November 21, 2011

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, California 95814

Re: Comment re USFS Waiver

To the Board:

Thank you for the opportunity to comment on the revised Waiver.

1. My name is Jonathan J. Rhodes. I commented on the original draft Waiver. My qualifications are described in my first set of comments.

2. I reviewed the portions of the "USDA Forest Service Pacific Southwest Region DRAFT Water Quality Management Handbook," dated May 23, 2011 (USFS, 2011) related to range management. I also reviewed draft "Attachment C: State Water Resources Control Board Monitoring and Reporting Program No. ------- For Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Activities on National Forest System Lands in California" (Att. C), which was available in July 2001. Since then, I have reviewed a revised draft of "Attachment C: State Water Resources Control Board Monitoring and Reporting Program No. ------- For Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Activities on National Forest System Lands in California" as available from the California State Water Resources Control Board website in November 2011 (Revised Att. C).

3. I also reviewed sections related to livestock grazing and range management in "USDA Forest Service Pacific Southwest Region Water Quality Management for Forest System Lands in California Best Management Practices" dated September 2000 (USFS, 2000). I also

reviewed some salient scientific literature related to the impacts of livestock grazing on riparian areas and water quality. I also relied on my education and decades of professional experience in preparing these comments.

4. In my previous comments, I described why the range management best management practice (BMP) approach in USFS 2011 does not ensure the timely implementation of BMPs that effectively reduce or control water quality impacts to a degree consistent with water quality goals. My review of the Revised Att. C. does not, in any way, alter my conclusions in my previous comments regarding the numerous inadequacies of the BMP approach in USFS (2011) with respect to pollution control from livestock grazing activities on USFS lands in California. I stand by all of the findings and conclusions in my previous comments regarding these issues.

5. I explain why the monitoring described in Revised Att. C is not adequate to assess:

- the impacts to water quality and beneficial uses from USFS-authorized livestock grazing;
- whether range management BMPs have been properly implemented as required;
- whether range management BMPs have effectively reduced water quality impacts from livestock grazing on USFS lands consistent with water quality goals and the unimpaired support of beneficial uses;

I also explain why the monitoring is inadequate for improving the effectiveness of BMPs in reducing water quality degradation consistent with water quality goals.

The Defects in the Revised Att. C are Significant Because Livestock Grazing on USFS lands in California has Extensive and Significant Impacts on Water Quality.

6. As noted in my previous comments, livestock grazing adversely affects water quality in many ways. These impacts include significant increases in soil erosion and sediment

delivery, which degrades water quality by increasing suspended sediment and turbidity. These water quality impacts from grazing adversely affect fish and water use, including downstream reservoirs, as a USFS researcher has acknowledged (Reid, 1999). Elevated sediment delivery is the one of the most widespread water quality problems in the streams draining Sierra Nevada national forests (Centers for Water and Wildland Resources, 1996).

7. These increases in sediment delivery also contribute to the adverse modification of stream channels via sedimentation, which reduces the frequency, depth, and quality of pools which are important to many aquatic biota, and increases the width/depth of streams, contributing to elevated temperatures. As USFS and USBLM (1997) noted:

> Grazing is a major nonpoint source of channel sedimentation (Dunne and Leopold 1978; MacDonald and others 1991; Meehan 1991; Platts 1991). Grazed watersheds typically have higher stream sediment levels than ungrazed watersheds (Lusby 1970; Platts 1991; Rich and others 1992; Scully and Petrosky 1991). Increased sedimentation is the result of grazing effects on soils (compaction), vegetation (elimination), hydrology (channel incision, overland flow), and bank erosion (sloughing) (Kauffman and others 1983; MacDonald and others 1991; Parsons 1965; Platts 1981a; 1981b; Rhodes and others 1994). Sediment loads that exceed natural background levels can fill pools, silt spawning gravels, decrease channel stability, modify channel morphology, and reduce survival of emerging salmon fry (Burton and others 1993; Everest and others 1987; MacDonald and others 1991; Meehan 1991; Rhodes and others 1994).

8. Livestock grazing degrades water quality by increasing water temperatures in several ways. It elevates water temperature via the loss and suppression of riparian vegetation that provides stream shade. Livestock grazing also widens channels due to bank damage from trampling and sedimentation, which also contributes to water temperature increases (Kondolf et al., 1996; Kattlemann, 1996). Elevated water temperature adversely affects numerous aquatic biota, particularly salmonids (McCullough, 1999). These effects on water temperatures are significant because elevated water temperature is a widespread water quality problem in many streams draining USFS lands in California.

9. Livestock grazing also degrades water quality by elevating coliform levels (Kattlemann, 1996), as studies on USFS lands in California have documented (Derlet et al., 2008). This bacterial pollution can pose threats to human health.

10. Livestock grazing also reduces water quality by elevating nutrients levels due to animal wastes deposited or washed in to streams (Derlet et al., 2010). This degradation of water quality contributes to the eutrophication of affected water bodies (Derlet et al., 2010), which is likely to accelerate with on-going climate change (CCSP, 2008).

11. The water quality impacts of grazing on USFS lands are significant, because it is the most extensive activity on the USFS lands in California. As noted in my previous comments, the area of USFS lands in the Sierra Nevada that is subjected to livestock grazing is far greater than the area annually affected by other impacts that affect water quality, such as roads and high severity fire, based on data in USFS (2004) for these national forests. The area subjected to grazing on these national forests is 8 times greater than the area affected by roads and about 462 times greater than the average area affected annually by high severity fire. Therefore, livestock grazing impacts on water quality are critical to address due to their pervasiveness and legacy impacts. The legacy impacts of grazing, particularly on USFS lands where it has occurred for decades, can and often is aggravated by continued grazing. Any sensible approach to mitigating for the impacts of ongoing or new grazing on water quality must consider and resolve the significant legacy impacts of grazing.

The Proposed BMPs and Implementation Approach in USFS (2011) for Livestock Grazing are Inadequate to Consistently and Effectively Control Pollution.

12. As noted in my previous comments, there are several inadequacies in the BMPs and BMP approach in USFS (2011) including the following:

- many of the proposed livestock grazing BMPs are ineffective, particularly in areas

where water quality impacts from livestock grazing are already significant;

- it allows the implementation ineffective BMPs in lieu of effective BMPs;
- it fails to require timely assessment of conditions on all livestock grazing allotments and subsequent implementation of BMPs that are effective under existing conditions;
- the failure to require consistent and timely implementation of effective BMPs.

These are highly significant defects because BMPs are the prime method for control of the considerable and extensive pollution generated by livestock grazing on USFS lands in California. Monitoring cannot compensate for inadequate BMPs nor can it ameliorate such defects unless: a) it is adequate enough to consistently identify in a timely manner where BMPs are ineffective; ***and***, b) trigger the timely implementation of effective BMPs. However, the Revised Att. C, together with USFS (2011), fails on both of these counts.

The Monitoring Described in Revised Att. C is Inadequate to Assess Water Quality Impacts from Grazing and the Effectiveness of Grazing BMPs on USFS Lands.

13. The monitoring proposed in Revised Att. C has numerous defects that render it inadequate to assess the effects of livestock grazing on USFS lands in California on water quality and beneficial uses. First, the Revised Att. C. it fails to ensure that the number and locations of monitored streams adequately represent the range of livestock grazing activities, physical settings, and their water quality impacts on USFS lands in California. This is a key defect, because it is well-established that a cardinal aspect of a sound monitoring program is that it yields results that are representative of actual impacts and/or conditions.

14. It is highly unlikely that the number of paired stream segments monitored to assess water quality and beneficial use impacts from grazing will be adequate to yield results that are representative of the diversity of impacts from grazing in the diverse physical settings in which they occur on USFS lands in California. The Revised Att. C lacks of any information on

the number of streams that might be monitored as part of assessments of the effects of grazing on water quality and beneficial uses. Therefore, the Revised Att. C fails to require that the number and location of monitored stream segments be adequate to yield truly representative results.

15. Moreover, the previous draft of Att. C (p. 2, emphasis added) acknowledged the logistical reality that:

> "Because USFS resources are limited, **this type of monitoring will be restricted to a relatively small number of watersheds and sites.**"[1]

Due to the diversity of biophysical settings and grazing activities that affect water quality on USFS lands in California, monitoring a relatively small number of watersheds and sites cannot possibly yield information that is representative of water quality effects of grazing on these lands.

16. This admitted logistical reality demonstrates that the monitoring in Revised Att. C will not be adequate to provide results that are representative of the impacts of livestock grazing on USFS lands in California, because a very large number of streams would have to be monitored due to the diversity of biophysical settings in which grazing occurs on these USFS lands.

17. Truly representative monitoring of grazing impacts on water quality on all such USFS lands requires a large number of monitored streams in a diversity of settings. This is necessary due to the highly diverse climate, land forms, soils, stream types, vegetation, and types of grazing management on USFS lands throughout the state, all of which influence the level of water quality impacts caused by grazing. As noted in my previous comments, to yield truly representative results, several streams would have to be monitored for every combination of

[1] Although this statement has been excised from the Revised Att. C, it still encapsulates logistical reality of monitoring on USFS lands.

climate, land form, stream type, soils, vegetation, and grazing management that exists on USFS lands.

18. The initial fecal indicator bacteria (FIB) monitoring proposed in the Revised Att. C provides is a prime example of how the proposed monitoring is grossly inadequate in terms of the number of streams sampled. This FIB monitoring is only required to occur in one stream in each of only three water quality regions: North Coast, Central Valley and Lahontan (Revised Att. C, p. 9, mark-up copy). While this is inadequate for all of the three sampled regions and unsampled regions, the defect is particularly glaring for the Central Valley Region. According to the Central Valley Water Quality Control Board brochure (2010), this region covers about 60,000 square miles, nearly 40% of the state, and contains about 50% of the state's drinking water. There are likely hundreds of grazing allotments on USFS lands that affect water quality in hundreds of stream segments in the Central Valley Region. However, Revised Att. C only requires that one stream in this region be monitored for FIB, which is plainly inadequate to yield representative results.

19. The FIB monitoring proposed in Revised Att C is would employ biased sampling, because it would only occur "…within or immediately downstream of active grazing allotments with recently developed BMPs". Such allotments are highly unlikely to be representative of the broader population of allotments, because the updating of USFS grazing allotments has occurred at a glacial pace. Therefore, it is extremely unlikely that the proposed the FIB monitoring will produce results that are representative of fecal coliform pollution from grazing activities on USFS lands.

20. The beneficial use monitoring in Att. C. is unlikely to provide reliable information on the effects of grazing on water quality in many ecotypes on USFS lands because it is partially

premised on monitoring streams in "reference" watersheds which potentially are somewhat degraded by management activities, particularly past and ongoing grazing.

21. As noted in my previous comments, it is unlikely that pristine watersheds exist in many biophysical settings, or ecotypes, due to the pervasiveness of past and current livestock grazing which has significantly degraded stream conditions in a persistent fashion (Kondolf et al., 1996; Kattlemann, 1996). Thus, it is highly likely that streams used as "reference" in the monitoring proposed in Revised Att. C will be degraded to some degree by grazing and will not have conditions that reflect stream and water quality conditions in the absence of grazing impacts. Therefore, the proposed monitoring approach is unlikely to provide a sound assessment of the effects of grazing on beneficial uses.

22. The use of "reference" streams, which are likely somewhat degraded, and potentially significantly also introduces another significant problem. Such degraded stream conditions can become a management target, even though such conditions constitute significant impairment of beneficial uses and have water quality that is more degraded than water quality would be in the absence of impacts.

23. As noted in my previous comments, a problem that persists in the proposed beneficial use monitoring in revised Att. C is that it does not clearly require targeting the streams and watersheds for monitoring that are most sensitive to degradation from grazing. This is a significant defect, because it is well-established that impact monitoring should focus on such reaches, especially when monitoring resources are limited.

24. Another problem afflicting the proposed paired-watershed approach is that it will largely focus on "comparing measures of central tendency" from paired managed and "reference" streams. This is inadequate because streams can have similar central tendencies,

while having vastly different levels of pollution over the course of a year.

25. Another defect in Revised Att. C is that it proposes to use limited monitoring resources on ”FIB monitoring on one ’best’ USFS grazing allotment in the state to verify the ‘best-case’ performance of the USFS BMPs.” (Revised Att. C, p. 9, mark-up copy). The use of such limited funds for such monitoring is not prudent, because it is highly unlikely that such “cherry picking” will yield results that are representative of the water quality impacts from livestock grazing on USFS lands.

26. The “Project-triggered Monitoring” proposed in Revised Att. C is highly inadequate for assessing the impacts of livestock grazing on beneficial uses. This is because the monitoring would be focused on watersheds that are “at or above Thresholds of Concern for cumulative watershed effects” (Revised Att. C, p. 7, mark-up copy). Such an approach is inadequate for grazing because cumulative effects methods used on USFS lands in California do not take livestock grazing into account in assessing whether watersheds are at or above “Thresholds of Concern” (TOC). As a result, many watersheds that have significantly degraded water quality due to grazing impacts are not considered to be near TOC under the cumulative effects methods used for USFS lands in California. Hence, the “Project-triggered Monitoring” in Att. C is likely to ignore many grazing activities on USFS that are significantly degrading water quality.

27. A significant shortcoming that remains in Revised Att. C is that the proposed monitoring fails to require the establishment and monitoring of livestock exclosures in grazing allotments in order to assess the effects of grazing on riparian areas, water quality, and USFS aquatic objectives. The establishment and monitoring of such exclosures are critical for several reasons. First, in many ecotypes, it is unlikely that there are sizable watersheds and streams that

are completely unaffected by livestock grazing. Exclosures at least provide some sort of reference for comparison of the effects of grazing versus no-grazing on reach-level conditions that affect water quality, such as bank conditions, channel width, soil properties, and riparian vegetation (Bock et al., 1993; Anderson et al., 1993; Rhodes et al., 1994; Kondolf et al., 1996; Knapp and Matthews, 1996; Magilligan and McDowell, 1997; Kauffman et al., 2002; Kauffman et al., 2004; Coles-Ritchie et al., 2007).

28. Second, monitoring in and outside of exclosure provides means of assessing the effectiveness of grazing BMPs for reach-level conditions that affect water quality. This is a critical need, because many of the grazing BMPs in USFS (2011) are ineffective in many situations, as previously discussed.

29. Third, monitoring conditions and trends in and outside of exclosures is critical to assessing if grazing complies with USFS standards and objectives related to grazing, which USFS (2011) acknowledges are part of the BMP approach for grazing. For instance, standards in PACFISH and INFISH (USFS and USBLM1995a; b), the Northwest Forest Plan (USFS and USBLM, 1994), the forest plans for several other national forests, such as the Klamath and Mendocino National Forest, require the elimination or modification of livestock grazing that retards attainment of plan standards for water quality and aquatic systems. Assessment of compliance with these standards requires the assessment of differences in trends, with and without grazing, in conditions that affect plan standards for water quality, such as streambanks, soils, vegetation, and stream attributes. This is necessary because even when livestock grazing does not continue to worsen conditions that affect water quality, it prevents or seriously impedes the recovery of attributes that affect water quality and related standards. Data and studies have repeatedly demonstrated that in comparison to comparable riparian areas that have not been

grazed for several years, areas with continued livestock grazing have wider streams, lower levels of streambank stability, lower levels of overhanging streambanks, more bare ground, more compacted soils, less wet-site vegetation, and lower levels of canopy cover from desirable, deep-rooted vegetation (Platts, 1991; Rhodes et al., 1994; Fleischner, 1994; Knapp and Matthews, 1996; Magilligan and McDowell, 1997; Kauffman et al., 2002; Kauffman et al., 2004; Coles-Ritchie et al., 2007) indicating that continued grazing prevents or retards recovery of these attributes that affect water quality and beneficial uses. Scientific assessments have repeatedly recommended establishing exclosures and monitoring conditions in and outside of them in order to assess differences in the trends between grazed and ungrazed areas (Bock et al., 1993; Anderson et al., 1993; Rhodes et al., 1994; Kauffman et al., 2002; Coles-Ritchie et al., 2007).

30. For these reasons, the failure of Revised Att. C to require the establishment and monitoring of exclosures on all allotments is a significant defect, which persists although this defect was identified and discussed in my previous comments. This defect precludes the proper assessment of grazing impacts on water quality, compliance of grazing with land management standards that are part of the BMP approach, and the effectiveness of grazing BMPs.

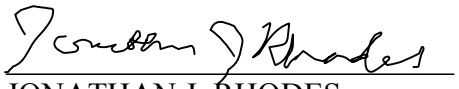
31. Revised Att. C also primarily focuses on implementation monitoring (whether BMPs were actually implemented as described), rather than sound monitoring of the effectiveness of grazing BMPs. This is a significant shortcoming, because most grazing BMPs are ineffective in protecting water quality.

32. Another significant problem is that the proposed "trend" monitoring will not be adequate to establish or assess trends during the life of the proposed waiver. This is because Revised Att C (p. 9, mark-up copy) proposes to monitoring only in selected areas only once every five years. The waiver will only be in place for about five years, based on the information

in Revised Att. C (p. 10, mark-up copy), so monitoring allotment conditions every five years will not be adequate for trend determination, because sound trend determination requires more than two data points in order to have non-trivial results.

33. Another major defect in Att. C is the failure to include a clear mechanism that requires that monitoring information is used to replace ineffective grazing BMPs with effective BMPs in a timely manner. This is a significant shortcoming because ineffective BMPs do not protect water quality and many grazing management BMPs in USFS (2011) are quite ineffective in many situations, as history and current water quality conditions demonstrate.

Thank you again for the opportunity to comment.



JONATHAN J. RHODES

Literature Cited

Anderson, J.W., Beschta, R.L., Boehne, P.L., Bryson, D., Gill, R., McIntosh, B.A., Purser, M.D., Rhodes, J.J., and Zakel, J., 1993. A comprehensive approach to restoring habitat conditions needed to protect threatened salmon species in a severely degraded river -- The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan. Riparian Management: Common Threads and Shared Interests, pp. 175-179, USFS Gen. Tech. Rept. RM-226, Fort Collins, Co.

Belsky, A.J., Matzke, A., and Uselman, S., 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. J. of Soil and Water Cons., 54: 419-431.

Beschta, R.L., Platts, W.S., and Kauffman, B., 1991. Field Review of Fish Habitat Improvement Projects in the Grande Ronde and John Day River Basins of Eastern Oregon. BPA Project No. 91-069, Bonneville Power Admin., Div. of Fish and Wildlife, Portland, Or.

Beschta, R.L., Rhodes, J.J., Kauffman, J.B., Gresswell, R.E, Minshall, G.W., Karr, J.R, Perry, D.A., Hauer, F.R., and Frissell, C.A., 2004. Postfire Management on Forested Public Lands of the Western USA. Cons. Bio., 18: 957-967.

Bock, C. E., Bock, J. H. and Smith, H. M. (1993), Proposal for a system of federal livestock exclosures on public rangelands in the western United States. Cons. Bio., 7: 731–733.

Burton,T.A., Cowley, E.R., and Smith, S.J., 2008. Monitoring stream channels and riparian vegetation – multiple indicators. Interagency Technical Bulletin Version 5.0/April 2008. BLM/ID/G1-08/001+1150. Idaho State Office, BLM and Intermountain Region U.S. Forest Service.

CCSP (Climate Change Science Program) (2008) The effects of climate change on agriculture, land resources, water resources, and biodiversity. A report by the US Climate Change Science Program and the Subcommittee on Global Change Research. P. Backlund, A. Janetos, D. Schimel, and 34 others. US Environmental Protection Agency, Washington, DC, http://www.climatescience.gov/Library/sap/sap4-3/final-report/default.htm

Centers for Water and Wildland Resources, 1996. Sierra Nevada Ecosystem Project Report, Summary and Final Report to Congress, Summary and Vol. I-III. Wildland Resources Center Report No. 39, University of California, Davis.

Clary, W.P. and Webster, B.F., 1989. Managing Grazing of Riparian Areas in the Intermountain Region. USFS Gen. Tech. Rept. INT-263, Ogden, Utah.

Coles-Ritchie, M.C., Roberts, D.W., Kershner, J.L. and Henderson, R.C., 2007. Use of a wetland index to evaluate changes in riparian vegetation after livestock exclusion. J. Amer. Water Resour. Assoc., 43: 731-743.

Cowley, E.R., 2002. Monitoring Current Year Streambank Alteration. Bureau of Land

Management, Idaho State Office, Boise, ID

Derlet, R.W., Ger, K.A., Richards, J.R. and Carlson, J.R., 2008. Risk factors for coliform bacteria in backcountry lakes and streams in the Sierra Nevada mountains: a 5-year study. Wilder. Environ. Med., 19: 82–90.

Derlet, R.W., C.R. Goldman, and M.J. Connor. 2010. Reducing the impact of summer cattle grazing on water quality in the Sierra Nevada Mountains of California: a proposal. Journal of Water and Health 8:326-333.

Elmore, W., 1992. Riparian responses to grazing practices. Watershed management: Balancing sustainability and environmental change, pp. 442-457, Springer Verlag, New York.

Elmore, W., and B. Kauffman. 1994. Riparian and watershed systems: degradation and restoration, pp. 212-231. In: M. Vavra, W.A. Laycock, and R.D. Pieper (eds.), Ecological implications of livestock herbivory in the West. Soc. Range Management, Denver, CO.

Espinosa, F.A., Rhodes, J.J., and McCullough, D.A.. 1997. The failure of existing plans to protect salmon habitat on the Clearwater National Forest in Idaho. J. Env. Manage. 49: 205-230.

Fleischner, T.L., 1994. Ecological costs of livestock grazing in western North America. Cons Biol., 8: 629-644.

Gifford Pinchot National Forest, 2007. Environmental Assessment for the Ice Caves Grazing Allotment, Gifford Pinchot National Forest. Gifford Pinchot National Forest, Mt. Adams Ranger Dist., Skamania County, WA

Henjum, M.G., Karr, J.R., Bottom, D.L., Perry, D.A., Bednarz, J.C., Wright, S.G., Beckwitt, S.A., and Beckwitt, 1994. Interim Protection for Late Successional Forests, Fisheries, and Watersheds: National Forests East of The Cascade Crest, Oregon and Washington. The Wildlife Soc., Bethesda, Md.

Karr, J.R., Rhodes, J.J., Minshall, G.W., Hauer, F.R., Beschta, R.L., Frissell,C.A., and Perry, D.A, 2004. Postfire salvage logging's effects on aquatic ecosystems in the American West. BioScience, 54: 1029-1033.

Kattelmann, R., 1996. Hydrology and water resources. Sierra Nevada Ecosystem Project: Final report to Congress, Vol. II, Ch. 30. Wildland Resources Center Report No. 39, University of California, Davis.

Kauffman, J.B., Bayley, P., Li, H., McDowell, P., and Beschta, R.L., 2002. Research/Evaluate Restoration of NE Oregon Streams: Effects of livestock exclosures (corridor fencing) on riparian vegetation, stream geomorphic features, and fish populations. Final Report to the Bonneville Power Administration, Portland, OR

Kauffman, J.B., A.S. Thorpe, J. Brookshire, and L. Ellingson., 2004. Livestock exclusion and

belowground ecosystem responses in riparian meadows of eastern Oregon. Ecological Applications 14:1671-1679.

Kondolf, G. M., R. Kattelmann, M. Embury, and D. C. Erman. 1996. Status of riparian habitat. Sierra Nevada Ecosystem Project Report, Summary and Final Report to Congress, Summary and Vol. II, Ch. 36. Wildland Resources Center Report No. 39, University of California, Davis.

Knapp, R.A., and Matthews, K.R., 1996. Livestock grazing, golden trout, and streams in the Golden Trout Wilderness, California: Impacts and management implications. N. Amer. J. Fish. Management. 16:805-820.

Kovalchik, B.L. and Elmore, W., 1991. Effects of cattle grazing systems on willow dominated plant associations in central Oregon. In: Symposium on ecology and management of riparian shrub communities. May 29-31, 1991.Sun Valley, ID. p. 111-119.

Leonard, S., Kinch, G., Elsbernd, V., Borman, M., and Swanson, S., 1997. Riparian Area Management: Grazing Management for Riparian-Wetland Areas. BLM and USFS, TR 1737-14, BLM, Denver, CO.

Magilligan, F.J., and McDowell, P.F., 1997. Stream channel adjustments following elimination of cattle grazing. J. Amer. Water Resour. Assoc., 33: 471-478.

Marlow, C.B. and Poganick, T.M., 1985. Time of grazing and cattle-induced damage to streambanks. Riparian ecosystems and their management: Reconciling conflicting uses, pp. 279-284, USFS Gen. Tech. Rept. RM-120, Fort Collins, Co.

McCullough, D.A., 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to chinook salmon, USEPA Technical Report EPA 910-R-99-010. USEPA, Seattle, WA.

Menning, K. M., D. C. Erman, K. N. Johnson, and J. Sessions, 1996. Aquatic and riparian systems, cumulative watershed effects, and limitations to watershed disturbance. Sierra Nevada Ecosystem Project: Final Report to Congress, Addendum, pp. 33-52. Wildland Resources Center Report No. 39, Centers for Water and Wildland Resources, University of California, Davis.

Murray, E., Hovekamp, S., and Liverman, M., 2004. HCD Online Guidance Livestock Grazing on Federal Lands. NOAA Fisheries, Northwest Region.

National Research Council, 2002, p. 336 in Riparian Areas: Functions and Strategies for Management, National Academy Press, Washington, D.C

National Riparian Service Team, 1999. PFC (Proper Functioning Condition) What It Is and What It Isn't. National Riparian Service Team, USBLM, Prineville, OR.

Ohmart, R.D., and Anderson, B.W., 1986. Riparian habitat. Inventory and Monitoring of Wildlife Habitat, pp. 169-199, USBLM Service Center, Denver, Co.

Platts, W.S., 1991. Livestock grazing. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats, Am. Fish. Soc. Special Publ. 19: 389–424.

Reid, L.M. 1999. Forest Practice Rules and cumulative watershed impacts in California. Unpublished response to an inquiry from Assembleyman Fred Keeley. USDA Forest Service, Pacific Southwest Research Station, Redwood Sciences Laboratory, Arcata, California. 10 p.

Rhodes, J.J., McCullough, D.A., and Espinosa Jr., F.A., 1994. A Coarse Screening Process for Evaluation of the Effects of Land Management Activities on Salmon Spawning and Rearing Habitat in ESA Consultations. CRITFC Tech. Rpt. 94-4, Portland, OR. http://www.critfc.org/text/tech_rep.htm

Rhodes, J.J. and Baker, W.L., 2008. Fire probability, fuel treatment effectiveness and ecological tradeoffs in western U.S. public forests. Open Forest Science Journal, 1: 1-7. http://www.bentham.org/open/tofscij/openaccess2.htm

Rhodes, J.J., and Purser, M.D., 1998. Overwinter sedimentation of clean gravels in simulated redds in the upper Grande Ronde River and nearby streams in northeastern Oregon, USA: Implications for the survival of threatened spring chinook salmon, Forest-Fish Conference: Land Management Affecting Aquatic Ecosystems, Proc. Forest-Fish Conf., May 1-4, 1996, Calgary, Alberta, Canada. Nat. Resour. Can., Can. For. Serv. Nort. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-356, pp: 403-412.

Rhodes, J.J. and Baker, W.L., 2008. Fire probability, fuel treatment effectiveness and ecological tradeoffs in western U.S. public forests. Open Forest Science Journal, 1: 1-7. http://www.bentham.org/open/tofscij/openaccess2.htm

Sedell, J., Lee, D., Reiman, D., Thurow, R, and Williams, J., 1997. Chapter 3, Effects of proposed alternatives on aquatic habitats and native fishes, *in* Evaluation of EIS Alternatives by the Science Integration Team. Vol. I PNW-GTR-406, USFS and USBLM, Portland, OR.

Spence, B.C., Lomnicky, G.A., Hughes, R.M., Novitzki, R.P., 1996. An ecosystem approach to and salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR. (Available from the National Marine Fisheries Service, Portland, Oregon.)

USFS, NMFS, BLM, USFWS, USNPS, USEPA, 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. USFS PNW Region, Portland, Or.

USFS and USBLM, 1995a. "PACFISH" – Decision Notice and Environmental Assessment for Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California. USFS and USBLM, Wash. D.C.

USFS and USBLM, 1995b. "INFISH" -- Decision Notice and Environmental Assessment for Inland Native Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada. USFS and USBLM, Wash., D.C.

USFS and USBLM, 1997. The Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins, Volumes I-IV, USFS PNW-GTR-405. USFS Pacific Northwest Research Station, Walla Walla, WA.

USFS, 2000. Sierra Nevada Forest Plan Amendment DEIS, USFS PSW Region, San Francisco, Ca.

USFS, 2004. Sierra Nevada Forest Plan Amendment FSEIS and Record of Decision. USFS PSW Region, Vallejo, CA.

Waters, T.F., 1995. Sediment in streams: sources, biological effects and control. American Fisheries Society, Monograph 7, Bethesda, MD.