APPENDIX F
OVERALL ROAD RISK ANALYSIS

Appendix F
Overall Relative Road Risk Analysis

Baseline road and watershed risk information is important in transportation planning, as road management activities need to consider the current condition and potential vulnerabilities of the areas where future activities will, or are proposed to, occur. The result of this analysis is an overall relative road risk rating that approximates the potential impact of roads on the eight different parameters studied.

As one component of Steps 4 and 5 of the Road Analysis Process (RAP), information was collected and processed using Geographic Information System (GIS) computer technology. Only roads or portions of them, contained within the Forest boundary were evaluated and categorized. In this appendix, as throughout this document, numbers and mileages are based upon best available BHNF GIS data. Field verification of the data was not completed as part of this analysis. Land use and cover type were not included in this analysis and were assumed to remain relatively constant over the Forest.

The GIS analysis was evaluated for each Forest System Objective Maintenance level 3,4,and 5 road including those under county jurisdiction. Small campground loop roads and short roads at administrative sites were not included. All subsequent discussions under this roads analysis section refer to this selection of roads unless stated otherwise

In all cases, the individual risk indicators are based on relative amounts of a parameter found on the Black Hills National Forest. The actual or 'absolute' risk that roads pose to the selected parameters could not be determined within the scope of this analysis. An attempt was made to be conservative in assigning risk conditions to increase the likelihood that high risk areas would be identified. The assigning of these risk conditions and the relative ranking of the results is based, in most cases, on the professional judgment of the specialists involved. It is important to note therefore that the relative risk rankings should only be used as an indicator of the road's potential for impact and as a flag for project level analysis teams to look at a road in more detail.

In combining the individual risk factors into the overall relative road risk rating, the factors were weighted equally. It is likely that certain risks would contribute more or less to the overall risk of a particular road, area, or watershed but a valid method of weighting them could not be determined.

General relative risk categories were assigned as follows:

0 - There are no or relatively low potential risks.
1 - There are relatively moderate potential risks.
2 - There are relatively high potential risks.

Relative road risk was evaluated using the following relative risk indicators:

1. **Hydrology Risks**
2. **Wildlife Risks** .
3. **Weed Infestation Risk**
4. **Resource Damage Area Risk**
5. **Botanical Area Risk**
6. **Heritage Area Risk**
7. **Land Right of Way Risk**
8. **Maintenance Cost Risk.**

The individual risk factors and the results of the analysis are presented below.

Hydrology Risk

This factor is based on the combination of six individual hydrology related factors. A detailed discussion is presented in Appendix C. The individual factors are:

1. **Road Density Risk**
2. **Perrenial Stream Crossing Risk**
3. **Stream Proximity Risk (30 feet)**
4. **Stream Proximity Risk (119 feet)**
5. **Highly Erosive Soils Risk**
6. **High Slope Risk**

Each individual factor was assigned a risk number of 0 to 2. The highest possible risk number would be 12. The overall hydrology road risk ratings assigned to each road was distributed as follows:

0 - Relatively Lower Overall Hydrology Road Risk: 0 to 4 relative points

1 - Relatively Moderate Overall Hydrology Road Risk: 5 to 8 relative points

2 - Relatively High Overall Hydrology Road Risk: 9to 12 relative points.

Wildlife Risk

This factor is also based on the combination of six individual related factors. A detailed discussion is also presented in Appendix C. The individual factors are:

1. **Road Density Risk**
2. **Goshawk Nest Proximity Risk**
3. **Martin Habitat Risk**
4. **Snail Colony Risk**
5. **Riparian Area Proximity Risk**
6. **American Dipper Stream Proximity Risk**

Each individual factor was assigned a risk number of 0 to 2. The highest possible risk number would be 12. The overall wildlife road risk ratings assigned to each road was distributed as follows:

0 - Relatively Lower Overall Wildlife Road Risk: 0 to 3 relative points

1 - Relatively Moderate Overall Wildlife Road Risk: 4 to 5 relative points

2 - Relatively High Overall Wildlife Road Risk: 6to 9 relative points.

Weed Infestation Risk

Noxious weeds generally represent a growing risk to the natural distribution and occurrences of plant species in the Black Hills as in other areas of the country. The risk posed by roads is primarily related to ground disturbance and transportation of seeds. Road maintenance, reconstruction and construction activities can expose a dormant seed bed or provide fertile, open ground for new noxious weed seeds brought in by other means. Roads allow vehicle traffic that can spread seeds brought from other parts of the forest or country. Treatment occurs along roads and seeding of road construction areas occur with Black Hills seed mixes however the risk remains. All roads present a risk associated with weeds however the roads with known weed infestations pose a much higher risk of weed re-growth and spreading of seeds to other areas. The Black Hills GIS weed layer was used along with system level 3,4,and 5 roads to determine the percent of each road that is in a known weed infested area. The distribution of these percentages was evaluated and the following risk ratings were assigned.

0 - Relatively Lower Risk: 0 percent of the road is within weed infested areas.

1 - Relatively Moderate Risk: >0 to 25 percent of the road is within weed infested areas.

2 - Relatively Higher Risk: >25 percent of the road is within weed infested areas.

Resource Damage Area Risk

With the relatively recent large increase in the sale of Off Highway Vehicles (OHV's,) the Black Hills has seen a similar increase in the amount of OHV use. The damage or disturbance to vegetation and soils as well as erosion from new, user-defined trails has increased proportionately. Shooting areas have also developed in some areas of the forest and their use is increasing. Resulting effects include tree mortality, disturbance of vegetation, pollution, and increases in erosion. Some areas of the forest have also become popular for dumping refuse. The GIS layer used for this analysis is a new one and as such is not a complete picture of all such areas on the forest. The risk posed by roads is that they provide easy access to areas of the forest that have been chosen for these uses. Closing or restricting roads that lead to these areas will not necessarily solve the problems but identifying and mapping these areas and the roads that lead to them provides information for addressing them at the project level in the future. If a road leads to one of these damage areas, it was assigned a relatively higher risk value of 2. All other roads were assigned a relatively lower risk of 0.

Botanical Area Risk

The Black Hills has a number of areas that are designated as Botanical Areas, Management Area (MA 3.1). Botanical Areas and other high quality natural communities are located in a number of places throughout the Forest. The common thread to all of them is that they exhibit plant communities, associations and/or individual species of particular interest. High quality MA 3.1 areas are generally managed to maintain their botanical features. MA 3.1 areas can provide habitat for threatened, endangered or sensitive species, and other elements of biological diversity, or for their scenic and/or public property values. Various disturbances of these areas can cause changes to their environment and/or damage that could take a long time to restore or may never be restored. A variety of risks are associated with roads, however a highly visual risk is that roads can provide easy access to the area by OHV's. If a road passes through or near a botanical area, it could also potentially contribute to the introduction of noxious weeds, sedimentation, or changes to the habitat. If a road passes within 300 feet of one of these areas, it was assigned a relatively higher risk value of 2. All other roads were assigned a relatively lower risk of 0.

Heritage Area Risk

The Black Hills has a large number of heritage sites, many of them resulting from the historical use of this area by several American Indian tribes. Many of these sites have been identified to be protected. Not all of the forest has been surveyed but in areas that have been surveyed, a record exists. Sites that were used for this analysis were either eligible for listing on the national registry, were unevaluated or there status was unknown. Sites that were "not eligible" for listing were not analyzed. The risk posed by roads is that they can provide easy access to historical sites with potential resulting damage. The roads themselves can also disturb sites during construction and maintenance activities. The risk factor chosen for this parameter is if a road passes within 50 feet of an archeology site that fell into the above categories for consideration.

Relative risk ratings used for heritage indicator are:

0 - Relatively Lower Heritage Risk: 0 sites on a road within 50 feet of road..

1 - Relatively Moderate Heritage Risk: 1 site on a road within 50 feet of road.

2 - Relatively Higher Heritage Risk: 2 to 14 sites on a road within 50 feet of road.

Land Right-of-Way Risk

The Black Hills is well distributed with sections of private land. Many of the BHNF system roads cross these private inholdings. Some of these roads have Right-of-Way (ROW) issues that have not been resolved. The risk associated with the road in this situation is related to the possibility, in some situations, of the Forest Service not being able to obtain a ROW in the future. In some cases this could result in having to construct a section of road around private property or having to deal with legal issues related to the continued Forest and public use of the road as well as authority to improve the road. The GIS layer used for this analysis is a new one and as such is not a complete picture of all such areas on the forest. If a road passes through private property and the Forest Service or a County does not have a ROW, it was assigned a relatively high risk value of 2. All other roads were assigned a relatively lower risk of 0

Maintenance Cost Risk.

Road maintenance costs were selected as a risk factor because declining Forest Service budgets have reached a point where the money is not sufficient to perform the short and long term maintenance needs identified for Forest Service System Roads in general. Roads with high future maintenance costs can be flagged for review if decisions have to be made on reducing maintenance levels, discussing transfers of jurisdiction or joint maintenance agreements with the counties, allowing some roads to deteriorate, or possibly even closing roads. As some roads deteriorate, they could present safety risks and a higher risk of sedimentation in streams and riparian areas.

Annual and Deferred maintenance costs were estimated for each road using the Forest Service Infrastructure database (INFRA). The figures in this system are higher than what would be expected locally because they are based on a regional cost estimating guide that includes high cost areas of the region. The assigning of risk ratings based on relative costs will remove any bias from the higher overall cost estimates. Annual maintenance costs include such things as routine road surface blading and culvert cleaning and the annualized cost of replacing signs, and road surfaces, mostly gravel. Deferred maintenance costs are those that have been identified as needed but have been deferred for a future date. These costs could include aggregate placement, turnout construction, road widening, and culvert & sign replacement. Each road was assigned a risk rating for both annual and deferred maintenance based on the level of projected costs. The two risk ratings were then averaged for use as a general maintenance risk rating for the road.

The risk ratings assigned for annual maintenance costs are based on:

0 - Relatively Lower Annual Maintenance Cost Risk: 0 to $20,000 per road.
1 - Relatively Moderate Annual Maintenance Cost Risk: >$20,000 to $50,000 per road.
2 - Relatively Higher Annual Maintenance Cost Risk: >$50,000 to $320,000 per road.

The risk ratings assigned for deferred maintenance costs are based on:

0 - Relatively Lower Deferredl Maintenance Cost Risk: 0 to $70,000 per road.
1 - Relatively Moderate Deferred Maintenance Cost Risk: >$70,000 to$200,000 per road.
2 - Relatively Higher Deferred Maintenance Cost Risk: >$70,00 to $1,160,000 per road..

The risk ratings assigned for average maintenance costs are based on:

0 - Relatively Lower Average Maintenance Cost Risk: 0 to .5 average maintenance points.
1 - Relatively Moderate average Maintenance Cost Risk: 1 average maintenance point..
2 - Relatively Higher Higher Maintenance Cost Risk: 1.5 to 2 average maintenance points.

Overall Relative Road Risk.

The risk rating for each of the above risk factors was added for each road with sixteen being the highest sum. None of the roads rated at sixteen. The distribution of these sums was reviewed and an overall relative road risk factor was assigned. The overall ratings are as follows:

0 - Relatively Lower Overall Road Risk: 0 to 4.5 relative points

1 - Relatively Moderate Overall Risk: 5 to 7.5 relative points

2 - Relatively Higher Overall Road Risk: 8 to 14.5 relative points.

This overall risk rating is used in section 5 of the main report, in conjunction with an overall value rating to categorize each road and discuss opportunities and priorities.

See Appendix H for maps showing each risk by road. The data is also presented in the following spreadsheet printout.