for the greatest good

Travel Analysis Report

Gifford Pinchot National Forest

September 2015

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Introduction

National Forest System roads are important for reasons that are diverse and often personal. Roads get you where you want to go and provide the freedom to explore, harvest and enjoy nature. One of the Gifford Pinchot National Forest's (GPNF) top priorities is providing a safe road system that is responsive to these public needs, as well as environmentally sound, affordable, and efficient to manage.

This travel analysis identifies the issues and opportunities around the GPNF's road system that will enhance land managers' ability to make better decisions related to the road network. Many roads on the GPNF are at or beyond their designed lifespan. Structural components such as bridges and pavements are failing. When aging roads are not maintained, closures compromise visitor experience and public safety is put at risk. Natural resources also suffer as unmaintained roads can degrade water quality and fish habitat. The cost of our current road system presents another challenge, as budgets for road maintenance has declined.

> The transportation system will maximize access needs, minimize environmental risks, and reflect long-term funding expectations.

This report evaluates the various sources and levels of past road maintenance funding; ensures that the GPNF transportation system provides sustainable access to national forest resources over the short and long term; and, provides information that will be used to inform the identification of the minimum road system necessary for the safe and efficient travel and for administration, utilization, and protection of National Forest System lands.

To inform this analysis, the GPNF considered access needs (both public and administrative); developed criteria to rate roads for their environmental risk (to both aquatic and terrestrial systems); and, overlaid these risk criteria with known access needs. Forest staff then considered the costs of maintaining the current road system and evaluated options to bring maintenance costs in line with projected available funding.

This report is not a decision document and will not make site-specific decisions about which roads will be retained or closed. Those decisions are made at the project scale with public input on site-specific situations. Findings and identified opportunities will instead be used to inform future decisions. Opportunities can be adjusted as new or better information becomes available.

When taken as a whole, the findings of this report inform readers concerning the critical issues related to road management on the GPNF. It is our hope that these findings and identified opportunities will lead to wise choices for road management in the future.

Background

From the 1940s to date, road construction, reconstruction and improvements have primarily been associated with timber management. At the present time, the Gifford Pinchot National Forest has 4,055 miles of road on its network. Of the 4,055 miles, 3,285 are maintained in an "open to public" travel status.

Road budgets have been steadily declining for the past 20 years or more. For the Pacific Northwest Region, the amount of funding for road work including both appropriated funding and funds contributed by commercial users is down by over 80 percent from what it was 20 years ago. The GPNF estimates a deferred maintenance need—what it would take to bring the roads to a like-new condition—of $53.3 million. The Forest's annual maintenance needs that would be required to keep them in that condition are estimated at $1.8 million. Present funding levels for annual road maintenance is about $1.3 million, a difference of $0.5 million from what would be necessary, after all of the deferred maintenance needs.

Travel Analysis Policy

The deterioration of road infrastructure over time, and the gap between the available maintenance funds and the annual maintenance needs, exists on all national forests. In response to these issues, beginning with the 2001 Road Management Rule, regulations were established that require the responsible official on each national forest system (NFS) unit to "identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of NFS lands" (36 CFR 212.5). It is expected that each national forest's transportation system will be comprised of a set of roads needed to maximize access needs, minimize environmental risks, and reflect long-term funding expectations.

The minimum road system is to be identified by the responsible official based on a process that is science-based and that, to the degree practicable, involves a broad spectrum of interested and affected citizens, other state and federal agencies, and tribal governments (36 CFR 212.5(b)(1)). Forest Service Manual 7712.4 directs responsible officials to use the Travel Analysis Process (TAP, formerly known as the Roads Analysis Process or RAP) as the science-based approach for identifying the national forest road system.

The specific analytical process for identifying access needs and relative risk rankings to aquatic and terrestrial ecosystems were developed at the Forest level and are explained in detail below under the heading *Travel Analysis Process*.

In order to meet the requirement that a minimum roads system "reflect long-term funding expectations" (36 CFR 212.5(b)(1), the GPNF is relying on direction from the Forest Service's Pacific Northwest Regional office which has defined this to mean that the *average annual funding* is reasonably in balance with the *average annual cost of routine road maintenance*. [1]

Because the total cost of annual maintenance work for the existing transportation system exceeds the average annual funding capacity of the GPNF, several general scenarios for balancing maintenance with available funding have been studied. These include either reducing the size of the transportation system and/or changing the composition of maintenance levels and treatments to a more affordable system.

Travel analysis is not a decision-making process; it is an assessment of the existing condition of the current road system.

The travel analysis process included public engagement. Throughout the process, the Forest leadership offered multiple public outreach opportunities to gather information about road usage and management. Forest staff summarized public input from questionnaires, comments and discussions. This information contributed to the identification and prioritization of opportunities defined in this report.

Travel analysis is not a decision-making process; it is an assessment of the existing condition of the current road system. Specifically, this report will be used to inform:

- Future plan and project-level proposed actions, purpose and need statements, and future decisions pertaining to road construction, reconstruction, decommissioning, and maintenance;
- Road investments at Regional, Forest, and District scales;
- Delivery of National, Regional, and Forest restoration programs for multiple resources; and,

[1] "Average annual funding" is defined as the average amount of funding available for each NFS unit for routine annual maintenance from appropriations, collection accounts, commercial users, cooperators, and other partners during the 2008-2012 timeframe, plus or minus 20%. It does not include funding from American Recovery and Reinvestment Act and Capital Investment Program. Only the modest amounts specified for "routine maintenance" in Legacy Roads and Trails funding allocations are included. "Average annual cost of routine road maintenance" means the average yearly need for basic road maintenance. This includes log out, drainage maintenance, erosion control, blading, brushing, traffic signs, etc. It does not include cyclical replacement costs (such as bridge replacement every 50 years, asphalt overlays, etc.), which are covered by funding beyond the individual NFS unit budgets (e.g., Regional Capital Investment Program).

- Forest Service strategies to comply with regulatory requirements, including those associated with the Clean Water Act and the Endangered Species Act.

It will be used to inform future decisions relating to administration of the forest transportation system and help to identify proposals for changes to travel management direction (FSM 7712). Future, project-scale analyses will rely on this report to develop proposed actions that begin to move the Forest toward the minimum road system identified. Project-scale analyses will be subject to the National Environmental Policy Act.

The Forest Service's travel analysis policy expects that future project-scale proposals will be analyzed in terms of whether the resulting road system is needed to:

- Meet resource and other management objectives adopted in the relevant land and resource management plan;
- Meet applicable statutory and regulatory requirements;
- Reflect long-term funding expectations; and
- Ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance (36 CFR 212.5(b)(1)).

The Travel Analysis Process

The travel analysis process is described in Forest Service Manual (FSM) 7712 and Forest Service Handbook (FSH) 7709.55, Chapter 20. Travel analysis considers access needs, environmental risks, and financial considerations. The Forest Service guide, *Roads Analysis: Informing Decisions about Managing the National Forest Transportation System* (1999) provides a six step process to complete a travel analysis process:

1. Setting up the analysis
2. Describing the situation (the need for access and environmental risks)
3. Identifying issues (key public and management concerns)
4. Assessing benefits, problems, and risks
5. Describing opportunities and setting priorities
6. Reporting

1. Setting up the analysis

The scope of the analysis was determined to be forest-wide. Forest Service natural resource specialists convened to evaluate current ecological risks that roads pose on the GPNF; public affairs specialists gathered input from the public on access interests; and, engineers contributed present costs and potential future costs of road construction, maintenance, and

closure/decommission. The core team reviewed previous travel analysis plans from the GPNF including the 2002 *Gifford Pinchot National Forest Roads Analysis*, as well as smaller, watershed- and project-scale roads analyses. The team also defined available data along with information gaps.

2. Describing the situation

From the 1940s to date, road construction, reconstruction and improvements have primarily been associated with timber management. At the present time, the Gifford Pinchot National Forest has 4,055 miles of road on its network. Of the 4,055 miles, 3,285 are maintained in an "open to public" travel status. There are 392 miles of road maintained for passenger cars (operational maintenance levels 3, 4 and 5), 2,893 miles of road maintained for high clearance vehicles (operational maintenance level 2), and 770 miles of road that are closed (operational maintenance level 1).

In addition to gathering existing data on the current road network, a public engagement effort was conducted to increase the understanding of the public's interest in the forest's road network. The emphasis of public outreach activities was to inform the public about the travel analysis process, gather input on specific roads and areas that are of interest to the public, and provide an interim progress update on the process. This information helped in identifying key public concerns which were incorporated into the issues (step 3).

A key to the success of the public outreach process was providing different ways for people to engage in the process. Through a combination of individual meetings and briefings, phone calls, public meetings, and an online questionnaire, input was obtained from a wide range of local residents and stakeholders who use the roads on the GPNF.

In late 2012, the GPNF, along with members of the Pinchot Partners and South Gifford Pinchot Collaborative (two local, standing collaborative groups), convened a series of six public meetings to gather information on the roads the public used, activities they were intending, and recently observed road conditions. One hundred twelve people attended the first round of public meetings. At the meeting, the public also had opportunities to provide information on road issues and suggestions for road use, and the GPNF posted a questionnaire on the Forest website, asking for responses before January 1, 2013. The Forest received 128 responses during the initial response period. Answers were collected from a set of six questions asked both at the meetings and from the online questionnaire.

During the response period, the Forest staff also received a number of phone calls and letters expressing the need to keep roads open for people with disabilities, for hunting, horseback riding, and quad opportunities, and for access when adjacent, non-National Forest System lands normally open to the public had closures. During this period, the Gifford Pinchot Task Force conducted their own online survey which garnered 228 responses. They summarized their survey and provided both the survey results and summary to the Forest leadership for consideration.

Responses gathered from the six public meetings, questionnaires, phone calls and letters were recorded, summarized and made available on the GPNF website for review. General themes from public input were identified by GPNF staff, including the public's strong interest in being kept informed and granted broader public engagement opportunities throughout the process; an interest in partnering/volunteering with road and trail maintenance; the need for emergency access for floods, search and rescue, and fire; access to trailheads and for dispersed recreation activities; access for aging citizens and people with disabilities; and an interest in more off-highway vehicle riding opportunities on roads and trails. Comments regarding roads-to-trails conversions were mixed, as was concern with decommissioning roads.

A total of 10 public meetings were held and 218 people filled out a questionnaire on their interest in the Forest's road network.

Forest staff held four additional meetings in March 2014 to share updates on the travel analysis process and what was learned during the public outreach period. Specific roads mentioned by the public and roads accessing specific sites/areas were displayed on maps for public review at the meetings and posted online. Additional input gathered at those public meetings and questionnaires submitted through December 31, 2014 provided an additional 90 responses which were included in the "public input roads" data set. Individual completed questionnaires are in the project file.

Following are the questions and a general summary of the information received from the public:

1. *Do you limit your travel to paved roads to reach your destination areas within the Gifford Pinchot National Forest (GPNF)?*

   Almost all responses were "no" and included a list of activities enjoyed on National Forest System lands.

2. *For each of your destination areas, please list the road number(s) used to access the areas and your intended activity (e.g., hiking, hunting, firewood cutting, forest product collection, etc.). If road number is not known, describe your starting location and destination area.*

Approximately 50% of road miles on the Forest were identified along with the intended activities. Approximately 1,500 miles of roads maintained for high clearance vehicles were identified through public input as used to access areas.

3. *Please list any roads you may be aware of causing erosion or other resource problems. Use a map to list road number, problem and specific road location details (milepost if known).*

   Only about a third of respondents noted a road that had erosion or resource problems, and those responses listed 33 roads. Several noted that the road was not causing erosion itself, but was subject to erosion and needed maintenance or repair.

4. *In the Gifford Pinchot National Forest, do you use roads closed to wheeled-motorized access for non-motorized activities or over-snow activities? If so, what roads closed to wheeled motorized use do you use and for what activities do you use them? For each road you list, give the road number and use (e.g., hiking, hunting, firewood collecting, snowmobiling, etc.).*

   

   Responses to this question were relatively few, and only about 40% of those respondents named either a specific road or a specific activity. Most indicated interests in either horseback riding/camping or winter activities such as snowmobiling, snowshoeing, and cross country skiing. Several noted that they enjoyed hunting on foot or bike-in hunting on roads closed to wheeled vehicles, but also noted the difficulty of removing game without having a wheeled vehicle nearby. Others noted there were few roads open to wheeled off-highway vehicles on the GPNF and that the Forest should open more.

5. *Opportunities to convert roads to trails exist for some roads recommended for closure or decommission, dependent upon resource risks and funding considerations. If there are roads or road segments you would like to have considered for conversion to trails (either motorized or non-motorized), please list specific road and type of activity for which you would use the road.*

   About 40 roads were identified for roads to trails conversion consideration. Responses to this question generally fell into three categories:

A. Do not close or decommission any roads (majority of responses). Reasons given included: fear of losing access to the Forest (for recreation and vegetation management), need for horse trailers, waste of money and not ecologically sound to decommission.
B. If you convert a road to a trail ensure it remains open to a specific use (either motorized or non-motorized uses).
C. Specific suggestions, often emphasizing the value in creating loops for hiking, horseback riding, or all-terrain vehicle/motorcycle riding, a need for easy motorized trails, etc.

Responses not falling neatly in these general groupings noted that there were too many illegal trails already and that the Forest does not have the resources to maintain its current trail system.

6. *Additional comments?*

These responses varied widely; appreciation, skepticism, suspicion, and acknowledgement of the process and fiscal challenges.

3. Identifying issues

The analysis team in conjunction with Forest leadership and the public identified key, road-related issues.

These issues include:

- The road system was designed and built largely to a facilitate vegetation management strategy that is no longer in place.
- Public user-groups have interests in the current road system that vary widely, sometimes conflict, and are geographically extensive.
- The funding available to the GPNF for road work is insufficient to maintain the road system in a like-new condition.
- Without active management, individual roads slowly become impassable due to natural regrowth and erosion processes.

The issues were combined with other factors to provide information for the formulation of findings and identified opportunities for the desired future GPNF road system, as described further in this report.

4. Assessing benefits, problems and risks

The GPNF's approach to travel analysis was to assess the benefits, ecological risks, and financial costs associated with the Forest's road network. An interdisciplinary team examined the environmental, social, and economic aspects of the existing road system and the output from this step is a synthesis of the benefits, problems, and risks. This section is broken into the subheadings of access needs, ecological risks, and annual maintenance costs.

Access Needs

Access needs (benefits) were identified for each INFRA[2] road segment (Appendix A). Twenty years was the time period used for determining the access need. Roads that connected to the current Operational Maintenance Level[3] 3, 4, and 5 road set from the roads that were identified as needed for a particular access were included in each access need. The six Access needs were:

1. Vegetation and Bough Management
2. Quarries and Mining Claims
3. Recreation Management
4. Public Interest
5. Communication and other administration needs
6. Rights of way, Easements and Special Uses

Each access need was defined by a specific GIS analysis as follows:

Vegetation and Bough Management: Any road that connects to, or is within one-quarter mile of a potential harvestable stand (Northwest Forest Plan areas designated Matrix or Adaptive Management Areas or Late Successional Areas that were less than 80 years of age in 2014) or connects to a potential bough management stand (further details for this specific GIS analysis is in the Project File: O:\NFS\GiffordPinchot\Project\gipTravelAnalysis2012).

Quarries and Mining Claims: Any road that connects to developed or undeveloped quarries plus all roads within areas where active mine claims are established.[4] These quarries are necessary for ongoing maintenance and reconstruction of the road system.

Recreation Management: Any road that accesses currently managed "recreation sites" recorded in the Forest Service Developed Recreation Corporate Database (NRM Developed Recreation Module). These include sites at all development scales (Dispersed and Concentrated Use Area

[2] INFRA is the Forest Service's corporate database for tracking costs and maintenance needs associated with roads, facilities, bridges, and other infrastructure on the national forest system.

[3] The Forest Service's road system assigns specific standards to roads depending on the road's operational maintenance level. Generally, Operational Maintenance level 3, 4, and 5 roads comprise the major forest roads that are maintained for low-clearance passenger car travel, with level 5 being the highest maintenance level. Level 2 roads are maintained for High Clearance Vehicles. Level 1 roads are not open for public use.

[4] The 1988 Rock Resource Management Plan defines developed as an existing source which has been used for at least one entry and Undeveloped as source which has been confirmed through detailed rock source investigation and/or drilling.

Sites, Primitive Recreation Sites, and Developed Recreation Sites), or that accesses area of known "High public use or interest". In addition, roads that have High public, community, partner or tribal interest were included as identified by District recreation staff based on on-the-ground knowledge and dispersed sites/concentrated use area maps. District line officer approved these additions.

Public Interest Roads: Any road where a specific road number was identified and/or specific road numbers could be derived by identifying most logical route to specific sites or places identified by a member of the public at the meeting or from questionnaires received during public involvement period. Roads identified by the public as used for recreation purposes were considered important in providing access to dispersed recreation opportunities.

Communication and other administration: Any road accessing radio repeaters, and fire administration sites such as lookouts, water sources, guard stations and vantage points.

Rights of Way, Easements and Special Uses: Any road subject to an easement (designated in the INFRA database as a Forest Road and Trail Act Cost Share Road), right of way (any road designated as a Separated Right of Way at the National Information Technical Center database) or any road within a section designated within an existing Special Use Permit (in the Special Uses Database).

Access for Vegetation and Bough Management included almost all of the Level 1 and 2 roads (Table 1). Public access interests accounted for about 2/3rds of the Level 2 roads. Access to quarries and mining claims includes about 1/3 third of the Level 2 roads.

Table 1. Access Needs and Associated Mileage.

Access Needs	Level 2 (miles)	Level 1 (miles)
Vegetation or Bough Management	2707	608
Quarries and Mining Claims	1110	69
Developed Recreation	450	4
Public Interest	1402	55
Communications and Fire	319	5
Easements	166	2
Rights of Way	234	39
Special Uses	252	48
Current Forest Total	**2893**	**770**

Ecological Risks

Aquatic and terrestrial ecosystem risks were identified for each road segment (derived from the Forest's INFRA database) and six risk criteria were developed for both. The most common mitigations to the risks were listed.

Aquatic Risks

Six risk criteria were developed to assess road effects or risk of effects to the aquatic ecosystems. Two criteria, Sediment Delivery and Mass Wasting, were the same as what was used in the 2002 *Gifford Pinchot National Forest Roads Analysis*. Three criteria were similar to those analyzed in the 2002 *Gifford Pinchot National Forest Roads Analysis*, but a different GIS analysis was used (Fish Culvert Barriers, Stream Crossings, and Riparian Occupancy). One criterion was new, Fish Bearing Crossings. Following is a description of the risk and/or effect to the aquatic ecosystem, the GIS analysis used, and potential mitigations to the risks for each of the criteria.

The levels of risk for each criterion were based on professional judgement. For example, road segments with three or more crossings were considered to have higher risk than road segments with two or less crossings. Another example is a road segment with a fish migration barrier blocking more than 0.5 miles of habitat was considered a high risk, while a road segment without a fish migration culvert barrier was considered to have zero risk.

Mitigations are treatments that could lower risk, or in some cases eliminate the risk. For example, adding surface rock to a road segment considered to have high risk of sediment delivery to streams lowers the risk of sediment delivery while removing fish migration barrier culvert from a road segment would eliminate the risk. Results of the risk analysis for each criterion are summarized by road maintenance level in

Table 2 and for each road in Appendix B.

1. Fish Bearing Crossings – Road segment crosses a fish-bearing stream

Description of risk

Roads crossing fish bearing streams pose risk to fish by modifying natural processes resulting in stream habitat degradation, or providing opportunities for fish harassment or poaching. Habitat or fish loss is of particular concern for threatened or endangered species. Habitat degradation examples are floodplain isolation, stream constrictions, or habitat simplification.

Roads crossing fish-bearing streams can directly contribute excessive sediment, and/or be the access point to streams for foreign substances such as chemicals or contaminants or non-native aquatic species. Some fish-bearing road crossings are desired dispersed recreation sites. The concentrated and prolonged use of some of these sites can result in compacted stream adjacent areas and create readily accessible opportunities for harassment and/or poaching. Poaching is a

concern for at-risk species and, and due to lack of Washington State and Forest Service law enforcement capabilities, can continue unabated over many years.

Table 2. Aquatic Risk Criteria and Associated Mileage.

Aquatic Risk Criteria	Risk Level			
	Not Rated (miles)	Low/None (miles)	Moderate (miles)	High (miles)
Fish Presence				
Level 1	0.0	690.6	73.2	6.1
Level 2	0.0	2,139.7	586.2	167.4
Level 3	0.0	125.1	91.6	84.2
Level 4	0.0	32.8	21.5	21.5
Level 5	0.0	0.0	3.5	12.0
Fish Barrier				
Level 1	0.0	752.2	5.5	12.2
Level 2	0.0	2,533.4	32.5	327.5
Level 3	0.0	224.7	0.0	76.1
Level 4	0.0	39.7	3.6	32.6
Level 5	0.0	7.7	0.0	7.8
Stream Crossing				
Level 1	0.0	306.8	299.2	163.8
Level 2	0.0	510.7	1,564.4	818.2
Level 3	0.0	19.7	128.6	152.5
Level 4	0.0	5.2	57.6	13.0
Level 5	0.0	0.0	0.0	15.5
Sediment Delivery				
Level 1	25.1	269.8	250.8	224.1
Level 2	169.7	491.1	1465.3	767.2
Level 3	84.7	25.3	108.0	82.8
Level 4	29.0	2.4	29.8	14.6
Level 5	0.0	0.0	15.5	0.0
Mass Wasting				
Level 1	23.1	533.8	102.8	109.6
Level 2	67.6	1456.4	474.0	890.2
Level 3	1.9	56.5	45.4	195.9
Level 4	3.9	6.6	0.6	64.8
Level 5	0.0	15.5	0.0	0.0
Riparian Occupancy				
Level 1	0.0	695.9	45.0	29.0
Level 2	0.0	2106.1	395.9	391.3
Level 3	0.0	146.9	47.8	106.2
Level 4	0.0	35.1	29.4	11.3
Level 5	0.0	4.2	0.0	11.3

Risk Level

- *High* – road crosses the GPNF mapped distribution and/or the critical habitat designated by US Fish and Wildlife Service and National Oceanic and Atmospheric Administration for the Endangered Species Act listed species: lower Columbia River coho, Chinook and steelhead, and Columbia River bull trout.
- *Moderate* – road crosses the GPNF mapped distribution of non-ESA-listed fish species.
- *No Risk*– road does not cross any mapped fish bearing streams.

Mitigations

- Improve road surface
- Reduce or eliminate traffic
- Increase or improve placement of ditch relief culverts
- Replace fish bearing stream culverts to simulate the natural channel form
- Close/ stabilize or decommission

2. Fish culvert barriers – Road culvert is a barrier to fish migration

Description of risk

Roads blocking fish migration pose risk to the aquatic ecosystem by reducing the viability, sustainability, or productivity of fish populations and reducing the amount of various habitat types (migration, spawning, rearing, refuge, hiding cover) required for all the fish life stages. Long-term fish population viability is dependent upon the free exchange of genes between members of the same populations or species. Isolated populations due to barriers pose a risk of reducing genetic diversity and fitness over time. Fish travel significant distances along streams throughout their life, both diurnally and seasonally. Most culverts barriers prevent or restrict upstream migration but can create hazards for fish migrating downstream also. Culvert barriers can affect other aquatic organisms as well (i.e. reducing or eliminating nutrients derived from the decomposition of fish after spawning).

Culvert barriers are often caused by undersized culverts constricting streams, increasing velocity above a fish's sustained swimming ability and creating a scour pool below the culvert outlet which causes an elevation difference greater than what fish are capable of jumping or swimming. Undersized culverts disrupt the natural flow patterns which result in changes to stream characteristics such as flow depth and sediment sorting.

Risk Level

Risk Levels are the same as was used in the 2002 *Gifford Pinchot National Forest Roads Analysis* with additional White Salmon River Watershed data in the updated culvert barrier database.

- *High* - road segment has a culvert barrier blocking 0.1 miles or greater of fish habitat.
- *Moderate*- road segment has a culvert barrier blocking less than 0.1 miles of fish habitat.
- *No Risk* - road segment does not have a culvert barrier.

Mitigations

- Replace fish passage barrier culverts
- Close/ stabilize or decommission

3. Stream Crossings – Road segment crosses streams

Description of risk

Road stream crossings pose risks to the aquatic environment because they disrupt aquatic processes. Road stream crossings can affect channel scour, hillslope to stream surface flow routing, sediment routing/sorting, and large wood repositioning and recruitment within streams during peak flows. Streams receive intercepted subsurface flows via ditches directly linked to a road stream crossing and the water flows faster in a ditch than subsurface. At a watershed scale, changes in flow routing can affect downstream accumulation of flow in surface channels influencing the magnitude and timing of peak flows. Road stream crossings often constrict flow and associated sediment movement which through time can result in excessive upstream sediment accumulations and a lack of downstream sediment sorting and transport.

Roads can be a barrier to the movement of large wood from hill slopes to valley bottoms and/or streams. Wood and gravels can become trapped behind culverts reducing delivery of these key aquatic habitat-shaping elements, and increasing risk of road failures. The large wood delivery to streams is a process that through time enables the formation of complex in-stream habitat features upon which fish depend for food, cover, spawning and rearing.

Roads receiving minimal maintenance often have culvert inlets with sediment and wood accumulations partially or fully clogging the culvert or have culverts not functioning properly. Over time, culverts corrode, become plugged, and fail, resulting in inputs of fine sediments, and/or road fill material including the culvert itself, to streams. After a culvert fails, often a stream will have over-steepened banks, constrictions from partial blockages or head cutting within the sediment that had accumulated upstream of the road crossings resulting in extended periods of sediment delivery. At culvert failures, streams can be over-widened and devoid of stream shade, resulting in stream warming.

Risk Level

Crossings per road segment for road segments less than 1 mile

- *High*- equal to or greater than 3 stream crossings.
- *Moderate*- 1 or 2 stream crossings.
- *No Risk*- no crossings.

Average Crossings per mile for road segments 1 mile or longer

- *High*- equal to or greater than 3.0 stream crossings per mile.
- *Moderate*- up to 3.0 stream crossings per mile.
- *No Risk*- no crossings.

Mitigations

- Annual maintenance to ensure functioning ditches and culverts
- Improve road surface
- Reduce or eliminate traffic
- Add or improve placement of ditch relief culverts
- Replace improperly functioning and/or sized culverts or ditch lines
- Close/ stabilize or decommission

4. Sediment Delivery – Road segment produces sediment from road surface and delivers to streams

Description of Risk

Sediment produced from road surfaces and delivered to streams poses risks to the aquatic ecosystems. Sediment is produced from erosion of an area occupied by a road constructed with native materials and/or surfacing material such as course rock rather than an area occupied by soils covered with native vegetation. Roads are a prominent source of accelerated sediment delivery to anadromous fish habitats in forested watersheds of the Pacific Northwest.

Roads are capable of promoting overland flow by capturing and concentrating precipitation runoff thereby increasing the erosive power and transport capability of overland flow. Mobile sediments are produced during precipitation events from erosion of a road surface and the associated cut and fills slopes. Through time from washing processes, fine particulates migrate from wetted subgrades to the road surface also. Road surfaces differ in the inherent erodibility

due to the bedrock or parent material on which they are constructed. Erosion from the surface of the road is lessened with surfacing material. For example, roads that have been paved produce far less sediment than roads with native surfaces.

The amount of sediment delivered to streams from roads is dependent on both the road erosion and the mechanisms of sediment delivery from a road to a stream. Sediment from roads can be delivered by surface runoff directly to streams in close proximity and by ditches that carry sediment-laden water directly or indirectly to streams. Ditches are drained at some spacing along roads either by ditch relief culverts or by culverts and bridges at stream crossings. Not all ditch relief culverts deliver sediment to streams because they discharge to non-channeled and forested slopes where water can infiltrate into the ground and/or sediment can be filtered and dropped out of suspension onto the forest floor.

Forest roads receiving minimal maintenance, continue to slowly deteriorate and produce fine sediment. During periods of runoff, some of these fines make their way to ditches or nearby streams. Roads receiving minimal maintenance will tend to have rills and gullies forming on the road surface which increases sediment produced from roads. Course and fine sediment produced from roads that reaches streams are considered in excess to the sediment regime under which aquatic ecosystems evolved. Excessive course road sediment in streams can cause scour, cover quality spawning gravels and be coarser and larger than the natural substrates of the streams. The excessive fine sediment's negative effects include turbidity, shallowing of pools, and fine sediments covering and/or filling interstitial spaces between spawning gravels. The biological results of these negative effects include shifts in macro-invertebrate populations which serve as a food source to fish, reduced spawning success, and increased mortality of egg and alevins from suffocation. High, prolonged turbidity events cause gill irritation leading to reduced feeding and increased susceptibility to diseases, and/or clogged gills causing mortality.

Risk Level

Risk level for each road segment is the same as in the 2002 *Gifford Pinchot National Forest Roads Analysis* which was based on one part of the Washington State Department of Natural Resource's model (Washington Forest Practices Board Manual: Standard Methodology for Conducting Watershed Analysis, Version 3.0, November 1995). The methodology description is available in the project files.

- *High*- relative high rate of sediment delivery from road surfaces to streams.
- *Moderate*- relative low rate of sediment delivery from road surfaces to streams.
- *No Risk*- no delivery to streams (no stream crossings and road not near stream).
- *Not Rated* - road segment was not rated for this criterion.

Mitigations

- Improve road surface
- Reduce or eliminate traffic
- Add ditch relief culverts
- Improve placement of ditch relief culverts
- Replace improperly functioning and/or sized culverts or ditch lines
- Close/ stabilize or decommission
- Wet season closure

5. Mass Wasting – Road segment crosses known landslides or potentially unstable soils

Description of Risk

Mass wasting features and potentially unstable soils in themselves, occur naturally and provide positive inputs to the aquatic ecosystem. These areas can deliver significant quantities of soil, rock and trees to streams typically during High runoff or saturated soil conditions. Roads crossing mass wasting features and to a lesser degree potentially unstable soils, pose a risk to the aquatic environment as roads can 1) initiate the movement, 2) change the character of the material, or 3) disrupt the movement in the case of small debris flows. Roads can initiate mass wasting movements by locally ponding/retaining excessive water and/or saturated soils thereby destabilizing hill slopes. Roads can change the character of the material when the landslides includes the road as the landslide travels through a road prism, incorporating road surface materials and/or culverts, and often depositing them into streams, diminishing the natural beneficial inputs from a landslide to a stream. In the case of small debris flows, roads can interrupt debris flow, preventing the soil, rock and trees from reaching a stream.

Debris flows originating from a road tend to have less large wood contributions to streams. The addition of gravels without large wood to low gradient streams can result in short term detrimental effects, such as channel aggradation or widening, pool filling, and fine sediment deposition on spawning gravels.

Forest roads receiving minimal maintenance in areas where mass wasting or potentially unstable soils exist tend to accumulate more soil and rock in culvert inlet areas and consequently have higher risk of culvert failures.

Risk Level

Levels are the same as analyzed in the 2002 *Gifford Pinchot National Forest Roads Analysis*:

- *High*- road segment crosses known landslides.
- *Moderate*- road segment crosses potentially unstable soils.
- *No Risk*- road segment does not cross known landslides or potentially unstable soils.
- *Not Rated* - road segment was not rated for this criterion.

Mitigations

- Install dips to encourage landslide material and or water to be transported across road at desired locations rather than affecting larger road prism area
- Annual clearing of culvert inlets in areas with mass wasting features or potentially unstable soils
- Close/ stabilize or decommission

6. Riparian Occupancy - Road segment is within Riparian Reserve for stream, lakes, ponds and wetlands

Description of risk

Long road segments within riparian reserves decrease the function of the riparian ecosystem. Roads that are positioned in close proximity and parallel to a stream can constrict a stream thus impeding channel migration, increasing or changing location of bank erosion and the processes of aggradation and deposition. Riparian vegetation is interrupted when long road segments occur within riparian areas reducing shade, leaf fall, and riparian invertebrates, and decreasing habitat for riparian and aquatic species.

Risk Level

- *High*-road segment is within Riparian Reserve for 0.3 continuous miles or greater.
- *Moderate*-road segment is within Riparian Reserve for 0.2-0.29 continuous miles.
- *No Risk* - road segment is not within Riparian Reserve for stretches over 0.19 miles.

Mitigations

- Annual maintenance to ensure functioning ditches and culverts
- Improve road surface
- Reduce or eliminate traffic
- Re-align contiguous miles away from stream
- Increase ditch relief culverts
- Close/ stabilize or decommission

Aquatic Risk Summary Rating

A summary aquatic risk rating was assigned to each road segment based on summing points from each individual criterion risk level, for which a *High* risk level was assigned 3 points and a *Moderate* assigned 2 points. No points were given to the *No Risk* level nor to road segments not rated. For the summary rating, a score (point total) of 15 or greater was considered *High Aquatic Risk* and meant that at least 3 of the individual aquatic criterion were rated *High*. A score of 4-14 was considered *Moderate Aquatic Risk*. A score of 0-5 was considered *Low Aquatic Risk* and meant that only one individual criterion was rated as *High*. The Aquatic Risk Summary Ratings were summarized by road miles for each Operational Maintenance Level (Table 3). Many of the high aquatic risk roads were close to the major rivers (Figure 1).

HIGH Aquatic Summary risk road segments have one or more of the following risks:

1) intersects GPNF mapped distribution and/or US Fish and Wildlife Service and National Oceanic and Atmospheric Agency critical habitat designation for Endangered Species Act listed species, Lower Columbia River Coho, Chinook and Steelhead, and Columbia River Bull trout.
2) has a culvert barrier blocking 0.1 miles or greater of fish habitat
3) has 3 or more stream crossings (road segment less than 1 mile) OR have 3.0 stream crossings per mile (road segments 1 mile or longer)
4) has relative high rate of sediment delivery from road surfaces to streams
5) crosses previous landslides, and/or,
6) within Riparian Reserve for 0.3 continuous miles or greater.

Table 3. Aquatic Risk Summary Rating and Associated Mileage.

Operational Maintenance	Aquatic Risk Summary Rating	Miles
Level 5	High	11.3
	Moderate	4.2
	Low	0.0
Level 4	High	44.7
	Moderate	2.6
	Low	28.5
Level 3	High	166.2
	Moderate	67.2
	Low	67.3
Level 2	High	825.0
	Moderate	891.4
	Low	1,176.9
Level 1	High	74.1
	Moderate	190.7
	Low	505.1

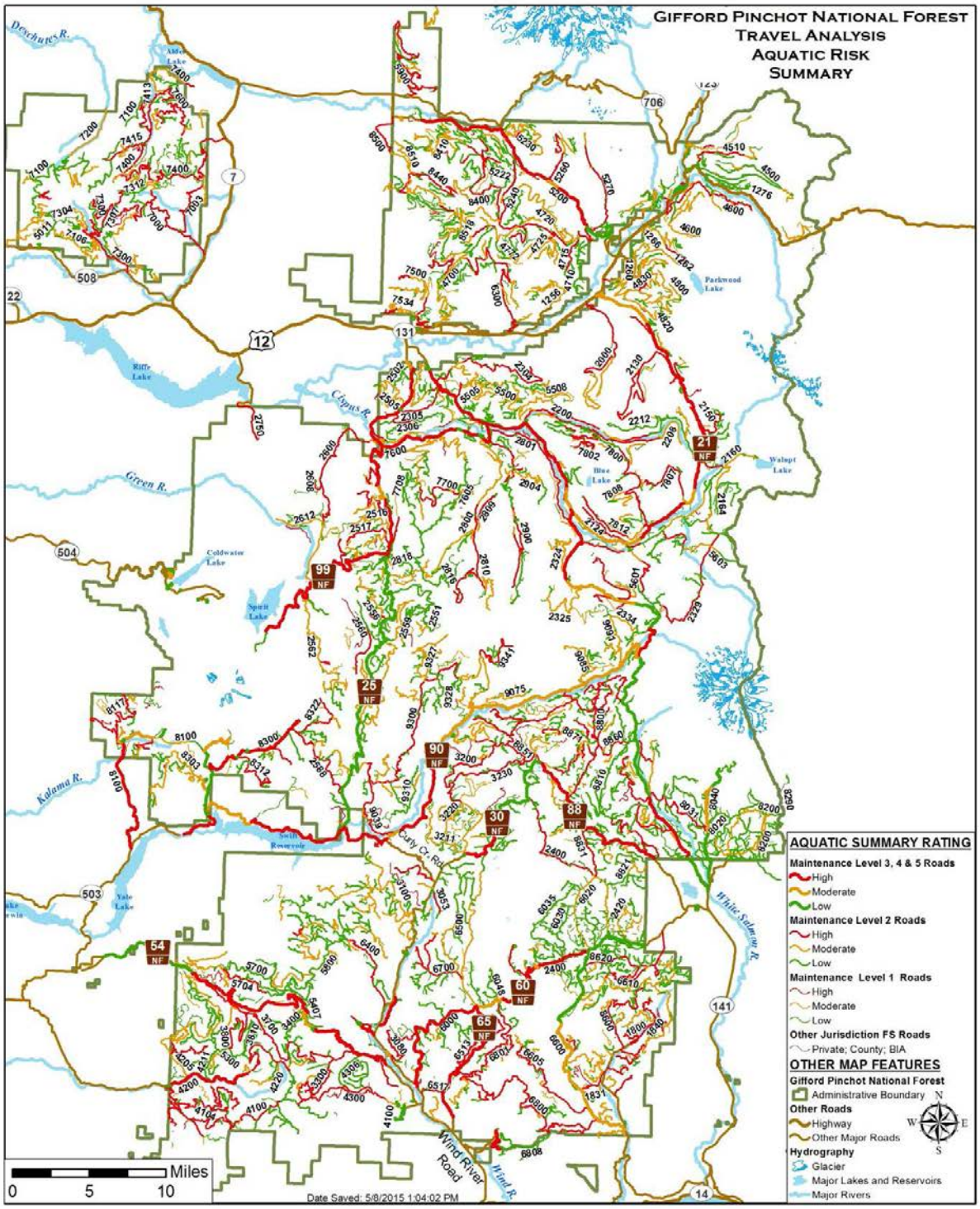

Figure 1. Map of Aquatic Summary Risk Rating for each Road Segment.

Terrestrial Risk

Six risk criteria were developed to assess road effects on wildlife and their habitats. Many studies on the effects of human activities related to forest roads indicate wildlife and wildlife habitat are affected by roads and the human use of roads. Two risk criteria are based on the GPNF Forest Plan which identified elk, deer, and mountain goat as management indicator species. The GPNF Forest Plan designated elk and deer biological winter range and mountain goat summer and winter range, and associated total road density thresholds. One criterion for northern spotted owl (NSO) and other late-successional species is based on the Northwest Forest Plan designation of Late Successional Reserves (LSRs) and the US Fish and Wildlife Service's (USFWS) critical habitat designation for the northern spotted owl. Another criterion was developed from the USFWS critical habitat designation for marbled murrelet. The criterion for the special habitats and general wildlife species along with the risk levels are based on professional judgement and experience along with local knowledge.

Roads or road segments were rated based on a total road density within the special habitats or areas analyzed. Factors considered included road segments that:

- Are within or providing access to GPNF Forest Plan land allocations such as winter range, summer range, LSRs;
- Provide public access to areas used by wildlife during critical periods such as reproduction, rearing, and wintering; and
- Provide public access to rare or unique habitats such as meadows, wetlands, and caves.

For each of the evaluation criteria, risk levels were assigned for each road segment (Appendix C) and summarized by maintenance level (Table 4).

1. Elk winter and summer range

Description of Risk

Elk tend to avoid areas near open roads and exhibit higher levels of stress and movement rates near roads thus affecting elk distribution in forested ecosystems. Open roads increase vulnerability to mortality from hunter harvest and roads also facilitate the spread of invasive non-native plants, which reduces habitat quality. The GPNF Forest Plan sets specific road density standards for elk and deer and so road density within these habitat areas were evaluated for risk to elk winter and summer range habitat.

A more recent analysis identified quality winter and summer range elk habitat using the 2012 *Greatest Nearest Neighbor* vegetation layer (currently considered the best vegetation information available for the GPNF) and added adjacent buffer areas to the quality habitat. This analysis was consistent with the analysis completed in the Westside Elk Model in which a distance from a road was evaluated rather than the traditional road density method.

Table 4. Terrestrial Risk Criteria and Associated Mileage.

Terrestrial Risk Criteria	Risk Level			
	Not Within (miles)	Low (miles)	Moderate (miles)	High (miles)
Elk Range				
Level 1	620.5	5.3	71.7	72.3
Level 2	2,192.5	36.5	380.4	283.9
Level 3	173.4	14.9	72.3	40.2
Level 4	54.5	0.0	19.9	1.4
Level 5	0.0	7.7	7.8	0.0
Mt Goat Range				
Level 1	754.1	0.0	1.3	14.5
Level 2	2,808.5	0.0	18.8	66.0
Level 3	295.0	0.0	5.8	0.0
Level 4	75.8	0.0	0.0	0.0
Level 5	15.5	0.0	0.0	0.0
Northern Spotted Owl				
Level 1	468.5	7.7	156.6	137.0
Level 2	1,321.0	78.8	785.4	708.2
Level 3	147.4	0.0	101.0	52.4
Level 4	7.5	0.0	42.6	25.7
Level 5	15.5	0.0	0.0	0.0
Marbled Murrelet				
Level 1	702.8	0.0	0.0	67.1
Level 2	2,449.6	0.0	14.8	428.9
Level 3	284.5	0.0	0.0	16.3
Level 4	75.8	0.0	0.0	0.0
Level 5	15.5	0.0	0.0	0.0
Rare and Unique Habitats				
Level 1	757.4	9.8	0.0	2.7
Level 2	2,834	42.8	4.6	11.9
Level 3	282.8	10.2	0.0	7.8
Level 4	75.8	0.0	0.0	0.0
Level 5	15.5	0.0	0.0	0.0
General Forest Species				
Level 1	0.0	293.9	336.6	139.4
Level 2	0.0	912.7	1,274.6	705.9
Level 3	0.0	95.7	149.2	55.9
Level 4	0.0	5.1	21.1	49.6
Level 5	0.0	0.0	15.5	0.0

Risk Level

Road segment is within elk winter and summer range with a total road density of:

- *High* - greater than 2.6 miles per square mile.
- *Moderate* - between 1.71and 2.59 miles per square mile.
- *Low* - less than 1.70 miles per square mile.
- *Not Within* – road segment was not within elk winter and summer range.

Mitigations

A number of the habitats require a seasonal road closure for protection from human disturbance. This could be accomplished through a seasonal gate which is closed to prevent harassment during critical winter months or spring calving season or through a permanent closure.

For most of the roads the following could apply:

- Reduce traffic
- Eliminate traffic – gate seasonally
- Close/ stabilize or decommission

2. Mountain goat summer and winter range

Description of Risk

Mountain goats are sensitive to human disturbance. They may habituate to human disturbance in some areas, but where disturbance is unpredictable; mountain goats tend to be alarmed by it. Potentially adverse effects of disturbance on mountain goats included altered movements, range abandonment, increased vulnerability to predation, increased human access for hunting, and increased stress. High stress levels associated with disturbance have been suggested as a cause of decreased birth and recruitment rates and reduced winter survival in mountain goat populations. High stress levels may also cause a reduction in an individual's ability to fend off parasites, bacterial infections, and other diseases.

This analysis identified key winter ranges, travel corridors, mineral licks, and birthing sites as areas where roads

and human-related disturbances represent risks to the mountain goat. Maintaining low road density and closing access with enforcement could reduce human activities in mountain goat habitats. The mountain goat is a Management Indicator Species in the GPNF Forest Plan and the road density for these risk criteria came from the GPNF Forest Plan.

Risk Level

Road segment is within mountain goat summer and winter range with a total road density of:

- *High* - greater than 0.7 miles per square mile.
- *Low* – less than 0.69 miles per square mile.
- *Not Within* – road segment was not within Mountain goat summer and winter range.

Mitigations

- Reduce traffic – seasonally close
- Eliminate traffic
- Close/ stabilize or decommission

3. Rare or unique habitats

Description of Risk

These habitats include wet meadows, marshes, bogs, mesic meadows or habitats with sensitive or candidate species. These habitats are at risk from roads due to human disturbance. A wet meadow which has traditionally had dispersed camping in or around the meadow is at risk from vehicle disturbance, dispersed camping locations, and an increased introduction rate of non-native plants. This analysis evaluated roads in or adjacent to these sites (one half-mile surrounding the rare or unique habitat). The risk of site modification is greater in areas of high road density.

Risk Level

Road segment is within rare or unique habitats including a 0.25 mile adjacency buffer with a total road density of:

- *High* - greater than 2.6 miles per square mile.
- *Moderate* - between 1.71 and 2.59 miles per square mile.
- *Low* - less than 1.70 miles per square mile.
- *Not Within* – road segment was not within rare and unique habitats.

Mitigations

- Reduce traffic - seasonally close
- Eliminate traffic
- Close/ stabilize or decommission

4. Northern spotted owl habitat as depicted by late-successional reserves and marbled murrelet critical habitat

Description of Risk

Roads and road systems could potentially fragment northern spotted owl and marbled murrelet habitat and lead to increased corvid populations due to dispersed camping and human occupancy. The following short- and long-term conservation actions for marble murrelet are recommended:

- Maintain potential and suitable habitat in large contiguous blocks;
- Maintain and enhance buffer habitat surrounding occupied habitat; and
- Minimize nest disturbances to increase reproductive success.

Long term conservation actions include increasing the amount and quality of suitable nesting habitat and decreasing fragmentation of nesting habitat by increasing the size of suitable stands. Roads that intersect or fragment habitat were also identified as high risk.

Risk Level

Road segment is within northern spotted owl as depicted by (late-successional reserves) and/or marbled murrelet critical habitat with a total road density of:

- *High* - greater than 2.6 miles per square mile.
- *Moderate* - between 1.71 and 2.59 miles per square mile.
- *Low* - less than1.70 miles per square mile.
- *Not Within* – road segment was not within northern spotted owl habitat or marbled murrelet critical habitat.

Mitigations

- Reduce traffic -seasonally close
- Eliminate traffic
- Close/ stabilize or decommission

5. General wildlife species including black bear

Description of Risk

Food availability, escape potential, and denning suitability (which are considered the "life requisite values" for wildlife species) depend on distance from roads and patch size (or conterminous forest). Closure and removal of roads has been found to effectively provide wildlife security and increase the amount of available wildlife habitat. Reducing road density will provide an increased amount of available habitat on the landscape.

Risk Level

Road is within Rare or unique habitats with a total road density of:

- *High* - greater than 3 miles per square mile.
- *Moderate* - between 2 and 3 miles per square mile.
- *Low* - less than 2 miles per square mile.

Mitigations

- Reduce traffic - seasonally close
- Eliminate traffic
- Close/ stabilize or decommission

A number of the habitats require a seasonal road closure for protection from human disturbance. This could be accomplished through a seasonal gate which is closed to prevent harassment during critical winter months or denning, nesting or spring calving season.

Terrestrial Risk Summary Criteria

All the terrestrial risk criteria are related to a road density within a certain area for a particular species, set of species and special habitats. For most of these individual criteria, the total road density attributing to a *High* risk level was greater than 2.6 road miles per square mile. The exception was the mountain goat summer and winter range high density rating which was greater than 0.7 road miles per square mile. A high summary terrestrial risk rating was assigned to a road if it was rated *High* in one or all of the following individual criterion: mountain goat range, elk range, marbled murrelet habitat, northern spotted owl habitat depicted by the LSRs, or in or adjacent to rare and unique habitats. A *Low* summary terrestrial risk rating was assigned to a road if it was not partially or completely in mountain goat range, or within elk range, marbled murrelet habitat, northern spotted owl habitat depicted by the LSRs, rare and unique habitats areas or was within a subwatershed with a low total road density (less than 2 miles per square mile). The *Moderate* summary terrestrial risk rating was all other combinations. The Terrestrial

Risk Summary Ratings were summarized by road miles for each Operational Maintenance Level (Table 5) and displayed geographically (Figure 2).

Table 5. Terrestrial Risk Summary Rating and Associated Mileage.

Operational Maintenance	Terrestrial Risk Summary Rating	Miles
Level 5	High	0.0
	Moderate	15.5
	Low	0.0
Level 4	High	25.7
	Moderate	48.6
	Low	1.5
Level 3	High	147.6
	Moderate	105.4
	Low	47.8
Level 2	High	1,174.5
	Moderate	1,354.8
	Low	364
Level 1	High	276.7
	Moderate	368.5
	Low	124.7

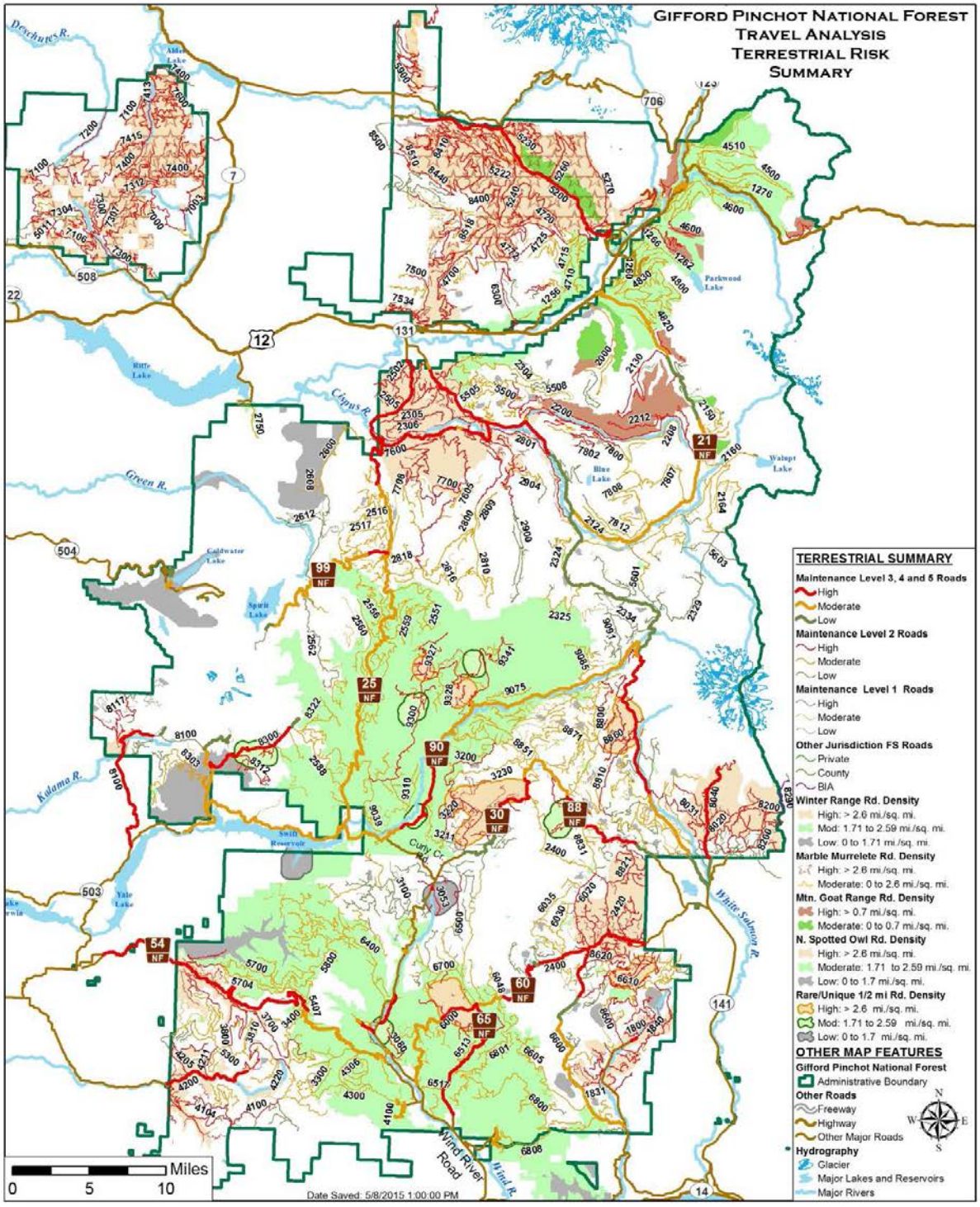

Figure 2. Map of Terrestrial Summary Risk Rating for each Road Segment.

Annual Maintenance Costs

Road budgets have been steadily declining for the past 20 years.

For the Pacific Northwest Region, the amount of funding for road work including both appropriated funding and funds contributed by commercial users is down by over 80 percent from what it was 20 years ago. The GPNF estimates a deferred maintenance need—what it would take to bring the roads to a like-new condition—of $53.3 million. The Forest's annual maintenance needs that would be required to keep them in that condition are estimated at $1.8 million (Table 6). Present funding levels for annual road maintenance is about $1.4 million (Table 7), a difference of $0.5 million from what would be necessary, after all of the deferred maintenance needs are accomplished.

The GPNF estimates a deferred maintenance need of $53.3 million.

Table 6. Cost Estimates for Annual Road Maintenance.

Cost Analysis: Maintenance Intensity to a "like new" condition					
OPML	**Intensity**	**$/mi**	**Miles**	**% / ML**	**Total**
5	High	$3,484	11	**71%**	$38,341
	Medium	$2,320	4	**29%**	$10,428
	Low	$1,849			
ML 5 Subtotal:			***16***	***100%***	***$48,769***
4	High	$1,778	74	**97%**	$130,749
	Medium	$1,523	3	**3%**	$3,926
	Low	$1,038			
ML 4 Subtotal:			***76***	***100%***	***$134,675***
3	High	$1,341	166	**55%**	$222,733
	Medium	$1,129	67	**22%**	$75,738
	Low	$858	67	**22%**	$57,572
ML 3 Subtotal:			***301***	***100%***	***$356,043***
2	High	$987	955	**33%**	$942,202
	Medium	$183	1,302	**45%**	$238,198
	Low	$75	637	**22%**	$47,739
ML 2 Subtotal:			***2,893***	***100%***	***$1,228,139***
1	High				
	Medium	$64	385	**50%**	$24,675
	Low	$2	385	**50%**	$693
ML 1 Subtotal:			***770***	***100%***	***$25,368***
			4,055		**$1,792,995**

Given the gap between available funding for road work and the cost to maintain the road system to a like-new condition, balancing the road system size with the cost of maintaining all roads, and still meet resource management needs or public interests is not possible. Instead, a reasonable balance will be established between the average annual funding and the average

annual cost of routine road maintenance by varying the intensity of routine maintenance to reflect long-term funding (as required by the travel analysis process described in (36 CFR 212.5)).

Table 7. Gifford Pinchot National Forest 5-Year Average Annual Maintenance Funding.

Budget Line Item	Forest Operational Budget					5 Year Average	% to Rd Mtc	Average Mtc Budget
	2011	2012	2013	2014	2015			
CMRD	**1,001,200**	**1,198,945**	**1,008,000**	**872,000**	**821,000**	980,229	**35%**	$343,080
CMLG	**344,000**	**354,141**	**308,000**	**143,000**	**323,000**	294,428	**23%**	$67,718
CWF2	**384,858**	**175,000**	**300,000**	**333,178**	**566,070**	351,821	**100%**	$351,821
CWK2	**0**	**0**	**0**	**0**	**0**	0	**100%**	$0
CWFS	**0**	**8,764**	**37,342**	**38,507**	**38,507**	24,624	**100%**	$24,624
TRTR	**0**	**0**	**0**	**0**	**0**	0	**100%**	$0
Purchaser Perf Mtc	**106,197**	**170,161**	**497,257**	**345,135**	**433,861**	310,522	**100%**	$310,522
Retained Receipts/Title II	**401,135**	**240,479**	**108,500**	**148,000**	**157,000**	211,023	**100%**	$211,023
								$1,308,789

5. Describing Opportunities

Access needs, environmental risk criteria and initial annual maintenance cost analyses were synthesized to identify opportunities that could go into future NEPA analysis and decisions.

The cost analysis was used initially to set context for critically examining "the necessity" of road system changes, be part of the information to formulate opportunities, and be re-evaluated after the synthesis identified opportunities for change. Investment costs to transition the current road system into the potential future road system and certain deferred maintenance costs (surface, culvert or bridge replacements) were also identified and recognized that they would come from sources other than annual road maintenance funds.

Several strategies on how to synthesize the access needs, environmental risks and annual maintenance costs were considered. The synthesis strategy used was presented to the public at several locations in May of 2015 and the draft reporting document was available for review and comment until June 30, 2015.

Management Strategy

The management strategy in general is to keep roads with a maintenance level of 3-5 open and reduce the number of maintenance level 2 (open) roads to focus limited annual road maintenance funds and road improvement investments on roads planned to remain in an open status into the future. Maintenance for ditch and culvert clearing is proposed for Operational Maintenance Level 2 roads that were rated as high aquatic risk.

Level 3-5 Roads
The management strategy proposes no changes to the Operational Maintenance Level 3-5 roads.

Level 2 Roads with Limited Access Needs
The proposal for Operational Maintenance Level 2 roads identified as *Single Purpose Vegetation and Bough Management* which have only intermittent access needs is to change them to a closed status (Operational Maintenance Level 1) through time.

Level 2 and Level 1 Roads with Multiple Access Needs
The management strategy for Level 2 and Level 1 (closed) roads which have more than one access need identified is to maintain status quo. In other words, those roads would be kept at the same Operational Maintenance Level as their current status. This category would account for 61% of the Level 2 roads (1,776.9 miles) and 17% of Level 1 roads (130.3 miles). These roads are referred to as *Multiple Purpose Roads*.

Exceptions to the General Management Strategy
In addition to the *Vegetation and Bough Management* access need, a small number of roads with relatively low miles were identified to have only one access need and were added to the *Multiple Purpose Roads* set.

The management strategy recommends leaving all Level 2 roads with more than one access need open.

Only a small number of Level 2 roads had a single access need for one of the following: Recreation Management, Quarries and Mining Claims, Communication and Fire Administration, and Easements or Rights of Way and involved relatively few miles (25.2 miles, <1% of the Level 2 roads). These access needs are neither intermittent or predictable so these roads are proposed to remain as Level 2 roads.

Similarly few Level 1 roads with single access needs for Recreation Management, Quarries and Mining Claims, Communication and Fire Administration, and Easements or Rights of Way were identified, involving relatively few miles (8.5 miles, 1%), and the proposal is to leave them as Level 1 (closed) roads.

Single purpose special use roads (7.3 miles Level 2 and 11.5 miles Level 1) can be reviewed with a finer scale analysis during subsequent NEPA to determine vehicular access need, as the criteria for Special Uses was coarsely obtained in GIS.

Level 2 Roads Important to the Public
Level 2 roads identified as needed by the public, having no other access need identified was limited to 8.2 miles, and are proposed to remain as Operational Maintenance Level 2. Upon close review, these roads were determined to be either needed for recreation management or used

to access known dispersed recreation areas. One Level 1 road (FR 8000200, 0.5 miles in length) was identified as needed by the public with no other access need identified, and will be left as a Level 1 (closed) road.

The roads identified in the questionares by the public for potential conversion to trails included roads categorized as *Multiple Purpose*, *Single Purpose Vegetation and Bough*, and *No Access Needs*. About a third of the roads proposed for conversion to trails were not on the GPNF road system, some of which had previously been decommissioned. The roads categorized for Single Purpose Vegetation and Boughs or No Access Needs and identified by the public for potential conversion to trails (Appendix D), can be further considered for trail conversion during future NEPA processes.

Summary of Proposed Open Road System

The combination of the *Multiple Purpose Roads* and the single access needs roads for Recreation Management, Quarries and Mining, Communication and Fire Administration, and Easements or Rights of Way, Public Interest and Special Uses combined to equal 1,818 miles of Level 2 roads, and comprise approximately 63% of the current Level 2 system. These Level 2 roads, along with the Level 3-5 roads, are identified as the Proposed Open Road System, which means they would be retained in an open status (Figure 3).

Investments to reduce environmental risks for the Proposed Open Road System would focus on roads that had a High Aquatic Summary or High Terrestrial Summary risk rating (Table 8).

As stated previously, the travel analysis report is not a decision document. Decisions to close or decommission roads are made at the project scale with public input on site-specific situations. It is expected that once a fine-filter is applied to the data in this report, adjustments will be made and recommendations for each road segment may change slightly.

Table 8. Proposed Open Roads with High Environmental Risks.

		% of total		% of total
Level 5	11.3	73	0.0	0
Level 4	44.7	59	25.7	34
Level 3	166.2	55	147.6	49
Level 2	825.0	29	1174.5	41
Levels 2-5	1047.2	32	1347.8	36

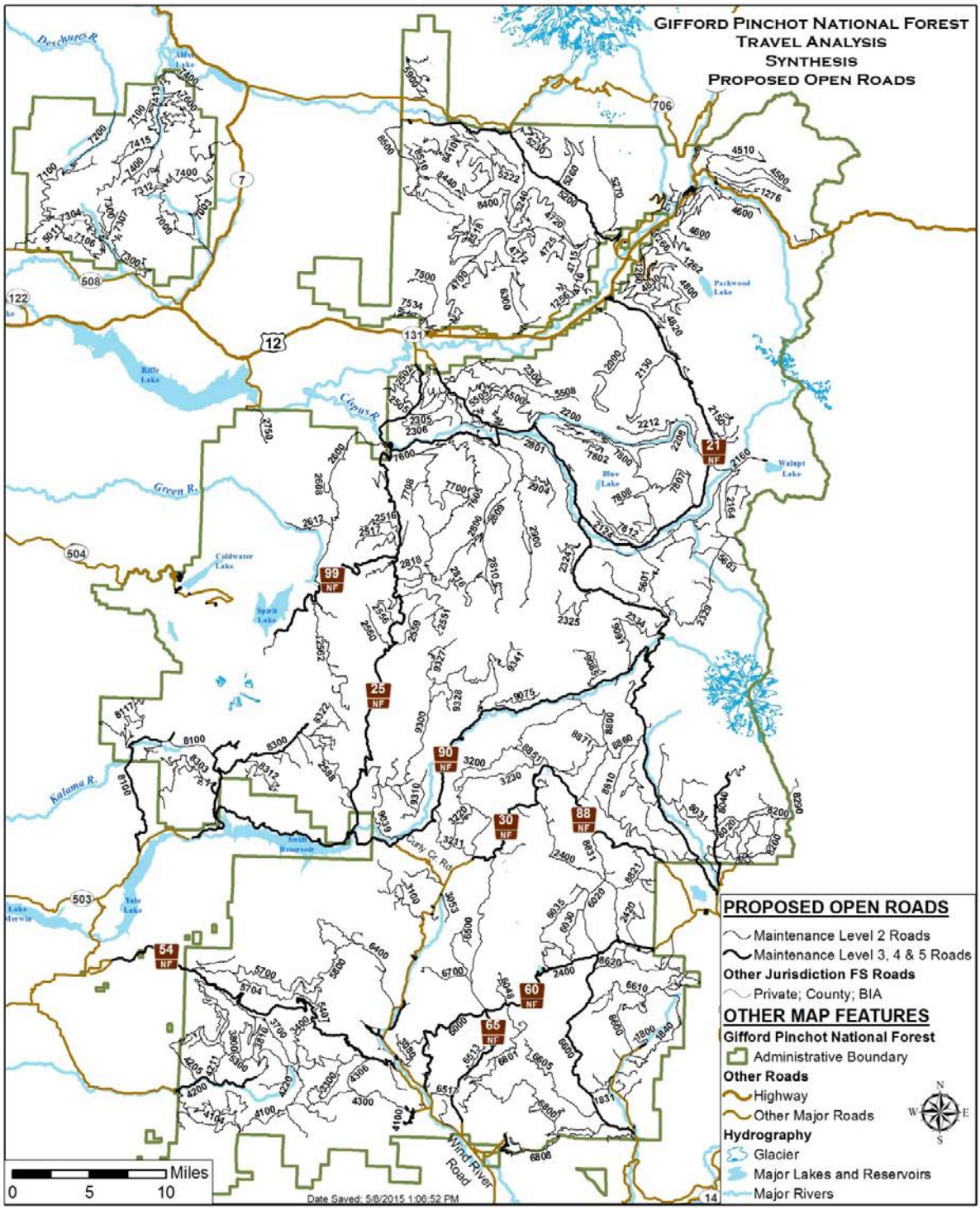

Figure 3. Map of Proposed Open Road System.

Investment activities to reduce aquatic risks include 1) fish culvert barrier replacements, 2) right-sizing or replacement of culverts, 3) road surfacing improvements, 4) dips to encourage landslide material to deposit or transport across a road segment at a preferred location or 5) small sections of re-alignments away from streams. Costs for these mitigations can be estimated from the deferred maintenance costs identified in INFRA. Adding ditch relief culverts and other treatments to reduce aquatic risks can be identified on a site specific basis.

High terrestrial summary risk roads contribute to road densities in one or more of the following:

1) 2.6 miles per square mile or greater in Deer and Elk Winter Range and spring calving areas, Marbled Murrelet circles, Northern Spotted Owl habitat represented by LSR boundaries, or Rare and Unique Habitats with a half mile surrounding buffer, and/or
2) 0.7 road miles per square mile in goat summer and winter range.

Investment activities to reduce terrestrial risks include wildlife seasonal closures (signage or physical gates/barriers), limiting motorized traffic to only administrative needs, Close and stabilize or decommission. Close and stabilize or decommission eliminate the terrestrial risk caused by a road or road segment although may only reduce the terrestrial risk of high road density in a particular habitat. For open roads, mitigation of terrestrial risks is wildlife closures or treatments to reduce traffic such as obscuring the road entrance. Currently gates are used to create seasonal closures to mitigate terrestrial habitat risks.

Roads with only Vegetation and Bough Access needs, called *Single Purpose Vegetation and Boughs* roads (959.9 miles, 33% of Level 2 roads) are proposed to be reduced to a Level 1 road status through time (Figure 4). These roads will be used during the period when vegetation and bough management is active and then returned to a closed condition. The costs estimated to change these roads to a Level 1 status averages $9,000/mile. Roads rated as HIGH in the Aquatic Summary Risk or Terrestrial Summary Risk and dependent spur roads will be those roads within this group prioritized for changing to Level 1 (Table 9). The estimated cost for these is closer to $20,000/mile because High aquatic risk roads have more treatment needed prior to considering it stabilized and closed. The environmental risk rating and timing of the vegetation and bough management period will influence the priority in which this group of roads is analyzed in a NEPA process and/or treated on the ground. Transitioning roads from a Level 2 (open) status to Level 1 (closed) status is expected to occur after the roads are used for the Vegetation and Bough Management planned in the next two decades.

Table 9. Single Purpose Vegetation and Bough Management Roads with High Environmental Risks.

Operational Maintenance	Total (miles)	High Aquatic Risk (miles)	High Terrestrial Risk (miles)	Both High Aquatic and Terrestrial Risk (miles)
Level 2	959.9	133.2	323.2	63.8
Level 1	486.2	51.5	166.9	21.7

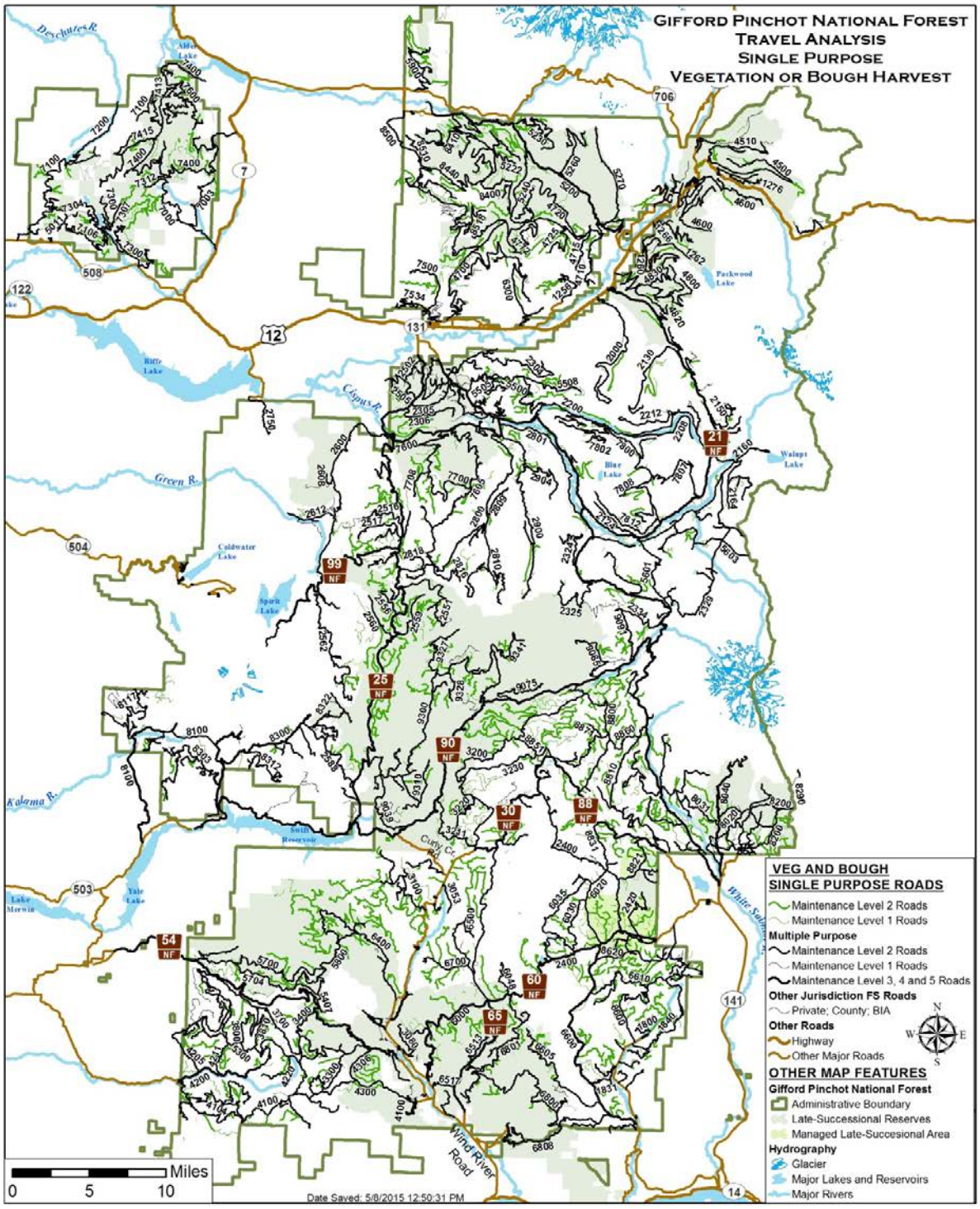

Figure 4. Map of Single Purpose Vegetation and Bough Management Roads.

Only 115.8 miles of Level 2 roads (<1%) and 132.9 miles of Level 1 roads did not have any access needs identified and likely not needed for future resource management activities. These roads will be further analyzed in future NEPA processes to determine if they should be decommissioned (Figure 5). The priority for treatment will be those rated with a High Aquatic or Terrestrial Summary rating (Table 10). Road segments with *No Access Need* identified are listed in Appendix E.

Table 10. Summary of road miles with No Access Needs and likely not needed.

Operational Maintenance	Total (miles)	High Aquatic Risk (miles)	High Terrestrial Risk (miles)	Both High Aquatic and Terrestrial Risk (miles)
Level 2	115.8	4.7	48.2	3.0
Level 1	132.9	7.6	54.4	5.8

Approximately 637 of the current 769.9 miles of Level 1 (closed) roads are proposed to remain as Level 1 roads. Treatments to reduce aquatic and terrestrial risks will be identified for these roads and brought forward during NEPA analysis.

A summary of the miles within each Operational Maintenance Level from the synthesis strategy is presented in Table 11, a conceptualized table for the synthesis strategy is presented in Figure 6, and Access Group for each road segment is identified in Appendix F.

Table 11. Access Group by Operational Maintenance Level.

Maintenance Level	Access Group	Miles
Level 5	Multiple Purpose	15.5
	Single Purpose Vegetation and Bough Management	0.0
	No Access Need	0.0
Level 4	Multiple Purpose	75.8
	Single Purpose Vegetation and Bough Management	0.0
	No Access Need	0.0
Level 3	Multiple Purpose	300.8
	Single Purpose Vegetation and Bough Management	0.0
	No Access Need	0.0
Level 2	Multiple Purpose	1817.6
	Single Purpose Vegetation and Bough Management	959.9
	No Access Need	115.8
Level 1	Multiple Purpose	150.8
	Single Purpose Vegetation and Bough Management	486.2
	No Access Need	132.9

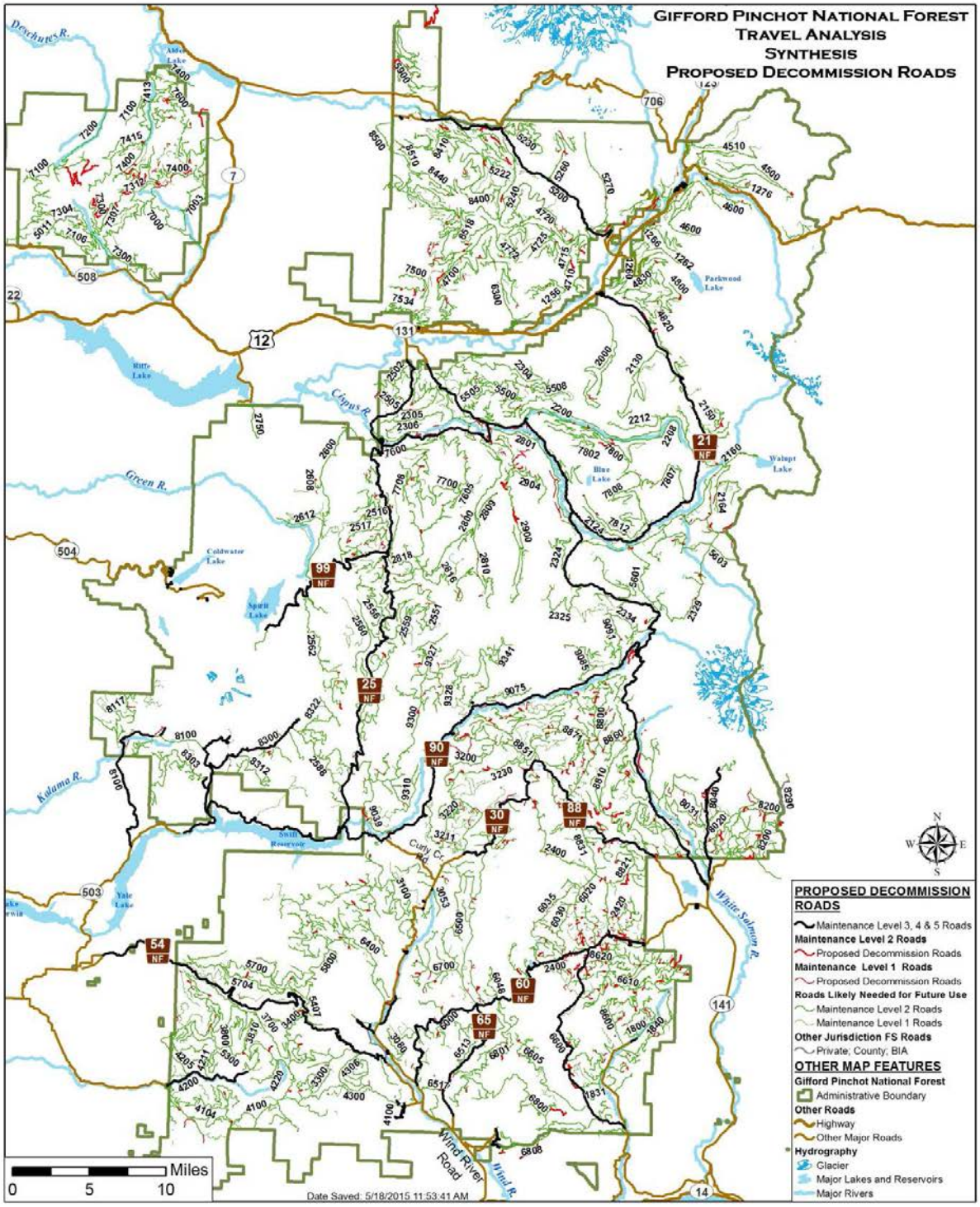

Figure 5. Map of Roads with No Access Needs.

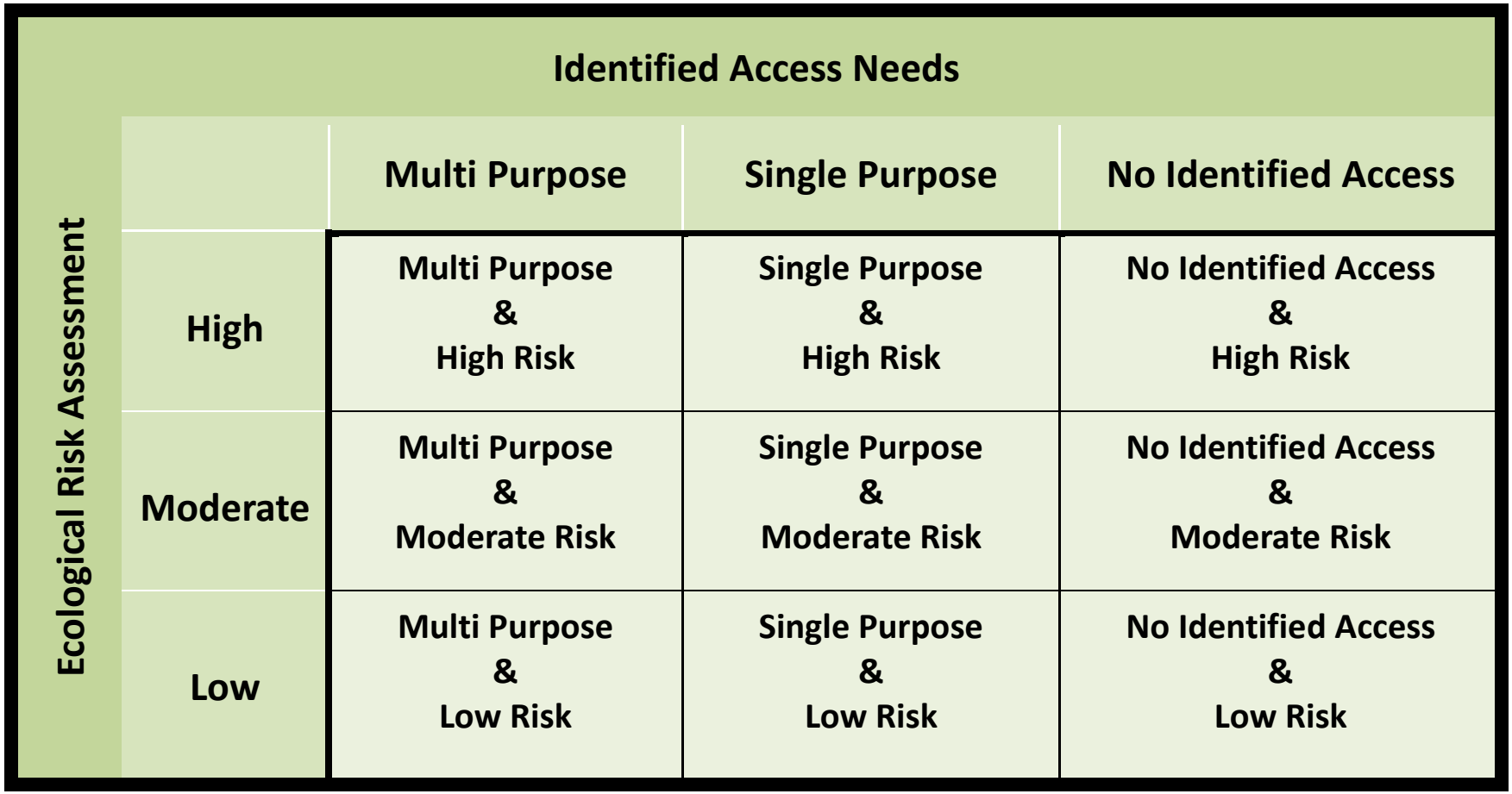

Figure 6. Access Needs Along a Continuum of Ecological Risk.

6. Reporting

Summary of Desired Future Road System

As stated previously, the strategy underlying the opportunities identified hope to:

- Keep the same roads managed for passenger car (PC) use;
- Convert High Clearance (HC) roads categorized as single access need for vegetation and bough management to a closed status, as vegetation and bough management is intermittent in nature; and,
- Decommission roads with no access needs identified.

Stabilizing and closing High Clearance (Operational Maintenance Level 2) roads will address aquatic and terrestrial risks and eliminate the associated annual maintenance costs. Roads where no access needs were identified will be considered for decommissioning, similarly reducing the environmental risk of those roads, and eliminating annual and deferred maintenance costs. Additionally, culvert and ditch maintenance is proposed for all high aquatic risk Multiple Use Level 2 roads (825 miles), as this is an inexpensive and effective way to reduce aquatic risks. This strategy will provide similar road conditions for Forest visitors who travel in low-clearance passenger cars to visit developed recreation sites (Figure 7). The strategy will change the road conditions for Forest visitors who travel high clearance vehicles roads in that more Level 2 roads will have culvert and ditch clearing resulting in an improved condition while other Level 2 roads would have little to no maintenance, transition into a dis-repaired state or become impassable by vehicles.

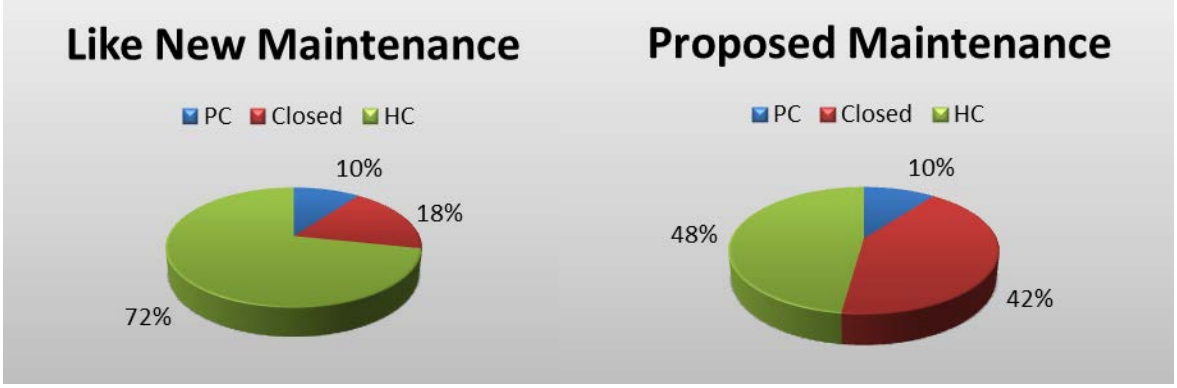

Figure 7. Current Versus Proposed Distribution of Operational Maintenance Levels.

If all of the Single Purpose Vegetation and Bough Level 2 Roads were closed and put into a Level 1 status, and roads that did not have any access needs identified were decommissioned, the Proposed Open Road System would be 2,210 miles, a reduction of 1,075 miles (Table 12). The overall road system, (open and closed) would be 249 miles smaller than the existing road system.

Table 12. Potential Changes to Gifford Pinchot National Forest Road Network.

Category (Maintenance Level 1-5)	Road Miles		
	Before	After	Difference
Overall size of transportation system	4,055	3,806	-249
Overall Open Road System (OPML 2-5)	3,285	2,210	1,075
Roads Maintained for Passenger Cars (OPML 3-5)	392	392	0
Roads Maintained for High Clearance Vehicles only (OPML2)	2,893	1,818	1,075
Closed Intermittent Service Project Roads (OPML1)	770	1,596	+826

Over the last five years, the costs of annual maintenance that is available ($1.3M) is short of what maintenance intensities are necessary to prevent the roads from continuing to fall into a state of disrepair. If road closures and decommissions are implemented in future actions, annual maintenance costs would be lower due to decreased maintenance intensity and changing 959.9 miles of road from a Level 2 to Level 1 status (Table 13). This desired future road system reflects the trend of high timber sale purchaser performed road maintenance and road use deposits and the trend of addressing aquatic risks from roads using retained receipts. The scenario decreases the costs of unmaintained culvert replacements and associated aquatic risk.

This proposal also increases maintenance intensity for all of the High Aquatic Risk Level 2 roads that are proposed to remain open into the future. The cost of keeping up the proposed road system would be about $1.4 million dollars per year, which is about 78% lower than what the current maintenance costs are estimated and would be about the 5-year average annual amount received as shown previously in Table 7.

Table 13. Annual Maintenance Cost of Proposed Road System.

OPML	Intensity	$/mi	Miles	% / ML	Total
5	High	$3,484			
	Medium	$2,320	11	**71%**	$25,530
	Low	$1,849	4	**29%**	$8,310
ML 5 Subtotal:			***16***	***100%***	***$33,840***
4	High	$1,778	45	**59%**	$79,258
	Medium	$1,523	3	**3%**	$3,926
	Low	$1,038	28	**38%**	$29,494
ML 4 Subtotal:			***76***	***100%***	***$112,678***
3	High	$1,341	150	**50%**	$201,751
	Medium	$1,129	82	**27%**	$93,059
	Low	$858	69	**23%**	$59,380
ML 3 Subtotal:			***301***	***100%***	***$354,190***
2	High	$987	825	**45%**	$814,041
	Medium	$183			
	Low	$75	994	**55%**	$74,556
ML 2 Subtotal:			***1,819***	***100%***	***$888,598***
1	High				
	Medium	$64			
	Low	$2	1,596	**100%**	$2,872
ML 1 Subtotal:			***1,596***	***100%***	***$2,872***
			3,807		**$1,392,177**

Investments

Investment costs for road improvements, road closures and decommissions address the aquatic and terrestrial risks. Funding for this type of work generally comes from other sources such as capital investment programs, Legacy Roads and Trails funding, Federal Highway programs, partnerships with outside groups and agencies, etc. The estimated costs to close stabilize, decommission, or improve (High Aquatic Risk Level 2-5 Roads) amount to approximately $16 million, and does not include the cost of replacing fish migration barrier culverts (Table 14). Investments will be focused on roads with higher environmental risks (Figure 8). A summary map of roads and their future need is presented in Figure 9.

Table 14. Estimated Capital Costs of Improvement and Decommissioning Work.

Category	Miles	Cost / Mile	Total Cost
Estimated Cost to put roads in storage	960	9,000	$ 8,640,000
Estimated Cost to decommission roads	249	11,000	$ 2,739,000
Estimated Cost for improvement work	1,047	5,200	$ 5,444,400
			$16,823,400

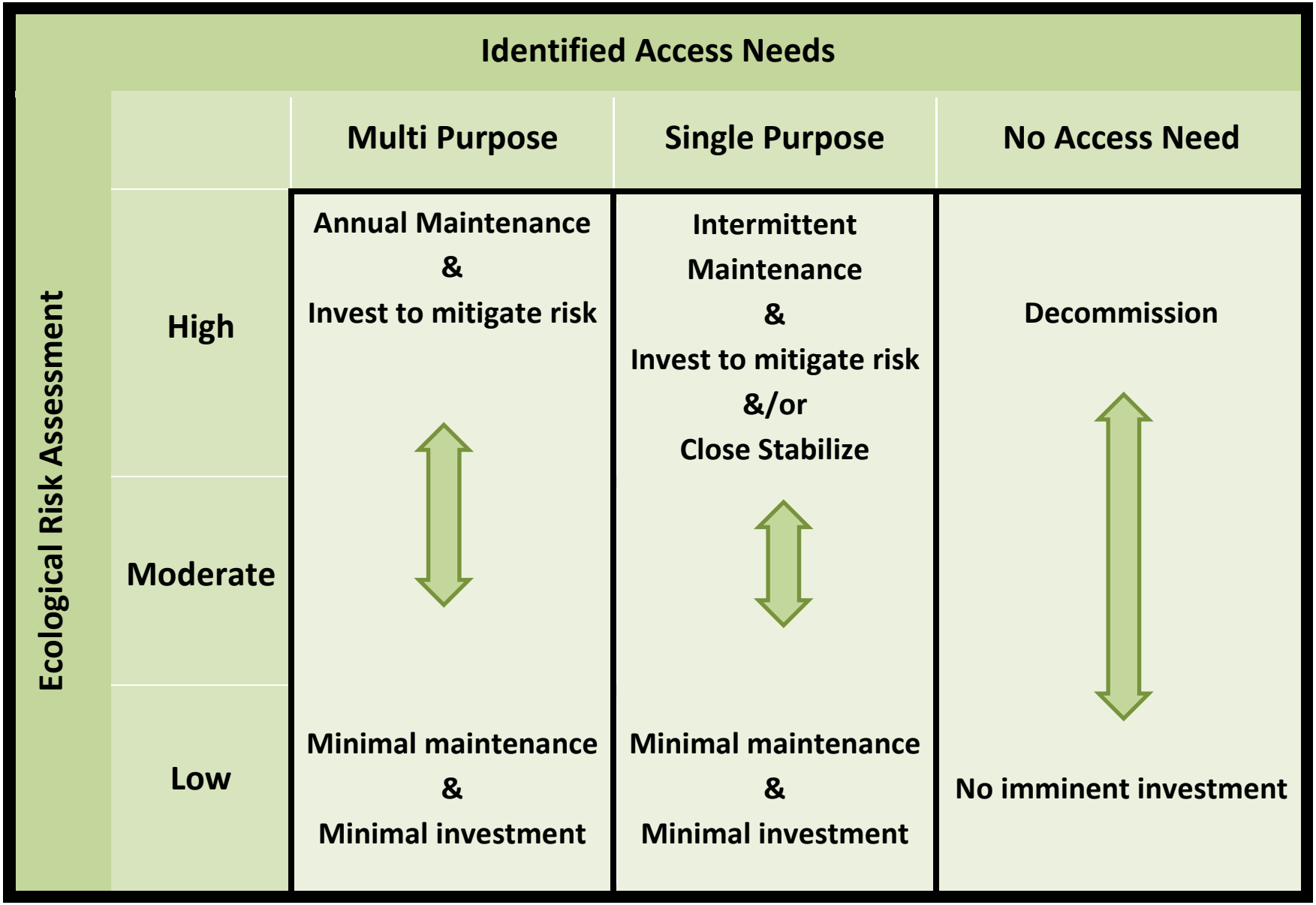

Figure 8. The Gifford Pinchot National Forest's Proposed Investment Strategy.

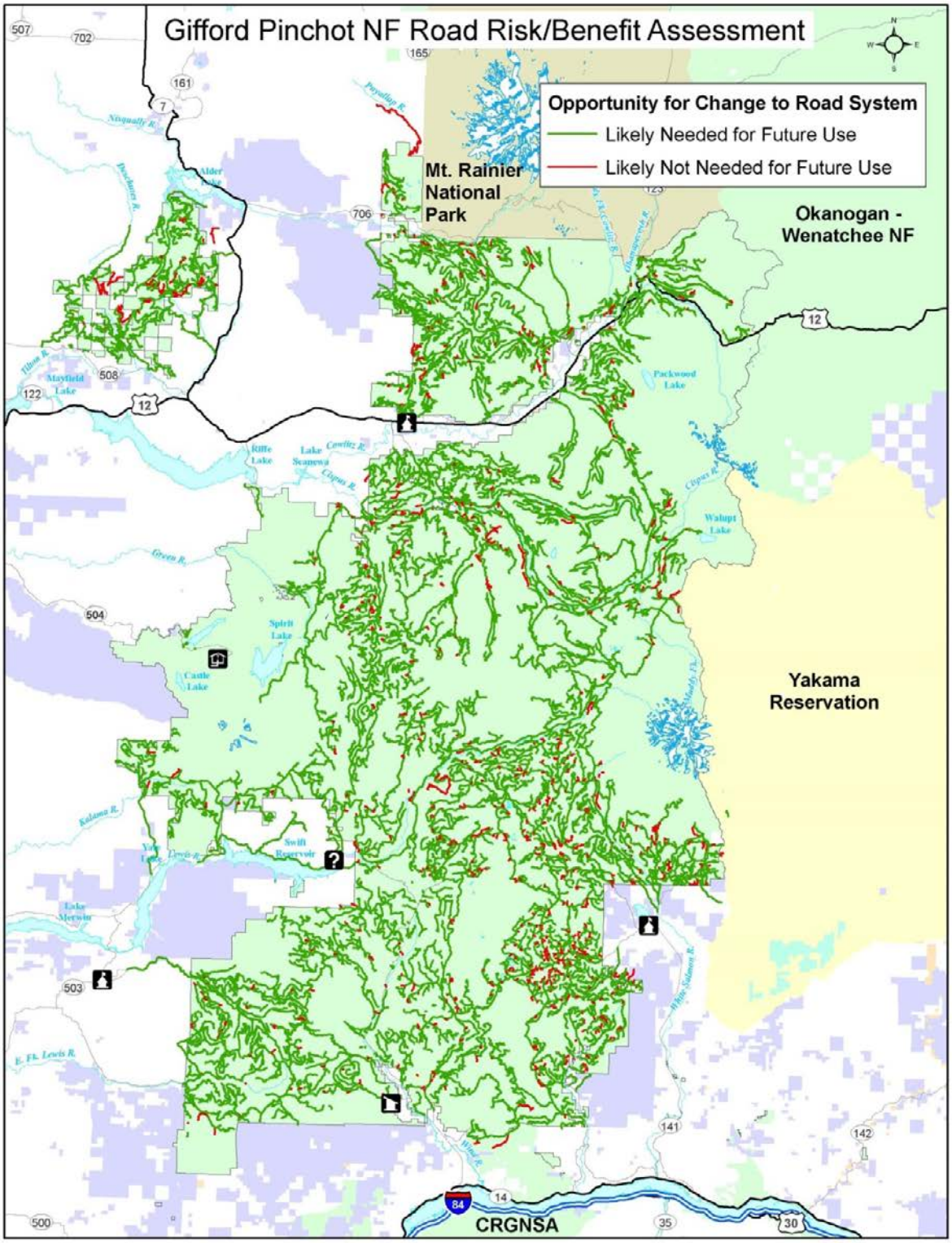

Figure 9. Summary Map of Gifford Pinchot National Forest System Roads and Future Need.