DEPARTMENT OF FORESTRY AND FIRE PROTECTION
P.O. Box 944246
SACRAMENTO, CA 94244-2460
(916) 653-7772
Website: www.fire.ca.gov

June 18, 2014

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

Subject: Comments on a Revised Strategy for the Total Maximum Daily Load (TMDL) for the Upper Elk River

Dear Mr. St. John:

The California Department of Forestry and Fire Protection (CAL FIRE) appreciates the opportunity to provide further input to the North Coast Regional Water Quality Control Board (North Coast Water Board) on their revised TMDL strategy discussed by staff at the June 4, 2014 meeting on the Elk River watershed held in Santa Rosa. Here we provide a brief assessment of the revised strategy, which sets targets for a 75% suspended sediment reduction and has the objective to promote scour in sediment-impacted reaches in Elk River. The strategy is informed by a modeling study that predicted net scour for the reach of interest (i.e., Middle Elk River) with a 75% reduction in suspended sediment concentrations/loading relative to those measured in 2003. The following comments address the uncertainties with this approach, and provide suggestions for improving the technical rationale and overall implementation of the proposed strategy.

Feasibility of Achieving the Suspended Sediment Target

The new strategy calls for a 75% reduction in suspended sediment loading from 2003 levels in order to initiate scour in the impacted middle reach of Elk River. The sediment load for 2003 was approximately 1370 t mi^{-2} yr^{-1}, and a 75% percent reduction would result in a load of approximately 350 t mi^{-2} yr^{-1}. While the targeted rate of loading implied through a 75% reduction is more realistic than the initial proposed load allocation of 114 t mi^{-2} yr^{-1}, it is still a much lower rate than that found in the regional literature addressed in our previous comments, dated April 8, 2014. Additionally, data from Stallman (2003) indicate long-term denudation rates of approximately 650 to 850 t mi^{-2} yr^{-1} from the Ryan Creek subbasin in nearby Freshwater Creek[1].

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[1] Stallman estimated long-term denudation by reconstruction of a paleotopographic surface in Ryan Creek. Differences in elevation between the reconstructed surface and present day elevations were converted to an eroded rock volume across the watershed area.

The assumption that a 75% reduction in sediment loading is achievable is rooted in the sediment source analysis in the Peer Review Draft (Table 1). When using a time weighted average over the analysis period, this table indicates that management is responsible for 90% of the total sediment load. Hence, a 75% reduction is theoretically possible (Figure 1). However, as mentioned in our previous comments, the sediment source analysis has fundamental errors in its assumptions that underestimate sources of natural erosion and overestimate sources of management-related erosion. For example, the sediment source analysis assumes that management increased the magnitude of streamside landsliding by a factor of seven over the analysis period, despite the fact that inner gorge landsliding is a well-noted naturally occurring geomorphic process in the northern part of the Coast Ranges province, and is strongly tied to tectonic, lithologic, and climatic conditions (i.e., storm events) (Kelsey, 1988). Also, data from regional studies suggest that the Peer Review Draft's estimates of watershed averaged loading rates from deep-seated landsliding are underestimated by two to three orders of magnitude.

If a more appropriate partitioning between natural and management sources is done, the achievability of a 75% sediment load reduction is called into question. Humboldt Redwood Company's (2014) revised Watershed Analysis suggests a more realistic partitioning by assuming that management contributes 30-40 percent of the combined load due to streamside landsliding and bank erosion (Table 2). The adjustment in streamside landsliding/bank erosion rates, along with increasing the natural loading rate due to deep-seated landsliding from 4 to 400 t mi^{-2} yr^{-1} (i.e., a two-orders of magnitude increase), brings the natural loading rates to a time-weighted average of 677 t mi^{-2} yr^{-1} (see yellow highlighted numbers in Table 2). This is within the range of calculated denudation rates estimated by Stallman (2003), and much less than the rates discussed in our previous comments. Due to this modification, the ratio of managed to natural sediment sources drops to the point where only a 50% reduction is theoretically possible (Figure 2).

Table 1. Summary of the Upper Elk River mass loading (t mi^{-2} yr^{-1}) by sediment source category for analysis time periods (adapted from Table 4.32 of the Peer Review Draft).

Source Category	1955-1966	1967-1974	1975-1987	1988-1997	1998-2000	2001-2003	2004-2011
Low Order Channel Scour	94	33	19	30	45	17	20
Bank Erosion	60	65	68	73	75	76	79
Streamside Landslides	318	222	42	371	412	412	303
Open Slope Shallow Landslides	265	115	8	281	165	71	7
Road-related Landslides	139	40	21	429	4	28	35
Management discharge sites	42	84	112	91	55	55	55
Skid trails	5	17	15	17	36	21	21
Treatment of Management Discharge Sites	0	0	0	0	18	5	33
Road Surface Erosion	72	109	122	191	76	79	24
Harvest Surface Erosion	3	8	2	7	8	6	5
Total Management Load	**998**	**693**	**409**	**1490**	**894**	**770**	**582**
Bank Erosion	12	12	12	12	12	12	12
Small Streambank Landslide	37	37	37	37	37	37	37
Shallow Hillslope Landslide	42	42	42	42	42	42	42
Deep seated Landslides	4	4	4	4	4	4	4
Total Natural Loading	95	95	95	95	95	95	95
Total Loading	**1093**	**788**	**504**	**1585**	**989**	**865**	**677**
Management to Natural Ratio	**10.5**	**7.3**	**4.3**	**15.7**	**9.4**	**8.1**	**6.1**

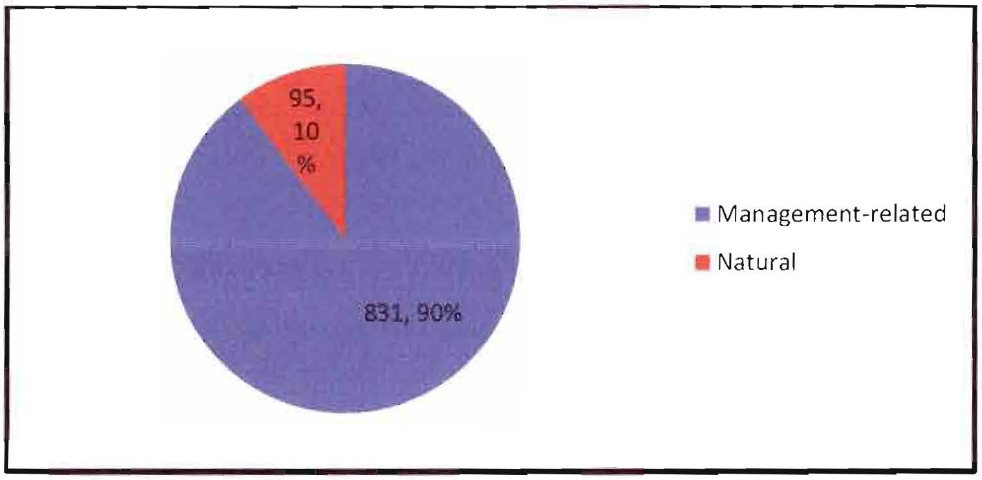

Figure 1. Relative contribution of management versus natural sediment sources to total sediment load time-weighted over the analysis period. Calculated from data in Table 1. Data labels include the estimated load in t mi^{-2} $yr^{-1}$and the load percentage, respectively.

Table 2. Modified numbers from the Upper Elk River sediment source analysis. Modifications based on the following assumptions: 1). Total streambank landsliding and bank erosion is partitioned between management and natural sources as per Humboldt Redwood Company's (2014) revised watershed analysis (i.e., 30-40% attributed to management depending upon pre- and post- HCP implementation); and 2) Natural rates of deep-seated landsliding are increased by two orders of magnitude.

Source Category	1955-1966	1967-1974	1975-1987	1988-1997	1998-2000	2001-2003	2004-2011
Low Order Channel Scour	94	33	19	30	45	17	20
Bank Erosion and Streamside Landslides	171	134	64	197	214	161	129
Open Slope Shallow Landslides	265	115	8	281	165	71	7
Road-related Landslides	139	40	21	429	4	28	35
Management discharge sites	42	84	112	91	55	55	55
Skid trails	5	17	15	17	36	21	21
Treatment of Management Discharge Sites	0	0	0	0	18	5	33
Road Surface Erosion	72	109	122	191	76	79	24
Harvest Surface Erosion	3	8	2	7	8	6	5
Total Management Load	**791**	**540**	**363**	**1243**	**621**	**443**	**329**
Bank Erosion and Streamside Landslide	256	202	95	296	322	376	302
Shallow Hillslope Landslide	42	42	42	42	42	42	42
Deep seated Landslides	400	400	400	400	400	400	400
Total Natural Loading	698	644	537	738	764	818	744
Total Loading	**1489**	**1184**	**900**	**1981**	**1385**	**1261**	**1073**
Management to Natural Ratio	**1.1**	**0.8**	**0.7**	**1.7**	**0.8**	**0.5**	**0.4**

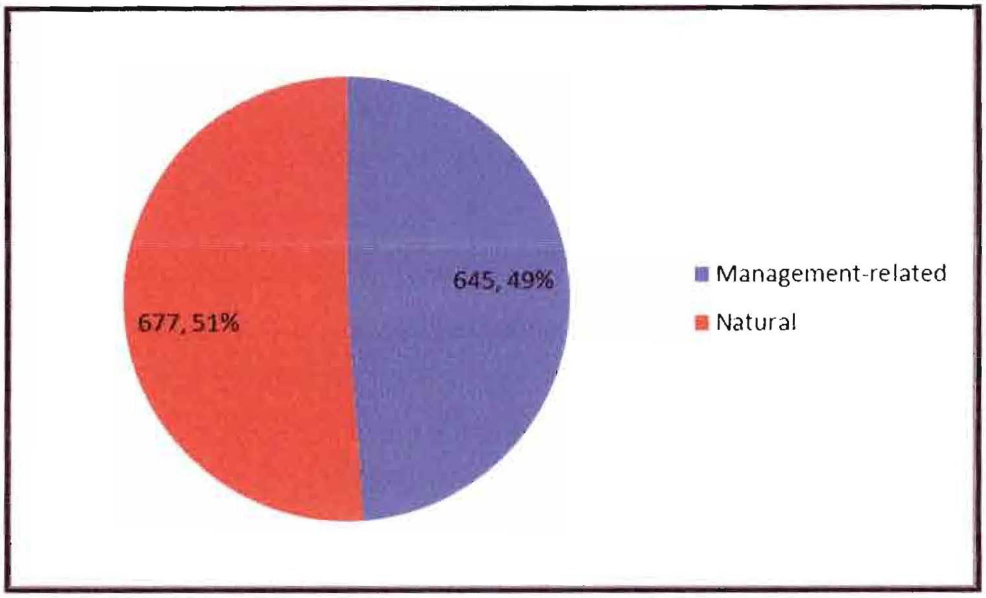

Figure 2. Relative contribution of management versus natural sediment sources to total sediment load time-weighted over the analysis period. Calculated from modified data in Table 2. Data labels include the estimated load in t mi^{-2} $yr^{-1}$and the load percentage, respectively.

Regardless of the level of sediment reduction expected with the new strategy, CAL FIRE believes that it is important to acknowledge how much of the reduction is to be accomplished through active or passive means. Active measures include activities such as additional sediment site stabilization, in-channel treatments (e.g., grade control), and additional harvest curtailment. Passive measures include allowing natural recovery with existing best management practices (BMPs) in place. The feasibility of achieving the target within a specified timeframe will depend upon the percentage of the reduction to be achieved through each type of approach (i.e., active vs. passive), as the timescale of implementation, erosional cost, and the lag in downstream response for each approach varies significantly. There is also uncertainty associated with each management approach. For example, watercourse crossing and road upgrades presumably have a higher certainty of reducing sediment then relatively small, incremental changes in harvest rates. With these factors in mind, it is important to provide a relative accounting for how the sediment reduction target will be achieved and the uncertainty associated with each type of reduction activity. This will help determine if the revised strategy is a feasible option.

Validating Targets through Model Simulation

The revised strategy offers an advantage over the turbidity objective approach due to its linkage to downstream nuisance flooding. The linkage is made by modeling sedimentation using the hydrodynamic and sediment transport (HST) model, which couples flow and sediment transport. The model was calibrated using local flow, suspended sediment, and morphometric data, and then used to predict water surface elevations, velocity, suspended sediment concentrations, bed elevation, and grain size under current conditions and under a "sediment reduction" scenario. The model run assuming a 75% reduction in suspended sediment loading predicted net scour in sediment impacted reaches.

The HST model does an adequate job predicting water surface elevations and flow velocity, but does a poorer job predicting sedimentation at smaller spatial scales (i.e., DEM grid scale). In many cases the model over or underpredicts by more than a factor of two or three, and also predicts in the wrong direction (i.e., scour versus deposition and vice versa) (Figure 3). The modeling report (Appendix 3D) states the following regarding this issue:

The extreme (0.5 to 1.0 meter) high and low spikes in the bed profile may be an artifact of the model grid resolution at the meander bend cross-over cells. Grid resolution or reconfiguration in these areas should be investigated in future Elk River modeling phases.

While reach-averaged predictions show better agreement with observed data, it is cause for concern that the model does not more accurately predict the general pattern of sedimentation at smaller spatial scales. Localized nuisance flooding is strongly controlled by sub-reach conditions, and the predictions made by the model (i.e., net scour with a 75% sediment load reduction) may not manifest itself in reduced nuisance flooding. Additional work needs to be done to determine if the noted model errors (i.e., high and low spikes associated with meanders) are driving the reach-averaged predictions. As mentioned in the previous section, CAL FIRE believes that a 75% reduction is infeasible given the hydrogeomorphic conditions operating in the watershed. Therefore a more realistic sediment load reduction should be modeled to determine if the desired outcome is achieved.

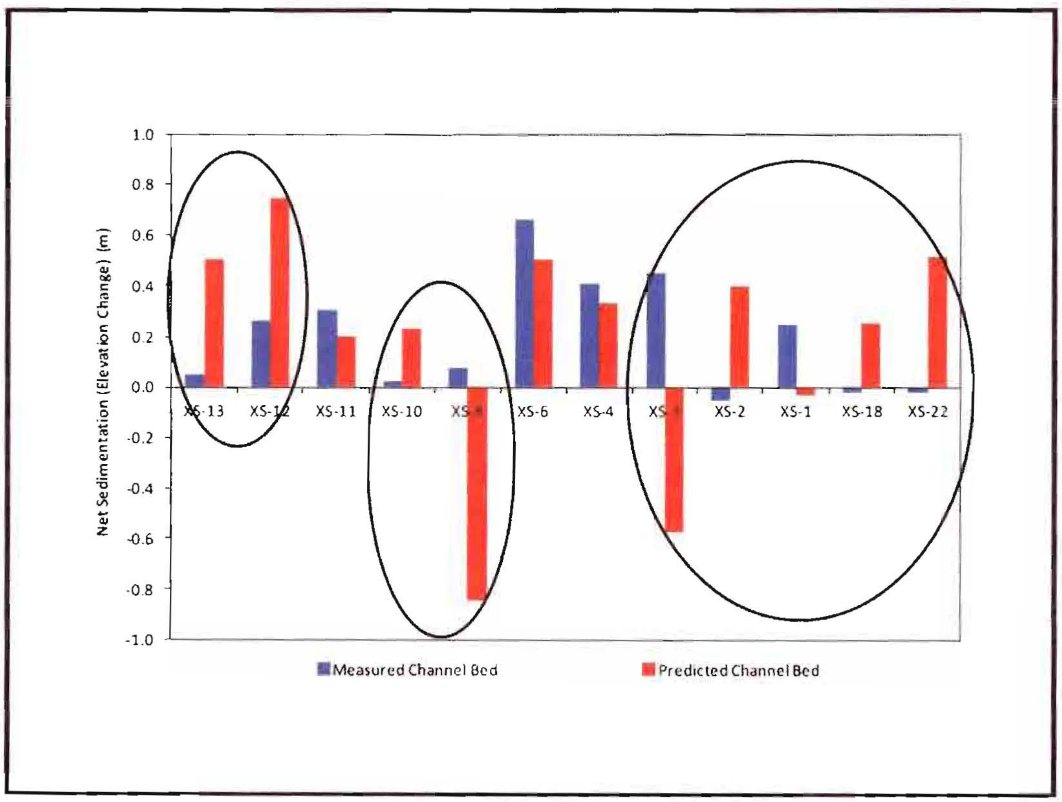

Figure 3. Measured and predicted channel bed cumulative sedimentation at cross-section and associated grid cell locations within the Elk River pilot project reach (taken from Figure 5-1 in Appendix 3-D of the Peer Review Staff Report). Circles represent predictions that are off by more than a factor of 2, or predict in the wrong direction (i.e., scour versus deposition and vice versa).

Recommendations

1. Revisit the sediment source analysis before committing to a 75% sediment load reduction. If this is unavoidable, treat the 75% reduction as a "soft" versus "hard" target to be adjusted iteratively through adaptive management.

2. Regardless of the sediment reduction target chosen, assess the feasibility of achieving the target through various approaches (i.e., active and/or passive), along with the uncertainty for each approach.

3. Explore uncertainties with the HST model before validating the sediment reduction target.

4. If necessary, model a more realistic sediment load reduction target with the HST model to determine if desired outcomes are achieved.

Thank you for the opportunity to provide input on the revised Elk River watershed TMDL strategy. As we stressed at the June 4th meeting in Santa Rosa, CAL FIRE staff is willing to assist NCRWQCB staff with the recommendations suggested in this letter. We look forward to our continued cooperative efforts with NCRWQCB staff on water quality protection and monitoring in the North Coast Region. If you have any questions or comments regarding this letter, please contact Drew Coe of my staff at (530) 224-3274, or drew.coe@fire.ca.gov.

Sincerely,

Duane Shintaku
Deputy Director
Resource Management

References Cited:

Humboldt Redwood Company. 2014. Revised Elk River watershed analysis. Scotia, CA.
Kelsey, H.M. 1988. Formation of inner gorges. Catena. 15: 433-458.
Stallman, J.D. 2003. Strath terrace genesis in the North Fork Elk River valley. M.S. thesis, Humboldt State University, Arcata, CA.