EPA, 1998

Redwood Creek Total Maximum Daily Load Comment Responsiveness Summary
December 29, 1998

List of Commenters

1. Paul Keiran, Parsons Engineering Science
2. Donald B. Koch, California Department of Fish and Game
3. Alan Levine, Coast Action Group
4. Tim McKay, Northcoast Environmental Center
5. Richard Dunning
6. Charles Wilson
7. Stephen Horner, Barnum Timber Company
8. Wayne Whitlock, Pillsbury, Madison & Sutro, LLP, on behalf of Redwood Creek Landowners Association
9. Mary Ann Madej, U.S. Geological Survey
10. S.E. "Lou" Woltering and Carolyn Cook, Six Rivers National Forest
11. Daniel Cahoon
12. Anne Hubbard
13. Terrence Hofstra and Greg Bundros, Redwood National and State Parks
14. Patrick Higgins
15. Ann and Joe Friedman, Nancy Cox, Nancy Cowell, Debi Falk-Young, Edith Butler, Steve Catton, Millie Brucker, Cindy Van Fleet, Lorraine Dillon, Sophia Pelafigue, Patricia Pearson, Becky Evans, David and Collen Imper, Larry L. Karsteadt, Michael Dehority, Joe Ashenbrucker, Kristian Morley, Nat Childs, Michael M. Minor, Kathy O'Leary, Norman F. Wright, John Gaffin, Gail Kenny, Virginia Marshall-Edwards, Michael Torbert, Paul Domanchuk, David E. Durbin, Sally S. Williams, Patricia L. Black, Katy Allen, Catherin Joyce, Frank Casasanta, Bunny Wilder, Laurel Maurer, Nathaniel Vaughn Kelso, and Kathleen Krauss (grouped due to similarity of comments)
16. Bradley Burns
17. Jesse Noel
18. David Keniston
19. Forest Tilley
20. Patrick Greene
21. Anne Conrad-Antonville
22. Michele Marta
23. Helen Stover
24. Joe Brecher
25. Larry Moss
26. Bernie Bush
27. Steven Self
28. Jim Komar, NRCS
29. Gary Rynearson
30. Richard Gienger
31. Robert Klamt, North Coast Regional Water Quality Control Board

Due to the length of comments received, many comments are paraphrased in this summary.

Comment 1: Paul Keiran, Parsons Engineering Science. Letter dated 11.17.98.

1.1 Reference is made to the commenters experience in Redwood Creek watershed with adverse effects of clearcuts and poor grazing practices. Conditional prohibitions in the draft Basin Plan amendment's implementation plan are ideally wonderful, but in reality a folly. Commenter suggests specific standards for reducing sediment loads.

Response: The TMDL contains load allocations divided by erosion process category, which set maximum allowable loads as long term annual averages. The TMDL also has been revised to include hillslope numeric targets which address erosion from roads and some silvicultural practices. These allocations and hillslope targets should help guide specific implementation provisions to be contained in the State's implementation plan.

Comment 2: Donald B. Koch, California Department of Fish and Game. Letter dated 11.17.98.

2.1 EPA should consider DFG's comments to the Regional Board concerning the State's draft TMDL dated July 1998 (attached to comment letter). Most comments address the draft State implementation plan. EPA should consider adding a specific numeric target for large woody debris because the "improving trend" target is difficult to measure. Commenter suggests a numeric target value defined in terms of permanent retention of a minimum number of trees of a certain size per 100 feet of the riparian management zone adjacent to waterbodies which support fish habitat.

Response: Inadequate information is available to assess the suitability of the suggested suite of numeric targets for large woody debris. The "improving trend" target has been retained. However, the table of values provided by the commenter is being added to the TMDL text to provide potential guidance in interpreting woody debris trends. In addition, the monitoring recommendations recommend monitoring of woody debris in the watershed.

2.2 Beneficial uses section should be changed to refer to fall chinook because Redwood Creek does not support winter chinook.

Response: The suggested change was made.

2.3 DFG does not concur with the theory that significant improvements in erosion control and associated sediment loading have occurred in Redwood Creek watershed. DFG believes improved conditions are more likely tied to drier weather.

Response: EPA believes available evidence is inconclusive with respect to the cause of lower sediment yield rates at Orick in recent years. EPA agrees that improved conditions may well be

associated with recent periods of below average rainfall and runoff. Preliminary analysis of the effects of the 1997 storm (recurrence interval = about 11 years) are also inconclusive but indicate that sediment yield rates exceeded the TMDL. Moreover, National Parks Service surveys indicated that a very large number of new road failures and landslides were found following the moderate 1997 storm event.

Comment 3: Alan Levine, Coast Action Group. Letter dated 11.13.98, copy of letter to Regional Board dated 7.28.98, and oral testimony at public hearing.
(Note: most comments suggesting specific implementation provisions are not addressed here because implementation requirements are not a component of the TMDL).

3.1 Please consider comments made to the State concerning the Regional Board's draft TMDL for Redwood Creek.

Response: EPA has considered those comments to the extent they were made available to EPA and the comments addressed the TMDL itself, as opposed to implementation plan provisions.

3.2 Any TMDL process should include an implementation policy. EPA should tell the State its implementation responsibilities.

Response: Federal regulations do not require EPA to develop an implementation policy as a TMDL component. However, the State is required to identify implementation measures for a TMDL as part of the State water quality management plan (40 CFR 130.6). The Regional Board is currently in the process of developing an implementation plan for the Redwood Creek TMDL, and EPA has included implementation recommendations in this TMDL decision. States are expected to implement TMDLs addressing nonpoint sources (see EPA, 1997a)

3.3 Monitoring data and numeric targets need to be based on parameters designed to allow interpretation of trends over reasonable time periods (e.g. turbidity). Monitoring plans should state quantitative goals.

Response: EPA agrees that it would be preferable to use parameters which could be interpreted over short time periods. EPA is working with the State and other resource experts to evaluate candidate indicators of this kind, including turbidity-based indicators. However, no parameters of this type were available for Redwood Creek which are well supported and which can be linked to aquatic habitat condition at this time. Many of the indicators used in this TMDL were selected to reflect our recognition that stream conditions vary substantially from year to year and from place to place, and that it is often difficult to draw conclusions concerning stream condition trends based on data from a limited period. EPA agrees that monitoring plans should state quantitative goals.

3.4 Target parameters should be provided for off channel habitat.

Response: While EPA concurs that this may be a good idea, insufficient information was available for us to identify appropriate indicators of off-channel habitat condition in this TMDL.

3.5 The TMDL should address the relationship between sediment loads and gravel extraction.

Response: Gravel extraction is not believed to be a significant issue in Redwood Creek. No information was available to support an assessment of the relationship between sediment loads and gravel extraction in Redwood Creek.

3.6 Commenter supports suggestion to measure longitudinal profile along with grain size and large woody debris measurements. This provides a better picture of bedload mobility.

Response: As the TMDL discusses, it may be appropriate for future monitoring efforts to include measures of longitudinal profile and woody debris.

3.7 There should be a discussion of uncertainty related to source assessment and how this relates to the allocation and reduction scheme and potential implementation policy.

Response: The TMDL includes a discussion of uncertainties associated with the source assessment and the analytical assumptions made to account for these uncertainties in the derivation of load allocations.

3.8 The relationship of road and skid trail density should be part of the allocation discussion and targets should include road density reductions or limitations in critical areas

Response: The TMDL has been modified to include numeric targets addressing road design and maintenance and harvest practices in steep, geologically unstable, and streamside areas which are prone to erosion.

3.9 The relationship of Class III watercourses to sediment production and related policy should be discussed.

Response: No direct information was available to EPA to support the suggested analysis. However, EPA is recommending that the implementation plan more directly provide for the protection of Class III watercourses from sediment delivery.

3.10 The TMDL should address temperature as a limiting factor.

Response: The TMDL is being developed for sediment and therefore does not need to address temperature issues. If Redwood Creek is listed on the Section 303(d) for temperature in the future, a TMDL for temperature would be required. EPA expects that some of the measures needed to address sediment will result in reductions in stream temperature.

3.11 Numeric targets for embeddedness, dissolved oxygen, and turbidity should be included.

Response: Information needed to evaluate the appropriateness of targets based on these indicators was unavailable for this TMDL. See response to comment 3.3.

3.12 Source assessment should be adjusted and updated by future monitoring.

Response: We agree, and we recommend that monitoring activities be developed to support this kind of future analysis.

3.13 Implementation timeframes are suggested for several source categories.

Response: Although some implementation timeframe recommendations are made, the TMDL is not required to include implementation timeframes.

3.14 A suggested set of numeric targets is provided.

Response: EPA reviewed these recommendations and believes the analytical basis for them is not sufficiently clear to warrant inclusion of them as changes to the instream indicators in the Redwood Creek TMDL. They were apparently developed as part of the Garcia River planning effort and may not be transferrable to Redwood Creek. EPA believes it has identified a reasonable set of instream and hillslope indicators which represent the desired condition of the watershed. Addition of more indicators would note necessarily add value to the effort and may result in an excessive focus on monitoring to the detriment of actual implementation investments.

3.15 EPA should revisit its approval of the management agency agreement with CDF and its associated approval of best management practices.

Response: This comment does not address TMDL content and requires no response.

3.16 Recent trends of decreasing sediment loads may be inaccurate given the rainfall patterns of the last 20 years.

Response. We agree. See responses to comments 7.2, 13.3, and 13.9.

3.17 Commenter supports hillslope targets and instream targets based on suspended sediment or turbidity monitoring.

Response: EPA has added several hillslope targets. See responses to comments 17.1 and 17.2 concerning instream target comment.

Comment 4: Tim McKay, Northcoast Environmental Center. Letter dated 10.19.98 and oral testimony at public hearing.

4.1 Draft TMDL downplays the magnitude of damage to Redwood Creek caused by upstream activities. The National Park Service watershed analysis notes the number of streamside landslides rose from 100 in 1947 to 415 landslides 30 years later.

Response: EPA did not intend to downplay the magnitude of historical damage to Redwood Creek. EPA concurs that these impacts to stream structure and aquatic habitat have been extensive.

4.2 Reference is made to language in the problem statement concerning channel deepening and pool development in Redwood Creek. An air photo is provided from 1998 as evidence of streamside landslides associated with a clear cut and associated stream channel impacts.

Response: We appreciate the information, which further supports EPA's conclusion that recent stream responses to higher flow events between 1995 and 1997 call into question any conclusions concerning the extent of stream recovery from historical damage.

4.3 Commenter notes results of source analysis indicating average sediment loads in Redwood Creek watershed of 4750 tons per square mile per year and that the TMDL asserts that 65% is controllable. Comparison is made to dump truck loads of sediment these sediment loads represent.

Response: Comment noted.

4.4 Numeric targets are laudable, but the date for achieving them (2038) is meaningless and laughable. A compliance date of 2015 is possible.

Response: EPA's TMDL does not include a compliance timeframe because it is not required by Federal regulations. EPA recognizes that attainment of instream targets may take several decades. However, as EPA recommends in the implementation discussion in the TMDL, it should be feasible to implement the needed measures to prevent and control key erosion sources over the next 5-13 years, depending upon the practice.

4.5 A compliance schedule for implementation is needed. Specific implementation provisions concerning retention of standing trees in the riparian zone are provided.

Response: This comment addresses the implementation plan to be developed by the State. EPA agrees clear implementation timeframes are needed and that it may be appropriate to establish provisions for the retention of standing tress in the riparian zone. The Regional Board should consider the merits of the provisions suggested by the commenter.

4.6 Road density is a good indicator should be addressed in hillslope monitoring and targets.

Response: We generally agree that road density should be reduced in Redwood Creek watershed. EPA concluded that insufficient data and analysis were avaialble to support establishment of road density targets or other measures of watershed disturbance. Instead, hillslope targets focusing upon road design and maintanance and silvicultural methods are included.

4.7 More attention is needed to Class 3 streams.

Response: We agree and are recommending that the implementation plan provide for effective protection of class 3 streams from excessive sediment loading.

4.8 TMDL should address conifer retention to provide for recruitment of large woody debris.

Response: See response to comment 2.1.

Comment 5: Richard Dunning. Letter dated 11.17.98

5.1 Road mileage per square mile should be reduced.

Response: See response to comment 4.6.

5.2 There is too much sediment in the creek, salmon need help, and the rivers need cleaning and protection.

Response: We agree and have attempted to develop a TMDL which will result in restoration of salmon habitat in Redwood Creek.

Comment 6: Charles Wilson. Letter dated 11.3.98 and oral testimony at public hearing. (Note: letter comments refer to the State's draft TMDL dated July 16, 1998. This summary addresses comments which are germane to the EPA draft TMDL.)

6.1 Was the report prepared by Redwood National Park?

Response: The report was prepared by U.S. EPA with assistance from staff at the North Coast Regional Board. The report was based largely upon published research conducted by Redwood National Park staff. In addition, researchers from Redwood National Park and the U.S. Geological Survey provided valuable unpublished data and insights concerning sediment issues in Redwood Creek Watershed. Park staff did not assist in the preparation of the TMDL.

6.2 Will numeric targets be enforced, and, if so, how?

Response: The State is responsible for implementation and enforcement of water quality standards and TMDL provisions. In its draft TMDL Strategy, the State has indicated its interpretation that instream numeric targets would not be enforceable. Since none of the sediment sources in the watershed are currently subject to discharge permits required by the federal government (i.e., NPDES permits), EPA is not responsible for enforcement or oversight of State enforcement of load allocations or TMDL implementation provisions.

6.3 Are federal agencies exempt from being subjected to the TMDLs?

Response: No, all land owners in the watershed are subject to the TMDLs provisions, including Redwood National Park.

6.4 The interpretation that a lack of rearing habitat has forced juvenile fish to the estuary is inconsistent with the impression given by the National Park that the estuary is the natural location.

Response: The watershed analysis for Redwood National Park indicates that the lack of adequate rearing habitat in Redwood Creek has forced juvenile fish to the estuary earlier and in greater numbers than would otherwise occur if rearing habitat were in good condition in the Creek.

6.5 What is the downstream boundary of the Redwood Creek basin or watershed? Where is the "Orick" monitoring station?

Response: For the purposes of the TMDL, the Redwood Creek basin is that area upstream of the Orick monitoring station located near the Route 101 crossing. The basin includes the Prairie Creek subbasin.

6.6 The Redwood Creek Watershed Analysis is a draft report which has not been distributed to or commented on by the public, yet is the basis for the TMDL analysis.

Response: Drafts of the watershed analysis have been made available to the public upon request by Redwood National Park. Copies of the latest draft can be obtained from Dawn McGuire of Redwood National Park (707-822-7611).

6.7 Because Redwood Creek was listed on the 303(d) list due to sediment impacts on cold water fisheries, the Orick area downstream from any redds should be exempted from the targets and potential fines and penalties.

Response: The TMDL, associated allocations, and the targets are intended to apply to the entire watershed upstream of Orick bridge monitoring station. Sediment impacts on salmonid habitat are not restricted solely to spawning redds which generally are found upstream from Orick. In addition to impacts to spawning redds, excessive sediment loadings have contributed to impairment of rearing pools and fish passage, which may be issues in the lower basin near Orick. Inadequate information concerning specific sediment impacts in specific reaches of the Redwood

Creek system were available to provide an analytical basis for delineating the applicability of TMDL provisions at a finer geographic scale.

6.8 Although the "sediment wave" is mentioned in the report, nothing in the report mentions the effect of overtopping the Orick levees when the wave passes through Orick.

Response: Although excessive sediments present in lower Redwood Creek may affect the operation of the levees and/or contribute to flooding near Orick, information was unavailable to EPA during preparation of the TMDL to provide an analytical basis for quantifying these effects. EPA generally believes that reduction of sediment loading to the levels called for in the TMDL may help prevent adverse effects of excessive sediment transport past Orick.

6.9 The document implies the 1964 flood was a 50 year flood, but the draft Redwood National Park general plan indicates it was about a 20 year flood.

Response: Comment noted. The Watershed Analysis indicates that there is conflicting information about the recurrence interval associated with the 1964 flood, and notes that one researcher estimated a recurrence interval of 45-50 years for the 1964 flood, while another study indicated that the peak flow in 1964 is associated with a recurrence interval of about 20-25 years.

6.10 TMDL should address situation where another landowner diverted water onto commenter's property, causing significant erosion.

Response: It is not clear how the TMDL would address this situation although it appears to be an implementation issue which the TMDL is not required to address directly.

Comment 7: Stephen R. Horner, Barnum Timber Company. Letter dated 11.17.98 and oral testimony at public hearing.

7.1 The entire record of public comment submitted to the North Coast RWQCB should be included into the record of the EPA version of the TMDL as the State and EPA versions of the TMDL are virtually identical.

Response: EPA has reviewed most of the public comments submitted in writing to the North Coast RWQCB, and has found that the vast majority of comments focus upon the implementation plan which is not part of the EPA TMDL. Moreover, our review of comments submitted to EPA during the comment period on the EPA TMDL cover most if not all comments concerning TMDL content which were submitted to the State. Federal public participation regulations at 40 CFR 25 require EPA to consider only those comments made during the federal comment period. We have considered all the comments made to the State which were subsequently submitted to EPA during the federal comment period to the extent those comments are germane to the EPA draft TMDL.

7.2 The proposed TMDL is based solely on historical data and does not reflect current conditions.

Data for Redwood Creek indicate that conditions relating to water quality and sediment yield have been improving steadily since 1972.

Response: In preparing the TMDL, EPA considered sediment yield data for Redwood Creek as a whole and for several tributaries for the period up to and including 1997. While we agree that some data indicate possible improving trends in sediment yield and water quality conditions over the past decade, we do not believe it is warranted to draw firm conclusions based on these data for several reasons:

1. The recent data were collected during a period of average to moderate rainfall and runoff. Most researchers agree that higher sediment yields are associated with high magnitude storm and runoff events which have not been observed over the past decade (with the possible exception of the 1997 flood). Therefore, the observed improvements may be the result of years of lower than average rainfall and not of actual reductions in erosion potential in the watershed.
2. The water quality and pool condition data are very limited. Inadequate data are available for most of the basin to draw firm conclusions.
3. Surveys of erosional features (e.g., landslides and road failures) since the 1997 flood indicate that there were a large number of new landslides and road failures triggered during and after the 1997 storm. National Park Service researchers report that many pools in the Creek which had been scoured out over the past decade were filled with sediment following the 1997 storm (see comments from USGS and Redwood National Park.

4. An analysis of 10 year rolling average sediment yields over the past ten years does not support the assertion that sediment yield trends have been steadily improving. Instead, that analysis found that in response to the higher magnitude storms of 1995-97, the rolling average annual sediment yield significantly exceeded the TMDL for the 1988-97 averaging period.

Therefore, recent data do not provide a clear picture of whether sediment yields and water quality conditions are improving. Also see response to comments 13.3 and 13.9.

7.3 Erosion rates from Barnum's road system in response to the 1997 flood were 13.5 cubic yards per mile, while erosion from "rehabilitated roads in Redwood National Park totaled 725 cubic yards per mile. EPA must compare erosion from private road systems to erosion from rehabilitated roads. If erosion from roads managed under existing regulations is less than erosion from rehabilitated roads, further reductions are not likely to be possible. Current erosion from Barnum's roads are de minimus, and further reductions are unnecessary.

Response: The load allocations establish the maximum annual loading per square mile for different loading categories, measured as 10 year rolling averages. If these allocations are already being met, further reductions are unnecessary in order to implement them.

7.4 The 1997 flood is the 5th largest on record, and the month that preceded it is the wettest on

record. The antecedent precipitation index for 60 days prior to the 1997 flood was the highest since the December 1964 flood. EPA should consider the current sediment loads and erosion rates in light of recent rainfall and floods prior to allocating sediment reductions to existing land uses.

Response: The National Park Service estimates that the rainfall intensity of the 1997 storm was relatively low (3-year return interval) and the flood flow was moderately high (11-year recurrence interval). EPA does not agree with the commenter's inference that the 1997 flood was a major flood event, and we evaluated the limited information available to us regarding erosion activity and channel response following this flood in that light.

7.5 The recommendations of the TMDL FACA report concerning difficult TMDL problems should be considered in development of the Redwood Creek TMDL.

Response: The FACA Committee Report has no bearing on the development of TMDLs under the current regulations. EPA is aware of it recommendations.

7.6 The TMDL should include a waste load allocation to historic problems separate from what is actually occurring from modern land use activities or could be expected to occur in the future.

Response: While EPA recognizes the desirability of being able to distinguish historic problems from pollutant loading associated with present or future activities, EPA lacked data or an analytical basis needed to implement this recommendation. Federal regulations do not require this distinction to be made.

7.7 The only human caused sediment source identified in the sediment budget which can be readily controlled or prevented is gullies. This source and many other human caused sources are already regulated through the Forest Practice Rules. Additional regulation is therefore unlikely to produce further reductions in sediment loading.

Response: EPA disagrees that the only human caused sediment source that can be controlled is gullies. The information available to EPA and cited in the TMDL support a conclusion that at least a portion of the erosion associated with roads, fluvial erosion associated with harvesting activities, and mass wasting features associated with roads and land management can be avoided.

7.8 Strict application of one single standard for fine sediment is impossible. Most studies of sediment relationships to salmonid survival-to-emergence are flawed because they do not reflect gravel cleaning and subsequent substrate sealing above the gravel layer where eggs are laid.

Response: EPA agrees that a single numeric target for fine sediments is not the optimal way to articulate the desired condition of aquatic habitat and stream bottom composition. However, we did not have information necessary to develop fine sediment targets which appropriately account for temporal and spatial variability within the watershed. EPA recognizes that actual values for

numeric indicators will vary from year to year in healthy streams. EPA is also clarifying that the fine sediment targets should be measured at riffle crests. Finally, more detailed monitoring methods are recommended for each numeric target indicator.

EPA disagrees that survival-to-emergence studies are flawed because they do not account for the gravel cleaning and substrate sealing phenomena the commenter mentions. Several of the key studies reviewed by EPA in deriving the targets were based on studies of actual redds (e.g., Koski, 1966, Taggart, 1984, cited in Chapman and McLeod, 1987). While EPA is aware that some researchers have reported the redd cleaning and surface sealing phenomena, EPA is unaware of research results which quantify these phenomena in a way that would enable EPA to factor them into our derivation of numeric target values. In the absence of such studies, the conservative approach is to evaluate the relationship between fine sediment levels and survival to emergence without factoring in reductions in fines through gravel cleaning or in the effect of fines through sealing of the surface layer. Finally, EPA notes that even if salmonids clean gravels prior to spawning, subsequent deposition of fine sediments during the egg growth period prior to emergence may adversely affect survival rates (See, e.g. Kondolf, et.al., 1993)

7.9 Lisle's 1989 study of Prairie Creek showed that fines less than 2 mm ranged from 12% to greater than 30%. Prairie Creek was in very desirable condition at the time of Lisle's study. The TMDL target for fines less than 6.5 mm of less than 30% is unreasonable.

Response: It is not clear how the information provided by the commenter concerning levels of fines less that 2 mm supports the conclusion that the numeric target for fines less than 6.5 mm is unreasonable. Without having the cited reference to review, EPA cannot determine whether the commenter's conclusion is accurate.

7.10 Setting blanket targets for fine sediments is unwarranted because of the inherent spatial and temporal variability of sediments in streams (e.g., Lisle, 1989) and because salmonid biomass was not correlated with volume of fine sediments in streams (Burns, 1971).

Response: We agree that fine sediment levels may vary substantially in space and time. The TMDL has been clarified to indicate that the fine sediment numeric targets are intended to be applied in riffle crests and measured during summer low flow periods. EPA does not agree that setting targets for fine sediments is unwarranted because salmonid biomass was not correlated with fine sediment volume in one study. Fine sediment targets are designed primarily to address a key limiting factor for spawning success, which may not be closely correlated with salmonid biomass. A large number of researchers have found that high levels of fine sediments are negatively correlated with low survival-to-emergence rates (see Chapman and McLeod, 1987).

7.11 The TMDL improperly assumes cause-effect relationships between (1) salmonid productive capacity and accelerated sediment delivery and (2) individual land use practices and sediment levels found in Redwood Creek.

Response: The TMDL is based on the finding, which is well supported by available studies and findings of National Marine Fisheries Service (1998 listing of coho salmon as a threatened species in Northern California ESU) that excessive levels of sediments in coastal streams including Redwood Creek are a limiting factor for salmonid habitat. EPA is not suggesting that sediment-related habitat impairment is the sole cause of salmonid population declines. EPA based its source analysis on the best available information concerning the sources of sediment loading to Redwood Creek-- the sediment budget prepared for the Watershed Analysis. That sediment budget and EPA's TMDL focus on historical loading rates and set the TMDL and allocations accordingly. EPA is not asserting that current land use practices caused the levels of sediment currently present in the stream. However, as discussed under comments 7.2, 13.3, and 13.9, significant evidence exists that current land use practices continue to create significant erosion potential in Redwood Creek watershed.

7.12 The TMDL fails to recognize that sediment is necessary to produce some of the beneficial uses in the basin, and some disturbance is necessary to provide for sediment recruitment to the stream channels.

Response: EPA recognizes that sediment is necessary to support well-functioning streams and associated habitat. EPA does not agree that some level of anthropogenic disturbance is necessary to provide necessary sediment recruitment. As the Redwood Creek Watershed Analysis indicates, Redwood Creek probably had a significant level of sediment recruitment from natural sources long before there was any human-caused disturbances. In addition, it appears that fish populations were far higher in North Coast streams prior to the period of intensive human caused land disturbance.

7.13 It is not clear why sediment is viewed as a limiting factor for salmonids. Are factors other than physical freshwater habitat being considered which may be causing a decline in salmonid populations?

Response: See response to comment 7.11. The TMDL is required to include estimates of stream assimilative capacity for sediment loading and to allocate that loading among sources. The TMDL is not required to consider all possible causes of salmonid declines.

7.14 It may be more cost effective to increase pool depth in Redwood Creek by introducing large woody debris than by reducing sediment input.

Response: EPA agrees that large woody debris are a key factor in well-functioning North Coast streams. The TMDL does not specify the method of attainment of the allocations. It may prove feasible to enhance stream habitat features, including large woody debris, as a more effective method of restoring instream habitat. If introduction of large woody debris or other restoration activities are demonstrated to increase the assimilative capacity of Redwood Creek for sediment loadings, it may be possible to increase the TMDL and/or specific load allocations in the future.

7.15 The effect on sediment yield of stream clearing should have been considered in the TMDL. This is one massive source of sediment delivery to Redwood Creek which does not exist anymore.

Response: EPA did not have information on this potential source during the development of the TMDL and was therefore unable to consider it.

7.16 Why does the TMDL not address the effect of levee structures on fish habitat quality since this may be an important cause of habitat degradation?

Response: It is not clear how consideration of levee structures and their impact on habitat quality would affect the content of a sediment TMDL. See response to comment 7.13.

7.17 There is no evidence that streamside landslides can be controlled, and one study (Colman, 1973) found that streamside landslides occurred equally in unlogged and logged areas.

Response: While EPA agrees that it is unlikely that streamside landslides can be effectively controlled after they occur, several studies indicate that the incidence of streamside landslides can be reduced through the selection of protective land management practices in areas near streams (see, e.g. Spence, et.al., 1996). While all streamside landslides probably cannot be prevented, appropriate measures to protect riparian vegetation, avoid road construction in unstable streamside areas, and livestock management practices can probably reduce the number of such landslides.

Although EPA was unable to obtain a copy of the Colman study referenced by the commenter, we note that two studies of Redwood Creek (Pitlick, 1982 and Kelsey et. al., 1982) found that although the number of landslides associated with logging were similar following the 1964 storm and flood, the average volume of sediments from those landslides in recently logged areas were much higher than for landslides in unlogged areas. In additin, Kelsey, et.al. suggests that the rate of landslides in logged areas may be higher than for unlogged areas.

7.18 Please reconsider the original listing of Redwood Creek as an impaired waterbody.

Response: EPA's analysis indicates that Redwood Creek remains impaired and that a TMDL remains necessary.

Comment 8: Wayne Whitlock, Pillsbury Madison & Sutro, LLP, on behalf of Redwood Creek Landowners Association. Letter dated 11.18.98.

8.1 EPA should consider the Redwood Creek Landowners Association (RCLA) proposal attached to the comment letter as an alternative to the EPA TMDL.

Response: The RCLA proposal contains no sediment TMDL for Redwood Creek. Rather, the

proposal describes RCLA's views concerning TMDL requirements and argues that the TMDL proposed by the North Coast Regional Water Quality Control Board (Regional Board) is inconsistent with Clean Water Act requirements. The RCLA's comments concerning alleged deficiencies in the Redwood Creek TMDL proposed by EPA are summarized below; comments in the proposal concerning the State's TMDL proposal which are repetitive of comments concerning the EPA TMDL are not addressed in this responsiveness summary.

RCLA suggests that an "alternative approach" to TMDLs is appropriate for Redwood Creek (petition, p. 7). This alternative approach appears to be an argument that water quality is not impaired in Redwood Creek, that any impairment is caused solely by historic sediment discharges, and that current and future expected sediment loadings will not contribute to water quality impairment and therefore need not be controlled. These arguments and EPA's responses are discussed below under comments 7.2, 13.3, and 13.9. EPA disagrees that water quality impairment of Redwood Creek is clearly associated solely with historical sediment discharges and that existing data support a finding that a TMDL is unnecessary. Because a TMDL is required, EPA considered whether the RCLA petition contains a TMDL which includes the required components of an approvable TMDL. The petition does not contain any of the required elements of a TMDL and therefore cannot be considered a viable alternative to the EPA-proposed TMDL. Because EPA's TMDL does not and is not required to contain implementation measures, EPA did not conduct a detailed review of the implementation provisions of the RCLA petition implementation section for purposes of this TMDL and responsiveness summary.

8.2 Numeric targets are not necessary or appropriate in this case since the water quality standard is itself narrative rather than numeric.

Response: We disagree that numeric targets are unnecessary or inconsistent with applicable water quality standards. Clean Water Act Section 303(d)(1)(C) requires a total maximum daily load to be set at a level necessary to implement the applicable water quality standards. While Section 303(d) does not explicitly require EPA to set numeric targets as a means to interpret and apply applicable water quality standards, the terms used in Section 303(d) (e.g., "total maximum daily load", "set at a level") imply that a quantitative approach to TMDL development is appropriate. Where applicable water quality standards are narrative, it is appropriate to develop quantitative interpretations of these standards in order to support the additional analysis needed to calculate TMDLs which will result in attainment of those standards. If TMDL targets were expressed solely in qualitative or narrative terms, it would not be possible to predict the prospective effectiveness of TMDLs in meeting applicable standards or evaluate the TMDL's effectiveness through followup monitoring.

8.3 EPA's method of setting numeric targets does not conform to Clean Water Act requirements. The proposed TMDL fails to analyze actual maximum sediment loading capacity and still meet applicable standards. Instead, the proposed TMDL assumes that pristine conditions are the only conditions under which salmonids would not be limited by sediment.

Response: EPA believes its approach to setting numeric targets is consistent with Clean Water Act requirements. EPA disagrees with the comment that the TMDL assumes that pristine conditions are the only conditions under which salmonids may thrive. EPA selected several measures of aquatic habitat characteristics which may be affected by sediment. EPA set numeric targets at levels associated with well functioning salmonid streams which support reasonably high levels of salmonid reproduction and survival, and not at levels associated with the most pristine salmonid habitats identified in the literature. EPA notes that the relationship between habitat conditions and salmonid population health is poorly understood. Given the uncertainty in the relationship between sediment conditions in aquatic habitat and impacts on resident salmonids, it is appropriate to make conservative assumptions in setting numeric targets. EPA has following this approach in the Redwood Creek TMDL. EPA also understands that factors beyond Redwood Creek may have contributed to the declines in salmonid populations. However, until freshwater aquatic habitat quality is restored to levels which can support healthy salmonid populations, which has not yet occurred in Redwood Creek watershed, freshwater aquatic habitat conditions will probably remain a key limiting factor for salmonids.

It appears that the commenter misunderstood the method which was used to estimate the TMDL itself. The maximum sediment loading capacity of Redwood Creek, from which the TMDL itself was derived, was estimated primarily by evaluating sediment loading rates in three "reference" tributaries within the Redwood Creek watershed for the same period for which the watershed-wide sediment loading analysis was developed. Two of these three reference tributaries (Lacks Creek and Panther Creek), which are representative of the geologies underlying over 85% of the basin, are not pristine by any measure. Rather, they were selected because they were relatively undisturbed during the analysis period and were believe to support reasonably well-functioning aquatic habitat (personal communication with Greg Bundros, Redwood National Park, 1998). Timber harvesting and road building did occur during the period of record in these tributary basins. Panther Creek, in particular, has experienced fairly intensive land management in recent years. The third reference tributary, Little Lost Man Creek, is in relatively pristine condition but is representative of less than 15% of the basin. Therefore, it is inaccurate to conclude that the TMDL is set at levels associated with pristine conditions.

8.4 The proposed TMDL fails to supply an adequate analysis of existing or future sources as required by 40 CFR 130.2(g). EPA mistakenly assumes that current sources are the cause of the impaired condition and must be allocated responsibility for load reductions. Data show the source of impairment in Redwood Creek is excessive existing sediment load in the stream. There is no gap between the total loading capacity of Redwood Creek and the current loadings. Therefore, no reduction from current loadings is necessary to stay within the maximum total loading capacity in the TMDL.

Response: EPA does not assume that current sources are the cause of the impaired condition of Redwood Creek. However, available information indicates that substantial erosion potential remains in Redwood Creek watershed associated with existing and future loading sources, and that it is inaccurate to conclude that there is no gap between current loadings and the estimated

loading capacity. See responses to comments 7.2, 13.3, and 13.9 as well as the Redwood Creek Watershed Analysis.

Federal regulations require that load allocations be established for that portion of loading capacity that is attributed to existing or future nonpoint sources. The total loading capacity and associated TMDL were established based on an analysis of average historical sediment yields from the watershed which considered sediment yield data up to 1997. EPA did consider recent loading information in deriving loading capacity.

Source-specific loading estimates were derived from the sediment budget for the period 1954-80 which was developed for the Watershed Analysis. This was the best available information to support the source analysis. EPA assumed that the relative contribution of loads from different source categories was the same during the period between 1981 and 1997 as it was from 1954-80. This assumption was reasonable because:
(1) No significant changes in land use patterns have occurred in the watershed since 1980. If land use patterns had changed, it would have been reasonable to question whether the relative sediment loading rates associated with different erosion processes may have changed.
(2) Changes in timber harvest practices may have changed the overall level of sediment loading associated with timber harvesting, but are not clearly associated with changes in the relative proportion of sediment loads associated with different erosion process categories (e.g, roads, mass wasting, fluvial erosion).
(3) No information was available to EPA to support an analysis of current loading rates from different source categories which would have been needed to implement the commenter's request. Development of such analysis would have been infeasible within EPA's time and resource constraints for completing this TMDL.
(4) The TMDL analysis did consider recent sediment yields from the watershed along with recent sediment loading trends in four tributary watersheds (Lacks Creek, Panther Creek, Coyote Creek, and Little Lost Man Creek). This analysis indicated that sediment yields increased in wet years, and that yields also increased substantially in tributaries which experienced increases in timber harvest activities (after accounting for differences in rainfall and flow rates).

EPA supports efforts to revise sediment source estimates in the future. Based on the results of that analysis, it may be appropriate to review and revise the load allocations in the TMDL.

8.5 Some uncertainty exists regarding how Redwood Creek will react during future large storm events. The RCLA's alternative implementation plan based on the current regulatory structure would provide additional assurance that current low levels of human caused sediment inputs are maintained.

Response: We agree that it is uncertain how Redwood Creek will react during future storms. However, we disagree that the RCLA implementation plan provides adequate protections from detrimental sediment loading events.

Comment 9: Mary Ann Madej, U.S. Geological Survey. Letter dated 11.19.98 and oral testimony at public hearing.

9.1 The TMDL process for Redwood Creek has been confusing for agencies and private landowners. Concurrently, there are several other efforts that are addressing ecological health in the region. Ideally, the TMDL process should dovetail with these programs.

Response: We agree. See response to comment 13.2.

9.2 The focus of the document on in-stream targets is inappropriate for the sediment problem in Redwood Creek due to the lag time between erosional problems and channel response. The link between current land use and downstream channel condition is not direct, and it is difficult to allocate responsibility for a given in-stream problem to a specific upslope site.

Response: The instream numeric targets are not intended to allocate responsibility to a specific upslope site. We recognize the lag time between sediment delivery to channels and beneficial use effects. The instream targets are intended to provide a basis for habitat trend monitoring as one tool to assess the long term effectiveness of the TMDL and the associated load allocations. To provide a basis for allocating responsibility to specific sites, we are adding hillslope targets for several parameters. See responses to comment 13.6 and 13.7.

9.3 The stream reaches most likely to respond to land use changes are low gradient, unconfined streams in the lower basin. The stream reaches under management of a single landowner are more likely to be a different stream type-- steep gradient tributaries with coarse substrate. A target of 1 m. pool depths is irrelevant to most tributaries because they do not exhibit a pool-riffle morphology.

Response: We agree. Separate pool depth targets were developed to recognize that pool depth tends to increase with stream size. The pool depth target has been modified to apply only in tributaries with pool-riffle morphology.

9.4 Commenter favors a top-down approach emphasizing erosion prevention as an alternative to using instream targets. Specific hillslope target indicators are recommended:
- reduce the number of road crossings with diversion potential,
- assure that all culverts are designed to pass a 50-year flood,
- pull back unstable road fills and landings,
- existing road network must be adequately maintained,
- "storm patrols" will patrol roads during storm events,
- road density should not exceed 4 mi/sq. mi., with no roads on inner gorge slopes,
- abandoned roads should be decommissioned,
- roads used during the rainy season should be adequately surfaced,
- road use during the rainy season should be minimized, and
- roads should be hydrologically disconnected.

Response: We agree that hillslope targets will usefully complement instream targets. We are establishing several hillslope targets, many of which are consistent with the commenter's suggestions. See response to comment 13.7.

9.5 Sediment budget used for the source analysis is appropriately used to evaluate the relative importance of different sediment input processes and distinguish between natural and management-related sources. The budget is valid with an accuracy of +/- 100%. Given the temporal and spatial variability of sedimentation processes, there may never be a year that truly exhibits the average loadings suggested by the TMDL and allocations. The input of sediment from an erosional process should be considered within the context of the recurrence interval of the generating event, and not for the arbitrary time period considered in the source analysis. The TMDL stretches the numbers to an extent that it misleads the public in terms of accuracy which we don't have.

Response: EPA did not intend to mislead the public. We have modified the TMDL text to emphasize the uncertainty associated with the sediment budget conclusions. We agree that the input of sediment should ideally be considered within the context of the recurrence interval of the generating event, but we did not have the analysis we would need to generate a variable source analysis of this type.

9.6 The allocations appear to treat all terrains equally. In a general sense the allocations make sense. However, the use of specific numbers in the allocations is misleading and will be impossible to monitor and enforce. A caveat should be added that the allocations should be interpreted in a relative sense so readers do not believe our knowledge of historic loads and percent controllable is more accurate than it really is.

Response: EPA considered establishing different allocations to account for differences in geology, soils, slope, proximity to streams, and vegetation patterns. However, we concluded that we lacked adequate information to develop such conclusions. As a result, we had to treat all terrains equally in these allocations. EPA has added hillslope targets which begin to account for differences in terrain and which will assist in monitoring and implementation of erosion prevention practices. We have modified the TMDL text to emphasize the uncertainty associated with the sediment budget and associated allocations.

9.7 The percent fines targets are based on studies of areas which may not be applicable to the highly friable rocks of the Franciscan assemblage.

Response: The fines targets were based on the best available information from research conducted in the Pacific Northwest, including California were such information was available. We are aware that the relationship between fine sediments and fish habitat quality in areas of California dominated by Franciscan geology could be different from the relationship observed in other areas of the Pacific Northwest. However, EPA had to develop these targets based on available information.

9.8 Pebble counts, if used as a trend-monitoring technique, need to be conducted on a given geomorphic unit (e.g. a riffle crest) as opposed to total channel transects. There is high spatial variability of substrate size. A mean based on integrating all geomorphic units would be meaningless. Redwood Creek exhibits a downstream fining of median particle size. Numeric targets should be reach specific. For example, a target for mean particle size should be based on the drainage area and channel gradient.

Response: The TMDL has been clarified to describe that fine sediment targets were intended to be applied to riffle crests. The TMDL also recommends monitoring methods which are appropriate for the evaluation of fine sediment trends. EPA agrees that it would be more desirable to set numeric targets on a reach specific basis so that they could reflect differences in location within the watershed and geomorphic structure. However, data and analysis necessary to delineate targets at this level was unavailable for the TMDL. The targets are meant to be measured over time, and EPA expects that actual values at different sampling locations will vary above and below the target levels. The intent is to evaluate the weight of evidence about future trends by evaluating the monitoring results for the instream indicators. Exceedence of an individual target value at any particular location is not, in itself, a basis for drawing conclusions about instream trends.

9.9 Pool depths alone do not define good pools. Length of channel in riffles is based on surveys in the lower 20 kilometers of Redwood Creek, and may not be appropriate for the steeper reaches upstream.

Response: The numeric target for percent riffles is specified to apply only in low gradient sections of Redwood Creek.

9.10. The statement on p. 34 concerning channel storage and sediment waves is incomplete. Surveys in 1996, 97, and 98 show that there is continual aggradation downstream of Tall Trees Grove, and localized aggradation in other reaches as well. The 1997 flood reversed the trend of recovery seen in lower Redwood Creek by partially filling many pools. About 150 new or reactivated streamside landslides were detected following the 1997 flood.

Response: The text has been clarified to incorporate this comment.

Comment 10: S.E. "Lou" Woltering and Carolyn Cook, Six Rivers National Forest. Letter dated 11.19.98 and oral testimony at public hearing.

10.1 Instream targets are a potentially weak and dangerous means of enforcing and striving towards restoration of water quality impaired watersheds due to the lack of a clear relationship between hillslope actions and downstream responses. Instream targets can also be misconstrued and taken out of context. Instream targets are best viewed as a monitoring tool indicating trends in watershed health, and not as a cause effect link to off-site management activities.

Response: Instream targets are not designed to indicate cause-effect relationships between instream conditions and sediment sources or to provide the primary means of determining whether a TMDL is being met. Also, see response to comment 13.2.

10.2 Instream targets should be expressed as improving trends rather than hard numbers. If hard numbers are needed, fine sediment is recommended. Instream targets should be legally unenforceable.

Response: See responses to comments 6.2 and 13.2.

10.3 Hillslope indicators should be added. Potential examples include:
- reducing diversion potential by __ %,
- upgrading roads to meet the 100 year storm,
- miles of road hydrologically disconnected.
Hillslope targets should be legally enforceable.

Response: Hillslope targets are being included to address desired conditions associated with roads and steep, geologically unstable and streamside areas. The State is responsible for TMDL implementation, and it is inappropriate for EPA to address the enforceability of numeric targets.

Comment 11: Daniel Cohoon. Letter dated 11.19.98

11.1 EPA should consider information set forth in Redwood Creek Landowners Association alternative strategy.

Response: See responses to comment 8.

11.2 The assumption that any management activity associated with a sediment source is assumed to have caused that contribution will give an artificially high figure of the amount of controllable sediment.

Response: The analysis of how controllable different erosion process categories might be (and the associated allocations) were not dependent on the assumption that management activity associated with a source was assumed to have caused that source contribution. Rather, estimates of controllable sediment were based on EPA's review of literature on erosion prevention and control measures and consultation with experts in the field. The assumption that management activity associated with a sediment source is assumed to have caused that contribution was used only to develop rough estimates of the amount of sediment loading in the watershed which could be attributed to human causation.

11.3 The commenter is concerned about the assumption that current land practices are the direct cause of sediment loads in Redwood Creek rather than major storm events of 20 or more years ago.

Response: See response to comments 7.2 and 8.4.

Comment 12: Anne Hubbard. Letter dated 11.19.98 and oral testimony at public hearing.

12.1 The conditions which caused destruction of the forest and stream have been identified and can be prevented by regulating logging so that it does not damage slopes.

Response: We do not fully agree that all factors which cause forest and stream damage have been accurately identified; however, the TMDL reflects the best available information concerning the effects of land management on sediment loading rates over the past 30 years.

12.2 Commenter questions the logic underlying analysis by some commenters of recent weather patterns and flow events.

Response: See response to comment 7.4.

12.3 Commenter is concerned about timber harvesting methods and advocates prohibition of clearcutting.

Response: Comment noted. The TMDL incorporates hillslope targets which address harvest methods in steep, unstable areas which are prone to erosion.

12.4 Precursors to slides need to be defined and prevented. Such precursors are caused by present-day logging.

Response: We agree that slides should be prevented if possible, but do not agree that all slides are caused by logging.

12.5 Commenter is concerned about impacts of timber harvesting on streams, fish, birds and wildlife.

Response: Comment noted.

Comment 13: Terrence D. Hofstra and Greg Bundros, Redwood National and State Parks. Letter dated 11.18.98 and oral testimony at public hearing.

13.1 Commenter supports development of TMDL.

Response: Comment noted.

13.2 The TMDL development process has been very confusing. In the future, EPA and the State should coordinate better do that different versions of the TMDL are not needed.

Response: We agree, and we apologize for any confusion the parallel TMDL development processes has created. EPA was obliged to establish the TMDL for Redwood Creek now in order to meet its consent decree schedule because the State did not complete and submit its TMDL in time for EPA to approve it before December 31, 1998. EPA did work closely with the Regional Board to develop the TMDL, and the State and EPA TMDLs are very similar.

13.3 Although the Creek has been recovering from sediment impacts associated with past large floods and earlier forest practices, the recovery trend occurred during a period of low to moderate rainfall that has not adequately tested current forest practices. Commenter remains concerned about potential sediment impacts from poorly designed and unmaintained logging roads, and silvicultural practices along streams and on unstable areas. There are over 1000 miles of roads and more than 4000 stream crossings in the basin. Forest practices have not given adequate consideration to water quality and aquatic habitat.

Response: We agree.

13.4 Erosion from roads can be minimized if properly designed and maintained. Most of the 1000 miles of roads on private lands in Redwood Creek watershed were build before current forest practices. Current forest practices do not limit miles of road that can be built or require routine inspection or long-term maintenance. The potential for off-site cumulative impacts from roads is largely ignored.

Response: We agree that road-related erosion remains a major concern and that erosion from roads can be minimized. In order to help focus attention on road construction and maintenance in the watershed and minimize erosion associated with roads, the final TMDL contains hillslope targets which address characteristics of road design, and maintenance.

13.5 Landowner and agency cooperation will be a key element to successful implementation of the TMDL in Redwood Creek. Cooperation will be partly based on the reasonableness of the assumptions and requirements in the TMDL and implementation plan.

Response: We agree, and have incorporated more detailed recommendations in the TMDL concerning the promotion of landowner and agency cooperation in implementation planning and action as well as monitoring. EPA believes the assumptions and analysis underlying the TMDL are reasonable.

13.6 Numeric targets should be presented in the context of desired future condition and in narrative form. Instream targets should not be the only measure of water quality and aquatic habitat conditions. Given the variability in monitoring results, numeric targets should be developed that are reach specific and based on relevant watershed information.

Response: Please recall that the primary purposes of numeric targets are to interpret applicable water quality standards in order to assist in (1) evaluating the water quality and associated

watershed conditions, and (2) estimating the assimilative capacity of the receiving waterbody for the pollutant(s) in questions (in this case, sediment). EPA believes that, where feasible, it is appropriate and necessary to set numeric values for instream and hillslope indicators which are associated with, and measures of well-functioning watersheds and aquatic habitat. Where it is infeasible to set target values, it may be appropriate to set narrative targets (e.g., improving trends). However, narrative targets do not provide a measure of the watershed and stream conditions necessary to attain the applicable water quality standards nor a supporting basis for estimating pollutant loading capacity.

Instream targets are not the only measure of water quality and aquatic habitat conditions used in this TMDL. Hillslope targets are being added in response to comments received which are believed to be consistent with well-functioning watersheds which will support healthy salmonid habitat. Moreover, the TMDL and associated load allocations identify loading rates which, if achieved, are expected to result in attainment of water quality standards.

Finally, EPA agrees that it would be desirable to develop instream numeric targets that are reach specific and which are based on relevant watershed information. Where locally generated data and analysis were available, they were used to support development of the Redwood Creek TMDL. However, such data and analysis were not available which address the full range of indicators which were necessary to characterize key attributes of stream condition. Where local information was unavailable, EPA used information from research conducted in comparable situations in the Pacific Northwest to the extent feasible.

13.7 Hillslope targets should be included to reach water quality objectives as a more proactive approach. The following are recommended:
- permanently eliminate diversion potentials at stream crossings
- ensure culverts at stream crossings are sized for a 50 yr. storm
- pull back landings and road fills on slopes greater than 50% and capable of sediment delivery to stream channels
- eliminate road systems from inner gorge slopes
- road densities should not exceed about 4-5 miles/square mile
- establish road surface drainage by installing rolling dips and outsloped surfaces
- establish routine, long-term road inspection and maintenance programs
- eliminate clear cutting of steep, potentially unstable streamside areas.

Response: We generally concur that these targets are appropriate and we are incorporating several of them in to the TMDL with some revisions and clarifications.

13.8 While the 1900 tons/square mile/year TMDL is a reasonable estimate, it was developed using studies that were not intended for that purpose. These studies quantified, in a relative sense, the amount of sediment contributed from different erosional processes, but the estimates are not expected to be accurate in an absolute sense.

Response: We understand that the sediment budget and other cited studies were not developed for the specific purpose of precisely estimating sediment loads and yields. The TMDL explains that the specific estimates are subject to significant uncertainty and possible error. EPA had to use the best available information to estimate sediment loads and source contributions, and the sediment budget and other studies developed by National Park researchers were the best available information to support TMDL establishment. EPA strongly supports an adaptive management approach to TMDL implementation and review based on strong follow-up monitoring. This iterative approach recognizes the uncertainties underlying the initial TMDL and provides a strong analytical framework for reviewing the accuracy and effectiveness of the TMDL and the load allocations, and making adjustments as necessary in the future. The implementation and monitoring recommendations contained in the TMDL address the issue of follow-up monitoring and evaluation of the TMDL and associated implementation provisions.

13.9 Commenter presents results of data analysis showing that 10 year rolling average annual sediment yields at both Orick and Okane exceeded the TMDL for the 1988-1997 averaging period, indicating that erosion and sediment yield increased in response to the higher rainfall amounts seen in 1995-97. This analysis shows the TMDL for Redwood Creek is probably a reasonable threshold for land management practices in the basin.

Response: We appreciate the additional analysis of recent data grouped by 10 year rolling averages. This analysis is being included in the TMDL discussion of the basis for the TMDL.

13.10 The greatest value of the source allocations is the relative priority placed on prevention or control of different erosional processes. These findings are consistent with previous studies of the Creek.

Response: We agree that the greatest value of the allocations is to guide prevention and control efforts at the most significant loading sources even though the specific allocation numbers may not be as accurate as would be desirable.

13.11 Statements concerning recent timber harvesting in Panther Creek and Lacks Creek should be corrected.

Response: The corrections have been made.

13.12 The description of channel storage and sediment movement in lower Redwood Creek should be corrected. Although number and depth of pools in lower Redwood Creek increase between 1977 and 1995, this trend of pool recovery was reversed after 1995. In addition, air photo analysis indicates the 1997 flood caused about 150 new or reactivated streamside landslides along the main channel of Redwood Creek.

Response: The text has been corrected as suggested by the commenter.

Comment 14: Patrick Higgins. Letter dated 11.19.98 and oral testimony at public hearing.

14.1 EPA should consider using the KRIS Coho database as a data sharing system suitable for TMDL monitoring and adaptive management.

Response: EPA will review KRIS Coho and consider the request, but no action is needed concerning the Redwood Creek TMDL decision.

14.2 EPA should review data in the database from Elk River and Yager Creek, including aquatic insect data, fine sediment data, and road densities which show a strong relationship. The TMDL overlooks aquatic invertebrates. Road densities above 3 miles/square mile are linked to high levels of fine sediment and depressed values for biodiversity measures.

Response: EPA cannot assume that the specific relationships between aquatic insects, fine sediment, and road density which were reported for Elk River and Yager Creek necessarily apply in Redwood Creek because parent geology and other factors vary among these watersheds. However, we believe the data provided by the commenter generally supports EPA's focus on fine sediments instream as a measure of aquatic habitat impacts. EPA does not have data on aquatic invertebrates for Redwood Creek which could be used in TMDL analysis. Regarding road density targets, see response to comment 4.6.

14.3 KRIS Coho also contains landsat imagery of vegetation types which provide an index of watershed disturbance. EPA should consider using vegetation types as an index of watershed disturbance.

Response: Detailed mapping of vegetation type in Redwood Creek watershed was not available to EPA to assist in development of the TMDL. EPA may consider the use of vegetation types as an index of watershed disturbance for future TMDLs.

14.4 Fine sediment levels are a function of stream gradient, and numeric targets should account for this.

Response: Numeric targets for fine sediments have been modified to apply in reaches with gradients less than 3%

14.5 The pool depth target is inadequate and should be at least 10 feet deep.

Response: The commenter did not provide data to support the suggested 10 foot target, but EPA raised the mainstem pool depth target to an average of 2 meters at low flow in response to this and other comments.

14.6 Commenter notes an inextricable link between sediment and temperature.

Response: EPA agrees that sediment and temperature are probably related and believes that reduction in instream sediment yields will eventually result in some reduction in stream temperatures. However, this TMDL does not directly address temperature because that is not a parameter listed on the 303(d) list.

14.7 Redwood Creek and Prairie Creek support one of the last viable populations of coho salmon in California.

Response: Comment noted

14.8 The TMDL should contain fish targets.

Response: Although EPA believes fish targets could be useful as a long term monitoring tool, inadequate reliable data on historical fish populations in Redwood Creek were available to inform the development of fish targets for the TMDL.

14.9 The TMDL should address streamside roads, roads on landslides, and roads in mid-sloped terrain.

Response: We agree that TMDL implementation will need to address these potential erosion sources in order for the allocations to be attained.

14.10 EPA should consider using an indicator of overall watershed disturbance in the TMDL.

Response: Although we agree this may be a useful indicator, we lack specific data we would need to determine appropriate targets at this time.

14.11 Landslide-related sediment loading can be reduced more than 50%.

Response: The commenter did not provide specific data or analysis to support this contention.

14.12 Inner gorge disturbances were shown in Elk River and Bear Creek to have a high correlation with landsliding and sediment delivery to streams.

Response: EPA agrees that inner gorge disturbance probably increases the incidence of streamside landsliding and sediment delivery to Redwood Creek. For this reason, the TMDL includes hillslope targets addressing roads and timber harvesting practices in inner gorge areas.

14.13 Sediment is a reversible problem. It is in the best interests of local landowners to recognize erosion processes and minimize erosion. Landowners should take advantage of available funding (e.g., from RCDs and NRCS) to help abate erosion sources.

Response: We agree, although we recognize the level of available funding from these sources will be insufficient to address the need.

Comment 15: Ann and Joe Friedman, Nancy Cox, Nancy Cowell, Debi Falk-Young, Edith Butler, Steve Catton, Millie Brucker, Cindy Van Fleet, Lorraine Dillon, Sophia Pelafigue, Patricia Pearson, Becky Evans, David and Collen Imper, Larry L. Karsteadt, Michael Dehority, Joe Ashenbrucker, Kristian Morley, Nat Childs, Michael M. Minor, Kathy O'Leary, Norman F. Wright, John Gaffin, Gail Kenny, Virginia Marshall-Edwards, Michael Torbert, Paul Domanchuk, David E. Durbin, Sally S. Williams, Patricia L. Black, Katy Allen, Catherin Joyce, Frank Casasanta, Bunny Wilder, Laurel Maurer, Nathaniel Vaughn Kelso, and Kathleen Krauss, Letters and postcards received between 11.17.98 and 12.3.98. (Note: These comments are grouped because they request nearly identical measures in the TMDL and implementation plan).

15.1 Sediment loads in Redwood Creek are unacceptably high and continue to impede salmon recovery. EPA should required stronger streamside protection measures (especially for class I and II streams), better erosion control plans implemented within 10 years, and reduction of road density to less than 3 miles per square mile.

Response: EPA believes the TMDL will result in improvements in streamside protection and better erosion control plans in all areas of the Redwood Creek watershed. The TMDL includes hillslope targets for silvicultural practices in steep, geologically unstable and streamside areas. EPA is recommending that the implementation plan provide clear protection of Class III streams from excessive sediment delivery. Regarding road density targets, see response to comment 4.6.

Comment 16: Bradley Burns. Letter dated 11.15.98.

Comment 16.1 Conditions in Redwood Creek are worsening. EPA should oversee enforcement of existing regulations. Several measures are recommended: less roads, sustainable timber harvest plans, resting of overcut areas, a moratorium on harvesting within streamside buffers on Class I, II, and III streams, lower road density, and erosion control plans.

Response: EPA's TMDL contains hillslope targets which address silvicultural practices in geologically unstable and sensitive streamside areas, and road design and maintenance. While EPA agrees action is needed to ensure that erosion rates do not exceed the TMDL, the EPA TMDL does not include an implementation plan. EPA recommends implementation provisions which address protection of streamside areas. Regarding road density goals, see response to comment 4.6.

Comment 17: Jesse Noel. Letter dated 11.18.98 and oral comments and public hearing.

17.1 Targets are unenforceable and will result in a long lag period before it will be known whether the targets are being met.

Response: We agree that there will be a lag time before it will be possible to assess whether instream numeric targets are being met. However, inadequate information was available to support the development of instream targets which would detect instream responses in a shorter timeframe. EPA supports the investigation of indicators which would be more sensitive to short term instream effects and which would not have the shortcoming of needing a long time before they can be properly evaluated. Also, see responses to comment 6.2 and 13.2.

17.2 Feasible numeric target methodologies are recommended (suspended sediment).

Response: EPA has reviewed the report attached to the comment. Inadequate information is available for Redwood Creek to use the suggested indicator. See response to comment 17.1.

17.3 The TMDL does not break down targets into "press" and "pulse" targets and allocations.

Response: The comment is not clear, and no information was provided about how this suggestion would be implemented. We do appreciate the offer of assistance, but inadequate time is available to conduct additional basic research to develop additional analytical elements for EPA's TMDL.

17.4 Monitoring is inadequate.

Response: The TMDL contains some monitoring recommendations, but specific monitoring plans are not a required element of EPA's TMDL. The State's TMDL and implementation plan may provide for development and implementation of a specific monitoring plan.

Comment 18: David Keniston. Letter dated 10.12.98 and oral testimony at public hearing.

18.1 Commenter notes damage to east side of Redwood Valley and continuing landslides and stream sedimentation as a result of logging in the 1950s and 60s. Appeals to California Department of Forestry have been to no avail. Erosion control and fish habitat enhancement structures have been obliterated by massive sediment loads.

Response: Comments noted.

18.2 A number of suggested land management practices are recommended:
- allow no timber cutting within 200 feet of any stream
- ban clearcutting
- remove old logging roads
- increase culvert size
- replace some culverts with bridges
- plant trees
- install silt fences in smaller creeks and sensitive areas
- limit cattle grazing and set back from watercourses
- outslope roads.

Response: Several hillslope targets have been added to the TMDL which address many of these suggestions.

18.3 Note that the "Redwood Creek Landowners Association" is made up of a small number of landowners involved in extractive industries. Commenter believes these landowners cause more sediment than average landowners and are therefore biased.

Response: Comment noted. EPA believes all the interested landowners in Redwood Creek watershed, including the landowners who are members of the Redwood Creek Landowner's Association, smaller landowners, and the federal and state agency landowners should explore opportunities to cooperate in implementing erosion prevention and control practices and appropriate monitoring efforts.

Comment 19: Forest B. Tilley. Undated letter.

Comment 19.1 Commenter supports Redwood Creek Landowner's Association proposal.

Response: See response to comment 8.

Comment 19.2 Commenter disagrees with several assumption in the TMDL:
- that sediment load in Redwood Creek is due to current land use practices
- that the Creek must be returned to pristine condition before fish habitat is restored
- that sediment or land use activity is the primary cause of fishery decline
- that one prescription fits all.

Response: We disagree that the TMDL makes these assumptions. See responses to comments 7.13, 8.3, and 8.4.

Comment 20: Patrick Greene. Letter dated 11.17.98.

Comment 20.1 Stronger streamside protection is needed. Clear cut logging should be stopped. Selective logging would be a better long range plan.

Response: See response to comment 15.1.

Comment 21: Anne Conrad-Antonville. Letter dated 11.19.98

Comment 21.1 Commenter is a Redwood Creek landowner who generally supports the TMDL. Will the TMDL be weighted for the amount or percentage of property ownership as well as the percentage of resource extraction occurring on those ownerships?

Response: The TMDL does not set landowner-specific allocations. However, the TMDL and load allocations are set on a per-square-mile basis. Larger landowners and landowners who are

engaging in more intensive land management practices would probably have to do more in the way of erosion control or prevention (other factors being equal) than owners of small parcels or who are not intensively managing their lands.

21.2 How will the TMDL be enforced for timber harvest plans?

Response: See response to comment 6.2.

21.3 There will be major gaps between CDF and EPA/Regional Board with respect to understanding, implementation, and enforcement of the TMDL.

Response: EPA (and presumably the Regional Board) are willing to meet with CDF to ensure that agency understands the TMDL and to discuss implementation implications of the TMDL.

21.4 Private citizens may be required to enforce the TMDL in the courts.

Response: EPA hopes this is not necessary, but appreciates the comment.

21.5 Will TMDL implementation include funding or some weight or credit for restoration efforts?

Response: The EPA TMDL contains no implementation plan. However, some funding for implementation activity may be available from the federal government through Clean Water Act Section 319(h) grants for nonpoint source management, US Department of Agriculture cost share programs, and/or through other financial assistance programs. Funding may also be available through State authorities. The TMDL indirectly provides for "crediting" existing restoration efforts to the extent those efforts have resulted in sediment loading reductions or improvements in instream conditions.

Comment 22; Michele Marta. Letter dated 11.16.98.

22.1 Commenter generally supports TMDL but suggests the following measures to strengthen it:
- reduce road miles to less than 3 miles/square mile
- specify minimum conifer retention requirements for riparian zones along Class 1 and 2 streams
- assure that class 3 streams do not carry sediment to fish bearing streams
- required full implementation of erosion control plans within 10 years.

Response: We appreciate the comments and refer to the responses to comments 2.1 and 15.1.

Comment 23: Helen Stover. Oral testimony at public hearing.

23.1 Redwood Creek is recovering from the effects of the 1964 flood.

Response: See responses to comments 7.2, 13.3, and 13.9.

23.2 Commenter supports Redwood Creek Landowners' Association alternative proposal.

Response: See response to comment 8.1.

Comment 24: Joe Brecher. Oral testimony at public hearing.

24.1 It is unclear why EPA expects State to promulgate an implementation plan for the TMDL. What will EPA do if the State fails to promulgate a TMDL and implementation plan?

Response: Federal regulations require States to incorporate TMDLs in State water quality management plans (Basin Plans in California) and identify management measures necessary to implement the water quality management plans (40 CFR 130.6). California has indicated its intent to develop such implementation plans. These reasons form the basis for EPA's expectation that California will adopt implementation plans for its TMDLs. If the State fails to adopt TMDLs for Redwood Creek and South Fork Trinity River, EPA's TMDLs will remain in effect and must be implemented. If the State fails to adopt implementation plans, EPA will use the program oversight authorities available to it to bring about State compliance with this requirement. These oversight authorities and EPA's policy for using them are described in a national policy memorandum issued by Assistant Administrator Robert Perciasepe in August, 1997, which is available upon request.

24.2 EPA should say more in its implementation recommendations, and should clarify that EPA will implement the plan if the State fails to do so.

Response: The implementation recommendations in the Redwood Creek TMDL have been expanded. To the extent that implementation depends upon voluntary action or upon State authorities, EPA would not have the authority to require implementation of the plan.

Comment 25: Larry Moss. Oral testimony at public hearing.

25.1 Commenter supports the use of upslope targets and instream turbidity type monitoring.

Response: EPA has added hillslope targets to the TMDL. Regarding turbidity-type indicators, see responses to comments 17.1 and 17.2.

25.2 Commenter stresses the importance of addressing mass wasting events and protecting Class 3 streams. Commenter believes forest practice rules do not adequately address these issues.

Response: EPA concurs that mass wasting is a key erosion process of concern in Redwood Creek watershed and has established several load allocations for this process category. EPA is recommending strong implementation measures to protect Class 3 streams.

Comment 26: Bernie Bush. Oral testimony at public hearing.

26.1 Commenter supports Redwood Creek Landowners' Association alternative proposal and stresses importance of cooperative efforts to control erosion in the basin.

Response: See response to comment 8.1 describing EPA's analysis that this alternative proposal does not meet TMDL requirements. EPA strongly supports the development of cooperative efforts through which private landowners can work with the National and State Parks to implement effective erosion prevention and control measures along with instream and hillslope monitoring efforts. EPA urges all interested Redwood Creek landowners to work with the Regional Board, EPA, the National and State Parks, other agencies, and other interested stakeholders to develop erosion control and prevention approaches.

26.2 Commenter notes ongoing efforts by Board of Forestry to evaluate hillslope and instream monitoring methods.

Response: EPA appreciates the comment. We are aware of these efforts and are hopeful that they will yield a more effective suite of monitoring methods which will assist in future TMDL development and monitoring efforts.

Comment 27: Steven Self. Oral testimony at public hearing.

27.1 Comment supports the TMDL's focus on sediment monitoring at Orick gauging station in order to take advantage of historical data collected at that location.

Response: Comment noted.

27.2 Development of reference tributary conditions based on small tributaries and comparison of reference tributary loading rates with loadings in the entire watershed may be invalid because the bigger a watershed in area, the higher the per-unit loads will be. Some adjustment factor would be appropriate.

Response: EPA is unaware of direct evidence demonstrating that, other factors being equal, sediment yields per unit of area from larger watersheds would be higher than sediment yields per unit area from smaller watersheds. Although EPA has heard mention of the effect described by the comment, we concluded that it would be inappropriate to make any further adjustments in the reference stream loading estimate to account for this alleged effect absent more conclusive evidence. If such evidence were available, it would presumably provide a basis for increasing the estimated "reference tributary" loading rate, which would have the effect of increasing the resulting TMDL. We concluded that the conservative approach to accounting for this uncertain effect would be to decide not to make such an adjustment.

27.3 Does the data from the tributary systems include bedload data? EPA's assumption that bedload comprises 25% of total sediment load is inappropriate and inconsistent with data from

Okane and Orick gauging stations. It would be more accurate to estimate bedload as a function of suspended sediment loads and peak flows.

Response: Although some bedload data were available for some tributaries for Redwood Creek, most of the available data were only for suspended sediment. In order to make these data comparable with total sediment yield data for Redwood Creek watershed as a whole, as measured at Orick, EPA estimated total sediment load data for the tributaries by assuming that bedload comprises 25% of total sediment load, and recalculating a total load estimate by applying this bedload factor to the available suspended load data. To assess whether the 25% bedload estimate was reasonable for the tributaries, EPA reviewed the limited bedload data for the tributaries and found it generally consistent with the 25% assumption. EPA also selected the 25% bedload estimate based on reviews of two studies of Redwood Creek sediment flux which reported the proportion of total sediment load comprised of bedload (RNP, 1997 and Lisle and Madej, 1992). EPA agrees that it could be useful estimate bedload as a function of suspended sediment loads and peak flows. EPA did not conduct this analysis for the TMDL because we did not believe it would substantially alter the source analysis results or the estimate of "reference" tributary loading rates.

27.4 Coarse sediment is the main issue, and direct bedload measurements are needed at Orick and Okane.

Response: EPA agrees that coarse sediment loads are a key issue from the standpoint of their important role in affecting channel form and contributing to habitat degradation which results from major aggradation and channel modification. We also agree that it would be desirable to continue bedload monitoring in the watershed. However, we are also aware that bedload monitoring is time consuming and potentially difficult. EPA encourages watershed stakeholders to evaluate the cost effectiveness of investing future monitoring efforts in collection of bedload data in comparison with other potential monitoring approaches.

27.5 There is agreement that the major sediment inputs to the system occurred between 1964 and 1975. During the recent period, sediment loads and flows have both been very low. The fact that the system has begun to export sediment during this period indicates that there have been improvements in terms of sediment inputs, and that current high inputs are not a problem. In addition, the sediment loads from 1982, 83, and 86 were higher than the 1995-97 period despite the fact that peak flows were lower in 1982, 83, and 86. This observation further confirms that the watershed can respond better to storms than it did in the past.

Response: While we agree that there were reduced sediment inputs and channel improvements over the past 10-15 years, it is not clear that reductions in sediment inputs can be attributed principally to improvements in land management practices. These reductions may also be attributable to low rainfall and runoff patterns during this period. We agree that the watershed can probably respond better to storms now than was the case in the past; however, this does not prove that erosion potential has been reduced to the point where stream channels and aquatic habitat will successfully recover. See comment 13.9.

27.6 The Redwood Creek Landowners' Association identifies mechanisms for preventing a return to large sediment inputs which exceed the system's capacity. The TMDL should include this.

Response: It is not clear from the comment what aspect of the Association's proposal is being recommended. See response to comment 8.1.

27.7 Commenter supports expressing TMDL and targets as 10 year rolling averages. The historic data should also be displayed in this way to help give a sense of how we are doing in meeting these targets.

Response: The TMDL has been modified to present recent 10 year rolling average results for sediment yield at Orick.

Comment 28: Jim Komar. Oral testimony at public hearing.

28.1 Up-to-date soil surveys would help water quality protection efforts. EPA should assist in conducting the Humboldt County survey.

Response: EPA concurs that up-to-date soil surveys would assist in land management planning and water quality protection.

Comment 29: Gary Rynearson. Oral testimony at public hearing.

29.1 Commenter cites successses of cooperative efforts with National Park Service to carry out erosion control projects and supports Redwood Creek Landowners proposal.

Response: See responses to comments 8.1 and 26.1.

Comment 30: Richard Gienger. Oral testimony at public hearing.

30.1 An effective approach for addressing Redwood Creek problems should include standards, peer review, and public review at all stages. The main stages are evaluation, recovery plan, and implementation. Monitoring and enforcement are also needed.

Response: We generally agree with the comment and believe the TMDL process provides that framework.

Comment 31: Robert Klamt, North Coast Regional Water Quality Control Board. Letter dated 11.19.98

31.1 The minimum median particle size diameter numeric target is states as >/= 37 mm. The appropriate target is 50mm.

Response: The requested change is not being made because the basis for the change is not explained. Knopp's 1993 study formed the primary basis for this numeric target. Knopp found that in 18 reaches located in watersheds which were either undisturbed or had not managed for more than 40 years, the minimum d50 values averaged 37 mm. This value was selected for use as the suggested average minimum d50 value for the Redwood Creek TMDL.

31.2 The Regional Board is proposing an alternative method of articulating the load allocations based on control of all controllable discharges. Please indicate whether the approach in the draft Regional Board implementation strategy is an acceptable method for implementing the load allocation.

Response: As indicated in EPA's December 8, 1998 letter to the Regional Board concerning the draft Garcia River and Redwood Creek TMDLs, EPA supported the changes to these TMDLs which embrace the concept of load allocations expressed as zero controllable discharges when this approach to allocation is supported by a quantitative analysis demonstrating that the TMDL will be met after these allocations are implemented.