SECTION H
SYNTHESIS

INTRODUCTION

The synthesis module presents a compilation of results with an attempt to summarize the most significant hillslope hazards and aquatic resource conditions for improvement. The information compiled will be a summary of sediment inputs, presentation of aquatic habitat condition ratings (on target, marginal, deficient), and any water quality information available. The synthesis module presented here differs from the protocols presented in the Washington state watershed analysis manual (Version 4.0, Washington Forest Practices).

Sediment Inputs

The estimated sediment inputs for the Elk Creek WAU have been summarized and are presented. The purpose of this summary is to demonstrate the relative amount of different sediment sources, indicate priorities for erosion control, and assist with interpretation of stream channel conditions in relation to sediment deposition and transport. A sediment budget provides quantification of sediment inputs, transport, and storage in a watershed (Reid and Dunne, 1996). In this case we are not doing a true sediment budget, only an estimation of the sediment inputs. Care must be used when interpreting these estimated values; by no means can the estimates be considered absolute. Rather, the sediment input estimates are best interpreted for relative comparisons between processes and planning watersheds.

This section combines and summarizes the sediment input results from the Mass Wasting and Surface and Point Source Erosion modules of the watershed analysis. Sediment input for the Elk Creek WAU is estimated from hillslope mass wasting, road associated mass wasting, road surface and point source erosion, and skid trail erosion. The sediment inputs are shown as an average rate for past conditions (1938-2004).

The average estimated sediment input for the time period 1938-2004 for the Elk Creek WAU is 521 tons/square mile/year. The inputs in the Elk Creek WAU over this time frame have come from mass wasting (45%) and surface and point source erosion (55%), including skid trails in the latter. The breakdown of total sediment input is presented by planning watershed for the Elk Creek WAU (Table H-1 and Figure H-1).

Road associated sediment delivery is the major contributor in the Elk Creek WAU. By adding the contribution of road surface, point source, skid trails and road-associated mass wasting sediment delivery, roads represented 74% of the sediment inputs in the Elk Creek WAU.

Roughly 17,876 cubic yards of controllable erosion is currently associated with the road network in Elk Creek. Since 1998, when the company was formed, approximately 26,900 cubic yards of erosion from the road network has been treated. This erosion control work, however, was completed prior to the road inventory in Elk Creek, so credit for treating controllable erosion cannot be taken at this time.

Figure H-1. Estimated Percentage of Sediment Inputs by Source for the Elk Creek WAU, 1938-2004.

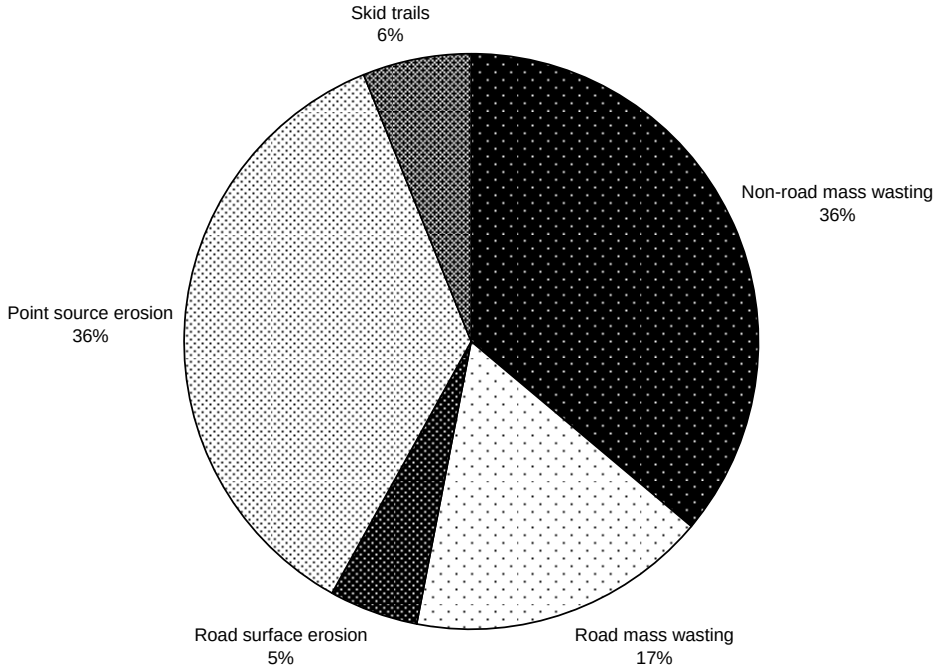

Table H-1. Estimated Sediment Inputs by Input Type the Elk Creek WAU 1938-2004.

Planning Watershed	Road Surface Erosion (tons/mi^2/yr)	Road Point Source Erosion (tons/mi^2/yr)	Road Associated Mass Wasting (tons/mi^2/yr)	Hillslope Mass Wasting (tons/mi^2/yr)	Skid Trail Erosion (tons/mi^2/yr)	Total (tons/mi^2/yr)
Lower Elk Creek	42	267	143	235	60	747
Upper Elk Creek	22	170	67	199	20	478

HABITAT QUALITY RATINGS

The habitat quality ratings for LWD, stream temperature, stream shade, stream gravel permeability, and fine sediment are presented here. Some of the ratings were previously presented in this watershed analysis.

LWD Quality Ratings (as reported in Section D, Riparian Function)
Table H-2 shows the instream LWD quality rating for the planning watersheds of the Elk Creek WAU. This quality rating will provide a tool to monitor the quality of the LWD in major streams over time. Currently both planning watersheds have a deficient LWD quality rating.

Table H-2. In-stream LWD Quality Ratings for the Elk Creek WAU.

Stream	Calwater Planning Watershed	Percent of segments† with low or moderate demand	Percent of segments† meeting at least half of the key piece target	In-stream LWD Quality Rating*
Elk Creek	Lower Elk	2%	12%	Deficient
Elk Creek	Upper Elk	10%	30%	Deficient

† – normalized by segment lengths
* – includes debris jams

Stream Temperature and Shade Quality Ratings (as reported in Section D, Riparian Function)
MRC uses two sequential sets of criteria to determine if a watershed has "on-target" effective shade and temperature quality. The first is based on most recent three year average maximum weekly average temperature (MWAT), the second on canopy cover. The Upper Elk Creek planning watershed has marginal stream shade and temperature conditions whereas Lower Elk Creek is rated as on-target as indicated by the stream shade ratings (Table H-3). It is anticipated that these ratings will improve over time with policies promoting stream shade.

Table H-3. Stream Shade and Temperature Quality Ratings for Streams in the Elk Creek WAU.

Planning watershed	Number of segments surveyed	% segments with MWAT < 15 deg C and/or average canopy greater than target	% segments with >70% average canopy	Stream Shade Quality Rating
Lower Elk Creek	9	89%	89%	ON TARGET
Upper Elk Creek	22	64%	91%	MARGINAL*

Marginal due to the fact that greater than 70% of the stream segments surveyed had canopy values that were greater than 70%

Stream Gravel Quality
Stream gravel quality has been monitored in one long term stream monitoring segment in the Elk Creek WAU (stream segment CE01). Both permeability and bulk gravel samples were collected in the summer of 2005. The percent fine sediment from bulk gravel samples and permeability quality ratings are defined below in Table H-4.

Permeability Ratings	
ON TARGET (OT)	>10,000 cm/hr permeability = >55% survival index.
MARGINAL (M)	>2000 cm/hr permeability = >30% survival index.
DEFICIENT (D)	<2000 cm/hr permeability = <30% survival index.

Fine Sediment Ratings	
ON TARGET (OT)	<7% in the size class 0.85 mm using dry sieve techniques.[1]
MARGINAL (M)	7-14% in the size class 0.85 mm using dry sieve techniques.
DEFICIENT (D)	>14% in the size class 0.85 mm using dry sieve techniques.

Table H-4. Stream Gravel Quality Ratings for Permeability and Fine Sediment for Elk Creek WAU Long Term Monitoring Segment, 2005.

Segment ID	Stream Name	Geometric Mean Permeability for Segment (cm/hr)	Standard Error Permeability (cm/hr)	Range of Permeability Observations (cm/hr)	Permeability Survival Index (Taggart/ McCuddin)	Percent Particles <0.85 mm	Bulk Gravel Survival Index (Tappel/Bjorn)
CE01	Elk Creek (at Twin Bridges)	6,293	2,113	867 - 37,368	48%	5 - 6%	75-85%
CL01	Elk Creek (below South Fork Elk)	8,852	3,880	701 – 82,585	53%	2 - 6%	79 – 94%

[1] MRC used information from the Noyo TMDL for sediment (EPA 1999) to develop the target for fine sediment from dry-sieve techniques; the target is less than 7% of the gravel composition in the size class 0.85 mm. In the TMDL for the Garcia River (NCRWQCB 1997), where dry sieving is not specified, the target for gravel composition in the size class 0.85 mm is less than 14%.

Table H-5. V-star data for Elk Creek WAU Long Term Monitoring Segments, 2005.

Upper Elk		Lower Elk	
Pool number	**V***	**Pool number**	**V***
1	0.47	1	0.16
2	0.20	2	0.35
5	0.35	3	0.26
7	0.20	4	0.22
8	0.17	5	0.62
11	0.17	6	0.12
12	0.16		
High	**0.47**	**High**	**0.62**
Low	**0.16**	**Low**	**0.12**
Mean	**0.17**	**Mean**	**0.26**
Variance	**0.000055**	**Variance**	**0.0026**
Standard Error	**0.0074**	**Standard Error**	**0.05**

The mean of the V-star observations (Table E-5) indicate that this long term monitoring segment exhibits fine sediment deposition characteristic of regional index streams with little to no prior disturbance, as observed in the study by Knopp 1993. The index streams observed by Knopp 1993 indicated mean V-star values ranging from 0.17 to 0.28 whereas the moderately to highly disturbed watersheds resulted in mean values of 0.37 to 0.42.

Aquatic Habitat and Water Quality Summary

The habitat quality ratings and sediment input summaries show that large woody debris recruitment, canopy, and road associated sediment have the greatest need for improvement. Currently MRC has made good improvements in its efforts to controlling road sediment, but information on the amount of controllable erosion that has been treated cannot be determined since the road inventory was finished in 2005.

LITERATURE CITED

Knopp, C. 1993. Testing Indices of Cold Water Fish Habitat. Final Report for Development of Techniques for Measuring Beneficial Use Protection and Inclusion into the North Coast Region's Basin Plan by Amendment of the.....Activities, September 18, 1990. North Coast Regional Water Quality Control Board in cooperation with California Department of Forestry. 57 pp.

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