Appendix D: Comment Letter from Dr. Greg Ruggerone

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Subject: Comments on the *Peer Review Draft Staff Report to Support the Technical Sediment Total Maximum Daily Load for the Upper Elk River, March 4, 2013.*

The North Coast Regional Water Quality Control Board proposed a sediment TMDL as a means to restore beneficial uses related to water quality in the Upper Elk River. I was contracted to provide a peer review of the draft Staff Report that was developed in support of the TMDL. My review focuses on fish related issues. I have addressed each of the 14 assertions, findings, and conclusion identified by the North Coast Regional Water Quality Control Board in its request for peer review.

Nature of the Water Quality Problem

1. Anthropogenic sediment loading has resulted in habitat changes, impacts to beneficial uses, and increase in nuisance flooding.

Chapter 3 of the Staff Report provides a variety of information showing that sediment loading has caused habitat changes in the river, impacts to beneficial uses, and increased nuisance flooding. Much of the information is anecdotal, but together these observations consistently show substantial impacts in the watershed caused by sediment loading. For example, residents report that stream pools used for domestic water extraction have been filled with sediment, and that turbidity levels now take substantially longer to decline following a storm. Overbank flooding reportedly occurs more frequently now in response to the documented reduction in the channel capacity and cross-sectional area of the river. Photographs show significant sediment deposition in some areas (e.g., burial of apple tree trunk) and encroachment of vegetation into the stream channel. Minimum volumes of deposited sediments were estimated for storage reaches.

The report documents the presence of salmonids, including coho, Chinook, steelhead, and cutthroat trout in the Elk River. No systematic monitoring of fishes has been conducted in the watershed, but Appendix 3B does contain information from periodic sampling of adult and juvenile salmon to show that salmonids are present.

Salmonid habitat quality was examined in the Staff Report in relation to sedimentation and water quality, and these data show degraded salmon habitat. Percent fines <0.85 mm is an indicator of salmon egg-to-fry survival. Survival declines rapidly, on average, when percent fines (<0.85 mm) increases above 10% (see review by Jensen et al. 2009). Most of the sampled stations had fine sediment much higher than 10%. There was no consistent increasing or decreasing trend over time among all stations from the late 1990s to 2009, indicating no improvement in spawning habitat quality over time following the period of high sedimentation in the 1980s. The report should clarify whether the samples were taken in areas of potential spawning habitat. Additional sediment size indicators were presented indicating poor habitat quality for spawning salmonids, and for insect production (salmonid prey).

Moderately deep pools provide key rearing habitat for salmonids. For example, Sharma and Hilborn (2001) reported that coho density increased with the density of pools and decreased with greater density of roads. Anecdotal information provided in the report indicated depth of pools declined after more intense logging and flooding events in the 1980s and 1990s. Monitoring of pools since 2000 indicates a gradual deepening of pools, although most are still less than 3 ft deep. In addition to providing rearing for juvenile salmonids, pools also provide holding areas for adult salmonids as they return to spawn.

The Severity of Ill Effects analysis (SEV) provides evidence that high levels of turbidity in the river often cause sublethal or more detrimental effects. A key component of this analysis is that SEV and turbidity values were provided for the reference stream, Little South Fork Elk, where logging-related impacts have been much less over time. This comparison provides important evidence that the sediment and turbidity impacts in the Upper Elk River are related to logging activities. Unfortunately, spawning habitat quality and pool quality data were apparently not collected and reported for the reference stream, Little South Fork Elk. A comparison between the impacted watershed (e.g., North Fork Elk River) and a reference stream having relatively little logging-related (Little South Fork Elk) is a powerful tool for quantifying logging-related effects in addition to describing the anticipated adverse effects such as severe sedimentation.

Desired Numeric and Narrative Target Conditions

2. The instream desired target conditions represent desired conditions supportive of beneficial uses including fisheries uses and domestic and agricultural water supplies.

Chapter 5 describes the desired sediment loading capacity for the watershed and Chapter 4 describes the estimates of sediment loading from natural versus management-related events (largely logging-related activities), and Chapter 6 describes numeric targets. Natural loading from all sediment sources loading is estimated to be 68 $yd^3/mi^2/yr$, whereas the long-term management-related loading was estimated to be 976 $yd^3/mi^2/yr$. The desired sediment loading level is 120% of the natural loading, or 82 $yd^3/mi^2/yr$. Thus, a 97-98% reduction in contemporary management-related sediment is necessary to meet the TMDL. The desired date for achieving the reduction is 2033.

Nine instream habitat indicators and desired target conditions for sediment were shown in Table 6.2. The indicators provide indices of stream conditions relevant to the sediment issue that support salmonids. A number of the indicators simply identify an improving trend in the condition. While an improving trend in number of pools, for example, should be beneficial for salmonids, it may take a number of years before an improving trend can be determined.

The target metric for % fines <0.85 may be somewhat high (<14% fines), based on the recent review by Jensen et al. (2009), although there is considerable variability in the fines relationship with salmonid egg to fry survival. For example, Jensen et al. reported that salmon egg-to-fry survival increased from ~38% at 14% fines (<0.85 mm) to ~56% at 10% fines. Improvements in percentage fines should be a key metric for evaluating changes in habitat quality for salmonids in the Elk River. The reported protocols identify sampling of both active salmonid redds and non-active spawning areas. Percentage fines is expected to be less in active salmonid redds versus non-active spawning areas because fines are displaced when salmonids prepare redds.

The presence of large woody debris (LWD) is highly important for creating more complex habitats, such as pools, that are utilized by salmon. Key habitats include pools and pool tailouts where spawning may occur. The LWD metric is important to monitor. Increasing LWD may be a slow process without specific actions, therefore the program might consider using a few local trees to cost-effectively create LWD that can be fixed in specific locations as a means to scour sediment and create pool habitat (Roni et al. 2002, 2008). A number of indicators are suggested for pool habitats, which are known to support higher densities of salmonids such as juvenile coho salmon (Sharma and Hilborn 2001). Pools will also provide holding areas for adults as they migrate upstream to spawn.

Many of the instream indicators are based on trend analysis over time. Ideally, baseline conditions should already be established for these metrics. It would be worthwhile to measure these indicators in multiple streams that have been impacted plus in a reference stream such as Little South Fork Elk River where logging-related impacts have been less. The reference stream might provide a benchmark for documenting improvements.

Indicators in addition to those in Table 6.2 would be useful to document habitat changes associated with sedimentation. For example, the Program should consider the Benthic Index of Biological Integrity (B-IBI). This index has been used in a variety of watershed as a measure of water quality and salmon habitat quality. The approach has been adopted for streams in Northern California (Rehn et al. 2005).

An increasing trend in the quality of the riparian area is identified as a desired target. Riparian buffer widths were discussed in the Staff Report but there was no mention of a riparian buffer requirement in managed areas. As discussed in the report, a riparian buffer of ~40 m or more would be beneficial (Beechie et al. 2003) and should be considered as a means to reduce sediment loading.

In order to achieve the desired turbidity reduction in streams, the Program calls for a maximum average harvest rate of 1.5% in Class I subbasins. This metric is based on a statistical relationship involving many watersheds, but Fig. 6.4 shows that turbidity levels in the Elk River watershed are higher at a specific harvest rate than other watersheds. Therefore, implementation of the 1.5% harvest rate in the Elk River watershed will have a less desirable effect on turbidity than implied by the model that uses data from all watersheds. In other words, a lower harvest rate may be needed to achieve the desired turbidity level in the Elk River watershed. Apparently the harvest rate cap (1.5%) only applies to Class I subbasins, and not to smaller Class II and III subbasins that are located upstream of Class I subbasins. Harvest rates should be defined for the smaller subbasins since sediment will eventually flow down to the larger Class I subbasins.

The numeric target calling for zero human-caused migration barriers for salmonids by 2018 (e.g., culverts) is an important worthwhile target. Implementation of this desired condition will be key.

3. Historical measurements by USGS from 1954-1965 on the upper mainstem Elk River provide an appropriate basis for the desired target conditions to prevent nuisance in upper mainstem, lower North Fork and lower South Fork Elk River.

The staff report provides evidence that cross-sectional area changes did not occur in 1958, 1959, and 1965 even though there was a major highwater event in 1964. Cross sectional area was greatly reduced when remeasured in 2003 (Table 3.2), leading to a ~35% decrease in the channel capacity. Some logging occurred during and prior to the 1954-1965 period of channel measurements, therefore the target conditions based on the 1954-1965 time period may not reflect channel capacity of a pristine watershed.

4. The hillslope desired target conditions represent conditions in which sediment sources are likely to be controlled by addressing controllable water quality factors.

No comment

5. The watershed desired target conditions support watershed and stream processes and functions for beneficial use protection.

Please see comments regarding instream targets under Conclusion 2 above. Watershed target conditions generally provide for improved conditions for salmonids if fully implemented. However, many of the targets call for an improving trend in the condition rather than a specific metric. As noted in the Staff Report, the outcome of the effort to control sedimentation can be uncertain, therefore monitoring is needed to make sure the Program is on track. Decision points for guiding an adaptive management process should be developed to better ensure that changes can be made if needed and that the desired beneficial conditions will be met.

The TMDL process only addresses sediment related issues. The status of salmonids in the watershed might improve to the extent that sediment related impacts in the Upper Elk River have been highly influential. However, other factors may also constrain salmonid production, such as conditions in the lower Elk River, the estuary, or ocean. For these reasons, improvements in the status of salmonids ultimately requires a landscape or watershed-wide approach that addresses all factors that may be affecting salmonid population viability (e.g., Roni et al. 2002, Beechie et al. 2003).

Sediment Source Analysis.

6. The sediment source analysis reasonably quantifies the timing and magnitude of natural and management-related sediment source categories.

No comment.

7. Little South Fork Elk River provides a reasonable reference watershed for Upper Elk River.

The Little South Fork Elk River is within the Headwaters Forest Reserve and it is described as a watershed having much less timber-related impacts. Comparisons of stream conditions in the Upper Elk River with those in a much less impacted reference stream, such as the Little South Fork Elk River, is highly desirable. To facilitate this comparison, additional information on the soil types and slope gradients could have been provided to show that the Little South Fork Elk River is representative of the Upper Elk River in terms of its natural sediment loading rate. The Little South Fork Elk River is a relatively small watershed, therefore the Staff Report did not use it as a reference stream for the shallow hill slope analysis. This seemed reasonable. As noted above, other analyses could have benefited from comparison with data collected in the Little South Fork Elk River, but apparently no data were available (e.g., spawning habitat quality and pool quality).

The text on page 4-10 (2nd paragraph) did not match information in Table 4.2.

Sediment TMDL, Load Allocations and Margin of Safety

8. 120% of natural sediment loading is a reasonable estimate of the sediment loading capacity for Upper Elk River and is likely to be supportive of beneficial uses of water.

The target of 120% of natural sediment loading represents a significant decline in the loading of sediment in the Upper Elk River. If achieved, this significant reduction in sedimentation should translate to improvements in habitat conditions for salmonids. However, as noted above, habitat improvements may require actions such as placement of LWD to help create pools. A passive off-hands approach, which seems to be the preference, will likely take longer time to improve habitat for salmonids.

9. The load allocation strategy appropriately represents 1) that a portion of the loading capacity is currently taken up by the instream sediment deposits in the middle reach of Elk River and 2) that a change in the volume of instream deposits resulting from recovery of the middle reach may result in a greater portion of loading capacity available for management-related sediment loads.

No comment.

10. The margin of safety will ensure beneficial uses are protected and it reasonably accounts for uncertainty in the estimates of the sediment source analysis, the loading capacity, and seasonal variation.

The Staff Report states, "The Upper Elk TMDL incorporates a margin of safety (MOS) through use of conservative assumptions…….Attainment of the numeric objective for turbidity provides the basis for the loading capacity established for the Upper Elk TMDL. The linkage analysis finds that on average and over a range of rainfall years, 124% of natural sediment loading would result in attainment of the turbidity objective."

In order to achieve the desired turbidity reduction in streams, the Program calls for a maximum average harvest rate of 1.5% in Class I subbasins. This metric is based on a statistical relationship involving many watersheds, but Fig. 6.4 shows that turbidity levels in the Elk River watershed are higher at a specific timber harvest rate than other watersheds used in the model. Therefore, implementation of the 1.5% harvest rate in the Elk River watershed will have a less desirable effect on turbidity than implied by the model that uses data from all watersheds. In other words, a lower harvest rate may be needed to achieve the desired turbidity level in the Elk River watershed. Apparently the harvest rate cap (1.5%) only applies to Class I subbasins, and not to smaller Class II and III subbasins that are located upstream of Class I subbasins. Harvest rates should be defined for the smaller subbasins since sediment will eventually flow down to the larger Class I subbasins.

As noted in the report, there is uncertainty in the outcome from the proposed measures. Will a 1.5% harvest rate be sufficient to substantially reduce the sediment loading rate? Monitoring is necessary to ensure progress towards the intended goals.

Slope Stability Modeling and Resulting Landslide Hazard Maps

11. The 4-meter Digital Elevation Model (DEM) generated from the bare-earth Light Detection and Ranging (LiDAR) points using kriging is a reasonable technique to model hillslope stability in the project area to maximize representative elevations and definition of actual geomorphic features while reducing topographic artifacts and computation time required for model application and other spatial analyses.

No comment

12. SHALSTAB and PISA represent reasonable models for predicting potential shallow landslide hazards, in common usage with proven performance in forest mountainous terrain.

No comment

13. The model testing resulted in determination of appropriate thresholds for breaks in potential instability classes that balance the goals of maximizing correct landslide prediction and minimizing over prediction of unstable area.

No comment

Identification of Additional Beneficial Uses of Water for the Elk River Watershed

14.The Wetland Habitat (WET), Flood Peak Attenuation/Flood Water Storage (FLD), and Water Quality Enhancement (WQE) beneficial uses exist in Elk River.

Wetland habitats provide important functions for salmonids and for stream conditions, as described in Appendix 1B. Appendix 1B provides information and specific locations of wetlands in the Elk River watershed. Wetlands are identified in the lower Elk River e.g., http://107.20.228.18/Wetlands/WetlandsMapper.html. It is reasonable to include WET, FLD, and WQE as beneficial uses in the Elk River.

"Big Picture" questions

(a) **In reading the technical reports and proposed implementation language, are there any additional scientific issues that should be part of the scientific portion of the proposed rule that are not described above? If so, comment with respect to the *TMDL Summary and Implementation Framework* and *Beneficial Use Amendment* given above.**

The Staff Report provides a detailed description of how they derived the TMDL, and it is reasonable to assume that achievement of the TMDL would lead to improvements in beneficial uses of the Upper Elk River. Numeric targets in support of the TMDL were described, but a detailed description of the monitoring component has not been developed. Monitoring is essential to ensure that the numeric targets are on track, and to inform decisions under an adaptive management framework. A decision tree should be developed to provide new direction when targets are not being achieved within the desired timeframe. For example, the implementation actions state that "If milestones for load reductions from instream deposits are not achieved, management-related discharges shall not be permitted." What does this mean given that sedimentation is dependent activities that occurred over many previous years and it cannot be simply stopped?

Details of the implementation plan are needed. It was not clear to what extent active restoration would occur versus passive restoration following changes in harvest management. The TMDL calls for a tremendous reduction in management-related sedimentation, but it was not clear how specific actions would achieve this target by the desired date, especially since the primary landowners have been implementing sediment control measures since 1997. What are the costs to implement the plan and are monetary resources available to implement the plan?

The Staff Report focuses on impact related to sedimentation in the Upper Elk River. Clearly, sedimentation has had a significant effect on beneficial uses such as salmon. However, to better achieve salmon restoration in the Elk River, it would be worthwhile to implement a landscape or watershed-wide approach that evaluates and repairs factors identified to be impacting the status of salmonids throughout the entire Elk River watershed, including the estuary. Factors important to salmonids in the Elk River may include issues beyond sedimentation.

Hydrology is a key factor influencing sediment loading and sediment transport through the watershed, yet relatively little information was provided on the Elk River hydrograph. For example, how might extended periods of low versus high water years affect implementation of the TMDL? Are flows sufficient to scour sediments, especially given that vegetation has encroached into the channel?

(b) Taken as a whole, is the scientific portion of the proposed actions based upon sound scientific knowledge, methods, and practices?

As described above, the proposed actions are based on reasonably sound science. However, additional actions may be needed to speed progress. For example, riparian buffers could be implemented and LWD could be strategically placed in the stream channel to scour the channel and to create pool habitat. A key uncertainty is the extent to which the Program will lead to desired conditions within the specified time frame. Monitoring and adaptive management with specific decision point triggers would help ensure that the Program is successfully implemented.

References

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