Appendix G
Aquatic Specialist's Report

Routt RAP
Aquatic specialist report
Liz Schnackenberg
South Zone hydrologist, Medicine Bow-Routt National Forests
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Analysis of the aquatic questions for the Routt NF forest scale roads analysis utilized the existing database, GIS queries, and professional judgment. Due to the time constraints and scale of the assessment, the decision was made to use only existing information; no new data was collected. The database for the roads is relatively accurate and up to date, although unclassified roads have not been inventoried. The database for streams is based on the USGS blue-lines which represent the backbone stream network, but under-represents the true stream network i.e. the true stream network is more extensive than what is shown by the blue-lines (IRI, 1995).

Due to the magnitude of the assessment, determination of where the road system may be affecting the water and aquatic resources was based on a risk assessment using GIS analysis. Since it is impossible to field verify every road at this scale of analysis, assumptions were made as to the level of risk roads pose in each watershed. Through map analysis and field knowledge, specific maintenance level 3-5 roads that have the highest risk of affecting watershed function and aquatic resources were also identified.

The watershed boundaries used in this analysis were from the GIS watershed layer completed in Fall 2002. This layer was developed and watersheds were numbered to be consistent with the NRCS national watershed delineation protocol. These watershed boundaries and acreages are not always consistent with work done prior to the fall of 2002. When comparing any of the data from this assessment with previous assessments, it is important to remember that watershed numbers and/or boundaries may have changed.

This analysis used sixth level watersheds to show the degree of risk for each watershed. Sixth level watersheds provide an assessment scale which differentiates areas of concern, but are still manageable to work with at the forest scale. The following table summarizes watershed risk by major river basin for the different factors considered.

Table 1: Summary of road risk factor ratings by major river basin. The first number indicates the number of watersheds with a high, moderate, and low rating for that factor, the second number indicates percent of the sixth level watersheds in that river basin with that rating; the last row is for the entire Routt National Forest.

River Basin	Risk rating	# of 6th level watersheds by river basin	Road density level 1-5 (#-- %)	Road density level 1-2(#-- %)	Road xing density level 1-5(#-- %)	Roads within 200' of streams (#-- %)	% of watershed with sensitive soils (#--%)	Road density or 5+ miles on sensitive soils level 1-5(#-- %)
North Platte	H		4--12%	1--3%	2--6%	6-19%	4--13%	7--22%
	M	32	14--44%	11--34%	9--28%	10-31%	10--31%	0--0%
	L		14--44%	20--63%	21--66%	16-50%	18--56%	25--78%
Colorado River	H		4--21%	0--0%	1--5%	2-11%	6--31%	3--16%
	M	19	8--42%	8--42%	4--21%	8-42%	11--58%	3--16%
	L		7--37%	11--58%	14--74%	9-47%	2--11%	13--68%
Yampa River	H		3--6%	1--2%	1--2%	5-9%	35--65%	17--31%
	M	54	5--9%	4--7%	5--9%	20-37%	14--26%	3--6%
	L		46--85%	49--91%	48--89%	29-54%	5--9%	34--63%
Little Snake River	H		0--0%	1--10%	1--10%	3-30%	6--60%	7--70%
	M	10	6--60%	1--10%	4--40%	3-30%	2--20%	1--10%
	L		4--40%	8--80%	5--50%	4-40%	2--20%	2--20%
TOTAL RNF	H		11--9%	3--3%	5--4%	16-14%	51--44%	34--30%
	M	115	33--29%	24--20%	22--19%	41-36%	37--32%	7--6%
	L		71--62%	88--77%	88-77%	58-50%	27--24%	84--64%

Road density: Total road density was determined for each sixth level watershed using GIS queries which determined the miles of road in each sixth level watershed. Road density was then broken down into the density of maintenance level 1-2 roads, and maintenance level 3-5 roads. The assumption here is that the level 3-5 roads receive regular maintenance and are generally not significantly affecting the aquatic resources. Many of the level 1-2 roads were built between 1950-1970 and did not incorporate Best Management Practices (BMPs). For this reason, it was assumed that the level 1-2 roads have the greatest potential for affecting aquatic resources, which is consistent with field reconnaissance.

The road density risk ratings were broken down into the following categories:

Total Road density (level 1-5 rds)	(miles/mi^2)	Road density level 1-2 roads	(miles/mi^2)
Low	0-0.99	Low	0-0.99
Moderate	1.0-1.99	Moderate	1.0-1.99
High	2.0+	High	2.0+

Road-stream crossing density: The density of road-stream crossings was determined through map analysis in which the number of road crossings were tallied for each watershed then divided by the drainage area in square miles. This included only the USGS blue-line streams, which under-represent the stream network as noted above; the density of road-stream crossings is most likely higher than what was accounted for in this analysis.

Road-stream crossings act as connected disturbed areas. Connected disturbed areas are defined as 'high runoff areas like roads and other disturbed sites that discharge surface runoff into a stream or lake… Connected disturbed areas are the main source of damage in all regions' (FSH 2509.25). The higher the density of road-stream crossings, the higher the potential for increased sedimentation to the stream network. Roads which did not incorporate BMPs are often the greatest contributors of sediment to the stream network through these connected disturbed areas.

Road-stream crossing density risk rating	Road-stream crossing density value (# of crossings/mi^2)
Low	0-0.99
Moderate	1.0-1.99
High	2.0+

Soil risk: The effects of roads on watershed health is highly dependant on the soil type. Some soils are susceptible to surface erosion or are highly erodible, while others are highly susceptible to mass movement. Soils with high surface erosion potential are on steeper slopes where slope is the driving factor. Highly erodible soils have physical characteristics with a high soil erodibility factor (K factor) that makes them susceptible to erosion even on flat slopes. The two extremes of highly erodible soils include shales with high clay content, and decomposed granite which has no binder. Some soils are susceptible to both erosion and mass movement, and are considered extremely sensitive soils. For this analysis, the acres of soil map units which are susceptible to surface erosion, are highly erodible, or susceptible to mass movement were queried by sixth level watershed. The percent of watershed with sensitive soils was then used as a risk factor for existing roads, and new road construction. The following table identifies the values used to rate soil risk by watershed.

Soil risk rating	Percent of watershed with sensitive soils
Low	1-20%
Moderate	20-50%
High	50-100%

In addition, the miles and density of roads on sensitive soils was used as an indicator of watersheds where a relatively high percent of road miles are on sensitive soils. Roads on sensitive soils have a higher risk of causing damage to the aquatic system due to having either higher surface erosion, or increased potential for mass movement associated with the road.

In this analysis, watersheds with five or more miles of road on sensitive soils were considered to have a high risk. If the watershed had five or more miles of road on soils which had high surface erosion potential or were highly erodible, AND five or more miles on high or moderate mass movement potential they were considered to have and extreme risk. In addition, watersheds with a density of roads of 1.00 or more on sensitive soils were also assigned a high risk factor. Watersheds were assigned a risk rating based on the table below.

Table 2: Risk ratings for the miles and density of roads on sensitive soils.

Soil risk rating	Miles of road on sensitive soils	Density of roads on sensitive soils
Low	0-0.99	0-0.49
Moderate	1.0-4.99	0.50-0.99
High	5.0+	1.00-1.49
Extreme	Erosion+mass movement	1.50+

Miles of road within 200 feet of stream courses: Roads are disturbed areas which are a potential source of sediment to the stream system, especially when there is a pathway which connects water and sediment derived from the road system to the stream network through connected disturbed areas. In this analysis, the miles of road within 200 feet of stream courses was used to identify the potential for connected disturbed areas other than road-stream crossings. The assumptions are that: 1) there is a high probability that drainage relief structures drain directly into the stream system during spring runoff and act as connected disturbed areas, 2) where roads are on flatter grades, there is a possibility that dispersed campsites have developed between the road and the stream system, and that runoff from the dispersed sites reaches the stream network, or 3) on steeper slopes, water and sediment from drainage relief structures reaches the stream system since the steeper slopes result in higher velocities. The following table identifies the values used to rate the risk of connected disturbed areas associated with roads close to the stream network. In general, miles of road was the deciding factor rather than density.

Table 3: Values used to rate risk of connected disturbed area.

Miles of road within 200 ft of stream courses (level 1-5)	(Miles/mi^2)	**Density for level 1-2 roads of miles of road within 200 ft of stream courses**	(miles/mi^2)
Low	0-0.99	Low	0-0.1
Moderate	1.0-4.99	Moderate	0.1-0.49
High	5.0+	High	0.5+

Factor and cumulative risk ratings: A numerical system was used to determine the cumulative risk of the different factors such as road density, sensitive soils etc. Each factor was given a numerical value, and the values for each of the individual factors was added together to come up with an overall risk rating. The following table summarizes the numerical values assigned to individual factors, and the range of values for overall risk.

Individual factor rating	**Factor numerical value**	**Overall risk rating**	**Overall risk values**
Low	1	Low	1-6
Moderate	2	Moderate	7-10
High	3	High	11+
Extreme	4		

The risk rating represents the potential for the road system to be significantly degrading watershed function and aquatic habitat. This is only a risk analysis to determine high priority areas to focus more detailed assessments. There may be watersheds with high risk ratings in which the road system is only having minor effects; similarly, there may be watersheds with low risk ratings which are being significantly affected by the road system. In no way does the risk rating represent the true watershed condition, but merely the potential for road related effects.

Aquatic species: The effects of the road system on aquatic species are largely tied to the watershed assessment. Watersheds with Colorado River native cutthroat trout (CRN) were identified. These watersheds were given a high risk rating for aquatic species due to the high potential for roads to affect aquatic habitat. In the overall risk rating, watersheds with CRN present were given an additional 3 points in the risk rating numerical summary to recognize the risk of the road system affecting CRN habitat. This resulted in upgrading some watersheds from moderate to high risk based on the presence of CRN.

Road matrix ratings

Road matrix watershed risk: The road matrix risk rating considered the miles of road adjacent to the stream system, miles of road of sensitive soils, and number of road-stream crossings. Due to the varying length of roads, the relative percent of road affected by each factor was considered rather than absolute miles.

> High risk: A substantial portion of the road segment (50% or greater) runs immediately adjacent to a stream so that it is hydrologically connected, there are known problem areas, and/or a high percent of the road segment is on sensitive soils; or a combination of any of these factors.
>
> Medium risk: 20-50% of the road segment was immediately adjacent to the stream system, or a high percent of the road segment was on sensitive soils, or knowledge of a potential or isolated problem area.
>
> Low risk: Less than 20% of the road segment was immediately adjacent to the stream system, little to no part of the road segment was on sensitive soils, and there were no known problems.

Road matrix aquatic risk: In the road matrix, roads were given a high risk rating where there were 1) migration barriers at road-stream crossings, or 2) the road is adjacent to populations of sensitive aquatic species. The aquatic species considered include CRN, boreal toads, wood frog, leopard frog, and rocky mountain capshell snail. Roads were given a moderate risk rating if TES species were in the vicinity, but probably not being directly affected by the road. Low risk ratings were assigned to roads that appeared to have minimal or no effect on TES species.

In the final road matrix, the aquatic species risk ratings were combined with the wildlife riparian species risk ratings since both of these ratings take into account similar factors.