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Chairman Jeffery Young
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

re: Timber Harvest Program Update – Monitoring and Reporting Program

Dear Chairman Young:

I was the Hydrologist for the Mendocino County Water Agency (MCWA) from May 1989 to November 1994. The Mendocino County Board of Supervisors appointed me as their representative on pre-harvest inspections for Timber Harvest Plans (THPs) with the potential to impact public water systems. As the MCWA Hydrologist, I reviewed Proof-of-Water pump tests for the Town of Mendocino and I also routinely reviewed CEQA documents for projects before the Planning Commission. I have a Masters in Physical Science specializing in Hydrology from Chico State University. Since 1994 I have been a private consulting Hydrologist. I have also taught Hydrology at California State University, Monterey Bay.

I am submitting the following comments on the draft *Monitoring and Reporting Program* for Timber Harvest Plans (THPs) on behalf of the Santa Cruz Group of the Sierra Club, the Lompico Watershed Conservancy, Citizens for Responsible Forest Management and The Ocean Conservancy.

I have reviewed the Staff Report for Item 4 of the February 10, 2005 meeting entitled *Proposed Timber Harvest Monitoring and Reporting Program* and its several attachments posted on the Regional Board web site. The Staff Report proposes a Regulatory and Monitoring Requirement Eligibility Criteria Decision Tool (Eligibility Criteria) to assist the Regional Board and its Staff in deciding whether a proposed THP or Non-Industrial Timber Management Plan (NTMP) is eligible for a General Conditional Waiver for Timber Harvest Operations or if Individual Waste Discharge Requirements for Timber Operations would be more appropriate. The Eligibility Criteria also recommend what level of Monitoring and Reporting would be required. (In this letter, I use THP to refer to both THPs and NTMPs).

In my opinion, the proposed Monitoring and Reporting Program (MRP) is a start but needs significant refinement. The Eligibility Criteria appear to be arbitrary and have not been demonstrated to protect the beneficial uses of water.

I have not had sufficient time to fully review the Staff Report and its numerous attachments. I offer the following comments to demonstrate that the proposed MRP need significant refinement. My comments should not be taken as a complete and exhaustive review of the proposed MRP and Eligibility Criteria. I request that the Central Coast Regional Water Quality Control Board direct staff to consult with recognized experts and all interested parties for the purpose of refining the proposed MRP and Eligibility Criteria and to report back to the Board at the May 2005 meeting.

Eligibility Criteria

The proposed Eligibility Criteria are based on three components, a Cumulative Effects Ratio (CER), a Drainage Density Index (DDI) and a Soil disturbance factor (SDF). There is no discussion as to why these three components were chosen and why other potential components were rejected. Furthermore, there is no analysis presented that the chosen components and the procedure to combine the values of the three components into a final rating will actually protect the beneficial uses of water.

One component that might be considered for inclusion in the proposed Eligibility Criteria is the proximity of Beneficial Uses to the proposed THP. The entire purpose of the proposed MRP and the Eligibility Criteria is to protect Beneficial Uses of water. Knowing the location and types of Beneficial Uses of water that are near a proposed THP will help keep the MRP focused on its purpose and will also provide feedback on whether the MRP and the Eligibility Criteria are successfully protecting the Beneficial Uses that are at risk from a given THP.

Secondarily, the proximity of a Beneficial Use to a proposed THP plays a role in defining the risk that the THP poses to the Beneficial Use. Beneficial Uses that are further away from a THP that is discharging sediment into the stream network may be less at risk that Beneficial Uses that are in close proximity to the THP.

Another component that should be considered for inclusion in the components of the Eligibility Criteria is whether a proposed THP plans on using Winter Operations. Ground disturbance during the winter is a high risk activity for water quality.

The Erosion Hazard Rate (EHR) which, is computed for every THP, should play a significant role in the Eligibility Criteria; however, it is not included in any of the calculations. The EHR attempts to characterize the susceptibility of the soils in a THP to erosion. The Forest Practice Rules use the EHR to attempt to reduce the risk of certain activities by prohibiting or at least limiting the activity on soils with an EHR rating of *high* or greater. The EHR could be used as a separate component of the Eligibility Criteria or could be included in one or more of the other components. There is no harm in repeating the use of an important factor such as the EHR in the calculations to rate a THP's risk to water quality and the beneficial use of water. For example, the plan area (PA) is used to calculate both the CER and DDI components in the formulas proposed by Staff.

Thresholds

The Staff Report claims that,

> The numeric values used for evaluation are empirically derived and rely on pre-selected thresholds that determine the outcome.

but, the only citation offered in the Staff Report is for the threshold used in the CER component of the Eligibility Criteria. And even that citation mentions that the threshold was adapted from Klein's work but no discussion is offered on why it was necessary to adapt the threshold or how it was adapted. No literature citations are offered for the thresholds presented for either the DDI or the SDF.

The thresholds used in the Eligibility Criteria appear to be completely arbitrary. In general, the thresholds lack either a literature citation or a thorough technical discussion of how the thresholds were derived. There is no demonstration that the thresholds proposed in the Eligibility Criteria are conservative enough to protect the Beneficial Uses of water.

Will the Eligibility Criteria Protect Beneficial Uses?

There is no direct discussion of the ability of the proposed MRP and Eligibility Criteria to protect the Beneficial Uses of water. That is, how will this procedure work in the "real world"? The Staff Report does say that;

> Staff has evaluated 12 existing waivers using the Eligibility Criteria (Attachment 3). This evaluation has been used to help "tune" the Eligibility Criteria.

In the language of Hydrologic Modeling, Staff has used the 12 THP's shown in Attachment 3 to *calibrate* the proposed procedure. This informal calibration procedure shows that the procedure could segregate the 12 THP's into the four possible Tiers. There is no demonstration in the Staff Report that the all of the THP's in the calibration set were assigned to the most appropriate Tier. In addition, the Staff Report did not apply the procedure to a randomly selected set of THP's to verify the validity of the procedure when applied to any THP. That is, the model was not *validated.*

The Staff Report does state that;

> As the Regional Board gathers more data from timber harvest monitoring, it may be necessary to amend the Eligibility Criteria to incorporate the growing body of knowledge of water quality impacts.

Indicating that the Staff plans to validate the proposed procedure after they find out how it works on future THP's. This method of model validation puts the Beneficial Uses of water at risk, including federally listed salmonids and municipal and domestic water supplies.

There are 18 different sets of values for the proposed components of the Eligibility Criteria. Attachment 4 shows which Tier each of the 18 possible sets of component values would be placed in. Staff confuses the distribution of the 18 possible sets of component values with how a large random sample of THP's would be classified by the procedure. Since the proposed Eligibility Criteria have not been subjected to a validation trial, independent of the 12 THP's used to calibrate the procedure, there is no guarantee that it is not biased. That is, a large random sample of real THP's might be divided into only three of the four tiers. Or, more importantly, a high risk THP's might be misclassified as presenting a lower risk than it actually does.

Cumulative Effects Ratio (CER)

The proposed Cumulative Effects Ratio (CER) uses area harvested in a watershed as a surrogate for Cumulative Watershed Effects. The proposed CER does not actually use the hydrologically meaningful watershed which ends at the downstream end of the THP under consideration but, uses the CalWater Planning Watersheds. The CalWater Planning watersheds, in general, do not represent real watersheds. CalWater Planning Watersheds are a somewhat arbitrary division of the California landscape for general planning purposes. CalWater Planning watersheds can be composed of several small streams that are roughly parallel, or they can be a portion of a larger watershed that has been split into several pieces. Using CalWater Planning Watersheds to do an assessment of the cumulative effects of Timber Harvest Plans on the Beneficial Uses of water may give very misleading information. I urge the Board to direct Staff to avoid dependence on the CalWater Planning Watersheds and to devise a method of selecting a watershed for analysis that represents hydrologic processes correctly.

The arbitrary nature of the CalWater Planning watersheds has been noted by the University of California Committee on Cumulative Watershed Effects (June 2001) in their review of the Cumulative Effects portion of THPs. They note that;

> Examples we have seen have not included the entire watershed into which a site drains, but include some seemingly arbitrary adjacent drainage areas.

Assuming that the CER formula will be applied to a hydrologically meaningful watershed, let us look at the CER formula. The CER is calculated by the following formula:

$$CER = ((AH+PA)/TA)$$

Where AH = acres of the CalWater Watershed harvested in the last 10-years, PA = the acres to be harvested and TA is the total acreage of the CalWater Watershed. There is no real justification given to a horizon of ten years and there is no literature citation provided. CDF tends to use a 10-year time period to

assess cumulative effects but they have not provided any real justification for its use. The Forest Practice Rules defines past projects as:

> **Past Projects** means previously approved, on-going, or completed projects which may add to or lessen impact(s) created by the THP under consideration. These generally include, but may not be limited to, projects completed within the last ten years.

So, the FPR does not require that the cumulative effects of projects be evaluated using a 10-year time horizon. It would seem desirable to set the time period for the analysis of cumulative effects ratio to be equal to the rate of recovery of the watershed from timber harvest activities. The Humboldt Watersheds Independent Scientific Review Panel report (August 2003, p. 23) states that:

> Reid used 15 years to separate recently harvested from non-harvested or recovered hillslopes.

So, it would appear that Leslie Reid would favor the use of a 15-year period to calculate AH for the CER. Staff should either demonstrate the validity of a 10-year period for cumulative effects or adopt the 15-year period suggested by Leslie Reid's work. Staff needs to do more research into what needs to be considered when defining a time horizon over which to judge cumulative effects. At the least, an extensive literature search should be done to determine what the length of a realistic recovery period is.

On the surface, the CER formula appears reasonable but further examination shows that it has a serious flaw. Two additional variables appear to be needed to properly evaluate the CER. These additional variables are defined as RA - the acreage that is subject to harvest from other THP's that are undergoing review and AA - the acreage that has been approved but has not been harvested.

The revised CER formula would be:

$$CER = ((AH + AA + RA + PA)/TA)$$

Where,

- AH = acres of the analysis watershed harvested in the last 15-years,
- AA = acres of the analysis watershed that have been approved but not harvested,
- RA = acres of the analysis watershed under active review,
- PA = the acres to be harvested by the THP under consideration,
- TA is the total acreage of the analysis watershed

The length of the time horizon used to evaluate the cumulative effects of the cut is set equal to 15-years as Leslie Reid used to differentiate hillslopes that had recovered from logging from those hillslopes that had not recovered.

The definition of CER used in the Staff Report lacks precision in describing the quantities to be used in calculating the CER. The Staff Report's definition refers to only acreage that has been harvested and the acreage proposed to be harvested by the THP under consideration. The Staff Report's formula for the CER ignores approved projects that have not been implemented and it ignores foreseeable future projects.

In addition, the proposed formula for computing the CER ignores non-forestry impacts in the watershed. Watersheds may be impaired by other land uses such as State Highways, County roads, rural residential developments, recently burned areas, and agricultural uses to name but a few. The level of impairment in a watershed is not merely a function of the area of timber harvest. More thought should be given to fashioning a formula that produces a reasonably accurate measure of cumulative effects.

The Staff Report defines a CER<10% as low, 10%<CER<15% as medium and a CER>15% as high. The Staff Report states that this scale was adapted from Klein, 2003. However, there is no discussion on why Klein's work was modified or how it was modified. The short period of time I had for my review

prevented me from obtaining a copy of Klein, 2003 and reviewing it myself. Therefore, I can not comment on whether Staff's modifications to Klein's work maintained the spirit of his work.

Drainage Density Index (DDI)

The Drainage Density Index (DDI) is calculated by multiplying the total number of lineal feet of stream for each CDF stream Class by a weighting factor for that stream class. The formula for the DDI is;

$$DDI = ((CI*WI)+(CII*WII)+(CIII*WIII))/PA$$

Where,

- CI is the lineal feet of Class-I streams within the plan boundaries,
- WI is the weighting factor for Class-I streams,
- CII is the lineal number of feet of Class-II streams,
- WII is the weighting factor for Class-II streams,
- CIII is the lineal feet of Class-III streams,
- WIII is the weighting factor for Class-III streams,
- PA is the number of acres to be cut in the THP,

The Staff Report arbitrarily sets the weighting factors as follows; 3 for Class I streams, 2 for Class II streams and 1 for Class III streams. There is also no justification given for the weighting factors used or why the weighting factors chosen are superior to any other possible set of weighting factors.

The Staff Report states that:

> **Drainage Density Index (DDI)** - The DDI is derived from the single most important factor governing water quality vulnerability; the accessibility or adjacency of waterbodies to the proposed activity.

The DDI is Staff's attempt to gauge what they consider to be the most important risk to water quality. Yet the formula for DDI proposed by Staff defines only a measure of the existing pre-project drainage density. The proposed formula for DDI does not have a component that estimates how the proposed THP will alter the "accessibility or adjacency of waterbodies" to risk to water quality and Beneficial Uses from the proposed THP.

It appears that several factors that determine the, "accessibility or adjacency of waterbodies to the proposed activity" have been left out of the calculation. For example, slope is a very important factor in determining the, "accessibility or adjacency of waterbodies" to a threat to water quality. Clearly, an activity that is 100 feet away from a stream on flat ground poses much less risk than an activity that is 100 feet away on a 50% slope. Or a new road with an inside ditch and associated drainage system reduces the effective distance to the stream channel for activities that are far from the stream but close to the new road. The DDI proposed in the Staff Report does not adequately assess the, "accessibility or adjacency of waterbodies" to activities that pose a risk to water quality.

Additional factors need to be added to the DDI to properly characterize the "accessibility or adjacency of waterbodies" of the proposed harvest area. The next step would then be to evaluate whether it would be prudent to create a new Eligibility Criteria component that would characterize how the proposed THP would alter the pre-existing "accessibility or adjacency of waterbodies" to a potential risk or the add another variable to the proposed DDI formula to capture the effect of the proposed THP on the "accessibility or adjacency of waterbodies to" risk factors.

A DDI > 100 is considered high and a DDI<100 is considered low. There is no medium ranking for the DDI. There is no literature citation to support the choice of these thresholds and there is discussion of how these thresholds were determined. There is also no discussion that directly couples the DDI to the risk a THP poses to the Beneficial Uses of water.

Soil disturbance factor (SDF)

The Soil Disturbance Factor (SDF) proposed in the Staff report is poorly presented. The SDF is the most complex of the three components of the Eligibility Criteria. The discussion of this complex calculation mentions a few of the types of operations considered in its calculation but gives no detail. The calculation procedure for the SDF is so complex that it is best performed in a spreadsheet.

The spreadsheet for calculating the numerical value of SDF is presented in Attachment 1b. The calculation of the SDF is broken down into several sections including:

- Silviculture
- Yarding
- Roads
- Skid Trails
- Landings

Each section includes several components. Each separate component is assigned a score. A weighting factor is applied to some of the scores, for example, the seasonal/temporary road component is assigned a score by noting the number of linear feet of seasonal road in the plan which, is then multiplied by a weighting factor of 4. No discussion of any of the numerous weighting factors is presented.

Once a *Final Sum* for the SDF has been calculated, it appears to be further manipulated. Directly below the label *Final Sum* there is the question: "Winter Use of Gd-based Eqp?" and the choice of yes or no. Below the box enclosing the SDF there are some lines dealing with the number of crossings and landings. How this information is used is not at all clear.

Once a numerical value for the SDF has been calculated a totally arbitrary set of thresholds is used to determine the associated qualitative rating. The Staff Report states that:

> Currently, the SDF is considered high when a value is greater than 2500. SDF is considered medium when a value is between 2500 and 1000. SDF is considered low when a value is less than 1000 (Attachment 1).

The word "*currently*" shows that the SDF is a work in progress and needs much work. One of the most important tasks that should be addressed is linking the threshold values chosen for the SDF to the actual risk to water quality and the Beneficial Uses of water.

It is interesting to note that not a single THP of the 12 that were used to calibrate the Eligibility Criteria received a SDF of *high*. Therefore, it is not obvious that the SDF, as defined, will ever assign a value of *high* to a future THP. Calibrating the SDF to a limited sample of 12 THPs necessitates making an assumption that the SDF factor will be able to correctly extrapolate to a condition it was not calibrated for.

I am amazed that the Erosion Hazard Rating (EHR) which, is a required calculation in all THPs, was not used in any way to calculate the SDF. It would appear intuitively obvious that an operation with a given level of soil disturbance on soil with a *high* EHR would pose a significantly greater risk to water quality and the Beneficial Uses of water than a THP with the same level of soil disturbance on soil with a *low* EHR.

I am also very concerned that yarding operations on slopes less or equal to 65% are apparently rated the same as operations on flat ground. The SDF spreadsheet appears to sanction tractor operations on slopes greater than 65% even though the 2004 Forest Practice Rules (quoted below) appear to prohibit tractor activity on slopes greater than 65%. Emphasis has been added to the FPR quoted below.

914.2, 934.2, 954.2 Tractor Operations [All Districts]

(f) [Coast only] Tractor operations shall be subject to the following limitations:

(1) Heavy equipment ***shall be prohibited*** where any of the following conditions are present:

(i) Slopes *steeper than 65%.*

(ii) Slopes steeper than 50% where the erosion hazard rating is high or extreme.

(iii) Slopes over 50% which lead without flattening to sufficiently dissipate water flow and trap sediment before it reaches a watercourse or lake.

Best Management Practices

Forestry operations are known to cause an increase in discharge. Studies of logging done in the Caspar Creek watershed, as part of a long-term study, showed storm discharges increased about 23%, for small storms producing a discharge with a return period of 2 years or less (Lewis 2001). At Caspar Creek, these small storms generated more suspended sediment and turbidity in logged basins compared to unlogged basins. A portion of the increased sediment loads was linked to the increased storm discharge. The actual production of sediment from a logging operation depends, in part, on the amount of ground disturbance, type of ground disturbance, the nature of the underlying geology and soil, and rainfall intensity, and other factors.

As noted in Jodi Frediani in her March 11, 2004 e-mail to Executive Officer Briggs;

> The EPA has never certified the Forest Practice Rules as Best Management Practices. The State Board acknowledges that in Region 1 the Forest Practice Rules are not protecting water quality. (SWRQB Draft. EPIC Petition to review Order Nos. Re-2002-0209 and R1-2003-0116: "The record establishes that timber harvesting conducted during the period of the 1987 waiver has had a significant adverse impact on water quality in some areas of the North Coast Region.)

While the water quality problems generated by harvest activities have been dramatically reduced under the Forest Practice Rules, there has not been a clear demonstration that the Forest Practice Rules adequately protect water quality.

The EPA does not consider the California Forest Practice Rules (FPR) to be an effective set of Best Management Practices (BMPs) to protect water quality and the Beneficial Uses of water. Therefore, it would be prudent for the Central Coast Regional Board to require BMPs that are known to be more effective in the control of the discharge of sediment and water temperature increases than the practices required by the FPR.

Only those THPs that adhere to the list of proven BMPs selected by the Regional Board should be granted a waiver or individual WDR in watersheds that are 303(d) listed as impaired by sediment or temperature.

Tier II Monitoring

The Staff Report states that:

> Currently Attachment 1 shows Tier II does not require water quality compliance monitoring. However, at this stage of Eligibility Criteria development, the proposed monitoring program requires water quality compliance monitoring of turbidity in all new and reworked Class I and II watercourse crossings, and temperature in Class I watercourses where timber harvest occurs in the WLPZ, until staff has reviewed a number of individual plans and data for Tier II THP's. Staff proposes to conduct this review after 24 months of data are collected.

CDF has noted that existing culverts generate more sediment than new or rework crossing, typically because the existing culverts are under sized. Therefore, it is important to monitor existing crossings and to systematically replace existing under-sized culverts with properly sized culverts.

I would like to request that staff clarify the exact meaning of this statement. Does this statement mean that;

1. water quality compliance monitoring of turbidity will be required for all new and reworked stream crossings.
2. water quality compliance monitoring of temperature will be required in all Class I watercourses when harvest activities occur in the WLPZ.

For at least the next 24 months or until staff completes its review of a number of individual plans and data for Tier II THPs. How many plans does staff intend to review?

Monitoring and Reporting Program

The proposed Monitoring and Reporting Program (MRP) must be consistent with the State Water Code.

Section 13269 of the Water Code requires that:

> Monitoring requirements shall be designed to support the development and implementation of the waiver program, including, but not limited to, verifying the adequacy and effectiveness of the waiver's conditions

The same section provides that a waiver may only be granted if:

> [T]he waiver is consistent with any applicable state or regional water quality control plan and is in the public interest

Water quality control plans have three components:

- beneficial uses to be protected,
- water quality objectives that protect those beneficial uses,
- and an implementation plan that accomplishes those objectives.

Water quality monitoring to support the granting of a waiver from the Regional Board must be able to verify the adequacy of the waiver conditions to protect beneficial and that the waiver conditions are properly implemented. The proposed MRP needs to ascertain:

1. whether beneficial uses are at risk;
2. whether timber harvesting practices are contributing to the impairment or risk of impairment to beneficial uses; and
3. the conditions of the waiver address the impairment or risk to water quality and beneficial uses
4. that the conditions of the waiver have been properly implemented

If the monitoring and reporting plan is not able to demonstrate these things, it does not meet the legal requirements.

In the Central Coast Region, the beneficial uses relevant to timber harvesting are

- Municipal and Domestic Water Supply (MUN)
- COLD,
- SPWN,
- RARE,
- MIGR.

The COLD, SPWN, RARE and MIGR Beneficial Uses apply to salmonids in the Central Coast Region. THPs are required to contain information on the presence of salmonids and other listed species and they are also required to list any drinking water sources in close proximity to the plan. However, the information in THPs is not always correct or may become out-of-date during the approval process. Therefore, this information should be verified independently of the THP. Furthermore, THPs do not address municipal (or domestic) water sources if they are further than 1000' from the plan boundary. However, water quality problems generated by a THP will not simply vanish 1,000 feet downstream of the plan. Therefore, the waiver or individual WDR needs to protect all domestic and municipal water supplies downstream of a THP.

It has been well documented that timber harvest activities can cause an increase in the amount of sediment delivered to streams. Timber harvest operations can also cause increases in water temperature. As noted above, the federal EPA does not consider the California FPR an adequate set of BMPs to protect water quality. These are the very reasons that THPs need to obtain either a waiver or an individual WDR.

The MRP must establish that the conditions it proposes for a given THP are sufficient to protect the Beneficial Uses of water and that the required conditions are properly implemented. To accomplish these tasks the Staff Report identifies five types of monitoring;

1. Implementation/Effectiveness Monitoring,
2. Forensic Monitoring,
3. Water Quality Compliance Monitoring,
4. Assessment Monitoring,
5. Trend Monitoring.

The Staff Report asserts that only the first three types of monitoring are considered relevant to the questions being asked regarding the determination of the risk that a THP poses to water quality and to the Beneficial Uses of water. I disagree. In my view, assessment monitoring is need to determine the current state of water quality in a watershed that is about to be disturbed. Understanding the condition of water quality and the associated Beneficial Uses of water prior to the approval of a THP will help is assessing the risk of the proposed THP to water quality. The Staff Report lists three on-going water quality studies. However, it does not appear that the Eligibility Criteria have a pathway to make use of the data sets being collected. And it is not clear that the three programs mentioned are structured in such a way as to answer the questions that the Regional Board and its Staff needs in assessing the risk to water quality and Beneficial Uses posed by new THPs. In addition, the three studies cited may not sample water quality parameters in the proper geographic area to be useful for forestry related questions.

Trend monitoring has the potential to provide the feedback needed to adjust the components used in the Eligibility Criteria to improve the ability to properly characterize the risk that proposed THPs pose to water quality and the Beneficial Use of water.

Implementation/Effectiveness Monitoring

The Staff Report clearly defines the goals of Implementation and Effectiveness monitoring by presenting the underlying questions that need to be answered by this type of monitoring. The Staff Report states:

> The questions we are trying to answer through visual implementation monitoring are:
>
> • Are timber harvest activities being carried out as planned?
>
> • Are management practices being implemented as designed?
>
> The questions we are trying to answer through visual effectiveness monitoring are:
>
> • Are the implemented management measures effective at achieving desired results?

Once the Eligibility Criteria and the MRP are finalized by the Regional Board they will need to be field tested. Therefore Effectiveness Monitoring is of paramount importance at this stage of the process. If the MRP can not clearly establish the effectiveness of the Eligibility Criteria and the MRP then it must be judged a failure.

The Regional Board and Staff must have total confidence that when a waiver is issued that it is appropriate and that operations conducted under the waiver will protect water quality. If the adopted Eligibility Criteria and MRP are faulty, it is important to determine so quickly. Rigorous monitoring may be necessary during the first few years of the program to establish that the overall program is sound.

Attachment 2 presents the actual mechanics of each type of monitoring that Staff is recommending. The Implementation/Effectiveness Monitoring is based on Visual and Photo Monitoring. As currently structured, the Effectiveness Monitoring is not sufficient to determine whether the Eligibility Criteria, MRP and required BMPs are effective in protecting water quality and the Beneficial Uses of water. Visual monitoring alone is not appropriate for assessing the effectiveness of the Eligibility Criteria and MRP. In addition to the proposed visual monitoring, some form of in-stream testing of water quality and aquatic habitat are necessary to assess the effectiveness of the Eligibility Criteria, MRP and any additional BMPs imposed by the Regional Board. Once the soundness of the waiver program is established, it may be appropriate to rely on visual monitoring.

Visual Monitoring

The details of the visual monitoring in Attachment 2 do not appear to give sufficient guidance to be consistently applied. Attachment 2 does not provide enough guidance for determining when a problem exists. Confusion over when a water quality problem actually exists could result in the failure to perform the required Forensic monitoring.

The proposed MRP requires visual monitoring a minimum of three times during the first year. The first round of monitoring is required within either 12 or 18 hours of a storm that produces more than 2 inches of rain in a 24-hour period. The location of the rain gauge that will determine when two inches of rain have fallen during a 24-hour period is not specified. In Santa Cruz County, there is a strong correlation between rainfall amount and elevation. A rain gauge within the City of Santa Cruz will probably indicate a lower amount of rainfall during a given 24-hour period than a rain gauge located between 1,000 and 2,000 feet in the San Vicente Creek watershed. Similarly, a rain gauge within the City of Watsonville will probably indicate a lower amount of rainfall during a given 24-hour period than a rain gauge located in the headwaters of the Corralitos Creek watershed.

The Staff Report does not provide any real justification demonstrating that 2 inches of rain in a 24-hour period is an appropriate intensity of rainfall to trigger monitoring. Intense periods of rainfall of an hour or less in duration could generate significant runoff from watersheds about the size of typical THPs. Antecedent precipitation is another important factor in runoff generation that is not considered by the

proposed MRP. An intense period of rainfall of less than an hour in duration, after several days with less than 2 inches of rain per 24-hour period, could potentially generate a larger water discharge and sediment load than a 24-hour storm producing 2 inches. Therefore, the proposed MRP require a more realistic and scientifically sound method of defining a significant storm.

Attachment 2 requires that Visual monitoring shall be conducted a minimum of three times during the first year. The frequency of monitoring should be change to require monitoring during all significant storm events. Of course, more work needs to be done to define a significant storm event.

Photo Monitoring

The required Photo monitoring should occur at the same time as the visual monitoring. The language in Attachment 2 does not clearly link the Photo monitoring with the visual monitoring. Photo monitoring is required after, "the first significant storm event" but there is no definition for "significant storm". Photo monitoring is also required, "Following a significant storm event during the month of April". No justification is give why it is important to monitor a storm in the month of April.

Failure to Trigger Forensic Monitoring

The description of Implementation/Effectiveness Monitoring in Attachment 2 does not contain a specific direction to perform Forensic Monitoring if a problem is discovered. The missing trigger to initiate Forensic Monitoring if a problem is found during Implementation/Effectiveness Monitoring is located in the Forensic Monitoring portion of Attachment 2. This statement should be copied into the Implementation/Effectiveness Monitoring section.

Forensic Monitoring

Attachment 2 describes how the Forensic monitoring is to be done. One of the tasks to be performed during Forensic monitoring is:

> If timber activities cause a discharge (sediment, soil, other organic material, etc.) into waters of the state, the Discharger shall measure instream turbidity (using grab samples) in the closest Class I or II watercourse downstream of the discharge.

Why are grab samples required only from the nearest Class I or Class II stream downstream of a sediment discharge? Why is sampling the closest downstream Class III stream excluded? Suspended sediment carried by a Class III stream will eventually enter a Class I stream.

Water Quality Compliance Monitoring

The Staff Report's discussion of Water Quality Compliance Monitoring is quoted below.

> The questions we are trying to answer through water quality compliance monitoring through in stream or grab sample collection are:
>
> • Are timber harvest activities impacting water temperatures?
>
> Impact is defined as a temperature increase of more than 5°F above natural receiving water temperature. (Basin Plan, 1994).
>
> Although not a Basin Plan water quality objective, another temperature criteria that will be considered when evaluating data is when water temperature approaches the upper limit of 68°F creating unsuitable habitat for salmonids (Cafferata, 1990).
>
> • Are timber harvest activities impacting water clarity?
>
> Impact is defined as when the down stream sample is at least 50 NTUs (Nephelometric Turbidity Units) and 20% greater than the up stream sample.
>
> This is an interpretation and non-scientific conversion of the Basin Plan (1994) general water quality objectives for turbidity in Jackson Turbidity Units (JTU).

Temperature

The definition of a water temperature impact as being an increase of more than 5^0F above natural receiving water temperature found in the 1994 Basin Plan is inadequate to protect the COLD, SPWN and RARE Beneficial Uses of water.

Sullivan (2000) evaluated several approaches to establishing temperature criteria to protect salmonids and presented a risk-based method to establish water temperature criteria. A substantial portion of the Abstract from Sullivan's paper is presented below along with Figure 7-3 from her report.

> To administer the Clean Water Act, the U.S. Environmental Protection Agency and state water quality agencies throughout the nation have adopted numeric and qualitative criteria that establish environmental conditions known to protect aquatic life from adverse effects. Pacific Northwest states have adopted temperature criteria designed specifically to protect fish with emphasis on salmonid species because water temperature plays a role in virtually every aspect of salmon life. Adverse levels of temperature can affect growth, behavior, disease resistance, and mortality. In recent years, the EPA and National Academies of Science and Engineering have promoted risk assessment techniques to develop water quality criteria, including formal protocols that have been peer reviewed nationally. Risk assessment is designed to combine the information from biological studies with an analysis of each population's exposure to quantified effects. Risk occurs when the stress' magnitude, frequency and duration exceed the species' ability to deal with that stress. A risk-based approach seems ideally suited to developing criteria for and assessing temperature risk to fish because exposure has been well documented through temperature monitoring and extensive research on the lethal and sublethal effects on salmon physiology has been conducted over the past 40 years. Nevertheless, risk-based approaches have not yet been used to establish temperature criteria in recent state agency reviews of water quality standards.
>
> In this paper we develop a risk-based approach to analyze summertime temperature effects on juvenile salmon species. ..... The results suggest that quantitative analysis of growth effects can be determined with reasonably simple methods that can be applied at specific sites or at a region scale to identify appropriate temperature thresholds. Assuming a 10% growth loss represents an appropriate risk level, an upper threshold for the 7-day maximum temperature of 16.5°C is appropriate for coho and 20.5°C is appropriate for steelhead. Criteria derived in this manner are somewhat lower than those developed in a U.S.E.P.A. paper in 1977 and close to, but not identical, to those currently specified in Washington and Oregon criteria.

Sullivan (2000) defines the different 7-day averages referred to in Table 7-3 as;

> Oregon specifies the average of the daily maximum temperature of the 7 warmest consecutive days. The U.S. EPA (1977) recommends the average of the daily mean temperature of the 7 warmest consecutive days (MWAT). Some have also argued that the daily temperature fluctuation should also be accounted for, but this characteristic has not been widely specified in states' criteria.

The 7-day averages referred to above are calculated from hourly data collected by a temperature datalogger such as a HoboTemp. Sullivan recommends using the column labeled "10% RMG" in her Table 7-3 above as the maximum temperature for Coho and steelhead. The "10% RMG" means that keeping water temperature in the range shown will reduce growth no more than 10% from maximum growth.

Table 7.3 Temperature criteria (°C) for growth of juvenile salmonids derived from temperature analysis at values of reduction from maximum growth (RMG) of 10% and 20%.

Temperature Index	Coho		Steelhead		MWAT (Updated EPA method (Table 6.1)
	10% RMG	20% RMG	10% RMG	20% RMG	
7-day Maximum[a] (°C)	13.0-16.5	9.0-20.5	14.5-20.5	10.0-24	
7-day Mean[b] (°C)	12.8-14.8	9.0-19.0	13.0-17.0	10.0-19.0	19.7 coho 19.6 steelhead
Annual Maximum[c] (°C)	13.5-17.5	9.5-23.0	15.5-21.0	10.5-26.0	

[a] maximum value of the 7-day moving average of the daily maximum temperature;

[b] maximum value of the 7-day moving average of the daily mean temperature;

[c] instantaneous maximum observed during the summer.

The Central Coast Basin Plan definition of an impact to water temperature is not in conformance with the risk-based criteria presented by Sullivan (2000). As written, the Basin Plan's definition for an impact to water temperature does not accurately characterize significant impacts to water temperature when the temperature of the receiving water is near the upper limit of the 10% RMG range shown in Sullivan's Table 7-3 above. For example, if the temperature of the receiving water was 62.6 ^{0}F (17 ^{0}C) and a 5 0F temperature increase was caused by a THP or other activity the temperature would be 67.6 ^{0}F (19.8 ^{0}C). The 5 ^{0}F change allowed by the Basin Plan would move the water temperature from the 10% RMG range of 13-17 ^{0}C to outside of the 20% RMG range of 10-19 ^{0}C for steelhead. Federal and State agencies concerned charged with protecting steelhead may rule such a change in water temperature a take under the Endangered Species Act (ESA).

Staff cites a report by Peter Cafferata, CDF's Hydrologist, that 68 ^{0}F (20 ^{0}C) as the upper limit of water temperature for suitable salmonid habitat. According to the last row in Sullivan's Table 7-3 (presented above) the upper instantaneous water temperature limit of the 10% RMG for Coho is 63.5 ^{0}F (17.5 ^{0}C). The value of 68 ^{0}F (20 ^{0}C) quoted by staff is appropriate for steelhead but it is too hot for Coho.

Attachment 2 indicates that HoboTemp dataloggers should be used to monitor water temperature at the upstream and downstream extent of the THP. However, no explicit protocol is given for how the HoboTemps are to be deployed. For example the calibration procedures; frequency of readings; and where in the stream channel they should be placed should be specified.

Turbidity

The 1994 Central Coast Basin Plan defines an adverse impact as follows:

> Turbidity
>
> Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increase in turbidity attributable to controllable water quality factors shall not exceed the following limits:
>
> 1. Where natural turbidity is between 0 and 50 Jackson Turbidity Units (JTU), increases shall not exceed 20 percent.
> 2. Where natural turbidity is between 50 and 100 JTU, increases shall not exceed 10 JTU.
> 3. Where natural turbidity is greater than 100 JTU, increases shall not exceed 10 percent.

> Allowable zones of dilution within which higher concentrations will be tolerated will be defined for each discharge in discharge permits.

It is interesting to note that the Basin Plan Water Quality Objective for turbidity is given in JTU (Jackson Turbidity Units) which are no longer commonly used. In fact, according to a USGS Office of Water Quality web site,

> Turbidity measurements reported for regulatory purposes require a true nephelometric measurement using turbidimeter instruments that meet U.S. Environmental Protection Agency (USEPA) specifications (see **6.7.1**) .http://water.usgs.gov/owq/FieldManual/Chapter6/6.7.html

In the past, turbidity was measured using the Jackson candle turbidly meter, which can not effectively measure turbidity levels of less than about 25 units. As a result, the American Public Health Association's, Standard Methods for the Examination of Water and Wastewater, 17th edition (1989) no longer discusses turbidity measurements using the Jackson candle turbidity meter.

There is a rough correspondence between nephelometric turbidity units (NTU) and Jackson turbidity units (JTU) at about 40 NTU. However, the relationship between NTUs and JTUs at other turbidity levels is not clear since the results depend on the differences in the types of instruments used and the calibration methods.

I recommend that the Central Coast Regional Board drop the use of JTUs and substitute the use of NTUs for measuring turbidity.

As noted above, the Staff Report defines an impact for turbidity as follows;

> Impact is defined as when the down stream sample is at least 50 NTUs (Nephelometric Turbidity Units) and 20% greater than the up stream sample.

Note that the Staff Report's definition of an impact is not consistent with the Basin Plan. The Staff Report is defining an impact only when the turbidity is greater than 50 NTUs which is roughly the same as 50 JTUs. The Basin Plan limits the increase to 10 JTU when the turbidity of the receiving water is in the range of 50 to 100 JTU but, the Staff Report allows a 20% increase which, corresponds to about 10 NTU when the receiving water has a turbidity of 50 NTU and corresponds to about 20 NTU when the receiving water has a turbidity of 100 NTU.

But the standards set in the Basin Plan do not appear appropriate for protecting salmonids. The Humboldt Watersheds Independent Scientific Review Panel report from August 2003 cites work by Trush that shows that the turbidity tolerance of salmonids varies through the year as follows:

> Trush (2003) has identified "chronic turbidity thresholds" for anadromous salmonid populations for each of the following flow conditions:
>
> - mean daily average streamflow (23%-24%): NTU < 10
> - winter base streamflow (10%): NTU < 25
> - receding winter peak streamflow (5%): NTU <70
> - winter peak streamflow (2.5%): NTU < 100.
>
> Identifying chronic turbidity thresholds for different portions of the annual hydrograph is an important step in developing TMDLs because it recognizes that the vulnerability of salmonids varies seasonally with position of the annual hydrograph. For example, the survival of salmonid embryos in gravel beds can be reduced by fine sediments entering streams during the critical species-specific incubation period (Everest et al. 1987). Also, chronically turbid water during the prime summer rearing period can reduce the density and growth of juvenile salmonids (Sigler et al. 1984), and cause a physiological stress response if turbidity occurs during periods when waters are normally clear (Redding et al. 1987).

Attachment 2 states that:

> **D.2 Turbidity** - The Discharger shall monitor all newly constructed or reconstructed Class I and II crossings within the timber harvest plan area in place after October 15th for turbidity (a hand held turbidimeter is acceptable for this purpose). Turbidity shall be measured approximately 25 feet upstream and downstream of all newly constructed or reconstructed Class I and II road crossings. Turbidity monitoring may be required as determined be the Regional Board Executive Officer if no newly constructed or reconstructed crossings exist within a proposed timber harvest plan and the plan has activity within a Class I or II WLPZ

Why is the Water Quality Compliance Monitoring done at fewer sites than the Effectiveness Monitoring which, is to be done at all watercourse crossings, water diversions, and watercourse confluences. Limiting the Water Quality Compliance Monitoring to just new or reconstructed crossings limits the usefulness of the monitoring. As mentioned above, CDF notes that existing culverts are very significant sources of sediment. Turbidity sample should also occur above and below the THP.

No guidance is given on how to take grab samples or measure turbidity. No standards are given for the accuracy and resolution of the equipment used to measure turbidity. The lack of a measurement protocol and quality assurance protocol for the water temperature and turbidity measurements required by the Water Quality Compliance Monitoring program is a significant flaw in the MRP.

Data Logging and Reporting

Attachment 2 lists six activities that are to be performed in reporting to the Regional Board.

- Logbooks
- Sediment Release Reporting
- Road Inventory Program
- Violation Reporting
- Annual Report
- Safety
- Right of the Executive Officer to modify the MRP.

The applicant is given 48-hours to notify the Regional Board of any violation of the FPR relating to water quality or of the release of sediment or a noticeable increase in turbidity. The Forensic Monitoring Program requires that:

> If at any time during implementation or effectiveness monitoring, the Discharger observes a discharge, the Discharger shall notify the Regional Board within 24 hours.

The 48-hour notification time should be reduced to 24-hours.

Summary

The Eligibility Criteria and the Monitoring and Reporting Plan described in the Staff Report is a start towards developing a workable system of deciding which THPs should be granted a waiver or be required to obtain an individual WDR and the level of water quality monitoring that each type of THP should undergo. However, the Eligibility Criteria and the MRP both need substantial revision. The following is a summary of the problems I noted in a quick review of the Eligibility Criteria and MRP.

Eligibility Criteria

- Not all relevant components are considered.
- The Erosion Hazard Rating is not used.
- Formula for the three indexes are incomplete
- The thresholds appear to be arbitrary and are not supported by literature citations
- A list of BMPs superior to the FPR needs to be developed.
- The Eligibility Criteria have not been validated

Monitoring and Reporting Plan

- Effectiveness monitoring should include water-column monitoring to validate the Eligibility Criteria.
- Visual monitoring lacks a well defined protocol that will assure consistency
- The use of a 2-inch in 24-hour rainstorm needs to be verified as an appropriate trigger for monitoring. A higher intensity rainfall may be more appropriate.
- It is not clear where the rainfall is to be measured.
- Monitoring should be done during all significant storm events.
- Photo monitoring should be done at the same time as visual monitoring
- Forensic grab samples should be taken in Class III watercourses as well as Class I and Class II watercourses.
- There are no measurement protocols or quality assurance plans for the Water Quality Compliance Monitoring.
- The Basin Plan standards for water temperature are not sufficient to protect salmonids.
- The Basin Plan standards for turbidity are not sufficient to protect salmonids.
- Turbidity measurements should be made at the same in-stream locations where visual monitoring is required.
- All problems should be reported to the Regional Board within 24-hours.

I request that the Regional Board direct Staff to work with all interested parties and recognized experts to refine the Eligibility Criteria and the MRP presented in the February 10 Staff Report for Item 4.

Sincerely,

Dennis Jackson

Dennis Jackson
Hydrologist

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