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Olympic National Forest Forest-wide Travel Analysis Report

Olympic National Forest
Washington

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Table of Contents

Appendices

List of Tables

Executive Summary

The purpose of this analysis is to complete the requirements for Travel Analysis in Subpart A of the 2005 Travel Management Rule as defined in 36 CFR 212 (b); with guidance provided in FSM 7712; and FSH 7709.55, Chapter 20. This analysis is intended to inform future decisions related to the Olympic National Forest road network.

This analysis is not a decision document. It does not make decisions about which roads will be retained or closed or what road treatments will be implemented on individual roads. Decisions for site-specific actions on individual roads are subject to the National Environmental Policy Act (NEPA) and would include opportunities for public involvement. The analysis may be used, along with other information, in considering future actions related to the Forest road network.

The Travel Analysis Process (TAP) used a science-based approach to evaluate access needs, environmental risks, and the anticipated level of future road maintenance funding. Results of this TAP will be used to inform future NEPA decisions. Analyses conducted at various scales will identify the minimum road system necessary for safe and efficient travel for the administration, utilization, and protection of National Forest System lands. Opportunities to bring road maintenance costs in line with projected funding and reduce resource risks are identified.

This TAP builds upon previous transportation analyses completed by the Forest. The analysis was conducted on a Forest-wide scale for all roads (Maintenance Levels 1 through 5). An interdisciplinary Analysis Team of Forest specialists conducted Travel Analysis over a three year period following the 6-step process described in Forest Service Handbook FSH 7709.55 Chapter 20.

Public involvement was an important part of the TAP. Public comments were solicited through a series of eight open houses throughout the Olympic Peninsula during the summer of 2014, a written questionnaire, and an online interactive map. Tribal governments, Washington State Department of Natural Resources, and adjacent large forest landowners with commercial interests in ONF roads were also consulted.

The ONF manages 2,020 miles of roads in Maintenance Levels (ML) 1 through 4. Twenty percent are maintained for use by passenger vehicles (ML3 and ML4). Fifty percent of the roads are intended for use by high-clearance vehicles (ML2). Thirty percent of the roads are currently closed to motorized vehicles (ML1). Limited funding for road maintenance has increased the backlog of deferred maintenance, increased the cost of reconstruction to bring roads up to commercial haul standards, increased resource risk, and decreased the overall condition of the road system.

Seven key issues guided the analysis:

1. Access Need for Legal and Administrative Uses
2. Access Need for Recreation
3. Access Need for Silviculture
4. Public Interest
5. Risk to Aquatic Resources
6. Risk to Terrestrial Resources
7. Road Maintenance Cost

Access Needs and Risk to Resources were evaluated for each of the 1,686 road segments (representing 2,020 miles of road) in the Forest's infrastructure database. Analysis Team

members were tasked with rating their respective Access Need or Resource Risk independently for all road segments. Analysis Team members worked within their respective staff groups to develop rating criteria and complete the ratings of High, Medium, or Low for each road segment.

Descriptions of the rating criteria and processes for each Access Need and Resource Risk can be found in Appendices A through G. Summary ratings for each Access Need and Resource Risk by road segment are shown in Appendix H.

After Analysis Team members completed their independent ratings of Access Needs and Resource Risk for their respective staff area, they met to develop preliminary lists of Likely Needed Roads (Appendix I) and Likely Not Needed Roads (Appendix J). The Analysis Team evaluated each road segment using the Access Need and Resource Risk ratings, detailed information from individual specialists, personal knowledge, and Google Earth aerial imagery where it was available. The Google Earth imagery was extremely valuable in understanding current road condition, potential risks and costs to utilize the road, position of the road on the landscape, and the characteristics of the timber stand where access was being considered.

The Analysis Team developed a series of general guidelines to help them make a recommendation of Likely Needed or Likely Not Needed Roads. The general guidelines did not fit all situations. Some recommendations also differed from the guidelines based on site-specific review and knowledge.

Recommendations for Likely Needed Roads and Likely Not Needed Roads often revolved around tradeoffs between maintaining access for silviculture restoration treatments versus aquatic risk. Determinations favored maintaining road access to potential silviculture opportunities unless the stand conditions were not suitable for commercial thinning, reconstructing the roads to standard for timber haul would be prohibitively expensive, or the road segment presented known or obvious risks to aquatic habitat.

The preliminary list of Likely Needed Roads and Likely Not Needed Roads was reviewed by the Forest Leadership Team to validate the Analysis Team's calls and resolve situations that did not fit cleanly into one category or the other.

Based on the analysis, 1,342 miles of road are considered Likely Needed. Many of these roads present ongoing risks to aquatic and terrestrial habitat. Likely Needed Roads include almost all of the roads currently managed as high standard passenger car routes (ML3 and ML4), as well as about 70 percent of high-clearance vehicle routes (ML2) and 40 percent of closed/intermittent use (ML1) roads. Likely Needed Roads are listed in Appendix I and mapped in Appendix L.

The analysis identified 676 miles of existing road as Likely Not Needed. The large majority of Likely Not Needed Roads are roads that are currently managed for high-clearance vehicles (ML2) or roads that are closed to motor vehicles (ML1). Over 40 percent of existing ML2 and ML1 roads are identified as Likely Not Needed. Likely Not Needed Roads are listed in Appendix J and mapped in Appendix L.

A financial analysis compared road maintenance needs and anticipated funding (Appendix K). Neither the existing road system nor the Likely Needed road system can be maintained to standard with the anticipated road maintenance funding of $550,000 per year.

Scenario 3 in the Financial Analysis suggests a road management strategy where the annual maintenance needs for the Likely Needed Roads could be managed sustainably within the anticipated annual road maintenance funding level. This scenario would decrease the

maintenance intensity and frequency of maintenance on all roads, especially the lower standard ML2 and ML1 roads.

The TAP identifies nine additional opportunities to improve financial sustainability of the ONF road system and focus limited road maintenance resources to the most important roads while reducing environmental risks.

The existing road system poses risks to aquatic and terrestrial resources. Managing the road system in a different way to better meet financial constraints could increase or decrease environmental risks depending on how the changes would be implemented. The resource risk assessments completed in Step 4 of the TAP can be used to help prioritize funding and help direct restoration efforts. The TAP identifies nine opportunities to manage resource risk from the existing and future road system.

Implementing the road management strategy for the Likely Needed Roads as proposed under Scenario 3 would not be possible within the normal annual road maintenance funding allocations, but would require substantial capital investments to transition roads to the desired condition. An additional $85.5 million in capital investments would be required to implement the appropriate road treatments to decommission roads, convert roads to ML1 closures, and correct existing culvert fish passage barriers.

Introduction

The purpose of this analysis is to complete the requirements for Travel Analysis in Subpart A of the 2005 Travel Management Rule. The requirements for Transportation Analysis are found in the Code of Federal Regulations (36 CFR 212) and within the Forest Service Manual Travel Management and Travel Planning (FSM 7700, Chapter 7710 Travel Planning). The process for conducting and documenting the analysis are found in the Forest Service Handbook under Travel Management and Travel Planning (FSH 7709.55, Chapter 20 Travel Analysis).

This analysis is not a decision document and will not make decisions about which roads will be retained or closed or what road treatments will be implemented on individual roads. Decisions for site-specific actions on individual roads are subject to the National Environmental Policy Act (NEPA) and will provide opportunities for public involvement. This analysis may be used, along with other information, in considering future actions related to the Forest road network.

The report identifies access needs and environmental risks. This report also considers the anticipated level of future road maintenance funding. Future NEPA analyses conducted at various scales will identify the minimum road system necessary for safe and efficient travel for the administration, utilization, and protection of National Forest System lands. The report identifies opportunities to bring road maintenance costs in line with projected funding and reduce resource risks.

History of Recent Transportation Analysis on the Olympic National Forest

1999 Roads Analysis

In 1999, the Forest Service produced a document entitled *Roads Analysis: Informing decisions about managing the National Forest Transportation System*. This document outlined an analysis process and suggested methods for analyzing a Forest's transportation system. Key elements include a science-based analysis with an emphasis on balancing the needs for access, the environmental risks associated with operating and maintaining the road system, and the financial capacity of the Forest Service unit.

2000 Road Management Strategy

The Olympic National Forest Road Management Strategy (RMS) was completed in 2000. It was driven by the need to prioritize limited watershed restoration, decommissioning, and road maintenance funds across district boundaries and across watersheds with a range of resource issues, hazards, risks, and values. The RMS analysis was one of the first road analysis processes (RAP) conducted at a Forest-wide scale. It was subsequently used in national RAP trainings as a good example of a science-based analysis balancing access needs and risk.

The RMS analysis was conducted at the Forest-wide scale and included all roads on the Forest road system. It evaluated five factors for each road segment and four additional factors at the broader watershed scale. Each factor was assigned a High, Moderate or Low value based on a series of attributes. For example, the Aquatic Risk Factor was created using the five individual elements of geologic hazard, delivery potential or proximity, stream crossing density, riparian zone proximity, and up-slope hazard. The elements were weighted by relative importance using professional judgement. The results were validated by comparing the model results with information from a recent Watershed Analysis. The RMS factors were then integrated into combinations of risk and needs that described various road management

opportunities. The resulting process was applied consistently across the Forest. The RMS has formed the framework for all subsequent analyses and Access and Travel Management Planning on the Forest.

2003 and 2007 Access and Travel Management

The 2003 Access and Travel Management (ATM) started with the RMS and added on-the-ground knowledge and professional judgment from most of the resource specialists on the Ranger Districts to provide a more site-specific understanding of the road system. Interdisciplinary Teams on each Ranger District integrated information and site-specific knowledge and developed recommendations for current and future management for each road on the Forest road system. The proposed management recommendations were shared with the public. After substantial public comment, final recommendations were developed for each road and published on the Forest's website. The final product included a list of all roads by operational maintenance level (ML), objective ML, risk, and need. In 2007, the ATM was updated for the South Fork Skokomish River watershed following the 2004 South Fork Skokomish Watershed Restoration Summary.

Step 1: Setting up the Analysis

Project Area and Objectives

The Olympic National Forest Travel Analysis Process (TAP) was conducted road-by-road at the Forest-wide scale. This is consistent with the previous Road Management Strategy and Access and Travel Management conducted in 2003. These prior analyses followed the 2000 RAP, are considered science based, and evaluated the entire road network (Operational MLs 1 through 5).

This analysis expands and extends the previous analyses summarized in the *History of Recent Transportation Analysis on the Olympic National Forest* above. New information was incorporated and more detailed assessments were conducted, especially for Recreation Access Needs, Silviculture Access Needs, Aquatic Risk, Terrestrial Risk, and Road Maintenance Cost. Extensive public information gathering and outreach to Tribal Governments, partners, and adjacent landowners was conducted during 2014 and incorporated into this TAP. The TAP was also informed by the 2007 ATM update in the South Fork Skokomish; recently completed Watershed Restoration Action Plans for the South Fork Skokomish River, Calawah River, and Dungeness River watersheds; and recent NEPA decisions for road closure and decommissioning in the South Fork Skokomish and Calawah Watersheds.

The objective of the analysis is to provide scientific information for managing a transportation system that is safe and responsive to public needs, conforms to the Olympic National Forest Land and Resource Management Plan, in balance with funding available for needed management actions, and minimizes resource risk.

The TAP is intended to be a broad scale comprehensive look at the transportation network. The main objectives of the TAP are to:

- Identify opportunities for making changes to the forest transportation system that balance the need for access while minimizing risks by examining important ecological, social, and economic issues related to roads;
- Develop maps, tables, and narratives that display transportation management opportunities and strategies that address current and future access needs, and environmental concerns;
- Identify the need for changes by comparing the current road system to the desired condition;
- Identify opportunities for change that can inform travel management decisions in subsequent NEPA documents; and
- Provide a list of opportunities and analysis background necessary for the identification of a minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands per 36 CFR 212. 5(b)(1).

The analysis area for this transportation analysis process encompasses all Forest Service roads within the Olympic National Forest. See map in Appendix L.

Team Members

An interdisciplinary Analysis Team of Forest specialists (Table 1) was assigned to conduct the TAP. Major contributors to the TAP and their roles are listed below. Almost all of the specialists in the various resource areas participated in developing and validating the access need and resource risk ratings for their

respective resource areas. Substantial contributions were also provided by Ranger District resource professionals and staff during the 2003 ATM process. This earlier step provided much in the way of on-the-ground knowledge, experience, and professional judgement.

Table 1. Analysis Team members.

Member	Resource
Bill Shelmerdine	Team Leader – Roads
Bob Metzger	Team Leader – Aquatics
Chris Dowling	Silviculture
Stephanie Neil Eric Stemmerman Sharon Yeh	Recreation
Joel Nowak	Lands and Special Uses
Kim Crider	Public Interest
Susan Piper Karen Holtrop	Terrestrial Habitat
Susie Lathom	GIS

Analysis Process

The TAP follows the six-step process described in FS-643, Roads Analysis: Informing Decisions About Managing the National Transportation System. The steps in the process are listed in Table 2.

Table 2. Travel Analysis Process Steps.

Step 1. Setting up the Analysis
Step 2. Describing the Situation
Step 3. Identify Issues
Step 4. Assessing Benefits, Problems and Risks
Step 5. Describing Opportunities and Setting Priorities
Step 6. Reporting

Public Involvement

Public involvement was an important part of the TAP. Public comments for the Sustainable Roads System were solicited through a series of eight open houses throughout the Olympic Peninsula during the summer of 2014, a written questionnaire, and an online interactive map. Additional comments were received via email. A total of 271 responses were received.

Individual meetings were conducted with the Washington State Department of Natural Resources and other adjacent large commercial landowners to validate legal access needs and easements.

Government-to-government consultation was initiated with the local American Indian Tribes.

Step 2: Describing the Situation

The Olympic National Forest currently manages 2,020 miles of road on the transportation system. Roads are identified by standard, level of service, and maintenance level (FSM 7720; FSH 7709.56, FSM 7730, and FSH 7709.59.62). Table 3 shows the breakdown of road miles by Operational Maintenance Level. This is a key element to describing road maintenance needs and standards and forms the basis for the financial capacity analysis (Appendix K). The Olympic National Forest does not manage any roads at Operational Maintenance Level 5.

Table 3. Miles of Roads by Operational Maintenance Level for the Analysis Area.

Operational Maintenance Level (OPML)	Current Road System	
	Miles	% of system
5 - High Degree of User Comfort	0	0%
4 - Moderate Degree of User Comfort	77	4%
3 – Suitable for Passenger Vehicles	321	16%
2 – High Clearance Vehicles	1,015	50%
1 – Closed	607	30%
Total	2,020	100%

Maintenance Level 3 through ML5 represent roads open to passenger car vehicles. Currently there are 398 miles intended for passenger car use. 1,015 miles are currently managed for high-clearance vehicle use, and 607 miles are closed and intended for intermittent administrative, resource management, and commercial uses. A total of 1,336 miles are managed as open to vehicle travel by the public, though some are closed or inaccessible to storm damage.

Road Maintenance Levels

Maintenance Level 1 through ML5 define the level of service provided by, and maintenance required for, a specific road. Maintenance levels must be consistent with road management objectives and maintenance criteria. Maintenance levels are defined in FSH 7709.59.62 and are summarized below:

Maintenance Level 1 (ML1) - These roads are closed to motor vehicle travel. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Road deterioration may occur at this level.

Maintenance Level 2 (ML2) - Assigned to roads open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Log haul may occur at this level. Appropriate traffic management strategies are to discourage or prohibit passenger cars, and to accept or discourage high clearance vehicles.

Maintenance Level 3 (ML3) - Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed with single lanes and turnouts.

Maintenance Level 4 (ML4) - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are low standard paved roads or double lane aggregate surfaced roads.

Maintenance Level 5 (ML5) - Assigned to roads that provide a high degree of user comfort and convenience.

Roads may currently be maintained at one maintenance level and planned to be maintained at a different level at some future date. The Operational ML is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. The Objective ML is the ML planned to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns.

Financial Capacity and Funding

The current estimate for annual maintenance needs to keep the existing Olympic National Forest road system maintained to standard would be about $2.7 million per year. Oversight and administration would require an additional $210 thousand per year. Over the past 5 years, the Olympic National Forest only received about $550 thousand per year for road maintenance contracts and work on the ground.

The available funding for road maintenance is far below what is necessary to keep the road system properly maintained. Many roads do not get the maintenance treatments they need on schedule and are falling into a severe state of disrepair. Furthermore, the majority of roads were constructed more than 30 years ago. Many are at or near the end of their design life without substantial reconstruction. Years of reduced funding for annual maintenance has increased the backlog of deferred maintenance and as well the cost of reconstruction to bring the roads to commercial and haul standards.

A financial capacity analysis was conducted as a part this analysis. The results are contained in Appendix K.

Step 3: Identifying Issues

Funding for road maintenance has decreased substantially in recent years. At the same time, motor vehicle use has increased as recreation use and local and out-of-area visitation have increased. An increasing frequency of road damage related to large storm events has reduced access and adversely affected aquatic resources. New listings of fish species under the Endangered Species Act have put additional focus on water quality and the need to minimize impacts to streams and rivers. Limited road maintenance and an increasing backlog of deferred maintenance needs, especially on ML2 roads, is impacting the Forest's ability to restore wildlife habitat and provide a consistent flow of timber products through commercial thinning restoration.

This analysis builds on the previous RMS and ATM analyses conducted by the Forest to develop strategies to manage the Forest's road system in a safe and environmentally sound manner within the context of substantially reduced road maintenance funding. Road maintenance funds have declined by 40% in the past 5 years alone (Appendix K).

Key Issues

Key issues are consistent with the access needs, resource risks, and funding challenges in the prior analyses. Key issues are summarized below.

1. **Access Need for Legal and Administrative Uses (Appendix A)**
   The Forest has a legal obligation to provide access to private land inholdings, and to uphold existing and future shared maintenance agreements and reciprocal easements with adjacent landowners and other interested parties. The Forest also provides the public with opportunities to obtain special use permits for powerlines, communication sites, driveways, and many other uses. There is also a need for access to the Forest's communication facilities, rock pits, campgrounds, and other administrative facilities.

2. **Access Need for Recreation (Appendix B)**
   The Forest provides access to a wide variety of high-quality recreation opportunities. Recreational users depend on the road system to access 5 Wilderness Areas, 20 developed campgrounds, 91 trailheads, 4 observation sites, 4 boat launches, and numerous dispersed recreation sites as well as scenic drives and other pursuits.

3. **Access Need for Silviculture (Appendix C)**
   Silvicultural activities are an important means of accomplishing forest goals and objectives. The Forest uses silvicultural activities to improve or restore wildlife habitat and develop late successional conditions. Silvicultural activities also frequently produce commercial timber products such as sawlogs. Silvicultural activities are commonly accomplished through timber sale and stewardship contracts, which require road access for equipment, personnel, and log haul.

4. **Public Interest (Appendix D)**
   The public use roads to access Forest lands for a wide variety of activities from recreation, to hunting and fishing, to collecting firewood, shrubs, mushrooms and other forest products, to nature study and meditation. Public Interest was specifically added as a key issue to identify roads that are of high value to members of the public that might not be addressed by one of the other access needs.

5. **Risk to Aquatic Resources (Appendix E)**
   Forest roads can have substantial adverse impacts to aquatic habitat by altering water flow, increasing delivery sediment, removing riparian vegetation, and creating barriers to fish passage.

6. **Risk to Terrestrial Resources (Appendix F)**
   Roads can adversely affect wildlife habitat and populations by reducing the amount of habitat available, increasing fragmentation, increasing disturbance during critical life stages, creating barriers to animal movement, and increasing wildlife mortality due to collisions with vehicles. Roads can facilitate the introduction and spread of invasive weeds and pose risks to sensitive botanical areas.

7. **Road Maintenance Cost (Appendix G and K)**
   The age of a road, how it was constructioned, the location on the landscape, and the amount and type of use it receives all effect the frequency and type of maintenance needed on individual road segments. Funding for road maintenance on the Forest is not adequate to maintain the existing road system and perform needed maintenance. Inadequate maintenance reduces access for Forest users and creates challenges in meeting Forest Plan goals and objectives. See Appendix K for more information on funding expectations and road maintenance costs.

The need for access for wildfire suppression activities was considered early in the analysis but was not carried forward as a key issue. The historic weather patterns on the Forest have kept fire occurrence at a lower level than most forested units. Lightning started fires have been less than 10 percent and mostly in the higher elevations where the terrain is steep. Over the past ten years, 90 percent of the fires on the Forest have been human-caused along roadways where dispersed camping has been the primary cause. Based on this, maintaining roads specifically for fire access would not be cost effective, and could create more of a fire problem.

Step 4: Assessing Benefits, Problems, and Risks

Evaluating Access Needs and Risks to Resources

Access Needs and Risk to Resources were evaluated for each of the 1,686 road segments (representing 2,020 miles of road) in the Forest's INFRA database. INFRA is the Forest Service's corporate database for tracking costs and maintenance needs for infrastructure on the Forest such as roads, bridges, and facilities. Road segment lengths ranged from less than 0.1 miles to 19.0 miles. Each Access Need and Resource Risk was rated as High, Medium, or Low for each road segment.

Analysis Team members were tasked with rating their respective Access Need or Resource Risk independently for all road segments. Analysis team members worked within their respective staff groups to develop rating criteria and complete the ratings of High, Medium, or Low for each road segment.

The rating criteria and process for each of the four Access Needs and three Resource Risks are summarized below. More detailed descriptions of the rating criteria and processes for each Access Need and Resource Risk can be found in Appendices A through G. Summary ratings for each Access Need and Resource Risk by road segment are shown in Appendix H.

Access Need for Legal and Administrative

Factors used to evaluate Legal and Administrative Access Needs were the existence and location of easements, maintenance agreements, public facilities, administrative sites, developed rock sources, and special use permits. Lands staff reviewed records to classify roads as High, Medium, and Low priority according to the following:

High: Roads that have easements, either granted or acquired; have maintenance agreements in place; or provide access to public facilities, permitted administrative sites, or developed rock sources. This also includes mainline and arterial roads that provide primary access to the above uses.

Medium: Roads that have special use permits, short-term authorizations, or provide access to Forest Service administrative uses, such as remote radio repeater sites. This classification also includes roads that cross private land to access National Forest System lands without a current easement and road segments that provide access across National Forest System lands to other ownerships for which easements have not been granted.

Low: All other Forest roads.

Access Need for Recreation

The Recreation Access Needs analysis categorized road segments into High, Medium, and Low priority using nine factors. The analysis generally considered the number of recreation sites, level of previous investment, importance of sites to volunteers and stakeholders, diversity of recreation opportunities, and level of public use.

- Recreation Facility Analysis Rank – All developed recreation sites were ranked in order of investment and priority in 2008 as a part of the Recreation Facility Analysis. Road segments

with developed sites on them were assigned an overall average for sites across the road segment.

- Developed Recreation Sites – The number of developed recreation sites accessed by the road segment.
- Dispersed Recreation Sites – A count of known dispersed sites along the road segment.
- Recreational Driving Route – Opportunities for recreational driving routes such as loops and viewpoints were assigned a qualitative score.
- Unique Experience – Presence of unique experience, something not found elsewhere on the Forest or surrounding areas.
- Cultural Site – Presence or absence of known cultural sites along the road segment.
- Volunteer and Stakeholder Value – Road segments that include or lead to sites that are of particular interest to volunteer groups and stakeholders.
- Assets Maintained to Standard – Overall level of recreation sites maintained to Forest Service standards along the road segment.
- Total Replacement Value – The level of capital investment for infrastructure along the road segment.

The nine factors were weighted and combined to create a final overall score. The final scores were graphed to identify natural breaks in distribution of values, and then assigned a High, Medium, or Low value. Recreation staff verified and adjusted the results where necessary.

Access Need for Silviculture

Silviculture Access Need is the need for a road segment to access Forest tree plantations to restore wildlife habitat through commercial tree thinning. Eight factors were used to assess Silviculture Access Need based on GIS computer modeling:

- Commercial treatment acres accessed per mile of road
- Commercial treatment acres in the watershed
- Site productivity
- Estimated stand volumes
- Stand ages
- Forest Plan land allocations
- Elevation
- Level of direct or indirect access

The factors were weighted based on their perceived influence on potential opportunities for commercial tree thinning to achieve forest stand structural restoration. A numerical formula was used which assigned the greatest values to road segments accessing the highest acres per mile of potential commercial thinning.

Roads needed to achieve about 33.5 MMBF of commercial thinning per year over the next 30 year period were given a Silviculture Access Need rating of High. Roads needed to achieve about 40.0 MMBF of commercial thinning per year over the next 30 year period include all roads with a Silviculture Access Need rating of High and roads with a Silviculture Access rating of Medium. Including roads rated as Low would provide additional opportunities to attain up to about 56.6 MMBF per year over the next 30 year period.

The computer-generated ratings were reviewed by the Forest Timber and Silviculture Team. During their review, they specifically considered the influence of disturbance processes, present road conditions, future economic viability, and potential for stands to develop structural attributes needed on the landscape. The team used professional judgment to adjust Silviculture Access Need ratings where necessary.

Public Interest

Public comments for the Sustainable Roads System were solicited through a series of eight open houses throughout the Olympic Peninsula, a written questionnaire, and an online interactive map. Additional comments were received via email. A total of 271 responses were received.

The written questionnaires provided an opportunity to comment on up to six different sites/ roads. Many of the comments also referred to more than one road needed to access the specific area of interest. A total of 842 individual comments were received providing information on 1,541 road segments.

The responses were entered into an excel spreadsheet along with information on the primary activities of the user and the frequency of use, if available. Each road mentioned in the comment or needed to access the specific area was included as a separate row in the spreadsheet. Rather than trying to tie comments to specific mileposts or individual INFRA road segments, comments were generally assigned to the entire road.

The number of public comments received for individual road segments ranged from 0 to 77. The number of comments was used to develop the summary rating for Public Comment as follows:

10 or more comments	High
1 to 9 comments	Medium
0 comments	Low

The vast majority of comments revolved around the desire to maintain vehicle access for public use. A minority of commenters suggested eliminating roads or converting them to other uses. In determining the ratings, the count of comments did not differentiate between those in favor of continued access from those suggesting potential road decommissioning or other uses.

Risk to Aquatic Habitat

Aquatic risk is the potential for a road segment to damage water quality and fish habitat by causing landslides, introducing sediment, altering riparian areas, or limiting natural channel movement. Five factors were used to assess aquatic risk based on GIS computer modelling:

- Geologic Hazard
- Proximity to Fish Habitat
- Stream Crossing Density
- Proximity to Stream Channels
- Upslope Hazard

The five factors were weighted based on their perceived importance in creating stream impacts. The greatest weights were given to road segments with a high potential to initiate landslides that would deliver sediment to fish habitat. A numerical formula was used to combine the five factors into High, Medium, or Low ratings with roughly one third of the total road miles in each category.

The computer-generated Aquatic Risk ratings for each road segment were reviewed by the Forest Aquatic Team. During their review, they specifically considered stream-adjacent road segments, potential delivery of sediment to anadromous fish streams, and potential delivery of sediment to municipal water supplies. The team used professional judgment to adjust Aquatic Risk ratings where necessary.

Risk to Terrestrial Habitat

Terrestrial risk is the potential for a road segment to affect wildlife and botanical species habitat by causing degradation or fragmentation of habitat, and disruption of life history function. Nine factors were used to assess terrestrial risk based on GIS computer modelling, local knowledge, and professional judgment:

- Critical areas of botanical species and habitats
- Critical areas of federally listed wildlife species and habitats
- Invasive plant infestations
- Northwest Forest Plan land management allocation
- Snag and coarse wood
- Open road distance to core habitat (unfragmented block of habitat)
- Road proximity to headwater aquatic habitat
- Distance from human activity centers
- Road density

The nine factors were weighted based on their perceived importance in creating impacts to terrestrial species, populations, and their associated habitats. The greatest weights were given to road segments with a high potential to create habitat fragmentation and disruption to federally-listed species and species of concern. A numerical formula was used in each category which was then combined into a High, Medium, or Low rating for each road segment.

The Terrestrial Risk ratings for each road segment were reviewed by the Forest Botany and Wildlife Team. During their review, they specifically considered the influence of road-related affects to species such as fragmentation, disturbance, and potential loss of habitat quality. The team used professional judgment to adjust Terrestrial Risk ratings where necessary.

Road Maintenance Cost

Road maintenance cost reflects the potential cost of ownership based on road operation and maintenance history and needs. It can also be considered an indicator for damage potential during storms. Six factors were used as principle considerations for this resource evaluation:

- cost and/or frequency of maintenance
- performance history
- storm damage history
- terrain or location considerations
- construction method
- road age

Road segments were rated High when the cost or frequency of maintenance was high, or when storm damage resulted in costly repairs. Repetitive storm damage sites and sites qualifying for Federal Highways storm damage relief funds (ERFO) are included in this group. Road segments were rated Low

when the road managers indicated a particularly low maintenance frequency or cost. Roads that met neither category were rated as Medium, and are interpreted as having average or typical cost/mile to maintain. Operational Maintenance Level 1 roads that are closed to motor vehicle access and receive little maintenance were not evaluated and were identified as Unrated.

Tables 4 and 5 display the miles of High, Medium, and Low ratings for each Access Need and Resource Risk as developed by the individual resource staff groups.

Table 4. Summary of Ratings for Access Needs for Olympic National Forest roads.

Rating	Legal & Administrative Access Need (Miles)	Recreation Access Need (Miles)	Silviculture Access Need (Miles)	Public Interest (Miles)
High	634	856	505	326
Medium	158	318	671	697
Low	1228	847	845	997

Table 5. Summary of Ratings for Resource Risks for Olympic National Forest roads.

Rating	Aquatic Risk (Miles)	Terrestrial Risk (Miles)	Road Maintenance Cost (Miles)
High	1032	749	445
Medium	651	862	865
Low	388	410	104
Unrated			606

Integration of Access Needs and Resource Risks

After Analysis Team members completed their independent ratings of Access Needs and Resource Risk for their respective staff area, they conducted a series of three interdisciplinary meetings to evaluate the available information and develop preliminary lists of Likely Needed Roads and Likely Not Needed Roads. The Analysis Team evaluated each individual road segment using the Access Need and Resource Risk ratings, detailed information from individual specialists, personal knowledge, and Google earth aerial photography imagery where it was available. The Google earth imagery was extremely valuable in understanding current road condition, potential risks and costs to utilize the road, position of the road on the landscape, and the characteristics of the timber stand where access was being considered.

The Analysis Team developed a series of general guidelines based largely on the Access Need and Resource Risk ratings to help them make an initial determination of Likely Needed or Likely Not Needed roads. The general guidelines did not fit all situations. Some determinations also differed from the guidelines based on site-specific review and knowledge.

The group of Likely Needed Roads includes:

- Roads where all Access Needs (Legal and Administrative, Silviculture, and Recreation) are rated High.
- Roads with Operational Maintenance Level 3 or 4.
- Roads where Legal and Administrative Access Need is High or Moderate.
- Roads are identified as needed in existing NEPA decisions.
- Roads where Recreation Access Need and Silviculture Access Need are both High.
- Roads where Recreation Access Need and Public Interest are both High.

- Roads where Silviculture Access Need is High and Aquatic Risk is Low.

The group of Likely Not Needed Roads includes:

- Roads approved for decommissioning in existing NEPA decisions.
- Roads recommended for Decommissioning or Convert to Trail (D or C) in the current ATM that do not have any access needs rated High.
- Roads where all access needs (Legal and Administrative, Silviculture, Recreation) and Public Interest are Low.
- Roads where Aquatic Risk and Terrestrial Risk are both High and Silviculture Access Need is Low or Moderate and Recreation Access Need and Public Interest are Low.
- Roads where Aquatic Risk and Road Maintenance Cost are both High and Silviculture Access Need is Low or Moderate.
- Roads behind existing road failures that would be very difficult and very expensive to repair
- Roads where Recreation Access Need and Public Interest are both Low or Moderate and Silviculture Access Need is Low.

Determinations for Likely Needed and Likely Not Needed Roads often revolved around tradeoffs between maintaining access for silviculture treatments to improve wildlife habitat versus aquatic risk. Determinations favored maintaining road access to potential silviculture opportunities unless the stand conditions were not suitable for commercial thinning, reconstructing the roads to standard for timber haul would be prohibitively expensive, or the road segment presented known or obvious risks to aquatic habitat. The Analysis Team split some INFRA segments into two or more sections to better reflect Likely Needed and Likely Not Needed portions.

The preliminary list and map of Likely Needed Roads and Likely Not Needed Roads was reviewed by the Forest Leadership Team to validate the Analysis Team's calls and resolve situations that did not fit cleanly into one category or the other.

The resulting list and maps of Likely Needed Roads and Likely Not Needed Roads were sent to American Indian tribes on the Olympic Peninsula as part of government-to-government consultation on the Sustainable Roads System process. Step 5 (below) provides the lists of Likely Needed Roads and Likely Not Needed Roads and potential impacts for each resource area.

Step 5: Describing Opportunities and Priorities

Likely Needed Roads and Likely Not Needed Roads

Table 6 summarizes the miles of road that are Likely Needed to meet access needs on the Olympic National Forest and the roads that are Likely Not Needed in relation to the current Operational Maintenance Level. Almost all of the roads currently managed as high standard passenger car routes (ML3 and ML4) are likely to be needed in the future. The most noticeable change would potentially occur on the roads that are currently managed for high-clearance vehicles and roads that are closed to motor vehicles (ML2 and ML1), where over 40 percent of the roads are Likely Not Needed.

Table 6. Miles of Likely Needed Roads and Likely Not Needed Roads by Operational Maintenance Level (ML).

Operational Maintenance Level	Current Road System (Miles)	Likely Needed Roads (Miles)	Likely Not Needed Roads (Miles)
5 - High Degree of User Comfort	0	0	0
4 - Moderate Degree of User Comfort	77.1	77.1	0
3 – Suitable for Passenger Vehicles	321.3	320.5	0.8
2 – High Clearance Vehicles	1013.8	700.9	312.9
1 – Closed	606.2	243.6	362.6
Total	2018.3	1342.1	676.3

Potential Impacts to Legal and Administrative Access

Likely Needed Roads include all roads where the Olympic National Forest has a legal obligation to maintain access, easements, shared maintenance agreements and certain Special Use Permits. They also include all roads needed for the Forest's communication facilities, rock pits, campgrounds, and administrative facilities.

Over time, the roads required to provide legal access may change. Some permits and possibly some easements may be terminated while others may be added. Inholdings and bordering lands will always need access, especially to timberlands. How these needs will be addressed is not known at this time.

Potential Impacts to Access for Recreation

Likely Needed Roads provide access to all existing developed campgrounds, high-use trailheads, and many dispersed recreation areas. Over time, low-use recreation sites accessed by ML2 roads would become more difficult to access in passenger cars.

Visitor use at recreation sites accessed by ML2 roads would continue to be assessed. Depending on visitor use trends and access needs there could be proposals to increase ML to ML3 to accommodate passenger cars, or to decrease ML or convert to trail. Opportunities to change road maintenance levels, change developed recreation sites, or convert roads to trails could be evaluated on a site-specific basis and addressed in future NEPA processes, if appropriate.

Potential Impacts to Access for Silviculture

Likely Needed Roads provide access to almost all viable cost-effective timber stands able to be commercially thinned within current forest plan direction. Potential timber stands accessed by Likely Not

Needed Roads generally have stand characteristics that would not benefit from commercial thinning, would utilize roads that would likely be very expensive to reconstruct and bring up to haul standards, or would utilize low standard roads that have substantial negative impacts to riparian areas and aquatic habitat. Over time, limited maintenance on ML2 and ML1 closures on roads that are used only for silviculture access would increase the costs of reconstructing roads for timber haul and reduce the viability of commercial thinning in some potential timber stands.

Potential Impacts to Access for High Public Interest

Likely Needed Roads provide access to all sites identified as high Public Interest during public involvement. Over time, sites with High Public Interest that are accessed by ML2 roads, especially the lower use roads, would likely become rougher and more difficult to access in passenger cars. Use at these sites might decrease.

Potential Impacts to Aquatic Habitat Risk

Approximately 46% (618 miles) of the Likely Needed Roads present High risk to aquatic resources due to proximity to streams or the potential to deliver sediment to waterbodies. Ongoing efforts to increase frequency and size of drainage structures, drainage maintenance, and treatments to stabilize hillslopes and maintain water quality will be needed to minimize risk to aquatic resources. Forty nine culvert fish passage barriers have been identified on the Likely Needed Roads, blocking over 33 miles of fish habitat. Site-specific treatments could be identified in watershed restoration plans and evaluated in future NEPA processes, if appropriate.

The Likely Not Needed Roads emphasize roads that were rated High for Aquatic Risk. Almost 60% (409 miles) of Likely Not Needed roads present high risk to aquatic resources that could eventually be removed from the road system. Decommissioning the Likely Not Needed Roads would also correct 18 culvert fish passage barriers that currently block access to over 16 miles of fish habitat. The Likely Not Needed Roads could be evaluated on a site-specific basis and identified in future watershed restoration action plans and addressed in future NEPA processes, if appropriate.

Potential Impacts to Terrestrial Habitat Risk

Approximately 29% (390 miles) of the Likely Needed roads present high risk to terrestrial resources due to habitat fragmentation, disturbance, and potential impacts to sensitive botanical areas. Potential impacts could be minimized by converting low-use ML 2 roads that are only needed for silviculture access to intermittent closure ML 1 roads when they are not needed for management activities. Road closures could be evaluated on a site-specific basis and addressed in future NEPA processes, if appropriate.

The Likely Not Needed Roads include 359 miles of roads that were rated High for Terrestrial Risk and could eventually be removed from the road system. Removal of these roads would be evaluated on a site-specific basis and addressed in future NEPA processes, if appropriate.

Potential Impacts to Road Maintenance Cost

Approximately 27% (365 miles) of the Likely Needed Roads present a high cost for road maintenance. The Likely Not Needed roads include 80 miles of roads that were rated High for Road Maintenance Risk and could eventually be removed from the road system. Removal of these roads would be evaluated on a site-specific basis and addressed in future NEPA processes, if appropriate.

Opportunities to Manage Within Financial Sustainability

In evaluating the benefits and risks of roads and considering the available road maintenance funding, 1,342 miles of existing roads on the Olympic National Forest are Likely Needed to meet current and

future uses and forest plan objectives. Over 676 miles of existing roads are Likely Not Needed and could be closed, decommissioned, or converted to trail to reduce road maintenance funding requirements.

A financial analysis was conducted that examined multiple scenarios for maintenance intensity and frequency. Refer to the Financial Capacity Analysis in Appendix K. Based on the financial analysis neither the existing road system nor the Likely Needed road system identified in this report can be maintained to standard with the anticipated road maintenance funding.

Scenario 3 in the Financial Analysis suggests one scenario where the group of Likely Needed Roads could be managed sustainably within the anticipated road maintenance funding level. This scenario would reduce the maintenance intensity and frequency of maintenance on lesser used roads in all maintenance levels to balance costs with anticipated road maintenance funding. Reductions in maintenance intensity and/or frequency would occur on roads in all maintenance levels but would most apparent on the lower standard (ML2) roads. Cost saving strategies and assumptions in this scenario include:

- ML4: 50% of routes, including local routes and those not frequented by heavy truck or commercial traffic would be maintained in reduced frequency or intensity. In addition, reduce maintenance frequency on asphalt roads.
- ML3: Routes receiving less use or lower commercial traffic volumes and are classified as local roads would be candidates to receive a lower intensity and frequency of maintenance. Roads proposed for a lower objective maintenance level in the 2003 Access and Travel Management (ATM) **and** those that are identified as high need for Silviculture Access only in the current TAP would also be candidates for reduced intensity and frequency of maintenance.
- ML2: Similar to the strategy used for reducing costs for the lesser used ML3 routes up to 35% of the ML2 roads would be maintained at low standard. This could include roads identified for closure (ML1) or decommissioning (D) in the 2003 ATM **and** not identified as high need for other than silviculture access in the current TAP. The ML2 roads proposed for reduced maintenance would be roads with low to moderate aquatic risk. Roads with high aquatic risk would be maintained at the higher cost or frequency.
- ML1: All of the ML1 roads in the Needed Roads system are assumed to be operated as ML1 in the current road system, so no treatments would be needed to close them.
- Roads identified as Likely Not Needed in the TAP would not be maintained.

One consequence of reduced maintenance frequency is reduced design life. For asphalt surfaced roads, if reconstruction with a new asphalt surface is not possible at the end of the design life or life cycle, then these roads would likely be converted to aggregate surfaced. The resulting annual maintenance needed could be conducted at a significantly lower cost.

The results of the Scenarios 2 and 3 are summarized in Table 5. The estimated cost of road maintenance under Scenario 3 would be $663 thousand per year. This is approximately 20% above the 5 year average maintenance budget shown in Table 1 and is assumed to represent a financially sustainable road system when timber sale road maintenance contributions are added. The calculation sheets used to arrive at these summaries are included in the attached excel file “ONF Financial Analysis SRS2015.xlsx”

Within the current road system, many of the higher use ML2 roads (collector routes) appear similar to Maintenance Level 3 roads and are passable by passenger cars. This would not be the case in the future under either Scenario 2 or 3. Maintenance on many ML2 roads would be reduced and would be focused on drainage and watershed protection rather than surface condition and user convenience. The surface of many ML2 roads would likely become rougher with more obstacles. Waterbars and cross drains would

be installed to control drainage on some roads to offset reduced maintenance frequency. More vegetation would be allowed to grow on the road shoulders, reducing visibility and sight distance.

Priorities for the higher maintenance frequency or intensity would be based on a combination of highest use, high needs, and resource risk. Federal Land Transportation Program (FLTP Network) routes, arterial routes, and collector routes are among those likely to receive more maintenance, especially with funds such as CMRD that focus on the passenger car road system (ML 3-5) and public safety. Other funds such as CMLG (Legacy Roads and Trails) will integrate watershed protection needs and risk into maintenance priorities.

Additional opportunities to improve financial sustainability of the Forest's road system and focus limited road maintenance resources to the most important roads necessary for management and enjoyment of the National Forest, and to the roads with the highest need for mitigation work associated with environmental risks include:

- Focus available maintenance funding and resources on the roads that have the highest use and that present the greatest resource risk (address issues related to user safety first, then repair/prevention of resource issues).
- Ensure that commercial users perform, or deposit funds, for road maintenance work commensurate with their use.
- Ensure that Special Use permitees and landowners with in-holdings assume an appropriate share of road maintenance responsibilities.
- Seek opportunities to transfer jurisdiction of Forest Service roads to other agencies.
- Seek additional funding for road maintenance through regular appropriations.
- Seek new and additional funding sources for road maintenance and improvements through any available funding programs such as Capital Investment Programs, Legacy Roads and Trails, Forest Highway Programs, etc.
- Seek partnership opportunities to help leverage funds with outside sources.
- Seek opportunities to convert roads from asphalt to aggregate surface.
- Continue to look for ways to reduce maintenance costs, and overhead costs related to Forest Service road programs to direct more funds to road maintenance and improvement work.

Opportunities to Manage Resource Risk

As displayed in Step 4 of this analysis, the existing road system poses risks to aquatic and terrestrial resources. Managing the road system in a different way to better meet financial constraints could increase or decrease environmental risks depending on how the changes would be implemented.
Opportunities to minimize resource risk from the road system include:

- Decommission, close, or convert-to-trail roads categorized as Likely Not Needed for future management. Prioritize funding to decommission those unneeded roads that pose the greatest isk to public safety or environmental degradation (36 CFR 212.5(2)).
- Focus funds intended for resource protection and restoration on roads with the highest environmental risks. Road decommissioning projects could be evaluated on a site-specific basis and analyzed in a future NEPA process, if appropriate.

- Implement road treatments to reduce Aquatic Risk in Focus Watersheds/ Priority Watersheds first, especially if the project is identified as an Essential Project in the Watershed Restoration Action Plan. Focus Watersheds/ Priority Watersheds are designated by the Forest under the Forest Service National Watershed Condition Framework and generally have the greatest influence on anadromous fish and/or municipal water supplies.
- Use Aquatic Risk to help determine the needed frequency and intensity of maintenance activities. (i.e. drainage maintenance activities would be needed more frequently on a road rated High for Aquatic Risk than on a road rated Low.)
- Stabilize low-use ML2 roads with frequent waterbars or cross drains to control drainage and reduce diversion potential if culverts plug.
- Emphasize drainage maintenance on ML2 roads, especially on road where Aquatic Risk is rated High or Moderate.
- Put more emphasis on extensive road treatments to reduce risk over long segments (waterbarring/ Storm Damage Risk Reduction) versus intensive work on small segments (decommissioning).
- Implement appropriate treatments to restore hydrology, stabilize fillslopes, and ensure habitat connectivity prior to converting a road to ML1. The aquatic risk assessment provides opportunities to prioritize limited funds to minimize adverse environmental impacts associated with the higest risk road segments.
- Correct culvert fish passage barriers on Likely Needed roads as funding is available. Barriers to anadromous fish migration would be first priority for correction. Barriers to resident fish would be prioritized based on the amount of habitat that would be reconnected. Culvert barrier correction projects would be evaluated on a site-specific basis and analyzed in a future NEPA decision prior to being implemented.
- In order to reduce disturbance to terrestrial species and reduce potential impacts to sensitive botanical areas, convert low-use ML2 roads that are only needed for silviculture access to intermittent closure ML1 roads.

Step 6: Key Findings of the Analysis

Desired Conditions for the Future Sustainable Road System

The 2005 Travel Management Rule at 36 CFR 212. 5 (b) states:

> "…b) Road system--(1) Identification of road system. For each national forest, national grassland, experimental forest, and any other units of the National Forest System (Sec. 212. 1), the responsible Official must identify the minimum road system (MRS) needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. In determining the minimum road system, the responsible official must incorporate a science-based travel analysis at the appropriate scale and, to the degree practicable, involve a broad spectrum of interested and affected citizens, other state and federal agencies, and tribal governments. The minimum system is the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR part 219), to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance."

This report documents the science-based travel analysis that may be used, along with other information, in considering future actions related to the Forest road network. The report identifies a variety of opportunities for making changes to current road management practices that would meet the direction in 36 CFR 212. 5 (b). Based on the analysis of benefits and risks in Step 4, 1,342 miles of road were determined to be Likely Needed to meet the needs of the forest. Likely Needed roads are listed in Appendix I and mapped in Appendix L. Over 676 miles of existing road were determined to be Likely Not Needed and could potentially be decommissioned and removed from the system.

Financial Analysis Results

A final consideration in developing the TAP is road maintenance funding. Based on funding levels over the previous five years, the Olympic National Forest can only afford to maintain about 20 percent of the current road system to Forest Service standards. This trend is continuing. This analysis will help inform future road management decisions to respond to long-term maintenance funding reductions and help prioritize scarce resources to maintain a forest transportation system that meets the access needs for the public and for administrative purposes while minimizing environmental risks.

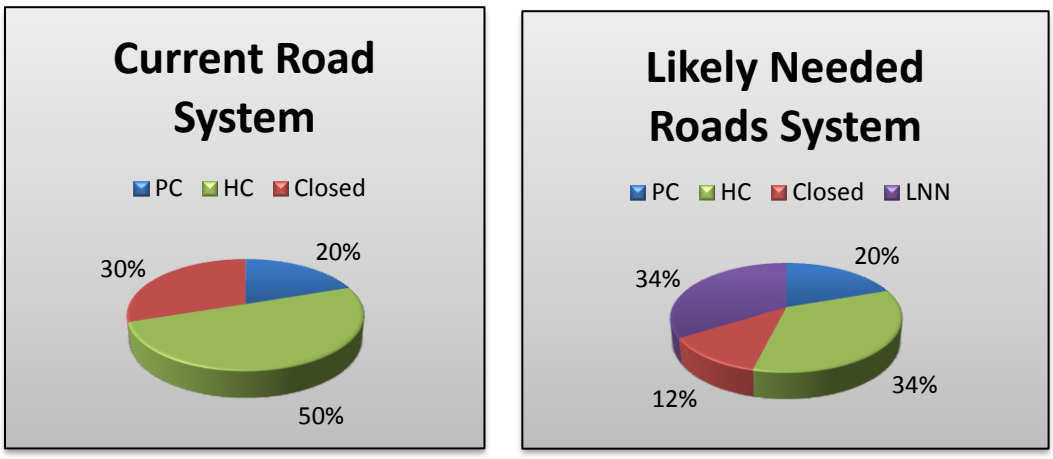
Each road segment on the existing Olympic National Forest road system was evaluated for the access benefits it provided and the environmental risk it created. Appendix H shows the ratings for Access Needs and Resource Risks for each road segment. The analysis determined 1,342 miles of road are Likely Needed to meet public use and Forest management needs. Likely Needed roads are listed in Appendix I and mapped in Appendix L. Many of these roads present ongoing risks to aquatic and terrestrial habitat. Road treatments to upgrade drainage, stabilize fillslopes, and reduce maintenance levels would reduce resource risks.

Just over 676 miles of road (33%) were determined to be Likely Not Needed for future needs. These roads, which are listed in Appendix J and shown as Likely Not Needed roads on maps in Appendix L, could be decommissioned or closed to reduce maintenance costs and resource risks. Potential road decommissioning and road closure projects could be evaluated on a site-specific basis and analyzed in a future NEPA process, if appropriate.

The results of the Financial Analysis in Appendix K show that the road management strategy proposed for the group of Likely Needed roads under Scenario 3 could reasonably be expected to balance the average annual cost of routine road maintenance with the anticipated average annual funding. Reducing the frequency or intensity of maintenance within a maintenance level, or reducing the maintenance level could also reduce annual maintenance costs but potential for resource impacts might increase. Similarly, reductions in maintenance could reduce access.

Implementing the road management strategy for the Likely Needed roads as proposed under Scenario 3 would not be possible within the normal annual road maintenance funding allocations. Substantial capital investments would be required to decommission roads, convert roads to ML1 closures, and correct existing culvert fish passage barriers. An estimated $85.5 million would potentially be needed to implement the appropriate road treatments.

Figure 1. Current Road System vs Likely Needed Road System (PC= Suitable for Use by Passenger Cars; HC = High-clearance Vehicles; Closed = Closed to Motorized Vehicles/Intermittent Service; LNN = Likely Not Needed Roads).



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Appendix A

Legal and Administrative Access Needs

The Legal and Administrative Access Needs evaluation captures the need of the Forest Service to provide varying levels of road access and maintenance in response to obligations created by right-of-way grants and acquisitions; cooperation with adjacent landowners; administrative sites such as communication sites, weather stations, and rock sources; and authorizations issued by the Forest Service. This report does not address recreational administrative needs as they are identified in a separate resource report.

Road segments were evaluated by Lands staff to determine the presence or absence of the following conditions:

DNR Cost Share Roads. The Washington State Dept. of Natural Resources and Olympic National Forest share in the costs of development and maintenance of a system of roads that serve both parties under the terms of a Road Right-of-Way Construction and Use Agreement. Under the terms of the agreement, easements are exchanged and capital projects and road maintenance are jointly funded.

Easements Acquired by the USA. Easements have been acquired across the property of other landowners to secure perpetual access to National Forest lands for both public and administrative purposes. In most cases the Forest Service is responsible for the jurisdiction and management of these road segments.

Easements Granted by the USA. Easements have been granted to other agencies, corporations, and individuals to provide long-term access to their properties across National Forest lands. Depending on the situation, the right-of-way granted may remain or become part of the Forest Service's road system, may be transferred to the jurisdiction of a public road agency such as the Dept. of Transportation or a County, or may be managed by the grantee as provided in the easement if the road does not serve a public use.

Roads that Provide Access to Non-National Forest Lands, No Easements Granted. This category includes roads that are known to have the potential to provide access to the properties of others, but for which long-term easements have not been issued. Short-term use may have been authorized by permit, interest in a long-term grant may have been expressed but not formally requested, or the potential for access may simply be recognized.

Roads Included in Road Maintenance Agreements. Olympic National Forest has entered into agreements with federal and state agencies and private corporations for the purpose of scheduling and sharing the costs of road maintenance on certain roads.

Designated Communication Sites. The Forest Service leases space for commercial and governmental communications facilities at several mountain-top sites.

Internal Use Communication Sites. Repeater sites for internal Forest Service radio communications are located throughout the Forest, and are part of a network that also serves the Park Service and State of Washington.

Developed Rock Sources. These rock pits are primary sources of rip rap, crushed rock, and/or pit run gravel developed by the Forest Service for road construction and improvement projects.

Weather Stations. The Forest Service maintains a number of remote automated solar-powered weather stations (RAWS) that provide precipitation, wind speed, and other climatic data to the National Weather Service.

Roads that Provide Access to Special Use Permit Sites. Long-term special use permits that may be dependent upon road access include authorizations for buried and aerial telecommunications and power transmission and distribution lines, water diversion and transmission systems, organized camps and education centers, and research studies.

Ratings

- High - Road segments for which easements have been granted or acquired, that are included in a road maintenance agreements, are mainline arterial roads (primary public access for all uses), or provide access to a designated communications site.

- Medium - Road segments that provide access to internal use communication sites, developed rock sources, weather stations, special use permit sites, and roads that cross private land that access NF lands (without current easement). This classification also includes road segments that provide access to non-National Forest lands but for which easements have not been granted.

- Low - Road segments that serve none of the functions included in the High and Medium categories.

Results

060901		
Low	550 road segments =	553 miles
Medium	51 road segments =	60 miles
High	292 road segments =	350 miles
060902		
Low	248 road segments =	211 miles
Medium	17 road segments =	33 miles
High	47 road segments =	126 miles
060903		
Low	270 road segments =	321 miles
Medium	36 road segments =	62 miles
High	65 road segments =	347 miles
060905		
Low	236 road segments =	612 miles
Medium	42 road segments =	105 miles
High	52 road segments =	292 miles
TOTAL		
Low	1304 road segments =	1697 miles
Medium	146 road segments =	260 miles
High	456 road segments =	1115 miles

Limitations of the Analysis

This analysis was performed largely by three individuals (one no longer works for the forest) with limited time available for detailed analysis. Most of the institutional knowledge came from a retired lands person working on the west side of the forest, and as such, the Hood Canal side may have more errors or incomplete information contained on the spreadsheet. The new lands lead has little "on-the-ground" knowledge of the forest and has relied heavily on existing information and others for input.

The bulk of the road segments are defined in INFRA as a single segment, but, to be accurate for this resource area, should contain multiple priority rankings within the segment, or each segment should be divided in INFRA and prioritized further. Many of these segments are shown as High priority on the SRS maps for their entire length, but in reality only a small portion of the segment is actually High priority on the ground. Since we are not able to divide the segments further in this analysis, an additional comment table provides for discrepancies between the mapped and actual needs (included as a reference).

The Medium category may need further refinement given that special use permitted activities do not require forest road system access. Any access needed by the permittee may be included in the special use permit and gated so as to not allow public access or need maintenance funds from the FS.

Some roads that are not shown on the spreadsheet or map may be valuable for access to Forest or private lands. These should be added to our system as medium or high, depending on the situation, for legal/administrative needs.

Other Considerations
Some of the mainline or other high use roads accessing the forest are high priorities to keep in good condition for public or other legal access. Most of these have maintenance agreements or easements in place, but there may be short segments that have neither. Part of the cost of maintaining the rest of the road system is acquiring forest or public (county) easements. This should be taken into consideration in the overall cost of the Minimum Road System.

Some easements are granted to counties or land owners, and as such, require the grantee to maintain the road to an existing standard. As long as the easement is in place, the forest does not have the responsibility for maintenance and therefore the cost to the forest will be very low, if anything.

Moving Forward
As time allows, the forest staff should update the analysis with additional or refined details on each segment. For this to be useful in the years to come, the forest will embrace it as a "living" analysis which will be updated as information becomes available and as on-the-ground conditions change.

Appendix B

Recreation Access Needs

The Recreation Access Needs analysis categorized road segments into low, medium, and high priority from a number of different factors. The analysis considered the number of recreation sites, level of previous investment, importance of sites to volunteers and stakeholders, diversity of recreation opportunities, and level of public use.

Factors used to evaluate recreation access needs

- Recreation Facility Analysis Rank – All developed recreation sites were ranked in order of investment and priority in 2008 as a part of the Recreation Facility Analysis. Road segments with developed sites on them were assigned an overall average for sites across the road segment.
- Developed Recreation Sites – The number of developed recreation sites accessed by the road segment.
- Dispersed Recreation Sites – A count of known dispersed sites along the road segment.
- Recreational Driving Route – Opportunities for recreational driving routes such as loops and viewpoints were assigned a qualitative score.
- Unique Experience – Presence of unique experience, something not found elsewhere on the Forest or surrounding areas.
- Cultural Site – Presence or absence of known cultural sites along the road segment.
- Volunteer and Stakeholder Value –Road segments that include or lead to sites that are of particular interest to volunteer groups and stakeholders.
- Assets Maintained to Standard –Overall level of recreation sites maintained to Forest Service standards along the road segment.
- Total Replacement Value – The level of capital investment for infrastructure along the road segment.

Each of the factors were weighted differently and combined to create a final overall score. For example, the number of dispersed routes was downplayed since that score was a total count, while the presence and absence scores (0,1) such as unique experience, were weighted more heavily.
The final scores were graphed to identify natural breaks in distribution of values, and then assigned a high, medium, or low value. These results were then transferred onto maps for field staff to verify and adjust the results.
The District Recreation Managers assigned final ratings for each road segment for the area they manage. Results were compiled and verified by the Forest Recreation Program Manager.

Appendix C

Silviculture Access Needs

Executive Summary

Silviculture Access Need is the need for a road segment to access forest tree plantations for restoration using commercial tree thinning. Silviculture Access Need can be considered as the degree of connectivity between roads and tree plantations.

Eight factors were used to assess Silviculture Access Need based on GIS computer modeling:

- Commercial treatment acres accessed per mile of road
- Commercial treatment acres in the watershed
- Site productivity
- Estimated stand volumes
- Stand ages
- Forest Plan land allocations
- Elevation
- Level of direct or indirect access

The factors were weighted based on their perceived influence on potential opportunities for commercial tree thinning for forest stand structural restoration. A numerical formula was used which assigned the greatest values to road segments accessing the highest acres per mile of potential commercial thinning.

Roads that are needed to maintain a high level of commercial thinning on the Olympic National Forest of 56.6 MMBF per year over the next 30 year period include all the roads given Silviculture Access Need ratings of "Low, Medium, and High". Roads that are needed to maintain a somewhat lower level of commercial thinning of about 40.0 MMBF per year over the next 30 year period include the roads with the Silviculture Access Need ratings of "Medium and High". Roads that are needed to maintain a low level of commercial thinning of about 33.5 MMBF per year over the next 30 year period only include the roads with the Silviculture Access Need rating of "High".

The computer-generated Silviculture Access Need ratings for each road segment were reviewed by the Forest Timber and Silviculture Team. During their review, they specifically considered the influence of disturbance processes, present road conditions, future economic viability, and potential for stands to develop structural attributes needed on the landscape. The team used professional judgment to adjust Silviculture Access Need ratings where necessary. Based on the limitations and gaps in the present data, the overall accuracy of this product is anticipated to be correct approximately 80% of the time.

Methodology and Key Issues

The Silviculture Access Need ratings were based on a forest-wide GIS computer model. The thinning acreage results were adjusted by retrospectively comparing the results of the model with results produced from commercial thinning NEPA and sale implementation in project areas in the Sitkum and West Fork Humptulips watersheds.

Eight factors were used to assess Silviculture Access Need based on GIS computer modeling:

- Commercial treatment acres accessed per mile of road
- Commercial treatment acres in the watershed

- Site productivity
- Estimated stand volumes
- Stand ages
- Forest Plan land allocations
- Elevation
- Level of direct or indirect access

The access needs were based on their perceived importance in utilizing commercial thinning as a restoration tool for converting structurally simple tree plantations into structures that will develop along trajectories that closer approximate those in stands of natural origin. The greatest weights were given to road segments that accessed the highest number of acres per mile and with a high potential to create future old forest associated habitat structures. This analysis was based on a 30 year operating window. The score was used to assign an Access Needs rating of "High", "Medium", or "Low" to each road segment. These ratings resulted in three annual commercial thinning timber sale volume production capabilities of 56.6, 40.0, and 33.5 MMBF respectively.

Based on tree stand age, Forest Plan land allocation, site productivity, and elevation over 25 percent of the plantation stands were identified as having the capability of being commercially treated more than once in the next 30 years. The acres accessed by each road segment were adjusted to reflect these multiple entry opportunities. An average of 15MBF per acre was used in this Forest-wide analysis. This was based on the production of past commercial thinning entries ranging from 8MBF to 22 MBF per acre. Acres located inside northern spotted owl circles were included. No plantation stands in designated Roadless Areas or stands with an average elevation greater than 3000' were considered for commercial thinning. Gross stand acres were estimated to decrease by 42% during NEPA and the NEPA acres were estimated to decrease by 25% during layout (estimates based on results from past projects in Sitkum and West Fork Humptulips).

This new SRS Silviculture Access Need analysis is an entirely new analysis. The original Olympic National Forest Road Management Strategy (RMS) completed in the year 2000 contained a Silviculture Vegetation model that was created without consideration of multiple commercial thinning entries, soil site productivity, or stand elevation. It also did not consider stands that are now 34 years of age and younger. In addition, many stands in LSR's included in the old analysis are now over age 80. The new Silviculture Access Need analysis was designed to addresses all of these deficiencies.

The Sustainable Roads System analysis (SRS) uses only the road segments delineated in the current Olympic National Forest Roads INFRA database. As a result, the SRS analysis contains 1,661 individual road segments. These segments range from 0.1 miles to 19 miles in length. Often only a portion of a road segment will actually be needed for silvicultural access. The Forest Timber and Silviculture Team considered the influence of disturbance processes, present road conditions, future economic viability, and potential for stands to develop structural attributes needed on the landscape. The team used professional judgment to adjust Silviculture Access Need ratings to fit the current INFRA road segments.

Based on our past NEPA and timber sale implementation experience across the Forest, we have a reasonable level of confidence that the need ratings correctly characterize the potential for roads to access restoration opportunities that are economical and maximize the ecological restoration potential. There are several limitations and gaps in the present data. These include a relatively poor soil site potential map layer, limited information on current tree stand size and density, poor stream map layer, and lack of cost estimates for bringing needed system roads up to safe haul standards. In addition, the modeling based access only by proximity to a stand, not by the actual number of acres that could be accessed by current harvest systems. Based on these limitations and gaps in the present data, the overall accuracy of this

product is anticipated to be correct approximately 80% of the time. Many of these limitations and data gaps will be improved as the Forest attains more LiDAR coverage of the Forest.

Results

The results of the SRS Silviculture Need analysis are shown below.

Table C-1. Silviculture Need rating summary of results.

Silviculture Need Rating	Miles of Road	Percent of Road System
High	834 miles	41%
Medium	337 miles	17%
Low	838 miles	42%
Total	2,009 miles	100%

The Silviculture Need results are based on a broad scale. Project scale review is needed to ensure restoration objectives are met. These results generally reflect the past timber harvest intensity and distribution, operational limitations, and soil site potential on the Olympic National Forest. The steep dissected terrain contains a road infrastructure that was designed for the even-aged extraction of large trees using much larger cable logging equipment than is available by operators today. The operational limitations inherent in commercial thinning of small logs using system roads designed for a very different purpose results in a large portion of the young-growth acres on the Forest being inaccessible. Also, stream buffers created to meet the intent of the Aquatic Conservation Strategy in the Northwest Forest Plan isolate additional forest segments accessible for treatment. In addition, much of the historic even-age harvest activity in the 1980'swas located in lower soil site productivity areas or high elevations where the trees do not grow to the large size that is needed by listed late-successional wildlife species. The plantations that were regenerated in these locations generally receive less benefit from commercial thinning actions and are less likely to be economically viable.

Future Refinements at the Project Scale

Prior to designing and implementing future decommissioning projects, Silviculture Need should be validated for the individual road segments. (This would also include adjusting the individual length of INFRA road segments as well.) Field assessments should include:

- The number of acres of current and future commercial thinning potential.
- The estimated cost of bringing the system road up to the safe haul standard.
- The wildlife habitat connectivity needs that would be improved by accelerating the development of old forest habitat structures through the use of commercial tree thinning.
- Determine each sites silviculture treatment intensity capability.

During commercial thinning NEPA all system roads should be re-evaluated for future commercial thinning needs and each stand silviculture prescription document should incorporate future access in the design of the thinning treatment.

Field assessments of these roads could substantially change the current Silviculture Need rating or the treatments needed to restore habitat. Commercial tree thinning should be completed prior to road decommissioning activities since the high financial cost of reopening a decommissioned road is usually cost prohibitive of performing commercial tree thinning treatments.

Appendix D

Public Interest

Methods

Public Involvement Opportunities

Opportunities for public involvement in the Minimum Roads System Travel Analysis Process for the Olympic National Forest were offered through a series of eight open houses in cities and towns throughout the Olympic Peninsula (Aberdeen, Forks, Olympia, Port Angeles, Port Townsend, Quilcene, Quinault, and Shelton) during June, July, and August 2014. The open houses provided an opportunity to comment in one of two ways: written questionnaires or hard copy Olympic National Forest maps. Outside of the public open houses, comments were also solicited online via a fillable questionnaire form (identical to the questionnaires provided at the open houses) and an online interactive map. All comment forms are stored at the Olympic National Forest Supervisor's Office in Olympia, WA.

Comment Processing

Response documents often included one to many comments regarding one or more specific roads or destinations. All comments were read in their entirety for content. Each specific comment was entered as an individual record in an excel spreadsheet. Lengthy comments were summarized. Information on the primary activities of the user and the frequency of use, was also recorded, if provided. If a destination was mentioned but the specific route used to reach it was not mentioned, the most common route to the destination was assumed and added to its associated individual comment record in the spreadsheet.

Development of Ratings

The vast majority of comments revolved around the desire to maintain vehicle access for public use. A minority of commenters suggested eliminating roads or converting them to other uses. In determining the ratings, the count of comments did not differentiate between those in favor of continued access from those suggesting potential road decommissioning or other uses (see Results below for more information). The number of comments was used to develop the summary rating for public interest using the following scale:

10 or more comments	High
1 to 9 comments	Moderate
0 comments	Low

Compilation of Ratings

Rather than relating comments directly to specific mileposts or individual INFRA road segments, comments were generally assigned to each INFRA segment on that road. Therefore, the total mileage of a road was used for all mileage calculations presented in Results.

Results

Responses Received and Reviewed

A total of 271 response documents were received:

- Written Questionnaires (open houses and online) 119 responses
- Online Interactive Map 81 responses
- Open Houses Maps 61 responses
- Email or Letters 10 responses

A majority of the response documents contained one or more comments regarding a specific road or road segment, or a destination accessed by a road. Review of the 271 response documents yielded a total of 842 individual comments that referenced 1,541 road segments.

Ratings

The number of public comments received for any individual road segments ranged from 0 to 77. Overall, 201 roads covering about 1,032 miles received a public interest rating of high or moderate (Table D-1). About 50% of total system road mileage received a public interest rating of low.

Table D-1. Summary of public interest ratings.

Public Interest Rating	Number of Roads	Total Miles
High	26	326
Moderate	175	697
Low	1007	997

The amount of public interest was related to operational maintenance levels (ML) (Table D-2). Relative to the total mileage of ML 4 roads on the Forest, ML 4 roads had largest proportion of miles with high public interest. ML 1 roads had the lowest proportion of miles with high public interest.

Table D-2. Summary of public interest by operational maintenance level.

Operational Maintenance Level	Miles of Road rated as High Public Interest (% of total mileage on Forest)
ML 4, total ONF mileage 77	59 (77)
ML 3, total ONF mileage 321	190 (59)
ML 2, total ONF mileage 1,015	72 (7)
ML 1, total ONF mileage 607	4 (<1)

Overlap of Public Interest Ratings and Recreation Access Need Ratings

Public interest ratings generally paralleled recreation access need ratings. However, differences between public interest ratings and recreation access need ratings (see Appendix B) were found because public interest was rated for the entire length of the road while recreation access was rated by individual road segments and was a more detailed analysis. Therefore, while direct correlation is not possible, roads with high public interest ratings tended to have high ratings for recreation access needs; approximately 90% of road miles rated as high for public interest were also rated high for recreation access need. Only 32 miles of the 326 total miles rated as high for public interest were *not* rated high for recreation access need. The road segments where differences occurred were assessed on a case-by-case basis during the integration phase.

Integration in Future Assessments

The public interest ratings for roads was integrated with other resource ratings to provide recommendations for each road segment to inform future decisions related to road management. All future decisions involving actions on specific roads or road segments will be analyzed through the NEPA process as part of smaller scale project planning. Public involvement is integral to the NEPA process. Public review of project proposals and NEPA documents, will be requested at the appropriate stages

during the planning process. The public will be offered the opportunity to comment on specific road management actions during that process.

Appendix E

Aquatic Resource Report

Executive Summary

Aquatic Risk is the potential for a road segment to damage water quality and fish habitat by causing landslides, introducing sediment, altering riparian areas, or limiting natural channel movement. Aquatic Risk can be thought of as the degree of connectivity between roads and streams.

The Aquatic Risk ratings from the Olympic National Forest Road Management Strategy (RMS) completed in 2000 were the foundation of this assessment. The RMS Aquatic Risk model was based on GIS computer modelling and was validated by comparing the results of the model with detailed results from the East Fork and West Fork Humptulips River Watershed Analysis. The RMS Aquatic Risk ratings have been used as a general guide for assessing the level of potential risk that a road poses to aquatic systems on the Olympic National Forest for over a decade.

The RMS used five factors to assess Aquatic Risk for each road segment:

- Geologic Hazard
- Potential for Sediment Delivery to Fish Habitat
- Stream Crossing Density
- Proximity to Stream Channels
- Upslope Hazard

The factors were weighted based on their perceived importance in creating stream impacts. The greatest weights were given to “Geologic Hazard” and to “Potential for Sediment Delivery to Fish Habitat” to highlight road segments with a high potential to create landslides that would deliver sediment to fish habitat. The score for each weighted factor was summed into an overall composite Aquatic Risk. The composite score was used to assign an Aquatic Risk rating of “Very High”, “High”, “Medium”, or “Low” to each road segment. For the purposes of this assessment, the “High” and “Very High” RMS Aquatic Risk ratings were combined into a single “High” category. A more detailed explanation of the risk factors, how they were weighted, and how they were combined to calculate the Aquatic Risk rating can be found in the Olympic National Forest Road Management Strategy documents.

The Aquatic Risk ratings from the RMS were reviewed by the Forest Aquatic Team. During their review, they specifically considered stream-adjacent road segments, potential delivery of sediment to anadromous fish streams, and potential delivery of sediment to municipal water supplies. The team used professional judgment to adjust Aquatic Risk ratings where necessary.

Methodology and Key Issues

The Aquatic Risk ratings from the Olympic National Forest Road Management Strategy (RMS) completed in 2000 were the foundation of this assessment. The RMS Aquatic Risk was based on a forest-wide GIS computer model. The RMS results were validated by comparing the results of the model with detailed results from the East Fork and West Fork Humptulips River Watershed Analysis. Over the past fifteen years, the RMS Aquatic Risk ratings have proven to be a reasonably good approximation of the potential risk that a road poses to aquatic systems on the Olympic National Forest.

The RMS used five factors to assess Aquatic Risk for each road segment:

- Geologic Hazard
- Potential for Sediment Delivery to Fish Habitat
- Stream Crossing Density
- Proximity to Stream Channels
- Upslope Hazard

The RMS Aquatic Risk factors were weighted based on their perceived importance in creating adverse stream impacts. The greatest weights were given to "Geologic Hazard" and to "Potential for Sediment Delivery to Fish Habitat" to highlight road segments with a high potential to create landslides that would deliver sediment to fish habitat. The score for each weighted factor was summed into an overall composite Aquatic Risk score. The composite score was used to assign an Aquatic Risk rating of "High", "Medium", or "Low" to each road segment. Road segments where "Geologic Hazard" and "Potential for Sediment Delivery to Fish Habitat" were both considered to be a High or Moderate concern were given an RMS Aquatic Risk rating of "Very High." For the purposes of this assessment, the "High" and "Very High" RMS Aquatic Risk ratings were combined into a single "High" category. A detailed explanation of how each of the RMS Aquatic Risk factors were developed, how they were weighted, and how they were combined to calculate the RMS Composite Aquatic Risk ratings can be found in the Olympic National Forest Road Management Strategy Factors in Appendix __.

Because the original RMS Aquatic Risk model was created with a software program that is no longer supported by the current GIS platform, re-running the 2000 RMS Aquatic Risk model with the current GIS layers would have been very time and labor intensive. Rather than re-creating the RMS model, we utilized the existing Aquatic Risk ratings from the RMS and adjusted them as necessary to reflect on-the-ground knowledge and current conditions.

The original RMS Aquatic Risk analysis delineated road segments based on a combination of the road segments in the Olympic National Forest Roads database (INFRA) and the 6th field watershed boundaries that were in place at the time. Each time a road crossed a 6th field watershed boundary a new road segment was created. Slightly more than 4,000 individual road segments were evaluated and rated for Aquatic Risk in the RMS.

The Sustainable Roads System analysis (SRS) uses only the road segments delineated in the current Olympic National Forest Roads INFRA database. It does not create new road segments at watershed boundaries. As a result, the SRS analysis only contains 1,670 individual road segments. Many of the SRS road segments overlay two or more of the original RMS Aquatic Risk road segments. The Forest Aquatics Team used the original RMS Aquatic Risk ratings, local knowledge, GIS information, aerial photographs, and professional judgement to adjust the Aquatic Risk ratings to fit the current INFRA road segments.

The length of the road segments analyzed for Aquatic Risk under SRS had a substantial influence on the Aquatic Risk rating for the segment. Shorter road segments tended to result in more definitively "High"

or "Low" Aquatic Risk ratings because they covered relatively smaller areas and landscape topography was more consistent. Longer road segments, by contrast, covered larger areas and often included some areas that would be considered high risk and some areas that would be considered low risk. Combining the different landscapes and factors encountered over a long road segment often resulted in high risk areas and lower risk areas averaging out to a "Medium" Aquatic Risk rating for the segment overall.

Based on our past experience with the RMS Aquatic Risk ratings across the Forest, we have a high level of confidence that the "High" Aquatic Risk and "Low" Aquatic Risk ratings correctly characterize the potential for roads to adversely impact streams, especially for relatively short road segments. A "Medium" Aquatic Risk rating should be viewed somewhat more cautiously. A "Medium" rating may indicate that the road segment does not fit clearly into either the high risk or the low risk category and it could turn out to be either. A "Medium" rating, especially for long road segments, may also indicate that the road segment passes through areas of both high Aquatic Risk and low Aquatic Risk and the rating is just an average of the two extremes.

Results

Table E-1. Aquatic Risk Rating analysis results.

Aquatic Risk Rating	Miles of Road	Percent of Road System
High	1,032 miles	51%
Medium	651 miles	32%
Low	338 miles	17%
Total	2,021 miles	100%

The Aquatic Risk results generally reflect the predominance of steep, unstable terrain and highly dissected slopes found on the Olympic National Forest. In the initial RMS Aquatic Risk analysis, half of the road segments on the Forest Service road system received the highest possible score for Geologic Hazard. Three quarters of the road segments on the Forest Service road system received the highest possible score for Potential for Sediment Delivery to Fish Habitat. A large number of road segments also received the highest possible scores for Stream Crossing Density and Upslope Hazard. Relative few road segments received high risk scores for their Proximity to Stream Channels, in part because long road segments diluted the impact of short sections of stream-adjacent roads.

The SRS Aquatic Risk results are quite different from the initial RMS Aquatic risk ratings. The SRS Aquatic Risk analysis reduced both the mileage and the proportion of roads in the High Aquatic Risk category. Surprisingly, the SRS Aquatic Risk analysis also reduced the mileage and the proportion of roads in the Medium Aquatic Risk category. The SRS analysis more than doubled the mileage and the proportion of roads in the Low Aquatic Risk category. The changes are likely due to decommissioning some of the highest risk road segments since the initial RMS, combining RMS road segments to fit the current INFRA road segments, an additional emphasis on stream-adjacent roads, and additional field knowledge of the road system.

Future Refinements at the Project Scale

Prior to designing and implementing future road stabilization or decommissioning projects, Aquatic Risk should be validated for the individual road segments. Field assessments should include:

- The presence of unstable sidecast material and the potential for failures to initiate landslides that would deliver sediment to stream channels.
- The number and size of existing stream crossings and their associated road fills.
- The potential for existing culvert to become plugged.

- The potential for the road segment to initiate stream diversions.
- Potential impacts on floodplains and riparian areas.
- Existing culvert fish passage barriers.

Field validation surveys should focus on the road segments rated as Medium Aquatic Risk because the roads could really be high Aquatic Risk or they could be low Aquatic risk. Field assessments of these roads could substantially change the current Aquatic Risk rating or the treatments needed to reduce risk. Field validation surveys should focus on the longer road segments because they often include areas of high Aquatic Risk as well as areas of low Aquatic Risk. Field surveys would provide the detailed information needed to design the appropriate road treatments at necessary sites.

Culvert Fish Passage Barriers

The Forest completed an inventory of culvert fish passage barriers on national forest system roads from 2000 - 2002. We have been aggressively correcting the highest priority barriers by replacing existing stream crossing structures and removing barrier culverts as part of road decommissioning projects. Using conservative criteria for fish passage, the ONF currently has 67 culvert barriers blocking approximately 49 miles of fish habitat. Two of the remaining culvert barriers are on anadromous streams. The number of culvert barriers by priority are shown in the Table E-2 below.

Table E-2. Culvert Barriers to Fish Habitat.

Type	# Culvert Barriers	Miles of Habitat Blocked
Anadromous	2	2.4 miles
High Priority Resident	14	26.0 miles
Moderate Priority Resident	16	10.8 miles
Low Priority Resident	35	10.1 miles
Total	67	49.3 miles

Potential Impact of Likely Needed Roads and Likely Not Needed Roads

The distribution of Aquatic Risk for the Likely Needed roads and Likely Not Needed roads identified in Step 4 of the TAP are shown in the Table E-3 below.

Table E-3. Aquatic Risk Summary of Ratings.

Aquatic Risk Rating	All Roads		Likely Needed Roads		Likely Not Needed Roads	
	Miles	Percent	Miles	Percent	Miles	Percent
High	1029.5	51%	618.5	46%	409.0	60%
Moderate	651.3	32%	476.6	36%	174.7	26%
Low	337.5	17%	242.3	18%	95.2	14%

Approximately 46 percent (618 miles) of the Likely Needed roads present high risk to aquatic resources due to proximity to streams or the potential to deliver sediment to waterbodies. Ongoing efforts to increase frequency and size of drainage structures, drainage maintenance, and treatments to stabilize hillslopes and maintain water quality will be needed to minimize risk to aquatic resources.
The Likely Not Needed Roads emphasize roads that were rated “High” for Aquatic Risk. Almost 60% (409 miles) of Likely Not Needed roads present high risk to aquatic resources that could eventually be removed from the road system.

The number and type of existing culvert fish passage barriers on the Likely Needed roads and Likely Not Needed roads identified in Step 4 of the TAP are shown in Table E-4 below.

Table E-4. Culvert Fish Passage Barriers on Likely Needed and Likely Not Needed Roads.

Species	Likely Needed Roads		Likely Not Needed Roads	
	# Barriers	Miles Habitat Blocked	# Barriers	Miles Habitat Blocked
Anadromous	2	2.4	0	0
Resident - High	11	16.6	3	9.4
Resident - Moderate	11	7.5	5	3.3
Resident - Low	25	7.2	10	3.0
Total	49	33.7	18	15.7

There are 49 existing culvert fish passage barriers on the Likely Needed roads, including two culvert barriers on anadromous streams. Culvert fish passage barriers on Likely Needed roads block over 33 miles of fish habitat. Decommissioning the Likely Not Needed roads would remove 18 existing culvert fish passage barriers blocking access to 16 miles of fish habitat.

Opportunities to Manage Aquatic Risk

To minimize the risk to aquatic resources from the future ONF road system, especially under the reduced maintenance scenario presented in the Financial Analysis as Scenario B, it would be important to implement appropriate treatments to restore hydrology, stabilize fillslopes, and ensure habitat connectivity prior to decommissioning roads or closing any roads to convert them to intermittent use ML1. Aquatic Risk ratings could be used to help determine the needed frequency and intensity of maintenance activities on open roads. Site-specific treatments for both the Likely Needed roads and the Likely Not Needed Roads could be identified in watershed restoration plans and evaluated in future NEPA decisions, if appropriate.

Appendix F

Terrestrial Resource Assessment

Terrestrial risk is the potential for a road segment to affect wildlife and botanical species habitat by causing degradation or fragmentation of habitat, and disruption of life history function. Terrestrial risk can be thought of as the degree of connection or connectivity between roads and upland or riparian habitats.

Nine factors were used to assess terrestrial risk based on GIS computer modelling, local knowledge and professional judgment:

- Critical areas of botanical species and habitats
- Critical areas of federally listed wildlife species and habitats
- Invasive plant infestations
- Northwest Forest Plan and Olympic National Forest Land and Resource Management Plan management allocations
- Snag and coarse wood
- Open road distance to core habitat (unfragmented block of older forest habitat)
- Road proximity to headwater aquatic habitat
- Distance from human activity centers
- Road density

The factors were weighted based on their perceived importance in creating impacts to terrestrial species, populations and their associated habitats. The greatest weights were given to road segments with a high potential to create habitat fragmentation and disruption to federally listed species and species of concern. A rank was used in each category which was then combined into a “High”, “Medium”, and “Low” rating for each road segment. Metrics used to determine road influence on species and/or habitats are published and standard analyses.

The Terrestrial Risk ratings for each road segment were reviewed by the Forest Botany and Wildlife Team. During their review, roads or road segments were given a specific score based on a set of evaluation criteria they specifically considered the influence of road-related affects to species such as fragmentation, disturbance and potential loss of habitat quality. The team began numerical ranking of each road segment, but with time limitations to complete the assessment a qualitative ranking of High, Medium, or Low were selected on the highest priority of risk. Local knowledge and professional judgment was used to determine the score throughout the assessment, in particular in areas where GIS analysis and site-specific or watershed data did not exist.

Analysis Factors: Ranking Process

The factors to analyze road segment included the following:

Critical Habitats (Botanical) – Rare plants and unique habitats

Does the road system allow public access to rare or unique habitats (balds, wetlands, etc.)?

Botanical habitats are extremely sensitive to human disturbance, in particular motorized vehicles which has the potential to impact unique habitats or individual rare plants.

High or 3: Road segment is negatively affecting one or more unique botanical habitats or sensitive plant species within the watershed to a point where these habitats or populations may be limited due to road influence.

Medium or 2: Road segment has potential to limit botanical habitats or populations.

Low or 1: Road segment does not affect unique botanical habitats or populations.

Critical Habitats (Wildlife)

Critical Wildlife Habitats include: Reproduction areas, occupied areas (such as home range), Designated Critical Habitat for federally listed species (northern spotted owl, marbled murrelet, Taylor's checkerspot butterfly), or species of special conservation status (such as fisher).

Does the road system allow public access to areas used by wildlife during critical periods (reproduction, rearing, wintering, etc.)?

Most wildlife species are extremely sensitive to human disturbance during the reproductive season. The level of disturbance varies based on the type and distance of the disturbance. Traffic associated with roads and the associated human use has the potential to disrupt reproductive activities.

High or 3: Road segment is affecting one or more critical habitats within the watershed to a point where species use may be limited due to road influence at a level that may impact local populations.

Medium or 2: Road segment has potential to be limiting use of critical habitat areas.

Low or 1: Road segment does not affect critical habitats.

Is the road within or provides access to wildlife or botanical species-related Land and Resource Management Plan or Northwest Management Plan management allocations (winter range road closure for elk, Bald Eagle Management Area, Botanical Area, Research Natural Area, Late Successional Reserve, etc.)?

Roads that enter identified areas that have restriction buffers or known reproductive areas have greater potential for disrupting reproduction than those that don't. Assess the amount and condition of road use affected by seasonal closures and disturbance to special designated areas.

High or 2: Road segment is within or provides access to one or more critical habitats within the watershed to a point where species use may be limited due to road influence at a level that may impact local populations.

Medium or 1: Road segment has potential to be limiting use of critical habitat areas.

Low or 0: Road segment does not affect critical habitats.

Is the road within a priority watershed identified in the Region 6 Terrestrial Restoration and Conservation Strategy, and provides access to priority habitats identified in TRACTS?

TRACS identifies the greatest impact to wildlife species and habitat comes from roads and the FS has moderate to high control over this threat. Road closures generally benefit priority species and habitats. Road closures can also reduce other threats like loss of dead wood habitat and a reduction fire risk due to lessening the risk for human starts.

Yes or 1: Road is within watershed identified in TRACTS.
No or 0: Road is outside TRACTS watershed.

Invasive Plant Species

Is the road system infested with non-native invasive plants that could compromise the natural native plant ecosystem?

Non-native invasive plant species compromise native plant species communities, as well as alter terrestrial wildlife and aquatic species habitat. Roads are one of the greatest conduits of weed spread. Road closures can help prevent new infestations from establishing in unaffected areas.

Yes or 2: Road has high level of infestation that has potential to spread invasive plant species.
No or 0: Road has low or no infestation of invasive plant species.

Snags and Down Wood

Is the road system contributing to the reduction of habitat for species dependent upon snags and down logs?

High or 3: Road provides access to the forest types and topography that are conducive to firewood removal. Road segments that are on relatively mild slopes in areas that allows easier access for woodcutting or has a history of or high potential for illegal wood cutting are the greatest risk for snag and down log reductions.

Medium or 2: Road is in the forest types and topography that have moderate potential to move levels below desired levels. This road segment may be located where there are moderate or steep slopes and firewood removal is somewhat difficult due to slope and topography; or in forest types that do not typically provide firewood.

Low or 1: Road segment has limited potential to have a large impact on snag and down log levels with the watershed due to location, vegetation types and/or topography. Illegal firewood harvest would be too difficult.

Core Habitats and Fragmentation

Does this road access an unroaded area or unfragmented block of habitat (also known as core habitat)?

Areas with no roads or low road densities provide unique habitats. Roads that allow access to human activities to these areas can reduce the quality of these habitats. Blocks of core habitat, or areas adjacent to core habitat (National Park, designated Wilderness, inventoried roadless area, contiguous unroaded areas) was reviewed.

High or 3: Road provides direct access to a core area or unfragmented block of core habitat. Road segment is contributing to fragmentation directly by impacting large amounts of core habitat and/or subsequently facilitating traffic to secondary roads and human associated activities within core habitats. Road is less than ½-mile from core habitat.

Medium or 2: Road is not the primary access route to core area or unfragmented habitat but facilitates access to these areas. Road segment is contributing to the fragmentation of some habitats. Road is between ½ to ¾ mile from core habitat.

Low or 1: Road does not provide access to core areas and does not affect core habitats. Road is greater than ¾-mile from core habitat.

Aquatic Habitat

Does the road bisect wetlands and/or 1st and 2nd order headwater streams?

Physical barriers limit the ability of some animals such as amphibians to cross roads. Barriers can increase the time or difficulty of crossing a road which can preclude animals from utilizing adjacent habitats or possibly resulting in mortality. Roads that intersect wetlands or streams are likely to increase sedimentation and subject the aquatic system to alteration of normal function.

Road that are within ¼-mile of wetlands and headwater streams were analyzed.

Yes or 2: Road is within ¼-mile of a wetland or headwater stream.

No or 0: Road is beyond ¼-mile of a wetland or headwater stream.

Proximity to Human Dwellings

Is the road within 5 miles of a city or subdivision or within 1 mile of dwellings, campgrounds, etc.?

Human activity centers have increased vehicle traffic and a much greater potential for human wildlife interactions. These areas may have other influences like dogs and habitat removal. Human activity centers combined with other factors reducing migration habitat effectiveness can cause pinch points which increase the potential conflict with a road segment and in some cases multiple factors can reduce or eliminate the potential for wildlife to utilize the corridor. Legal and illegal wood cutting activities that reduce snag and down log levels are typically greater closer to population centers. The more remote and inaccessible the road is the less traffic it typically receives, and thus has lower potential for impacts to snag and down log levels.

High or 3: Road is within 5 miles of city limits.

Medium or 2: Road is > 5 miles within of city limits, but < 1 mile of campground or dwellings (may include private homes, guard stations, resorts, etc.).

Low or 1: Road is neither within the range of a city or dwelling/campground.

Road Density

Does the road density in the watershed exceed Olympic National Forest Land and Resource Management Plan standards?

Road density is provided for FS lands only; review of neighboring land ownership is done to determine watershed road densities and impacts to species.

High or 3: High road density = > 3 miles/square mile.

Medium or 2: Medium road density = 1-3 miles/square mile.

Low or 1: Low road density = < 1 miles/square mile.

Results of Terrestrial Resource Assessment

The majority of the road segments (535) were rated as high risk to terrestrial species. The 749 miles of road were an average of 1.4 miles in length, and had more than three of the nine factors ranked as high. The roads are predominately located in the interior of the forest boundary and in close proximity to unroaded areas, such as the Olympic National Park or Wilderness. A high risk road generally has several locations of a federally listed species, and their designated critical habitat. Road density above desired levels in these road systems, or areas with previous illegal removal of standing dead trees along the roadway may also affect its ranking.

Medium risk roads included 862 miles on 506 road segments. On average they were 1.5 miles in length and were mainly found in the middle and outer edges of the forest boundary. The roads were in areas with limited federally listed species occurrence and higher amount of fragmented forest. A factor may have had one or two high risk ratings, but the other factors were categorized as either low or medium.

Low risk roads were found along the middle section of the forest on steeper sections of the forest, and were typically in highly fragmented habitat with few, if any federally listed species or specially designated habitats. No special or unique habitats were located in these areas. Approximately 409 miles on 426 segments were ranked as low and were on average about 1 mile in length. These roads were generally either main system roads, or located in close proximity to one away from water.

Problematic Elements and Using Analysis at Project Level

The sustainable road analysis was done at the forest-wide and watershed scale for each of the nine factors, assisted with the local knowledge of the wildlife and botany staff. Additional field review and finer-scale analysis would be conducted during NEPA analysis for projects such as proposed thinning, road decommissioning or other activities that influence the road network. Some potential outcomes of this analysis include a review of the year-round or seasonal wildlife gate closures and the influence on roads to wildlife species. This, in partnership with Washington Department of Fish and Wildlife, will be useful for future discussion on the effectiveness of the conservation closures. As more technological and peer-accepted analysis, including GIS modeling, are created or available to assess roads with terrestrial resources, along with field verification and validation, future sustainable roads analysis would be updated.

Appendix G

Road Maintenance Cost

Road Maintenance Risk reflects the potential cost of ownership based on road operation and maintenance history and needs. It can also be considered an indicator for damage potential during storms.

Six factors were identified as principle considerations for this resource evaluation:

- cost and/or frequency of maintenance
- performance history
- storm damage history
- terrain or location considerations
- construction method
- road age

Within each factor there are varying degrees of knowledge or available data on hand to conduct the analysis. Road maintenance history and storm damage history were the primary elements used in the final ratings. For this analysis records of past flood damage were examined and current and past Road Managers and Maintenance Engineers were consulted. We relied on anecdotal information and professional judgment for identifying roads that required the most maintenance and those that require the least maintenance over time.

Cost and frequency of maintenance and repair are closely linked to use, construction method, and terrain or road location. Construction method is not readily available without a more detailed or site-specific assessment. Road age is a factor that may provide a surrogate for construction method, however, neither was used for this analysis. Those factors as well as current condition are recommended for more detailed project-level assessment where changes to the current transportation system are being considered.

Road segments were rated as high for Road Maintenance Risk when the cost or frequency of maintenance was high, or when storm damage resulted in costly repairs. Repetitive storm damage sites and large storm damage repair sites qualifying for reimbursement from the Federal Highways Administration (ERFO sites) are included in this group. Road segments were rated low for Road Maintenance Risk when the road managers indicated a particularly low maintenance frequency or cost. Roads that met neither category were rated as medium, and are interpreted as having average or typical cost/mile to maintain. A fourth category was identified as un-rated. This includes most of the Operational Maintenance Level 1 roads that are closed to motor vehicle access and receive little maintenance currently.

Appendix K

Financial Capacity Analysis

Introduction

The purpose of the Financial Analysis is to identify opportunities for how the road system could be managed in the future to better reflect long-term funding expectations. This information in conjunction with the benefit and risk assessment will be used by the Responsible Official to strike the best balance between access needs, risk, and cost. The official decision and "identification" of what will constitute the future road system will be made following subsequent NEPA analyses at the project scale.

Background

Forest Service road budgets have been steadily declining for the past 20 plus years. Region-wide, the amount of funding for road work including both appropriated funding and work contributed by commercial users is less than 20 percent of what it was 20 years ago. Appropriated road funds to the Pacific Northwest Region (Region 6) have been reduced 40% in the past 5 years alone. Current levels of funding for road work on the Olympic National Forest are shown in Table K-1 below.

Table K-1. Olympic NF Road Maintenance Budget, Five year average (FY 2010 – 2014) in thousands.

BLI	Forest Road Maintenance Spending					5 Year Cumulative	Average Annual Maintenance Budget
	2010	2011	2012	2013	2014		
CMRD	236	324	170	118	99	947	$189
CMLG	60	30	25	137	27	279	$56
CWF2	77	84	134	137	40	472	$94
SRS2	156	101	339	198	119	913	$183
NFTM	0	0	0	0	148	148	$30
Other					6	6	

Total annual road maintenance funds applied to work on the ground:	**$552**
Annual overhead cost to administer program:	$210
Total:	**$762**

5YR Ave Mtc Budget	Range	
	-20%	+20%
$552	**$442**	**$662**

With funds being far below what is necessary to keep the road system properly maintained, many roads do not get the maintenance treatments they need on schedule and are falling into a severe state of disrepair. Furthermore, the majority of roads were constructed more than 30 years ago. Many are at or near the end of their design life without substantial reconstruction. Years of reduced funding for annual maintenance has increased the backlog of deferred maintenance and increased the cost of reconstruction needed to bring the roads to commercial and haul standards.

Annual Maintenance is defined as "work performed to maintain serviceability, or repair failures during the year in which they occur. It includes preventive and/or cyclic maintenance performed in the year in which it is scheduled to occur", (Financial Health - Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Deferred Maintenance is defined as "maintenance that was not performed when it should have been or when it was scheduled and which, therefore, was put off or delayed for a future period. When allowed to accumulate without limits or consideration of useful life, deferred maintenance leads to deterioration of performance, increased costs to repair, and decrease in asset value", (Financial Health - Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Since 1999, the Forest Service has been tracking the amount of the deferred maintenance backlog. Table K-2 shows the accumulated totals for deferred maintenance (DM) and the annual maintenance (AM) needs that would be required to keep the road system fully maintained to standard for the Forests in the Pacific Northwest Region.

Table K-2. R6 Annual Maintenance and Deferred Maintenance Needs.

National Forest	Road Miles	Total Maintenance Need[1]	
		DM	AM
Deschutes	8,109	$80,566,681	$7,526,877
Fremont-Winema	12,548	$133,971,908	$13,642,507
Gifford Pinchot	4,103	$53,330,891	$5,312,486
Malheur	9,628	$56,025,932	$6,153,833
Mt. Baker-Snoqualmie	2,453	$81,915,920	$9,660,568
Mount Hood	2,881	$51,813,990	$4,896,610
Ochoco	3,253	$33,260,537	$3,313,734
Olympic	2,026	$42,680,614	$4,467,995
Rogue River-Siskiyou	5,288	$111,614,953	$11,581,995
Siuslaw	2,128	$26,115,387	$2,777,636
Umatilla	4,624	$65,211,612	$6,647,168
Umpqua	4,776	$73,669,140	$7,148,103
Wallowa-Whitman	9,150	$64,279,905	$6,808,709
Okanogan-Wenatchee	8,163	$158,111,026	$17,050,400
Willamette	6,542	$90,942,456	$8,838,067
Colville	4,309	$37,336,065	$4,306,765
Columbia River Gorge	99	$1,454,584	$121,557
Totals	90,078	$1,162,301,600	$120,255,010

It would take approximately $1.2 billion to bring the entire road system in Region 6 back up to standard (all roads in a like new condition), and then it would take approximately $120 million per year to keep all roads fully maintained to standard. For the Olympic National Forest, it would take approximately $43 million to bring the entire road system back up to standard, and about $4.5 million per year to keep it that

[1] These costs are derived from average National Unit Costs and include a burden rate of approximately 40% to cover planning, contracting, and all other overhead costs associated with returning the road system components to an original "like new" condition.

way. Note that the unit costs used to arrive at the figures above are made up of national averages to restore and maintain the road system in a like new condition. They also include the cyclical items necessary to replace gravel surfacing, pavement overlays, bridges/structures, and major culverts on schedule.

Using Regional unit costs, without the national burden rate, the current estimate for annual maintenance needs to keep the existing Olympic National Forest road system maintained to standard would be about $2.7 million per year for contracted work. Oversight and administration would require an additional $210 thousand per year. Over the past 5 years, the Olympic National Forest has only received about $550 thousand per year for road maintenance contracts and work on the ground. This is only about 20% of the funding necessary to address the estimated annual maintenance needs to maintain the road system.

Financial Analysis Process

The goal of the financial analysis step in the overall Travel Analysis Process is to identify opportunities to help move the road system to a more affordable state.

Based on the figures in the previous section, if the Olympic National Forest were to focus their currently available funds on a given set of roads to fully maintain to standard, they would only be able to maintain approximately 59 miles of the higher standard asphalt surfaced roads. Alternatively, about 113 miles of aggregate surfaced road, or 243 miles of lower standard high-clearance native-surfaced road could be maintained for the same amount.

A road system of that size would not meet the needs of the forest or the public, and does not meet the requirements of the 2005 Travel Management Rule (36 CFR 212.5(b)(1)). The Transportation Analysis Process (TAP) requires identification of a minimum road system that would meet resource management objectives in the Forest Plan and allow the forest to meet statutory and regulatory requirements.

Given the enormous gap between available funding for road work and the cost to maintain the road system to standard, the Region recognized that it would not be possible to balance the size of the road system with the cost of maintaining all roads fully to standard and still be able to meet resource management needs or the needs of the public. Since the requirement to "reflect long-term funding expectations" was not defined in regulation or policy, Region 6 defined it in the *R6 Guidance for Preparing a Travel Analysis Report* document to mean that "average annual funding" is reasonably in balance with the "average annual cost of routine road maintenance", where:

> 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 past 5 years , plus or minus 20%. It does not include funding from the American Recovery and Reinvestment Act (ARRA) or the Capital Improvement Program (CIP).
> Average annual cost of routine road maintenance is defined as 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 replacement of bridges and large culverts, asphalt overlays, etc.) and reconstruction.

The Olympic National Forest utilized the *Region 6 Financial Analysis Template*, which is based on the definitions above, to perform the financial analysis. This template is an excel spreadsheet workbook that allows users to input budget information and calculate unit costs for a variety of road maintenance work activities for different maintenance intensities on different standards of road. This allows the user to compare the cost of maintaining the current system of roads with a variety of scenarios for different

potential future road systems. The user is able to alter the overall size of the road system, the composition of different maintenance standards, and the intensity or frequency of maintenance work on different types of roads.

Financial Analysis Steps:

1. Estimate 5 year average funding available for road maintenance work
2. Identify local Unit Rates used for routine annual road maintenance work
3. Use work item unit rates to build unit rates for different road standards and maintenance intensities
4. Calculate cost to maintain current road system at current maintenance intensity
5. Develop different scenarios for future road systems that show what size and composition of road networks can be maintained within range of average annual funds.

Results

This transportation analysis process was conducted using an interdisciplinary process that evaluated the needs for each road within the transportation network along with the risks and costs associated with those roads. Those elements were integrated on a road-by road basis to generate a list of roads likely needed, and a list of roads, likely not needed. That process is described in Step 4 of the Transportation Analysis Report.

One requirement of the Transportation Analysis is to define a road system that is affordable or *"reflects the long-term funding expectations".* In order to accomplish this, we focused the financial analysis on the Likely Needed roads as defined in the analysis and displayed in Appendix (I).

The key variables used for estimating annual maintenance cost in this analysis are the amount or number of miles to be maintained, the road standard to be maintained, and the frequency of maintenance. Other variables such as traffic volume or use, construction method, and location relative to geomorphic conditions or hazards are best applied at the site-specific or project scale.

Multiple scenarios for applying anticipated road maintenance funds to the list of Needed Roads were analyzed. For distribution of annual maintenance funding the scenario that best balances the identified resource needs with the funding expectations is presented as Scenario 3. The risk assessments presented in Step 4 of the TAP report and the opportunities presented in Step 5 provide information that can be used to help prioritize annual maintenance funds as well as where capital funds are directed to transition the current road system to the proposed road system.

Scenario 1: Maintain all Likely Needed Roads to Current Condition Standard

This scenario would maintain all of the roads identified as Likely Needed Roads in Step 5 of the TAP to current condition. Designated Maintenance Levels on Likely Needed Roads would not be changed from their current Operational Maintenance Level. Annual maintenance treatments would be completed at the appropriate frequency on all system roads (ML 2-4). Very little maintenance would occur on closed (ML1) roads. All of the ML1 roads in the proposed Likely Needed Roads system are assumed to already be operated as ML1 roads in the current road system so no treatments would be needed to close them. No maintenance would occur on the roads designated as Likely Not Needed in Step 5 of the TAP.

The results of this scenario are summarized in Figures K-3 through K-5 and Figure K-1 below. The calculation sheets used develop cost information for this alternative are included in the attached excel file "ONF Financial Analysis SRS2015.xlsx"

Table K-3. Comparison of Annual Road Maintenance Costs for the Current Road System and the Likely Needed Roads System Maintained to Current Standard (Scenario 1).

OPML	Current Road System			Scenario 1 – Likely Needed Roads Maintained at Current Standard		
	Miles	% of sys	Cost	Miles	% of sys	Cost
5	NA	0%	$0	NA	0%	$0
4	77	4%	$407,025	77	4%	$378,359
3	321	16%	$441,215	321	16%	$441,215
2	1,015	50%	$705,391	693	34%	$481,612
1	607	30%	$12,146	247	12%	$4,942
Likely Not Needed	--	--		682	34%	0
Totals System Roads	**2,020**	**100%**	**$1,565,777**	**2,020**	**100%**	**$1,306,128**

Figure K-1. Current Road System vs Likely Needed Road System (PC= Suitable for Use by Passenger Cars; HC = High-clearance Vehicles; Closed = Closed to Motorized Vehicles/Intermittent Service; LNN = Likely Not Needed Roads).

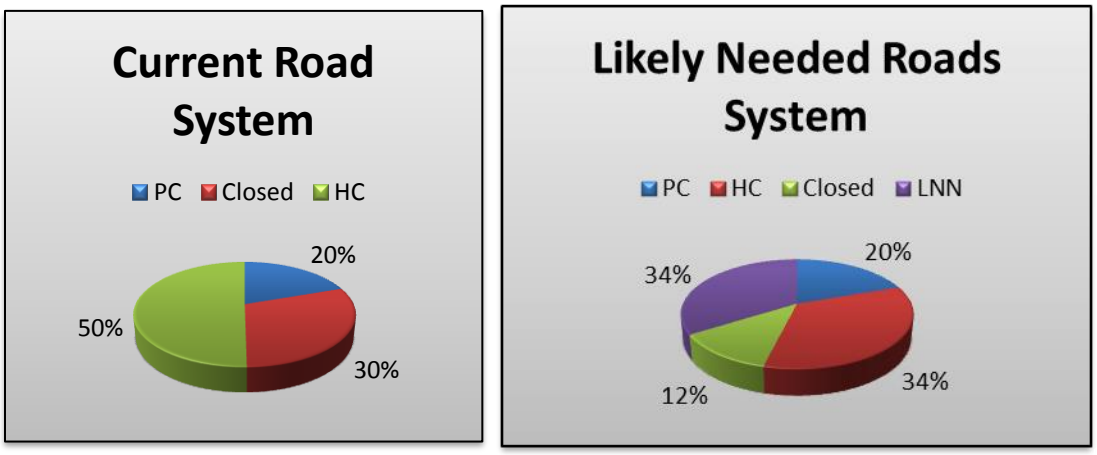

Table K-4. Comparison of the Current Road System and the Likely Needed Roads System (Scenario 1).			
Road Category Overall size of transportation system (open and closed roads)	**Current Miles**		
	2,020	**Likely Needed Roads**	**Difference**
Overall Open Road System (ML 2-5)	1,413	1,338	-682
Roads Maintained for Passenger Cars (ML 3-5)	398	1,091	-322
Roads Maintained for High Clearance Vehicles only (ML2)	1,015	398	0
Closed Intermittent Service Project Roads (ML1)	607	693	-322

The current road system shown in Figure K-3 is the existing transportation system on the Olympic National Forest stratified by maintenance level. Scenario 1 is the Likely Needed road system as determined through this Transportation Analysis Process and defined in Step 5 of the report. The Likely Not Needed Roads as determined in Step 5 of the TAP are shown for clarity. Annual maintenance costs are calculated based on the assumption that all Likely Needed Roads are maintained for each maintenance element at typical unit costs and recommended maintenance frequency.

Moving from the current road system to the Likely Needed Roads system would reduce the overall road network by 682 miles (Figure 5). The miles of road maintained for use by passenger cars ML3 and ML4) would not change. Mileage reductions would be distributed between high-clearance vehicle roads (ML2) and Closed- Intermittent Use roads (ML1). The amount of roads maintained for high clearance vehicles (ML2) would be reduced by 322 miles and the closed - intermittent use roads would be reduced by 360 miles. These are the roads that were identified in Step 5 of the TAP as being "Likely Not Needed". This alternative would result in a cost savings of approximately $578 thousand per year over annual road maintenance costs for the current road system but costs would still substantially exceed the anticipated funding available for maintenance.

Under Scenario 1, the amount of road maintained for passenger cars (ML3 & ML4) would not change, however, the amount of roads actually driveable by passenger cars would likely decrease. On the current road system, many of the higher use ML2 roads (collector routes) appear similar to Maintenance Level 3 roads and are passable by passenger cars. This would not be the case in the future under Scenario 1. Maintenance on many ML2 roads would be focused on drainage and watershed protection rather than surface condition and user convenience. The surface of many ML2 roads would likely become rougher with more obstacles, waterbars and cross drains would be installed to control drainage on some roads to offset reduced maintenance frequency, more vegetation would be allowed to grow on the road shoulders, reducing visibility.

Scenario 2: Adjust Maintenance on Likely Needed Roads through increased intermittent use and decreased maintenance frequency.

This scenario would reduce the maintenance intensity and frequency of maintenance on lesser used roads in all maintenance levels to balance costs with anticipated road maintenance funding. Reductions in maintenance intensity and/or frequency would occur on roads in all maintenance levels but would most apparent on the lower standard (ML2) roads. Roads needed for Silviculture Access only would be operated at intermittent use standard and closed between projects (ML1) or operated as Maintenance Level 2 at a lower level or frequency of maintenance. Thus some high clearance roads would be left

unmaintained and would eventually be closed due to vegetation encroachment or road damage. Cost saving strategies and assumptions included in this scenario include:

- ML4: 50% of routes, including local routes and those not frequented by heavy truck or commercial traffic would be maintained in reduced frequency or intensity.
- ML3: Routes receiving less use or lower commercial traffic volumes and are classified as local roads would be candidates to receive a lower intensity and frequency of maintenance. Roads proposed for a lower objective maintenance level in the 2003 Access and Travel Management (ATM) **and** those that are identified as high need for Silviculture Access only in the current TAP would also be candidates for reduced intensity and frequency of maintenance.
- ML2: Similar to the strategy used for reducing costs for the lesser used ML3 routes. Roads identified for closure (ML1) or decommissioning (D) in the 2003 ATM **and** not identified as high need for other than silviculture access in the current TAP (106 miles or 15% of ML2) would be potential candidates for the lower maintenance treatment intensity and frequency. The ML2 roads proposed for reduced maintenance would be roads with low to moderate aquatic risk. Roads with high aquatic risk would be maintained at the higher cost or frequency.
- ML1: All of the ML1 roads in the Needed Roads system are assumed to be operated as ML1 in the current road system, so no treatments would be needed to close them.
- Roads identified as Likely Not Needed in the TAP would not be maintained.

Table K-5. Comparison of Annual Road Maintenance Costs for the Likely Needed Roads System Maintained to Adjusted Frequency (Scenario 2) and the Likely Needed Roads System with Reduced Maintenance to an Affordable Level (Scenario 3)

OPML	Scenario 2 – Maintain Needed Roads to Adjusted Frequency			Scenario 3 – Adjust Maintenance to Affordable Level		
	Miles	% of system	Cost	Miles	% of system	Cost
5	NA	0%	$0	NA	0%	$0
4	77	6%	$327,025	77	6%	$247,114
3	321	24%	$358,172	321	24%	$235,989
2	693	52%	$273,189	693	52%	$179,541
1	247	18%	$296	247	18%	$296
Totals	1,338	100%	$958,682	1,338	100%	**$662,940**

Scenario 3: Adjust Maintenance on Likely Needed Roads to Affordable Level

Scenario 3 applies the same strategy as detailed in Scenario 2 with these additional cost reduction measures:

- ML 4: Reduce maintenance frequency on asphalt roads; 50% maintained at moderate standard, 50% at low standard.
- ML 2: Further reduce maintenance frequency of high-clearance (ML 2) roads: 65% of highest use roads maintained to moderate standard; 35% roads maintained at low standard.

One consequence of reduced maintenance frequency is reduced design life. For asphalt surfaced roads, if reconstruction with a new asphalt surface is not possible at the end of the design life or life cycle, then these roads would likely be converted to aggregate surfaced. The resulting annual maintenance needed could be conducted at a significantly lower cost.

The results of the Scenarios 2 and 3 are summarized in Table 5. The estimated cost of road maintenance under Scenario 3 would be $663 thousand per year. This is approximately 20% above the 5 year average maintenance budget shown in Table 1 and is assumed to represent a financially sustainable road system when timber sale road maintenance contributions are added. The calculation sheets used to arrive at these summaries are included in the attached excel file "ONF Financial Analysis SRS2015.xlsx"

Within the current road system, many of the higher use ML2 roads (collector routes) appear similar to Maintenance Level 3 roads and are passable by passenger cars. This would not be the case in the future under either Scenario 2 or 3. Maintenance on many ML2 roads would be reduced and would be focused on drainage and watershed protection rather than surface condition and user convenience. The surface of many ML2 roads would likely become rougher with more obstacles. Waterbars and cross drains would be installed to control drainage on some roads to offset reduced maintenance frequency. More vegetation would be allowed to grow on the road shoulders, reducing visibility and sight distance.

Priorities for the higher maintenance frequency or intensity would be based on a combination of highest use, high needs, and resource risk. Federal Land Transportation Program (FLTP Network) routes, arterial routes, and collector routes are among those likely to receive more maintenance, especially with funds such as CMRD that focus on the passenger car road system (ML 3-5) and public safety. Other funds such as CMLG (Legacy Roads and Trails) will integrate watershed protection needs and risk into maintenance priorities.

Other Scenarios: Maximize level of open roads by conversion of paved roads to aggregate

Due to the long-term cost to maintain asphalt surfaced roads, substantial savings can be gained by reducing the amount of asphalt surface road managed. The Olympic National Forest currently manages almost 100 miles of asphalt surfaced road, generally as Maintenance Level 3 or 4. The cost to maintain them is high, and long-term maintenance requires periodic treatments such as chip sealing, or reconstruction, resurfacing, etc. Many have not received these treatments and show signs of fatigue and are close to the end of their design-life.

While conversion from asphalt to aggregate surfaced roads would save a substantial amount of money in annual maintenance, the capital cost of conversion is high. Without a capital investment program to make these conversions possible, this does not appear to be a strategy that can be applied over large parts of the road system without substantially reducing the annual maintenance capacity. Therefore, this alternative was not evaluated in detail.

Capital Investments

The above analysis only considers annual road maintenance needs and costs. However, there would also be substantial capital costs associated with bringing the existing road system into alignment with current needs while minimizing adverse environmental impacts. These costs are not included in the balancing of road maintenance funds because funding for these activities is not appropriated along with the normal road maintenance funds used in the calculations. Funding for road decommissioning, road stabilization, treatments needed to convert a road to ML1 status, and culvert fish passage barrier corrections generally comes though other programs such as capital investment programs, Legacy Roads and Trails funding, and partnerships with other agencies or watershed restoration groups.

The proposed road system described in Scenario 2 was used to estimate the capital costs of moving from the existing road system to the system of Likely Needed Roads identified in Step 4 of the TAP. Total estimated capital costs would be over $85 million (Table K-6).

Table K-6. Estimated Capital Costs to Decommission Likely Not Needed Roads, Convert Open Roads to ML1, Improve Drainage on ML2 Roads with Lesser Maintenance, and Correct Culvert Fish Passage Barriers on Likely Needed Roads.

Category	Miles	Cost / Mile	Total Cost
Estimated Cost to put roads in storage (ML1)	106	$20K to $60K	$4,240,000
Estimated Cost to decommission roads	682	$60K to $120K	$61,380,000
Estimated Cost for improvement work (SDRR)	601	$10K to $40K	$15,025,000
Estimated Cost to Correct Culvert Fish Barriers	49 sites	$100K/ site	$4,900,000
Total			$ 85.5 million

Potential opportunities to prioritize capital investments to reduce aquatic risk are described in Step 5 of the TAP report.

Conclusions

The Financial Analysis displays one scenario (Scenario 3) where the Needed Roads identified from the risk/benefit analysis in Step 4 of the Olympic NF TAP Report are in line with the R6 guidelines for identifying a future system of roads where "average annual funding" is reasonably in balance with the "average annual cost of routine road maintenance".

This balance addresses routine annual maintenance work needed to keep roads open and safe for use, and addresses critical resource concerns such as maintaining ditches and culverts for proper drainage. This work is accomplished by the Forest Service using appropriated road funds and collections and through commercial users who are required to maintain roads commensurate with their project uses.

Given the current trend in reduced funding for road maintenance work, and the large gap between current funding and need, it does not appear possible to identify a road system that meets the Forest's needs where the cost of annual maintenance work necessary to fully maintain the roads to standard is in balance with available funding. Because we do not have enough funding available to keep all road surfacing materials and structures replaced on schedule, we can expect the deferred maintenance backlog to continue to grow, and we will continue to see a decline in the overall serviceability of our road system. This will make it challenging to meet Forest Plan objectives.