

**BOARD OF FORESTRY AND FIRE PROTECTION**

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**Forest Practice Committee Meeting**

September 30, 2014

**RE: Inclusion of Turbidity as a Potential Metric in Technical Rule Addendum #2**

**Discussion:** During the Forest Practice Committee Meeting on August 26, 2014 the FPC reviewed proposed staff revisions to Technical Rule Addendum #2 (TRA #2). One of staff's revisions focused on the addition of providing guidance to RPFs on the inclusion of addressing turbidity as a metric within the cumulative impact assessment when preparing a Plan. The committee expressed concern on inclusion of turbidity within the proposed revision of TRA #2 and instructed staff to conduct research on the topic to help inform the committee on either including or eliminating the issue of turbidity within TRA #2.

The contents of this staff report therefore attempt to provide supplemental information on the issue of turbidity, particularly as it relates to the management of forested resources. The information provided within this report reflects findings of research reports, peer reviewed literature, and discussions with watershed scientists from both within and outside of the Department.

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended solids. Suspended solids in forested watersheds are primarily associated with suspended sediment, but also includes other factors such as leaf matter, algae, colored organic compounds, and microorganisms. For example, organic suspended sediment can have important effects on turbidity measurements.

Since the 1970's, the research community has embraced the measurement of turbidity to identify potential impacts to water quality. Turbidity sampling is commonly used within the forested setting and agricultural lands, as well as for domestic water sources and treated waters. This metric of water quality sampling and monitoring is reliant upon optical instrumentation. Prior to the mid 1990's, automated or recording turbidimeters were not widely available and in many cases cost prohibitive. Grab samples with turbidity measurements made with a laboratory turbidimeter, however, were routinely analyzed before that time.

Generally speaking, the utilization of the turbidity monitoring to identify potential sediment impacts to water quality from land management activities at the watershed scale requires robust datasets collected over an extended period of time. Continuous measurements made with recording turbidimeters based on 10 minute, hourly, bi-hourly, or other standardized temporal scales often provide the

best opportunity for data analysis that will provide useful information. This standardized sampling is of particular importance during precipitation events, which are when elevated levels of turbidity are observed. Even large data sets can be of marginal value without standardized sampling techniques which correspond well to the hydrograph.

Comprehensive data sets on turbidity are relatively few in California, with the Department of Water Resources collecting and maintaining one of the largest bodies of data for continuous sampling of turbidity. Other sources of data include Freshwater Creek and Elk River watersheds (Humboldt County), Jacoby Creek (Humboldt County), Sierra Pacific Industries in select watersheds, Swanton Pacific Ranch (Santa Cruz County), Kings River Experimental Watershed (Fresno County), Bureau of Reclamation, Casper Creek Watershed (Mendocino County), other industrial timberland owners, and many purveyors of domestic water (private and municipal utilities. Harris et al. (2007) provides a detailed list of turbidity monitoring occurring in California, and Klein et al. (2012) provides data from turbidity monitoring in several North Coast watersheds. Small and unconsolidated ownerships will likely not have sufficient data, or access to sufficient data to make meaningful determination of impacts as they relate to turbidity at the watershed scale. These data would be most useful in efforts focused upon effectiveness monitoring.

In addition to long term trend monitoring, turbidity sampling can also be utilized effectively at site specific locations (CDF and NCRWQCB 2002). For instance, grab samples can be taken upstream and downstream from a specific stream crossing or other types of stream restoration projects to make determinations of impacts to water quality from the individual project (Harris et al. 2007). This method of turbidity sampling can be completed as a “snapshot in time” or over an extended period of time to aid in determining water quality impacts from a project. This same method of turbidity sampling could also apply to an assemblage of projects located along a watercourse with a determination of impacts from the string of projects being assessed. These data would be most useful in efforts focused upon forensic monitoring (Harris et al. 2007).

Existing language in TRA #2 provides guidance to RPFs on how to assess “Sediment Effects.” In some cases, turbidity could supplement this discussion well, while in other instances the discussion of turbidity could serve of negligible value. Research has been conducted on the relationship between suspended sediment, organic matter, and turbidity. If a strong relationship exists, then this would allow one to make an inference about the levels of suspended sediment within a watercourse based upon observed turbidity levels. While in some cases the relationship is cogent, in other instances the relationship is weaker. This is particularly true in watersheds with coarse sediment, such as decomposed granitic watersheds, where most sediment is moved as bedload. The parent material, or geological substrate of certain watersheds, do not support a strong relationship between turbidity and suspended sediment.

**Conclusion:** Visible increases in turbidity into a watercourse can be used as an indicator of a significant sediment discharge, as stated in the Road Rules, 2013 rule package. Turbidity levels affect fish feeding success, as reported widely in the literature. Turbidity can also be a metric that requires quantitative assessment, when linking it to suspended sediment concentration and determining sediment yields from watersheds. Capturing large datasets of data through trend monitoring is required in order to make determinations of the relationship between suspended sediment and land management activities at the watershed scale. Turbidity monitoring on a watershed or sub-watershed basis is required to develop localized relationships, and in some areas the relationships are weak. These datasets are currently somewhat limited within the state. It is likely that more data will become available as time passes, given that the research community champions turbidity monitoring as a method to greatly reduce the cost of obtaining accurate sediment yield data on a storm basis or annual basis where appropriate relationships can be developed. Turbidity monitoring on an individual project basis may provide useful information with limited effort or samples. This type of turbidity monitoring is less rigorous and may supply valuable information as it relates to project impacts.

#### **References:**

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