: Helge Eng
Dennis Hall

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