From: Arnold, Jane@Wildlife
Sent: Friday, October 09, 2015 12:36 PM
To: St.John, Matt@Waterboards
Subject: RE: Request for review of instream sediment indicators in Elk River TMDL staff report

Hi Matt,

Thanks for letting me review this. I only read Page 26 and my comments are based only on that page. Some of the comments may be addressed elsewhere in the document.

I believe the statement instream indicators is correct, but not well supported in the table on Page 27. That is the table lacks information concerning which targets are for which life stage. The table appears loosely based on the NMFS PFC matrix, which has similar targets but by life stage in Appendix A and in other portions (see attached). I would suggest adding the salmonid life stage being protect to the numeric target. I would also suggest either a numeric target or more description of the narrative target for inhibiting salmon feeding in turbid waters. Newcombe and Jensen may be a source for this information. Turbidity can cause a full range of reactions in salmon, from coughing, to increased time to find food, to sublethal (abraded gills and reduced growth), and finally to lethal effects. I am unsure why only one effect is chosen to have a target. The reason why only one effect of turbidity has a target may need to be explained.

I hope this is of some use and if you have any questions, please feel free to contact me.

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Upper Elk River:
Technical Analysis for Sediment

Prepared by:

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Prepared for:

Environmental Protection Agency,
Region 9

North Coast Regional Water Quality
Control Board

October 5, 2015

Chapter 4 – Desired Watershed Conditions

This chapter includes a description of the WQS applicable to the Elk River watershed (Regional Water Board 2011a). By defining instream and hillslope WQIs, it also describes the desired watershed conditions that represent a functioning hydrologic and ecologic system. Collectively, these are presented as numeric targets and are appropriate for inclusion in the TMDL and WDR(s). The narrative water quality objectives (WQOs) for sediment are interpreted by deriving numeric instream WQIs and target conditions from the scientific literature and other agencies. Attainment of the instream targets is further interpreted by deriving numeric hillslope WQIs and target conditions (also obtained from scientific literature and documentation from other agencies). The goal condition described by the narrative WQOs, numeric instream targets, and numeric hillslope targets is a dynamic equilibrium (Chapter 6.1.1) in which WQS are attained, including supporting conditions for beneficial uses and abatement of flooding risks in the impacted reach[7] (Figure 9).

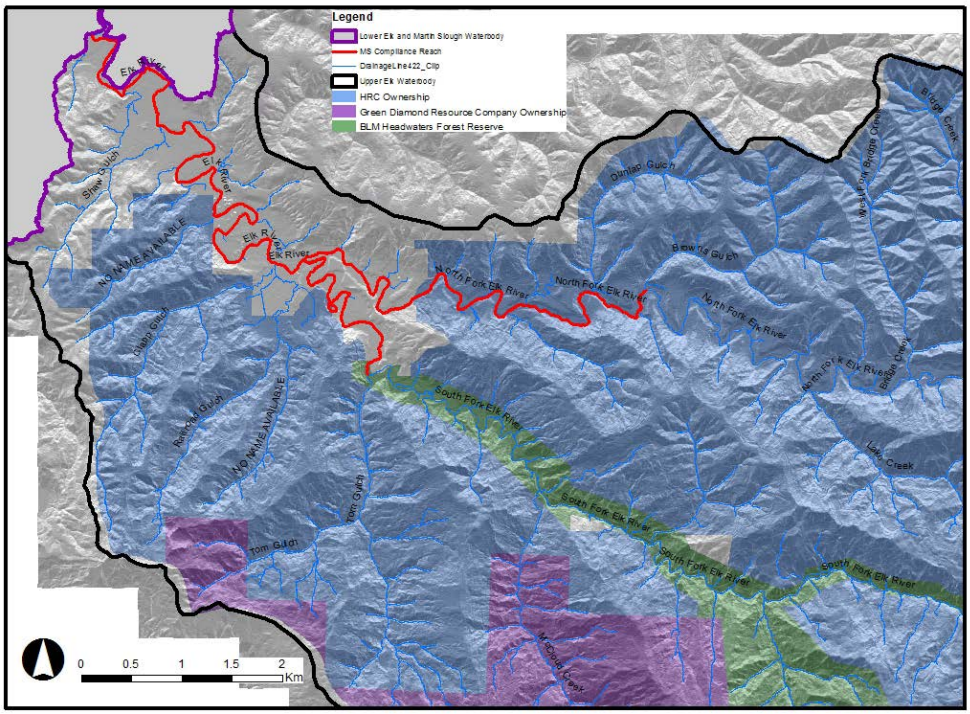

Figure 9. Upper Elk River watershed impacted reach

[7] The impacted reach extends from the confluence of Browns Gulch on North Fork Elk and Tom's Gulch on South Fork Elk downstream to the mainstem Elk River to Berta Road.

The desired watershed conditions and numeric targets are based on the current understanding of recovery potential and the conditions necessary to support beneficial uses. Under the Regional Water Board's proposed implementation strategy, these conditions and targets are expected to be continuously evaluated as part of the adaptive watershed management approach. This chapter can be considered as the initial starting point for the adaptive management process.

4.1 Water Quality Standards

WQS are adopted by the Regional Water Board to protect public health and welfare, enhance the quality of water, and serve the purposes of the federal CWA (as defined in Sections 101(a)(2), and 303(c) of the CWA). WQS, as described in the Basin Plan (Regional Water Board 2011a), consist of 1) designated beneficial uses, 2) the WQOs to protect those beneficial uses, and 3) implementation of the Federal and State policies for antidegradation. In accordance with the federal CWA, TMDLs are set at a level necessary to achieve applicable WQS. This chapter describes the state WQS for the Elk River watershed.

4.1.1 Beneficial Uses

Beneficial uses of water (beneficial uses or uses) are those uses of water that may be protected against quality degradation such as, but not limited to, domestic, municipal, agricultural supply, industrial supply, power generation, recreation, aesthetic enjoyment, navigation, preservation and enhancement of fish, wildlife and other aquatic resources or preserves.

Beneficial uses of water in the Elk River watershed include:

- **Municipal Water Supply (MUN)**
- Non-Contact Water Recreation (REC-2)
- **Agricultural Supply (AGR)**
- Commercial or Sport Fishing (COMM)
- Industrial Service Supply (IND)
- **Cold Freshwater Habitat (COLD)**
- Industrial Process Supply (PRO)
- Wildlife Habitat (WILD)
- Groundwater Recharge (GWR)
- **Rare, Threatened, or Endangered Species (RARE)**
- Freshwater Replenishment (FRSH)
- **Migration of Aquatic Organisms (MIGR)**
- Navigation (NAV)
- **Spawning, Reproduction, and/or Early Development (SPWN)**
- Hydropower Generation (POW)
- Aquaculture (AQUA)
- **Water Contact Recreation (REC-1)**
- Estuarine Habitat (EST) (applies only to estuarine portion of the watershed)
- Flood Peak Attenuation/Flood Water Storage (FLD)
- Wetland Habitat (WET)
- Water Quality Enhancement (WQE)

Comment [NPS2]: If SPWN is to be accurately assessed, incorporation of fish population monitoring should be incorporated and discussed. Current and potentially restorable high quality coho spawning and rearing reaches should be mapped and identified.

Comment [MG3]: CDFW, Arcata office (Ricker) has Humboldt Bay anadromous fish monitoring reports available. Elk River is included in the random samples.

Comment [NPS1]: It may be worth mentioning the current LWD barriers on the Upper North Fork Elk River and South Fork River, which have blocked coho passage to approximately 7 miles of upstream habitat for the last ten years. An assessment of these potentially limiting factors is going to be conducted this winter by BLM, HRC and CDFW . It might be good to have a NCRWQB representative there as well. See HRC Elk River Watershed Analysis Revisit 2014.

As noted above, there are many beneficial uses of the Elk River watershed. The beneficial uses of primary focus in this document for the Upper Elk River include: domestic drinking water (MUN) and agricultural (AGR) water supplies and salmonid habitat (including cold freshwater habitat [COLD]; rare, threatened and endangered species [RARE]; migration of aquatic organisms [MIGR]; spawning, reproduction, and/or early development [SPWN]). These are shown in bold in the list above. Water contact recreation (REC-1) is also a key

These goals (and, therefore, the associated beneficial uses) are linked to the specific Instream WQIs in Table 4~~Table 4~~ below.

While the Instream WQIs focus on conditions within the stream channel, it is also important to manage and improve conditions on the land. The Hillslope WQIs collectively describe hillslope conditions that are expected to support attainment of beneficial uses. This is accomplished by reducing the signature left on the landscape from land use activities. The Hillslope WQIs describe conditions in which sediment delivery, hydrology, and large woody debris recruitment supports attainment of beneficial uses, as measured by trends in the Instream WQIs.

4.2.1 Instream Water Quality Indicators

The proposed Instream WQIs are comparable to those adopted by the Regional Water Board and EPA in numerous sediment TMDLs throughout the region[11]. They are adapted from the *Desired Salmonid Freshwater Habitat Conditions for Sediment-Related Indices* (Regional Water Board 2006b; see also Regional Water Board 2013a, 2013b for additional rationale on use of the specific indicators) as well as the National Oceanic and Atmospheric Association (NOAA) National Marine Fisheries Service *Properly Functioning Conditions Matrix* as incorporated into the HCP for HRC (USFWS and Calfire 1999).

The Instream WQIs offer a suite of numeric targets to strive for and to gage improvements in the aquatic system (see Chapter 4.2.3 for a discussion on the application of WQIs). Table 4~~Table 4~~ identifies the Instream WQIs, their associated instream goal, numeric target, and the associated stream type (each Instream WQI is not applicable to all stream reaches). When evaluated comprehensively (Chapter 4.2.3), these are numeric targets that demonstrate attainment of beneficial uses; however, when evaluated individually, they should be interpreted as recommendations.

The salmonid habitat indices that serve as a foundation for the Instream WQIs were developed primarily for Franciscan geology (produces both course and fine sediment) and the Wildcat Group, which is predominate in the Upper Elk River watershed and produces primarily fine sediment. Therefore, specific numeric target values should be evaluated using a weight-of-evidence approach to ensure applicability to the watershed (Chapter 4.2.3). Sediment related habitat needs vary by life stage for different salmonid species, and the numeric target values selected generally represent average conditions supportive of all life stages. In addition, specific values may not be appropriate for all life stages of all salmonids, so a series of environmental conditions that trend toward the target conditions is the desired condition.

[11] See http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/ for sediment TMDLs adopted by the Regional Water Board.

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Comment [MSS4]: Geoff: would you support this statement?

Comment [NPS5]:

D50 particle size goals have been established in Table 4 below and HRC's Properly Functioning Condition Matrix as between 65-95 mm. This was based on a study conducted by Knopp (1993), which compared a series of index and impacted streams in Northern California. Index stream pebble counts fell within this range. Index reaches were established with watershed areas ranging between 4 and 6,000 acres.

I would recommend index monitoring reaches in Elk River fall within the 4 to 6,000 acre range if the 65-95 mm metric is used.

Table 4. Summary of Instream Water Quality Indicators

Instream Indicator	Instream Goal[a]	Numeric Target[b]	Associated Stream Type[c]
Percent Fine Sediment	SALMON; SUPPLY	≤10% fines <0.85 mm in diameter ≤30% fines <6.40 mm in diameter	Wadeable streams and rivers with a gradient <3%
Particle Size	SALMON	D_{50} of 65–95 mm	Streams with slopes between 1 and 4%
Large Woody Debris (LWD)	SALMON	Increasing volume and frequency of LWD and key pieces of LWD	Streams and rivers with bankfull channel widths >1 meter
Embeddedness	SALMON	Increasing number of locations where gravels and cobbles are ≤25% embedded	All wadeable streams and rivers
Pools – Average Residual Pool Depth	SALMON; SUPPLY	Pools >1 meter in depth, based on minimum residual pool depth	Wadeable streams and rivers with channel morphology that supports the development of specified pool-type, as appropriate
Pools – Backwater Pool Distribution	SALMON	Increasing number of backwater pools	
Pools – Lateral Scour Pool Distribution	SALMON	Increasing number of lateral scour pools	
Pools – Primary Pool Distribution	SALMON	Increasing number of reaches where length of the reach is composed of ≥40% primary pools	
Thalweg Profile	SALMON	Increasing variation in the thalweg elevation around the mean thalweg profile slope.	Streams and rivers with slopes ≤2%
Bankfull Channel Capacity	FLOOD	Channel cross-sectional area sufficient to contain the historic bankfull discharges (see Regional Water Board 2013a for additional details): Upper Mainstem = 2,250 cfs Lower North Fork, = 1,172 cfs Lower South Fork = 1,015 cfs	Area of impacted reach near confluence of North and South Forks Elk River
Chronic turbidity[d]	SALMON; SUPPLY	Clearing of turbidity between storms to a level sufficient for salmonid feeding and surface water pumping for domestic and agricultural water supplies	Salmonid feeding—watershed-wide historic range of salmonids Water supplies—Impacted reach

[a] Key for Instream Goals:

SALMON: Support salmonids throughout their historical range in Elk River

SUPPLY: Support the use of surface water for domestic drinking water and agricultural water supplies

FLOOD: Contain flood flows within the channel bankfull discharge

[b] Adapted from Regional Water Board 2006b; mm = millimeters; cfs = cubic feet per second.

[c] There is no numeric target for streams reaches that fall outside of the specified criteria for stream type.

[d] The WQO for turbidity also applies (Chapter 4.1.2). The Instream WQI target condition focuses specifically on turbidity values between storms.

Comment [MG6]: Do the NMFS Coho recovery plan (2014) and now the public review draft multispecies recovery plan (2015) support information presented in this table?

Comment [NPS7]: The sediment sample for this metric is pebble counts. I believe pebble counts are the most quantitative measure for measuring changes in bed composition. In my experience, QAQC studies revealed the smallest error between the measurements.

See my comment above (NPS 5), which describes where the targeted metric came from.

Comment [NPS8]: This may be in contrast to SALMON beneficial uses, as flood plain habitat and associated backwaters/off channel habitat is very important to coho rearing and habitat development. (Roni 2010)

Comment [NPS9]: Recommend setting specific thresholds based on actual fish feeding data. See my 6.1.3.4 comment on turbidity below.

Monitoring of Instream WQIs is critical to track progress toward attainment of WQOs and beneficial use protection and restoration. Recovery of some habitat conditions, such as an increasing number of pools, is likely to take a number of years. If during this period progress is not being made toward attainment of the Instream WQIs, then through an adaptive management process, additional implementation measures could be identified, such as pool enhancement by placement of large wood. The stewardship process can assist with coordinated monitoring to track progress towards improved salmon habitat and water supplies. Evaluation of the proposed instream numeric targets through special

studies is encouraged and could be guided by the proposed watershed stewardship group, as appropriate. Similarly, landowners could propose alternative targets, as determined necessary, through monitoring and adaptive management.

4.2.2 Hillslope Water Quality Indicators

The proposed Hillslope WQIs are divided into two categories: 1) common indicators that are comparable to those adopted by the Regional Water Board in numerous sediment TMDLs or WDRs and 2) Hillslope WQIs that are specific to the Upper Elk River watershed due to its unique characteristics. A subset of these indicators may be translated to permit terms, so they become enforceable.

The Hillslope WQIs offer a suite of controllable factors that can be managed through the use of best management practices (BMPs) that can be implemented in support of beneficial use attainment (see Chapter 4.2.3 for a discussion on the application of WQIs). Table 5~~Table 5~~ depicts the Hillslope WQIs, associated instream goal, numeric target for each indicator, and the applicable area in the Upper Elk River watershed. This table includes both the common and specific indicators. The Peer Review Draft provides detail on these indicators, including applicable source categories (Regional Water Board 2013a).

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It is important to recognize that these Hillslope WQIs require careful interpretation. Similar to the Instream WQIs, when evaluated comprehensively (Chapter 4.2.3), these are numeric targets that demonstrate attainment of beneficial uses; however, when evaluated individually, they should be interpreted as recommendations. They focus on the controllable sources of sediment in the watershed and their implementation is expected to support attainment of instream WQOs. The pertinent instream goals are generally associated with salmon habitat; however, meeting Hillslope WQIs is also expected to indirectly support the other instream goals through reduction in sediment loads, including fine sediments, which can reduce aggradation and turbidity (thereby improving nuisance flooding and water supply, respectively).

Table 5. Summary of Hillslope Water Quality Indicators

Indicator	Instream Goal[a]	Numeric Target	Associated Area
Common Road Indicators			
Hydrologic connectivity of roads to watercourses	SALMON SUPPLY FLOOD	100% of road segments hydrologically disconnected from watercourses	All roads
Sediment delivery due to surface erosion from roads	SALMON SUPPLY FLOOD	Decreasing road surface erosion	
Sediment delivery due to road-related landslides	SALMON SUPPLY FLOOD	Decrease in sediment delivery from new and reactivated road-related landslides	
Common Harvest-Related Indicators			
Sediment delivery due to surface erosion from harvest areas	SALMON SUPPLY FLOOD	100% of harvest areas have ground cover sufficient to prevent surface erosion	All harvest areas
Sediment delivery from open slope landslides due to harvest-related activities	SALMON SUPPLY FLOOD	Decrease in sediment delivery from new and reactivated open-slope landslides	All open slopes

Indicator	Instream Goal[a]	Numeric Target	Associated Area
Sediment delivery from deep seated landslides due to harvest-related activities	SALMON SUPPLY FLOOD	Zero increase in discharge from deep-seated landslides due to management-related activities	All deep-seated landslides
Common Management Discharge Site Indicators			
New management discharge sites	SALMON SUPPLY FLOOD	No new management discharge sites created	Across ownership
Specific Upper Elk River Watershed Indicators			
Headward incision in low order channels	SALMON SUPPLY FLOOD	Zero increase in the existing drainage network	Lower order channels
Peak flows	SALMON SUPPLY FLOOD	Less than 10% increase in peak flows in 10 years related to timber harvest	Class II/III catchments
Channels with actively eroding banks	SALMON SUPPLY FLOOD	Decreasing length of channel with actively eroding banks within sub-basins	Across ownership
Characteristics of riparian zones (i.e., 300 feet on either side of the channel) associated with Class I and II watercourses	SALMON SUPPLY FLOOD	Improvement in the quality/health of the riparian stand so as to promote 1) delivery of wood to channels, 2) slope stability, and 3) ground cover	Class I and II watercourses
Characteristics of riparian zones (150' on either side of the channel) associated with Class III watercourses	SALMON SUPPLY FLOOD	Improvement in the quality/health of the riparian stand so as to promote 1) delivery of wood to channels, 2) slope stability, and 3) ground cover	Class III watercourses

[a]Key for Instream Goals:

SALMON: Support salmonids throughout their historical range in Elk River

SUPPLY: Support the use of surface water for domestic drinking water and agricultural water supplies

FLOOD: Contain flood flows within the channel bankfull discharge

Comment [NPS10]: CDFW recommends the retention of the largest trees in the riparian stands, to ensure large diameter logs are being recruited to watercourses. Scott et al 2014 showed larger logs perform more efficiently than similar volumes of small wood in storing and routing sediment. 13 largest trees per acre in Class I and II watercourse riparian zones is established in the HRC Properly Functioning Condition Matrix.

Scott, D. N., Montgomery, D. R., Wohl, E. E., 2014. Log step and clast interactions in mountain streams in the central Cascade Range of Washington State, USA. Geomorphology 216, 180-186.

4.2.3 Application of Water Quality Indicators

The WQIs identified above can be applied in multiple settings. They help to:

- Establish appropriate metrics for ongoing monitoring, whether it is effectiveness monitoring, trend monitoring, or compliance monitoring;
- Determine appropriate control measures to be included in a regulatory mechanism, including specific numeric permit provisions; and
- Establish adaptive management thresholds, appropriate for identifying temporal and spatial conditions for re-evaluation of the applied control measures.

Because NPS restoration is driven by BMPs, evaluating post-implementation monitoring data against these numeric targets can show if the BMPs are adequate to restore and maintain beneficial uses. BMPs prevent sediment from entering waterways and increase the potential that instream numeric targets will be met.

Scientific methods to describe hydrogeomorphic processes are constantly expanding and evolving and, because of this, specific methodologies are intentionally not prescribed for the Instream or Hillslope WQIs. This encourages use of the latest techniques and emerging science to characterize and monitor water quality conditions. The numeric targets can be

Chapter 9 – References

Benda, L.E., P. Bigelow, and T. M. Worsely. 2002. Recruitment of Wood to Streams in Old-Growth and Second-Growth Redwood Forests, Northern California, USA. Canadian Journal of Forest Research. 32: 1460-1477.

Buffleben M. 2009. Evaluation of soil creep rates for application in Elk River and Freshwater Creek watersheds.

Cafferata, P. and L. Reid. 2013. Applications of long-term watershed research to forest management in California: 50 years of learning from the Caspar Creek Experimental Watersheds. California Forestry Report No. 5. The Natural Resources Agency, Sacramento, CA. 110 pp.

Calfire. 2014. Memorandum from D. Shintaku to Mr. St. John. Comments on "Peer Review Draft – Staff Report to Support the Technical Sediment Total Maximum Daily Load for the Upper Elk River. Dated April 8, 2014. California Department of Forestry and Fire Protection, Sacramento, California, 16 p.

California Department of Fish and Game (CDFG). 2008. Letter from Gary B. Stacey, Regional Manager, Northern Region to Mr. Kevin Hamblin, Director, Community Development Department, City of Eureka Subject: "Draft Eureka Greenways and Gulches Ordinance." Dated May 19, 2008.

California Department of Fish and Wildlife (CDFW). 2014. Memorandum to North Coast Regional Water Quality Control Board. Subject: Elk River Total Maximum Daily Load Analysis and Technical Report. Dated October 6, 2014. CDFW Region 1.

Dhakal, A.S., and K. Sullivan, 2014. Shallow groundwater response to rainfall on a forested headwater catchment in northern coastal California: implications of topography, rainfall, and throughfall intensities on peak pressure head generation. Hydrological Processes 28: 446-463.

Dudik, E. 1998. Interview of residents in the North Fork Elk River watershed, Humboldt County. North Coast Regional Water Quality Control Board. February 2, 1998.

Eastlick, D.J. 1993. Surface Processes and Landforms. New York: MacMillan Publishing Co.

Environmental Protection Agency (EPA). 2012. *Channel Processes: River Stability Concepts*. U.S. Environmental Protection Agency, Office of Science and Technology. Updated March 6, 20112; accessed March 11, 2015. Available at: http://water.epa.gov/scitech/datait/tools/warsss/rivstab.cfm.

Comment [MG16]: Additional recommended references:
-CDFW's State Wildlife Action Plan is available online while it is under 90 day review by USFWS: https://www.wildlife.ca.gov/SWAP/Final . See North Coast and Klamath Province sections, anadromous fish chapter, etc…
-CDFG, Recovery Strategy for California Coho Salmon (2004)
- There are numerous Elk River tributary stream inventory reports in CDFW Document library. Query for Elk River at this site: https://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=Fisheries--StreamInventoryReports . I believe large woody debris inventories may also be available from CDFW Fortuna office.
-NMFS Coho and Mulit-Species Recovery Plans
-Impact of Fine Sediment on
Egg-To-Fry Survival of Pacific Salmon:
A Meta-Analysis of Published Studies
DAVID W. JENSEN,* E. ASHLEY STEEL, AIMEE H. FULLERTON,
and GEORGE R. PESS
Northwest Fisheries Science Center, NOAA Fisheries, Seattle, Washington, USA
-Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. Meehan. Special Publication 19
Turbidity impact references:
Bash et al, 2001; Berg and Northcote, 1985; Gregory and Levings, 1998; Sontag, 2013. I have all 4 of these pdfs.